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# A History of the World's Columbian Exposition Held in Chicago in 1893.

Published 1893







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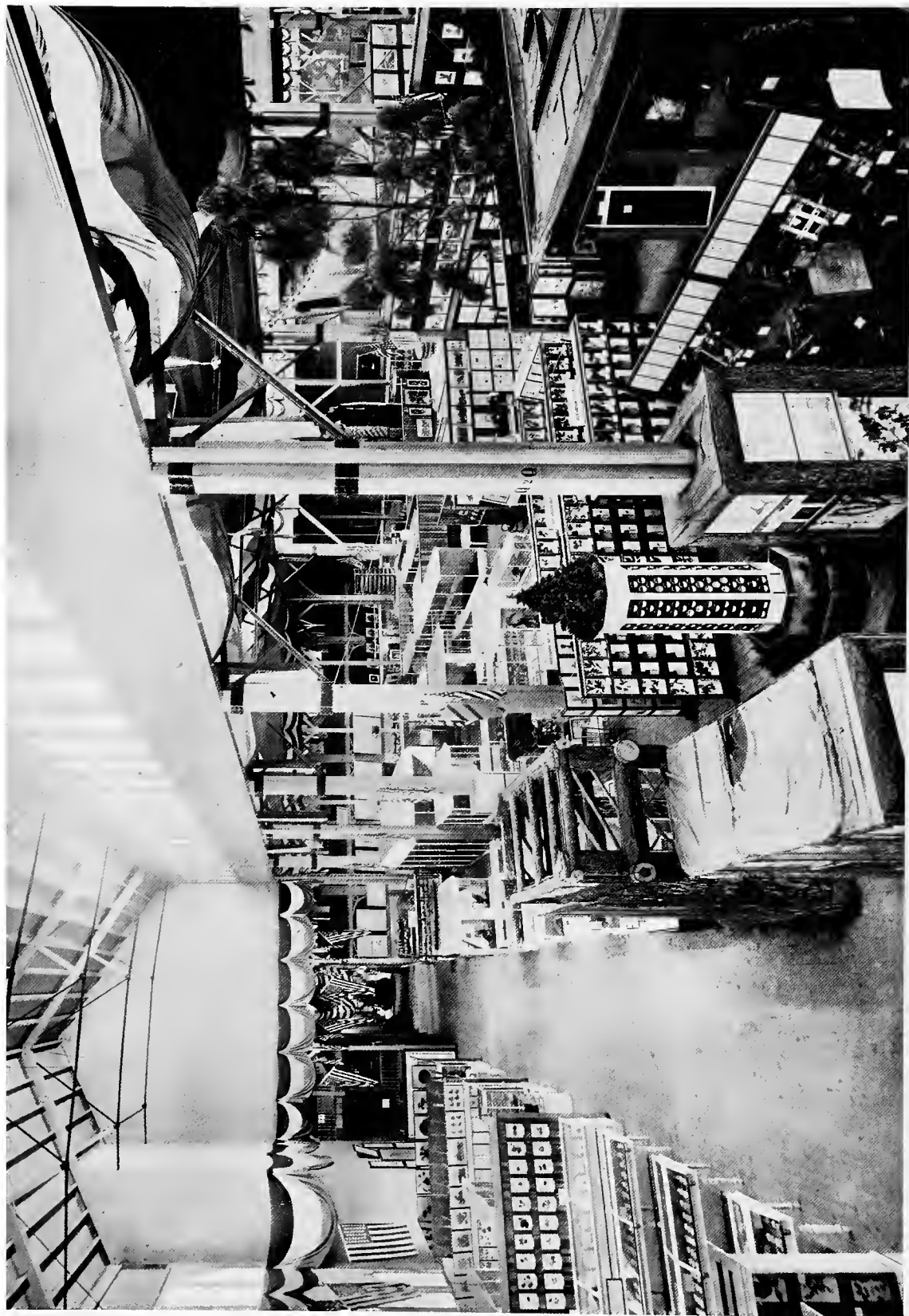


EXHIBIT OF THE UNITED STATES DEPARTMENT OF AGRICULTURE.





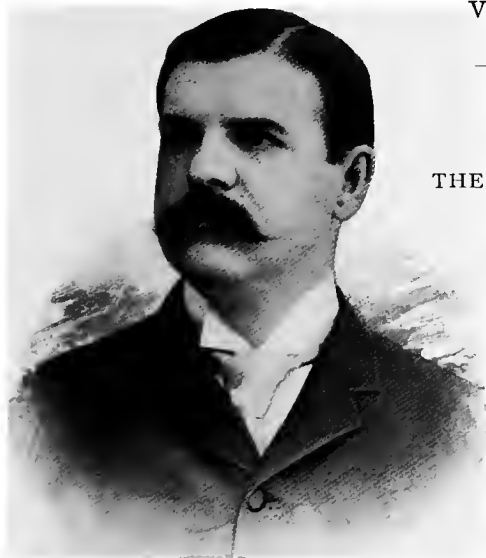
Tympanum on the Manufactures Building.

## A HISTORY OF THE WORLD'S COLUMBIAN EXPOSITION.

VOLUME III.—EXHIBITS.

### CHAPTER I.

#### THE AGRICULTURAL EXHIBITS.



CYRUS H. McCORMICK,  
Member of the Directory.

Collecting the exhibits—Difficulties encountered—Group of cereals, grasses, and forage plants—Group including bread, biscuits, pastes, starch, and gluten—Group of sugars, sirups, confectionery, etc.—Group including potatoes, tubers, and other root crops—Group including brooms, corn, pumpkins, squashes, peas, and beans as crops—Group of preserved meats and food preparations—Group of dairy processes and products—Group embracing tea, coffee, spices, hops, and aromatic and vegetable substances—Group of animal and vegetable fibers—Group embracing pure and mineral waters, natural and artificial—Group comprising whiskies, cider, liquors, and alcohol—Group of malt liquors—Group embracing machinery processes and appliances of fermenting, distilling, bottling, and storing beverages—Group of farms and farm buildings—Group representing the literature and statistics of agriculture—Group comprising farming tools, implements, and machinery—Group embracing miscellaneous animal products, fertilizers and fertilizing compounds—Group consisting of fats, oils, soaps, candles, etc.

WHEN the first agricultural nation of the world organized a world's exposition in the heart of its agricultural region, at the emporium of its agricultural products, it was natural that its agriculturists should worthily signalize their primordial and fundamen-

tal art and bring offerings of its best fruits to celebrate the chief national industry. And other nations, even those in which other crafts have gained ascendancy, might be expected to present in the best light their skill in this most honorable branch of labor, and to produce the choicest growths of their native soil, out of pure national pride, regardless of prospective mercantile gains.

Satisfactory exhibits of farm produce were not collected from remote parts of the United States without manifold difficulties, which were greatest in some of the most productive of the younger States. These, however, in the desire to attract settlers to their lands, had an incentive to exert themselves that offset the organization and experience of the older States. Many selected their exhibits of grains, seeds, etc., from the State and county fairs of 1892. The World's Fair Commissioners in some, as in the ambitious Commonwealth of Kansas, offered premiums at these fairs, and thus brought out the best samples. The same State, and Illinois, Kentucky, and others, sent in abundant specimens of the growths of 1893 while the Exposition was in progress, as soon as the crops were ripe for the harvest. In Illinois special plantings were made in the three agricultural zones of the State, whereby it was discovered that the season of maturity advanced from south to north at the rate of twelve miles a day. In such States as New York and Massachusetts it was enough to ask well-known growers to set aside select samples of their special products; but in some of the Western States the commissioners, failing to get together a good exhibit by sending out circulars, succeeded only when some officer of the State Agricultural College, or other expert, traveled from farm to farm in search of good specimens of staple products. Kentucky, owing to a legal hitch, suffered the exhibits selected in 1892 to go to waste, and had to wait until the fields were ripe again before it could exhibit its wealth of grains and grasses. Some States made collective exhibits, more interesting and effective than a profusion of individual exhibits, winning laudatory certificates from the judges, but depriving the individual producers of the separate awards that fell to farmers of other States. With the same unselfish State pride, the finest display of several of the States was made in the State building, where the exhibits were shut out from awards. The plans and accomplishments of the managers and the awards of the judges did not fail to evoke the usual criticism from all who could conceive a system that would redound more to their own particular interest. Several States duplicated in the State building the exhibit in the agricultural hall. From a good many States representative collections of all the agricultural products, or of the grasses, cereals, or varieties of tubers, or of legumes, or cotton, or tobacco, or other special product, were sent by the Agricultural College or contributed by specialists. The scientific work done by the agricultural colleges and experiment stations in connection with the Fair, or produced there to elucidate the agricultural conditions and resources of the several States, was one of the most im-

portant parts of each State exhibit. Invaluable also was the aid of the State agricultural boards and of associations for special branches of agriculture, and of the exchanges and boards of trade dealing in agricultural produce.

The railroads were kept busy hauling enormous masses of farm and forest produce to Chicago. Many States and foreign governments were slow in gathering and forwarding their exhibits. Some that had purposed making only a small exhibit, or abstaining altogether, appreciating too late the magnitude and success of the Exposition, applied for space when all had been bespoken by their more sagacious rivals. Thus, while the products and resources of New South Wales were magnificently displayed, Victoria, Queensland, and New Zealand had to share the space of Great Britain.



CANADA'S GRAIN EXHIBIT.

Nevada, which had despaired of being able to make an exhibit, collected a fine one at the eleventh hour, which was set up in the space allotted to Idaho, that State having had the misfortune to lose a large part of its agricultural exhibit by fire in transit.

The pavilions, pagodas, kiosks, and other ornamental structures that housed many of the exhibits were often exhibits in themselves, being formed of leaves, stalks, grains, and grasses, or of native woods, in the latter case finished at home and shipped to Chicago in sections. The decorators of the different States vied with each other in arranging the exhibits in artistic



order, using the natural products of the State to produce a dazzling variety of ornamental designs and color effects.

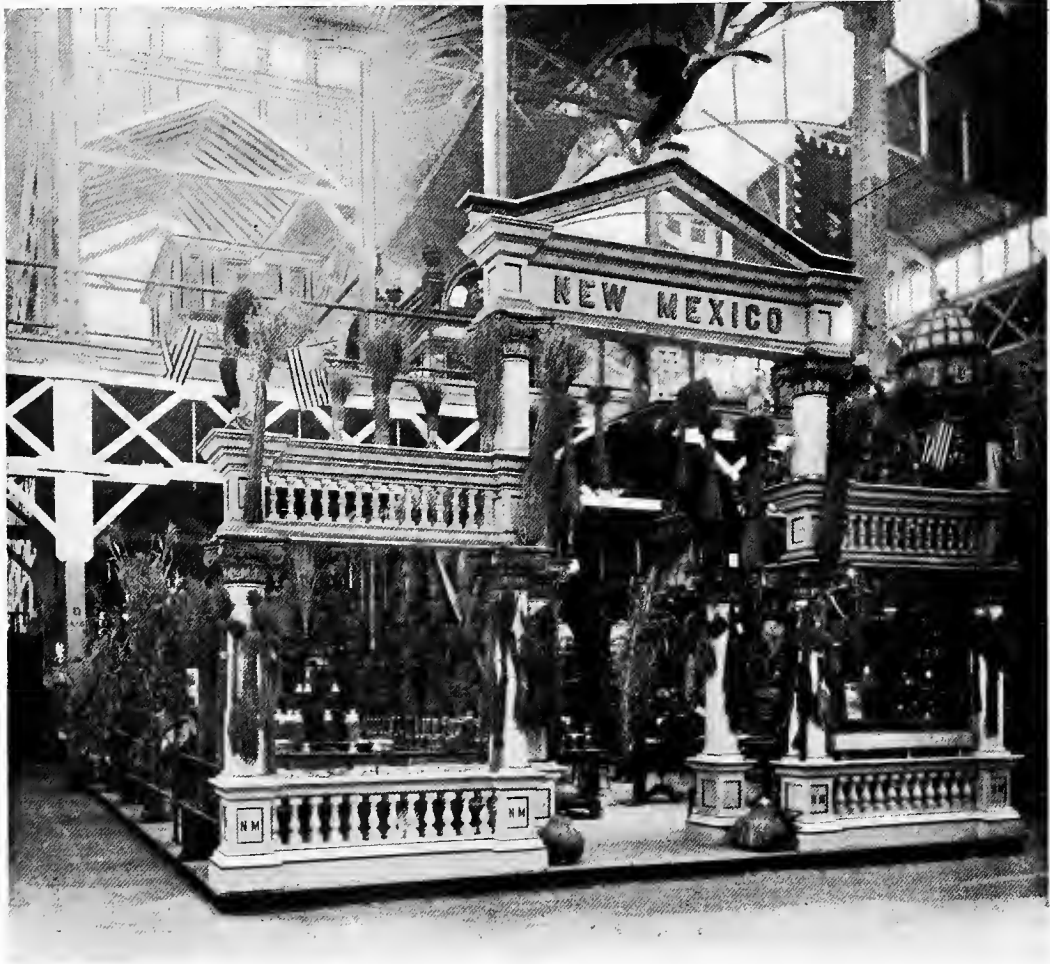
The first group of the Agricultural Department—the group of cereals, grasses, and forage plants—consisted of the following classes: 1. Wheat and its culture; varieties of wheat grown in America and abroad; statistics of products and prices. 2. Indian corn—all varieties; illustrations of methods of planting, tilling, and harvesting; statistics of products and prices. 3. Oats. 4. Barley. 5. Rye. 6. Rice and its culture. 7. Buckwheat and other grains. 8. Grasses, various species; hay and haymaking. 9. Forage plants—clover, alfalfa, cowpea, cornstalks. 10. Ensilage—silos, etc. 11. Flours, meals, decorticated grains, etc.

The corn States made the most ostentatious and lavish display of cereals. Some of them obscured somewhat the practical and scientific objects of the exhibition by the decorative disposition of the exhibits and the profusion of emblematic, conventional, or naturalistic designs, all wrought in grains and grasses, with which every surface was bedizened. The decorations of Kansas, the Sunflower State, in its agricultural pavilion and in the State building, were remarkable for fertility of design, especially for the ingenious diversity of patterns worked from the ears, kernels, and husks of corn and cross-sections of the cobs. The Iowa pavilion was ornamented likewise with corn, mingled with heads of rye and wheat and grass, in varied fanciful arrangement of many-colored flowers, rosettes, garlands, and decorative panels. A masterpiece of the use of such materials for artistic purposes was found in the Illinois pavilion, a large landscape, representing a typical Illinois farm home, with its buildings, live stock, growing crops, meadows, and woodland, having an ornamental frame and a draped curtain, the whole made out of one hundred and twenty-five kinds of cereals and grasses.

One of the agricultural revelations of the Exposition was the advance that the middle West has made in mixed farming and the diversification and rotation of crops. The Illinois farmers, who raise two hundred million bushels a year of the chief American staple, exhibited also wheat, oats, barley, rye, buckwheat, grasses, and forage plants in great perfection. Many kinds of root crops were exhibited, too, by F. E. Bone, David Brumback, J. L. Burdick, T. P. Chester, A. Ernest & Co., E. S. Fursman, Leon Hay, Helms & Ripley, W. H. Hodge, M. A. Hooker, W. G. Kimmel, S. D. Larosh, Massac County Fruit-growers' Association, J. E. Nash, J. E. Seiler, C. W. Sibley, Adam Vaubal, and T. S. Weedman. Experimental plantings made in connection with the Fair showed that central Illinois is the most productive corn district, but that corn attains a greater size in the southern part of the State, where selected ears, when thoroughly dried, weigh seventeen ounces and three quarters, compared with fourteen ounces in the center and eleven ounces and three quarters in the north; and the stalks, which were fourteen feet and two inches in the center, were two feet longer in the south, but in the north two feet less in length. Illinois exhibited one hun-

dred and fifty-two varieties of wheat, eighty of oats, eighteen of barley, nine of rye, ninety-nine of field corn, twenty of pop corn, and nine of sweet corn, eleven of grass seeds, four of millet, six of clover, four of buckwheat, and of wild and cultivated grasses and sedges and clover one hundred and thirty-two species. In Iowa's exhibit of corn were one hundred and thirty varieties worked into a Pompeian palace. L. G. Clute, A. F. Collman, E. P. Wright, F. S. White, and E. H. Knickerbocker & Co. showed the principal grains and most of them root crops as well. The Ohio exhibit of cereals was very large and complete, comprising one hundred and thirty varieties of wheat, one hundred and twenty-eight of corn, thirty-seven of oats, and one hundred and two of grasses. The samples of corn and other cereals, thrashed and in the sheaf, that were sent from Indiana were also fine, and the special collection of wheat and oats in the stalk contributed by the agricultural experiment station of Purdue University was interesting. J. H. Everitt and John Goss had the most varied exhibits, excepting that of James Riley, of Boone County, who was one of the fifty-three exhibitors of corn, and exhibited also oats and seven varieties of wheat. Missouri had as full and large an agricultural exhibit as any of the States, with corn as its salient feature, illustrated by maps and crop statistics, but not deficient in any of the grains and nutritious grasses. George Folk, Lorens Geiger, William M. Peterman, A. S. Scarce, Fred Sessinghaus, and William G. Waters showed more than one kind of grain, others some specialty. Kansas also made a striking and profuse display of cereals. Over-ornamentation and fanciful decorative arrangements could not hide the magnificent results obtained from the rich prairie soil by the educated skill of Kansas farmers. The Indian corn from the crop of 1892 was unsurpassed in size and quality ; and when the examples of the crops of 1893 began to pour in, the Easterners wondered what will grow when it rains in a country producing such stuff in a year of drought. Stalks of corn were sent by G. W. Glick and S. C. King, of Atchison County, and T. A. Coulter, of Cowley County. From Kansas came Kaffir corn, grown in 1892 by Joel A. Stratton, of Reading, from seed raised in India the year before, excelling the growth of the grain in its native land. There were stalks of German millet sixteen feet and a half high. The samples of wheat, a crop of which Kansas produced seventy million bushels in 1892, were contributed by S. H. Cramer, of Ottawa, N. I. Dalton, of Topeka, S. Detweiler, of Hiawatha, H. W. Hoffman, of Salina, L. Landon, of Russell, among others, and weighed from sixty-three to sixty-five pounds a bushel ; oats from the farms of Thomas Anderson and F. Fry, of Salina, Charles Hatje, of Glasco, W. S. Lower, of Holton, A. C. Rait, of Junction City, J. E. Vanatta, of Belleville, and others, thirty-five to forty-two pounds. From the crop of 1893 were shown wheat, oats, millet, timothy, alfalfa, blue grass, orchard grass, and stalk corn. The new Territory of Oklahoma made a good showing of its progress and productivity in a collective exhibit of wheat, corn, sorghum, timothy, oats, and barley.

The Wisconsin exhibit of cereals and minor farm products gave evidence of the high state of cultivation in which its farms are kept. There were a thousand classes of exhibits, embracing all kinds of wheat, corn, oats, barley, rye, buckwheat, and seeds of timothy, blue grass, millet, clover, redtop, sor-



NEW MEXICO'S AGRICULTURAL EXHIBIT.

ghum, German vetch, and other forage plants and grasses of more than sixty kinds. Out of the six hundred and twenty-two exhibitors, J. C. Loomis, H. P. West, W. Harland, R. E. Parcher, Simon Thibendeau, A. Selle, H. Pansie, C. E. Angell, Thomas Davis, August Fehrmann, H. D. Wiepking, J. G. Martin, George Schley, J. W. Thomas, J. Vickerman, and Mark West exhibited from three to six cereals, and most of them beans or peas as well. The wheat, corn, oats, barley, rye, buckwheat, and clover in the diversified exhibit of Michigan gave proof of fertility of soil and diligent and intelligent farming. David Woodman, of Paw Paw, and A. W. Jewett, of Mason, exhibited the five principal cereals, and Frederick Hurtzell, A. C. Titus, Peter

Dewey, D. L. Avery, W. Clemens, T. Faverite, C. Lazell, and J. G. Reichart had three or four kinds of grain. The States of the Red River Valley made a magnificent showing of their wheat. Minnesota, which harvested forty-one million bushels in 1892, was as strong as any State in oats also, and by large and fine exhibits of barley, rye, even corn, and a great number of grasses, as well as legumes and root crops, showed its rapid advancement in the alternation and diversification of cultures. Barley was prominently shown to attract attention to this Minnesota product that is grown more and more extensively, mostly for export to Canada, to be there converted into malt. Francis Dick, of Afton, showed six kinds of grain; James I. West, of Leaf Valley, L. Loughbridge, of Warren, and Willis Chambers, of Havana, four; and T. J. Ryan and August Peterson, of Red Wing, three. The exhibit of South Dakota consisted mainly of wheat and grasses. There were two hundred and twenty-seven exhibitors. Four grains, besides grass, were shown by J. A. Fowles, G. S. Kartredt, James Keene, Austin Olson, Ole Overseth, and A. A. Ringheim; and five by Samuel Thorson. Specimens of the switch grass were thirty feet long. North Dakota showed wheat and other grains. Robert Fleming and Ferdinand Schindele had wheat, oats, and barley, and O. G. Meacham and E. P. Wells wheat, barley, and rye. The farmers of Bismarck and other places sent excellent corn.

An exhibitor of Irish oatmeal from Drogheda insisted that no good oatmeal could be made in America, as the oats are not heavy enough. His statement simply suggested to the prairie farmers that they must grow heavier oats. The Rocky Mountain States exhibited oats to compare with any, and Oregon proved itself a wonderful country of heavy oats and hard wheat and exuberant vegetation of every kind. The diversified exhibits showed that its husbandmen by no means confine themselves to wheat-growing. Barley and oats were as fine as the wheat; even the corn was good, and the grasses and forage plants were unsurpassed.

Of wheat, M. Wilkins showed two hundred varieties, and George Belshaw one hundred and fifty. The other principal exhibitors of wheat were John Allison, F. W. & M. S. Durbin, Ladd & Reed, Edward Lafave, George W. Olds, W. L. Simeral, and Amos Wilkins. Oats and barley or rye were exhibited by M. Wilkins, Amos Wilkins, Hamilton & Rourke, and Ladd & Reed. For exceptional fertility of soil, Oregon and all the world besides must yield the palm to the State of Washington, which showed one hundred and one bushels of wheat, of the Northwest Giant variety, from a single acre in Pullman, and one hundred and fifty-seven bushels of Shonan oats grown on one acre of a reclaimed tidal marsh in Skagit County. Timothy was shown nearly nine feet high. A typical exhibit collected by W. O. Bush, showing the resources of one Washington farm, included wheat, corn, oats, barley, rye, buckwheat, grasses, and alfalfa.

The exhibits of the Rocky Mountain States were an astounding revelation of the potency of irrigation and of the enormous resources that it has

already unlocked. Colorado, which now has four million acres irrigated and raises twenty million bushels of cereals a year, showed a great variety, both thrashed and in the stalk, all of prime quality. There were four hundred specimens of wheat, including samples of crops running fifty bushels to the acre; one hundred exhibits of oats, some of which ran one hundred and thirty bushels to the acre; seventy samples of barley and rye, including barley yielding eighty bushels an acre; and a hundred varieties of grasses and forage plants, among them the native grama and buffalo grasses, now supporting sheep ranches where herds of the bison once grazed. There were one hundred and sixty-three exhibitors, of whom F. M. & Henry Berry, J. H. Crowley, F. A. Doepke, J. B. Marshall, and Allen Ramsey exhibited four kinds of grain. Wyoming, which ranks only after California and Colorado in the extent of its irrigation works, displayed cereals and grasses not less prolific. M. R. Johnston, of Wheatland, and A. A. Lambrigger, of Sheridan, exhibited wheat, corn, oats, barley, rye, buckwheat, millet, grasses, clover, and alfalfa, and John H. Gordon, John McCormick, and M. A. Sonneberger four cereals. Nevada brought forty varieties of wheat and the barley, oats, corn, millet, and timothy that thrive in its rich valleys and on the irrigated plains, with luxuriant alfalfa. Montana, which is carrying irrigation ditches into the less favored localities, exhibited cereals from its abundant crops—thirty-three bushels of wheat to an acre, thirty-five of barley, and forty of oats was the average for 1892—and fine grasses and hay in great variety, including blue joint, blue stem, bunch grass, clover, timothy, and redtop. Baily & O'Donnell, T. W. Baker, V. E. Cline, Crawford Bros., D. Hackie, W. Spurgin, and others had varied exhibits. Idaho showed grain of fine growth and productiveness and many kinds of succulent grass. An exhibit of alfalfa showed the enormous product of one acre, from which three crops were taken in a season. There were some remarkable examples of luxuriant growth, such as cornstalks ten or twelve feet high bearing several full-grown ears.

The exhibit of wheat and other grains from New Mexico, comprising nearly five hundred specimens, revealed what is being done there in irrigation and cultivation. The Utah exhibit of cereals attested the value of a superior system of irrigation, and did honor to the assiduous and mutually helpful Mormon cultivators. David Cazier, John Titcomb, and C. L. Christenson showed wheat and oats, T. H. Hanson and C. I. Handley and others barley, W. Woodfield wheat and barley, Logan farmers corn, and J. C. Lemon and R. Jessup lucern seed.

A multifarious display was that of California, whence distinctive exhibits were sent from each county, varying with the great differences in latitude, altitude, and rainfall. On silken banners were proud inscriptions vaunting the agricultural advancement of the State, the wheat crop of forty million bushels in 1892, the barley crop of fifteen million bushels, used for horse feed and for malting, the largest crop of any State in the Union. Beautiful

grasses were used to deck the pavilions—wild oats from Alameda County eight feet high, and the feathery pampas grass, raised commercially by Mrs. H. R. W. Strong, of Whittier, and others. There were sheaves of wheat nearly eight feet tall from Placer County. Los Angeles, Sutter, and other counties made striking exhibits of grain—wheat, barley, oats, rye, and corn. Sacramento County had a wider range of exhibits, including buckwheat, Egyptian corn, and other grains. The farm of General John Bidwell, near



BRITISH GUIANA'S EXHIBIT.

Chico, furnished sixty-five varieties of wheat, twenty-eight of barley, ten of oats, six of rye, and six of corn. Mrs. Anna K. Bidwell contributed eighteen varieties of barley. The San Francisco Produce Exchange provided samples of the leading market varieties—of oats, four; of wheat, seventeen; of corn, eight; of buckwheat, two.

The University of California collected three hundred varieties of grain. The main hay crop of California—alfalfa—was well exhibited by J. Branch, A. Eddy, and W. P. Ramsaur. Of this, three or four crops of three or four tons to the acre can be grown on irrigated land.

Pennsylvania had a handsome and comprehensive exhibit of the standard grains, accompanied with statistical charts explaining the agricultural wealth



of the State, which was strikingly exemplified by three immense arches built of glass jars containing the plump fruitage of Pennsylvanian grain fields. A collection of one hundred and sixty-six native grasses was arranged by Dr. Thomas C. Potter. Wheat, corn, oats, and other products were exhibited by M. G. Greider, David Fansolo, P. F. Bottorf, J. S. Aten, S. H. Bennison, J. H. McGrann, Henry J. Miller, and M. M. Naginey among one hundred and sixty-nine exhibitors.

New York, though it has long since ceased to be the granary of the Western World, had an exhibit of the most highly developed and diversiform cultures of any State, which maintained its imperial predominance in agriculture. The cereal exhibit was a selected representative one, composed of twelve hundred and fifty samples of corn, barley, wheat, oats, rye, grasses, and grass seed. A systematic collection of the grasses of the State, with their seeds, was made by Daniel Batcheler. New Jersey had one hundred and twenty-five exhibitors of corn and other cereals and hay and fodder crops. Among over four hundred individual exhibitors, A. G. Aldridge, W. B. Pease, Daniel Pickett, M. F. Pierson, L. L. Sayles, H. C. Cook, J. Howland, William Fox, W. H. Fisher, and C. P. Gregory showed four or more cereals.

If the notion prevailed in some of the thriving new communities of the West that husbandry was a neglected and forgotten art in the East, the exhibit of the old Commonwealth of Massachusetts dispelled the error. There were stalks of corn bearing two, three, and four perfect ears. Fine samples were shown of field, sweet, and pop corn of very many varieties, and of wheat, rye, barley, oats, buckwheat, Japanese and other millets, and wild and cultivated grasses and clover. Of twenty-six varieties of field corn, the ears were all of the most perfect type. Stalks were exhibited rising from the small sweet corn, three feet high, to the Southern White, having a growth of sixteen feet. The value of commercial fertilizers was demonstrated by exhibits of the Bradley & Bowker Companies, showing two tons and a half of timothy an acre and other crops in proportion. C. E. Stebbins, of South Deerfield, had exhibits of all five staple cereals, and D. Frissell & Sons, Walter Cutting, Amos Denning, and H. W. Nichols showed three or four.

New Hampshire's corn and oats were placed in a pavilion built like an old New England granary. Maine had a somewhat meager but choice exhibit of corn, wheat, and buckwheat. R. N. S. Batchelder, Edwin F. Evans, C. W. Pulsifer, S. R. Abbott, J. C. McIntosh, W. H. Perry, M. Moore, T. C. Sweatt, and D. Whitcher exhibited a variety of grains.

The Southern States generally made no great effort to display their cereal crops. Kentucky's exhibit of grain and grasses was creditable; the corn was very fine, the thrashed wheat of a high order, and the meadow grasses and clover from the crop of 1893, with blue grass at the head, were unsurpassed. There were one hundred and fifty-three cereal exhibits; the greatest variety was found in those of E. N. Offut & Co., L. W. F. Cann, J. D. Clardy, W.

D. Drake, and J. H. Hart. Cereals and grasses were shown from North Carolina in more than three hundred and fifty classes. Most of the exhibits were made up of a variety of products; some had a good list, notably those of W. W. Boyce, Holt & Homewood, J. M. Gibbs, W. L. Kennedy, R. P. McAnally, D. L. McLain, A. J. Moye, W. S. Pharr, J. R. Rust, W. S. Terrell, R. L. Wyatt, A. A. Wolfe, R. H. Riggan, R. A. Brown, L. A. Bolinger, J. A. Bowditch, C. Canup, and Baron d'Alinge. Corn, wheat, and oats were a subordinate department of Virginia's agricultural exhibit, but these crops, with oats, were more prominent than tobacco in the exhibit of West Virginia, select and excellent in quality. Several farmers, as Jeff Jenkins, D. A. Foard, J. W. Councleman, R. T. Harvey, George McNeal, Mazwell Bros., Thomas Hartley, and J. M. Rowan, exhibited wheat, corn, and oats, and two hundred others one or two cereals or other produce.

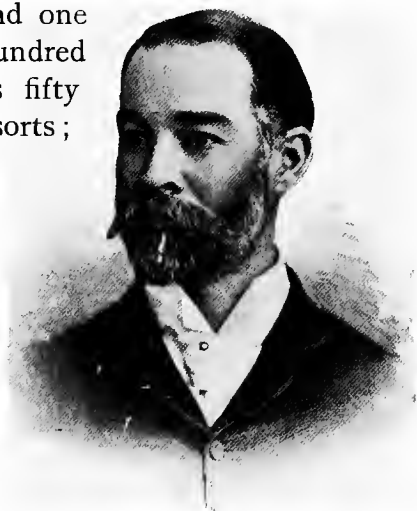
The representative exhibit of Maryland, prepared by the President of the State Agricultural College, included seven varieties of wheat, yielding from twenty-five to thirty bushels an acre; corn of twenty-six good varieties, giving from forty to eighty, and one Maryland variety, the Stephenson, even a hundred bushels an acre; oats yielding as much as fifty bushels; buckwheat and barley of the thriftiest sorts; orchard, evergreen lawn, timothy, and blue grass, scarlet clover, redtop, and crimson clover. The heaviest crops of wheat were obtained from the Longberry by Thomas Pierce, and from Everts Smooth Head by R. J. Williams.

Louisiana had a collective exhibit of cereals and grasses and a large one showing the quality of its rice crop and the processes of cultivating, harvesting, and milling.

North Carolina also exhibited rice, while South Carolina was unrepresented. Rice and rice products were very prominent in the Florida exhibit.

The exhibits of the principal foreign rice-growing countries afforded an opportunity of comparing their product and methods of cultivation and treatment with the American. There were eighty-one exhibits of rice from Japan; rice in the husk and cleaned rice from Mexico, Porto Rico, Trinidad, British Guiana, Brazil, Argentina, Johore, and Siam; exhibits of the French local administrations in Cochin China, Tonquin, and New Caledonia; and forty-two varieties of paddy exhibited by the Ceylon Commission. The Siamese Government exhibited gluten rice and rice of various kinds on the stock.

In the United States pavilion were exhibits of wheat from Neils Anderson and G. W. Baker, of Utah, George Belshaw, of Oregon, and Holden



J. J. QUELCH,  
Commissioner from British Guiana.

Ferguson, of Missouri, and of corn from J. King & Chambers, of South Dakota. The Albert Dickinson Company, of Chicago, had exhibits of pop corn, ensilage, and clover and other seeds; E. W. Conklin & Son, of Binghamton, N. Y., exhibited recleaned timothy, and the Noyes Whitney Seed Company timothy and clover seed; Peter Henderson & Co., of New York, who gave assistance to the New York commissioners, had field seeds; also Samuel Wilson, of Mechanicsville, Pa. Winterhoff & Wessel, of Lansing, Ill., exhibited curled grass.

Canada made a very full exhibit of cereals, with the aid of the Government experimental farms at Ottawa, Agassiz, Brandon, Nappan, and Indian Head.

The Mexican agricultural exhibit was very full, comprising two thousand varieties of grains and seeds. The principal cereals were corn, wheat, and barley. There were good samples of Mexican hay. The same cereals were shown by Costa Rica. Brazil's cereal exhibit proved that it has large areas capable of producing good corn, barley, rye, and oats. There was a collection of the strange and beautiful grasses of Brazil. The Argentine Republic had over six hundred exhibitors of wheat and corn. Uruguay exhibited all the familiar species of grain.

Great Britain, with a decreasing wheat area and a crop in 1892 of 58,500,000 bushels (less than that of some of our States), still instructs the world in cereal farming, getting an average crop of thirty bushels of wheat an acre, weighing from fifty-seven to sixty-four pounds to the bushel, and of oats thirty-nine bushels an acre. From the agricultural experiment grounds of R. and J. Garton, at Newton-le-Willows, Lancashire, were sent ears and grain, the result of experiments carried on for thirteen years in the improvement of the cereals of all countries by a prolonged course of artificial fertilization and selection. W. H. Mold sent from a farm in Kent a single root of wheat, the produce of one seed, which bore seventy-six heads, with about forty-five hundred kernels. Samples of the grain and malt from which Scotch and Irish whiskies are distilled were shown by the Bowmore distillery and Sir John Power & Co.

There was a representative display of the cereals, meadow grasses, and forage plants of France in sheaves and grain; also of the excellent wheat and the barley and oats of Algeria, and of wheat, millet, and barley from Tunis. Spain sent a comprehensive exhibit of summer, red, and winter wheat, barley, rye, and corn. Of the superior wheat and other grains of Italy there was a small exhibit. Germany, whose well-cultivated soil yields fifty bushels of wheat to the acre, and other grains in proportion, showed a few samples of cereals. Barley and various seeds were noticeable in the Austrian exhibit, and Hungary sent samples of its prolific crops.

The numerous agricultural schools, museums, and model farms of Russia, such as the Petrovskaja Agricultural Academy, the Imperial Agricultural Museum of St. Petersburg, the farm of the Institute of Agriculture and

Forestry, and the experimental farms maintained by the Ministry of Domains in Kharkov, Kazan, Mogilov, Saratov, and Kiev, assisted by the exchanges of Riga, Rostov, Odessa, and Nikolaiev, and by many scientific agriculturists who farm on a large scale with machinery, sent samples of seeds and stalks of wheat and rye, and also forage plants, oats, millet, corn, barley, buckwheat, and clover. Farmers from far Siberia exhibited their oats, barley, rye, wheat, and native buckwheat. A dozen of the co-operative peasant farms of Yeniseisk had exhibits of local wheat and other grains, Australian oats, and Himalayan barley. A cultivator of Bessarabia showed the forage plant mogora.



CAPE COLONY'S EXHIBIT.

The exhibits of wheat from South Africa were of remarkable quality, some samples from Cape Colony weighing seventy pounds to the bushel. The Government of the Orange Free State had a varied exhibit of wheat, mealies, oats, barley, barley wheat, and forage crops. The cereals of New South Wales were interesting, especially the maize, of which the colony exports considerable quantities. A collection of the grasses and other plants of New South Wales accompanied the exhibit, which was profusely decorated with Indian corn.

The Persian Government exhibited the grains of the country. There was some diminutive corn from Liberia. In the Javan section were rice and other grains. Some unfamiliar farinaceous products were soldome from Uruguay, guinea corn from Curaçoa, and jicamus, scarlet grain, porotillo, and guaviduda from Ecuador.

Among the exhibits of wheat flour, that of the millers of Minnesota took the rank to which the magnitude of their industry and the perfection of their product entitle them. In their flour pavilion were exposed one hundred and fifty-three distinct brands, to seventy-three of which awards were granted—nearly half the total number given to all exhibitors, American and foreign. A model of the Washburne-Crosby plant in Minneapolis showed the recent improvements in milling, and the contrast between new and old methods was strikingly presented by the Duluth Imperial Mill Company, which placed its models of the machinery used in the patent roller process inside an old-fashioned mill with a wooden overshot water wheel—a reproduction of a mill that has been running a century and a half near Reading, Pa. California millers exhibited flour, Graham flour, rolled oats and barley, semola, oat groats, oatmeal, hominy, buckwheat flour, cracked wheat, breakfast food, etc. Some Nevada flour received a certificate. In the United States pavilion were the further flour exhibits of the R. T. Davis Mill Company, of St. Joseph, Mo.; the Hungarian Mills, of Denver, Col.; the Listman Milling Company, of Superior, Wis.; the L. C. Porter Milling Company, of Winona, Minn., which exhibited a flour-testing system; the Sessinghaus Milling Company, of St. Louis; and the Charles Tiedemann Milling Company, of O'Fallon, Ill. The Charles Pope Glucose Company, of Chicago, exhibited corn meal, and Stein, Hirsch & Co. potato flour. The Chicago Sugar Refining Company prepared an exhibit of thirty different non-alcoholic products of Indian corn.

Russian mills exhibited rye and wheat flour, buckwheat grits, pearl barley, and bran. There were flours from New South Wales, from Algeria, from the Argentine Republic, from Brazil, from Uruguay, from Mexico; French flour and meal; flour, meals, grits, and decorticated grains from the Orange Free State; rice flour and other flours from Siam; flour, cornmeal, and oatmeal from Ontario; and patent oats and barley for invalids from England.

Farinaceous foods and breakfast cereals were exhibited in endless variety by millers in various parts of the United States. The American Cereal Company, of New York, had girls clothed in Quaker drab serve visitors with Quaker oats. The Pettijohn Company, of Minneapolis, displayed its specialty, and Woodward & Crofut, of Chicago, cereal flakes. Minnesota and California exhibited a great variety of preparations of wheat, oats, corn, and buckwheat. A Copenhagen firm had some nourishing dietetic powders.

The second group of agricultural exhibits was that which included bread, biscuits, pastes, starch, and gluten, embracing the following classes: 12. Bread and its manufacture, baking powder, yeast and its preparations. 13. Cakes

and pastry. 14. Biscuit industry ; crackers of all kinds. 15. Italian paste, semolino, vermicelli, macaroni, etc. 16. Starch and its manufacture from all sources—from cereals, tubers, arrowroot, plantain, cassava, manioca, tapioca, sago, pearl flour, etc.

The American Biscuit & Manufacturing Company, of Chicago, the United States Baking Company, of Pittsburg, the William Schmidt Baking Com-



AN OLD-TIME FLOURING-MILL.

pany, of Chicago, and the New York Biscuit Company displayed all kinds of crackers and biscuit ; Margaret H. Bailey had an exhibit of old-fashioned beaten biscuit, and the People's Bread Company, of Madison, Wis., exhibited gingerbread. In the English section, which was mainly filled with food and drink exhibits, biscuits and other preparations of flour were conspicuous. Custard and egg powders were exhibited by England and Australia. Crackers and biscuit of innumerable kinds were displayed by American bakers. Wheat biscuits were brought, too, by many exhibitors from Spanish-American countries and others made from tropical farinaceous meals and from Indian corn, such as the tortas of Ecuador and the totopa of Mexico. Deventer cake from Holland and gingerbread from Belgium and Russia were noteworthy European products. Rice biscuits and other biscuits were shown from Siam. French bakers exhibited bread and fine biscuits. Parisian proficiency in this craft was illustrated by the apparatus of a model bakery.



The Middleby Oven Company, of Boston, placed bakers' ovens on exhibition, and J. A. De Muth, of St. Joseph, Mo., had a kneader and biscuit machine.

Baking powders were displayed impressively in the United States pavilion. The Rumford Chemical Works, of Providence, R. I., called attention to the acid-phosphate preparations of Prof. E. N. Horsford's invention. Mixtures of bicarbonate of soda and cream of tartar were exhibited by H. D. Thatcher & Co., of Potsdam, N. Y. ; the Price Baking Powder Company, of Chicago ; the J. P. Dieter Company, of the same city ; and E. R. Durkee & Co., of



MINNESOTA'S AGRICULTURAL EXHIBIT.

New York. The National Starch Manufacturing Company and E. W. Gillett, of Chicago, exhibited yeast.

Macaroni and other farinaceous pastes were exhibited by Italy in the manifold variety known in that country. The number of other countries that exhibited Italian pastes was surprising. Besides France and Algeria, whose glutinous macaroni is widely known, Spain, Mexico, Ecuador, Paraguay, Argentina, and Costa Rica showed vermicelli, macaroni, and soup pastes, more successful often than the American product ; and even countries of the far East, as Tonquin, Siam, and Johore, had exhibits, while a dozen makers showed Japanese vermicelli. The American exhibitors of these

pastes were Canepa Bros., of Chicago ; the Chicago Macaroni Manufacturing Co. ; the Columbia Macaroni Manufacturing Company, of New York ; and A. F. Mazza & Co., of Denver.

Of starches and feculas, the Spanish colonies in the East and the West Indies, Jamaica, Mexico, New Caledonia, Brazil, Paraguay, and other tropical countries furnished cassava, tapioca, and manioc meal and starch ; banana meal and starch came from Jamaica ; yucca flour from Costa Rica ; bean flour from Cambodia ; and manive and sago starch from Mexico. Brazil exhibited also green corn, carnahuba, chique-chique, and pumpkin starch. In the pavilion erected by the Sultan of Johore, sago, the chief product of his dominion, was exhibited in flour and in cakes, with the tools with which the pith is extracted from the palm, grated into powder, and kneaded with water into the commercial form. There was also sago from Siam. Arrowroot was shown in various forms from Jamaica and other American countries, from the Philippine Islands, from Teneriffe, from New South Wales, and from Ceylon. Rice starch was exhibited by France and other countries. Japan had a large exhibit of starch, and starch from potatoes and from grains was exhibited by European countries. Of starches from Indian corn for the laundry and for food, the firm established by Thomas Kingsford, inventor of the process, in Oswego, N. Y., made a striking exhibit. Starches were also exhibited by the National Starch Manufacturing Company, of New York ; the Nebraska City Starch and Cereal Mills ; the Charles Pope Glucose Company, of Chicago ; Stein, Hirsh & Co. ; the Chicago Sugar Refining Company ; and William Barnett, of Philadelphia.

In the California pavilion were exhibits of semola, farina, etc. Semolino was exhibited largely by Russia and Algeria.

The third of the agricultural groups of exhibits was that of sugars, sirups, confectionery, etc., comprising the following classes : 17. Sugar cane, its cultivation and treatment ; manufacture of sugar. 18. Cane sugar, sirup, molasses, etc. 19. Grape and fruit sugars. 20. Beet-root sugar. 21. Maple sugar, sirup, etc. 22. Palm sugar. 23. Milk sugar. 24. Sorghum, its culture and uses, and preparation of sirup and sugar. 25. Glucoses, etc., prepared. 26. Honey bees and honey ; hives and appliances. 27. Confectionery, confections, etc.

Sugar naturally was the largest part of the Louisiana exhibit. The walls and pillars of the sugar pavilion were composed of sugar cane. A collection of photographs presented by the New Orleans Sugar Exchange pictured the laborers toiling in the cane fields, the mills in operation, the sugar heaped in the warehouses and the buyers and sellers trading in the Exchange. The methods of planting and cultivating the cane and of producing sugar and molasses were illustrated. Sugar cane was exhibited by Florida. A complete exhibit of raw and refined sugars and sirups was furnished by the American Sugar Refining Company. G. W. Dunbar Sons, of New Orleans, exhibited sugar cane and sirups, as did Hamilton Disston, J. J. Dunne,

Arthur C. Jackson, J. Z. Kreamer, R. E. Rose, and Louis Wiselogle, all of Jacksonville, in the Florida pavilion. There was a large display of Cuban raw sugars, and Brazil also had a big exhibit. Sugar and moscoboda and sugar cane were brought from Mexico. Porto Rico had a plentiful display. The British Guiana exhibit contained raw sugar and the Demerara crystals of all grades, as made for the various markets. Samples of Queensland sugar were shown in the pavilion of New South Wales. Jamaica exhibited raw sugar from many plantations. Cane and sugar were exhibited also by Guadeloupe, New Caledonia, Paraguay, Argentina, Costa Rica, Ecuador, Tonquin, and Mayotte.

California, which has some of the largest beet-sugar mills in the United States, made a good showing of the sugar beet, of which nearly fifteen thousand tons are produced every year. France exhibited raw and manufactured sugar of all classes. The Belgian Association of Manufacturers made an exhibit; there was one also from Italy; and there were many samples of sugar-beet seeds in the Russian section, also the products of extensive beet-sugar works and refineries.



MARQUIS ENRICO UNGARO,  
Commissioner General from Italy.

An excellent exhibit of Vermont maple sugar and sirup was furnished by forty-eight individuals. The sample of W. R. Dean was chosen by the judges as the standard of sirups in flavor, color, and thickness. There were good exhibits also from Ohio, New York, Minnesota, New Hampshire, Massachusetts, and Canada.

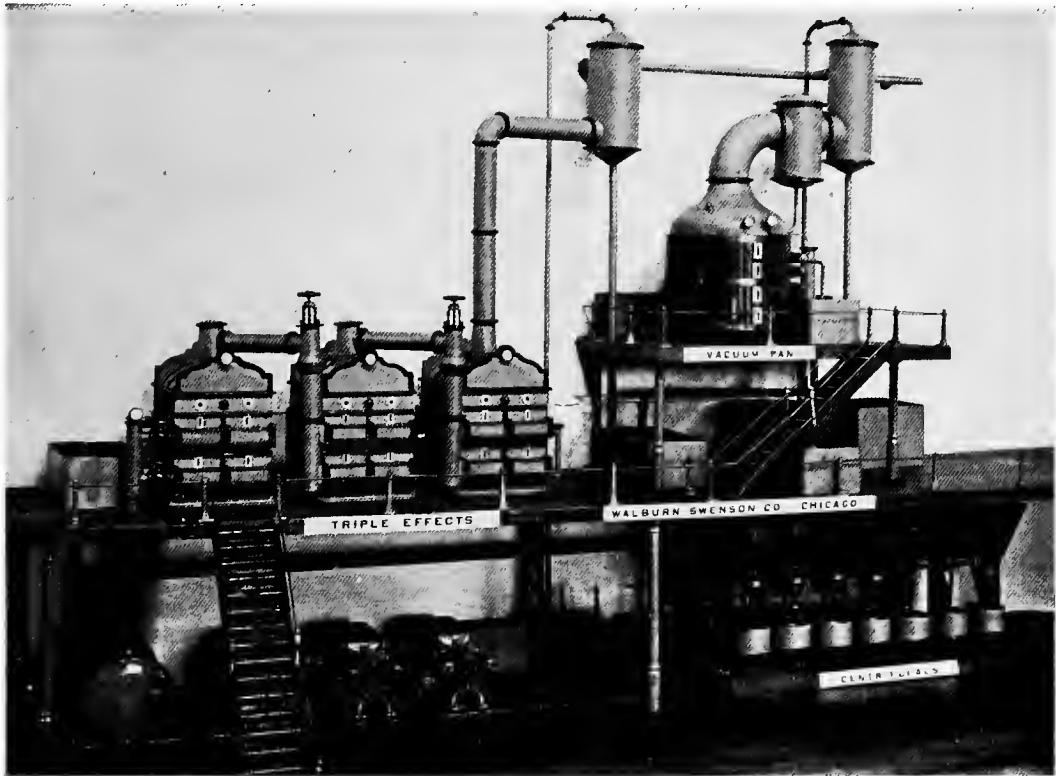
Jaggery, or palm sugar, was exhibited in sirup and in the crystallized form in the Ceylon pavilion, and formed a part also of the exhibit of Johore. Sorghum with its seed and sorghum sirup formed a conspicuous group in the North Carolina exhibit.

There was a display of sorghum sugar and sirup from Kansas and of canes of many varieties. Malcolm Little, Isaac McKeel, and James McMillan, of New York, and Seth Kennedy, of Minnesota, exhibited the cane and amber sirup. Illinois had numerous exhibits of cane, which was shown also by Missouri and Oklahoma, and from the irrigated lands of Nevada and Colorado. T. W. Mendenhall exhibited sorghum from Whittier, Cal.

Glucose of all grades, crystallized and other grape sugars, and sirups, with the associated products of maize—starches, gluten, dextrin and gum, bran feed, oil, and oil cake—were exhibited by the Chicago Sugar Refining Company. The National Starch Manufacturing Company, of New York, and the Charles Pope Company, of Chicago, had exhibits of glucose and grape sugar. A French and a German concern exhibited their forms of these products, while from Japan came twenty-two individual exhibits of glucose.

Grape sirup was exhibited by F. Albertz, of Cloverdale, Cal. Strange saccharine products were bagazo, sorghum honey, and camoati from Argentina, and the sirups of cajú and cacau from Brazil. A sweetening substance belonging in another department, a wonderful chemical product called saccharine, derived from coal tar, five hundred times sweeter than sugar, was exhibited in the German section.

Apparatus used in the production of the various sugars was shown by American manufacturers; sugar pumps by H. R. Worthington, of New York; cane mills and evaporators by the Chattanooga Plow Company;



A BEET-SUGAR PLANT.

spouts and bucket hangers by C. C. Post, of Burlington, Vt.; an evaporator for maple sap by the Warren Evaporator Works in Ohio; sugar pumps; and a beet-sugar plant by the Walburn-Swenson Company, of Chicago.

The bee exhibit consisted of six hives of bees, comprising two colonies of leather-colored Italian bees, one of golden Italian bees, two of Carniolan bees, and one of common black bees. It was designed that the bee exhibit should be a practical demonstration of the methods of producing both comb and extracted honey, and accordingly openings in the wall of the building were made so that bees might fly from and to their hives in the natural way. Inasmuch as the six hives of bees produced during the summer, under the most unfavorable circumstances, two hundred and fifty-two pounds of honey,

one hundred and twelve pounds of which was in the comb, this part of the apiarian exhibit was successful beyond expectation. Honey in various marketable forms, honeycomb, and wax were shown in the collective exhibit of American beekeepers' associations. The honey was classified, according to the flowers from which it was derived, into white-clover, basswood, white-sage, buckwheat, orange-flower, and other varieties. From Attica, N. Y., was sent a mass of honey weighing one hundred pounds, made by a single colony. There were many samples of the honey gathered from the flowers of California. The Minnesota varieties were in an exhibit of the Beekeepers' Association of that State, in which was granulated honey. Wisconsin, Nevada, and other States, North and South, had exhibits of honey, the finest of all from Nebraska. Canada also sent many samples. Honey and wax and articles made from wax formed a part of very many foreign exhibits. Honey of many flavors came from Costa Rica, Trinidad, and South American countries. There was agave honey and other kinds from Mexico. New South Wales made a considerable exhibit. Honey was brought from Tonquin, Algeria, and New Caledonia. There was the famous honey of Spain, and Athens sent the honey of Hymettus. The British Beekeepers' Association had a collection of a thousand pounds of extracted honey, contributed by one hundred members, with the books and lecture apparatus used in giving the course of instruction for which the British Government grants money. An English exhibitor had confectionery, biscuits, and medicines containing honey. The Russian Bee-breeding Society and the Bee-breeding Museum of St. Petersburg exhibited beehives and apiarian appliances. A Siberian breeder sent, with specimen bees and honey, a collection of honey plants. A Bavarian apiary was exhibited, with its products. The methods and appliances of Austrian beekeepers were exhibited, with samples of wax and manufactures of wax. The apiary display included working colonies of bees from New York, and specimens of Italian bees bred in Costa Rica were exhibited. An Ohio maker, A. I. Root, exhibited many kinds of appliances for bee culture. From Minnesota straw hives and other kinds and the latest improved apiarian contrivances and apparatus were placed on exhibition. Matthew E. Hastings, of New York, A. G. Hill, of Kendallville, Ind., and W. H. Putnam, of River Falls, Wis., also exhibited hives and beekeepers' supplies.

Several countries exhibited their favorite kinds of confectionery. The makers of chocolate tablets and bonbons, several of whom obtained the privilege of building pavilions outside for the sale of their luscious and nutritious wares, gave their exhibits a sumptuous setting. Henry Maillard, of New York, had a heroic statue of Columbus and copies of the Venus of Milo and Minerva carved out of chocolate, each statue weighing nearly fifteen hundred pounds. A German exhibiting firm, Stollwerck Brothers, of Cologne, had a temple made out of thirty thousand pounds of chocolate and cocoa butter to enshrine a statue of Germania, ten feet high, sculptured out

of a solid block of chocolate, resting on a pedestal of huge chocolate blocks. The booth of the Walter M. Lowney Company, of Boston, was a temple of Vesta. The Paris houses of Menier and Potin, and Matte, of Montpellier, displayed their chocolates with tasteful elegance. Belgian sugar bakers showed chocolate and confectionery. There were Russian gingerbread, marchpane, and other sugar and honey confects; Spanish fruit and almond



STOLLWERCK BROTHERS' PAVILION.

confectionery and orange-flower sirup; Japanese confections and canned wafers; French chestnuts in sirup, sugar candy, and bonbons in incalculable variety; and Italian almond and honey cake, caramels, and candies. Sweets were shown from Brazil, prepared from guava, figs, and other ambrosial southern fruits, and the Argentine, Costa Rican, and Mexican confections. In the United States pavilion J. W. Hall, of Portland, Me., displayed checkerberry, sassafras, and peppermint wafers. Curtis & Sons, of the same town,



had a booth filled with spruce chewing gum, and other kinds were shown by F. Borg, of Chicago, and Croft & Allen, of Philadelphia, and the Confectioners' and Bakers' Supply Company, of Chicago, exhibited confectionery.

A French dealer in vegetable colors for cooks and confectioners had an exhibit. Confectioners' cartoons were placed on view by Overbaugh & Hartman, and ornaments by Schall & Co. and Dietrich & Co., of New York.

The fourth group of agricultural products consisted of potatoes, tubers, and other root crops, and was subdivided into the following classes: 28. Potatoes, sweet potatoes, yams, etc. 29. Sugar beets, mangel wurzel. 30. Carrots, turnips, beets, artichokes, etc. 31. Peanuts; methods of cultivation, statistics, etc.

One of the most comprehensive exhibits of potatoes was made by the Agricultural College of Oregon, a State claiming to grow as fine vegetables and tubers as any in the world. This embraced two hundred separate varieties. The seeds of Oregon varieties of vegetables, among them the Yellow Danvers onion, were furnished by the O. Dickenson Seed Company, of Salem, to be freely offered to visiting farmers. Seeds of the grain that grows to such perfection in Oregon were also given away. Potatoes from California, where they and other winter vegetables are now planted for the Eastern markets, were fine in quality, and some of them, as also beets and other garden produce, were enormous in size. There was an attractive exhibit of fifteen kinds of potatoes from Nevada, in which one potato weighed fifteen pounds and three quarters. The central and provincial experimental farms of the Canadian Dominion had a superb exhibit of potatoes and tubers. The exhibit of potatoes was a special feature of the collective display of New York produce. Specimens of two hundred and fifty varieties were selected from special plantings made in the spring of 1893, with a great many samples, obtained from many different localities, of the ten leading market varieties. Potatoes were exhibited by Maine and Massachusetts, by Illinois, by Iowa, by Minnesota; Washington showed them of vigorous growth, and Montana had an abundant exhibit.

Germany, which raises potatoes of prolific yield in enormous quantities, showed specimens; France and Spain had exhibits; the product of the Orange Free State was exhibited by its Government, with samples of the common potato, as well as of sweet potatoes. Sweet potatoes were exhibited by Illinois, Iowa, Florida, and other States, and by Brazil, Costa Rica, and Cambodia. There were yams from Illinois to compare with yams from Brazil. Costa Rica exhibited yams and other roots for starch. The manioc root was shown by Brazil and the Argentine Republic.

There was a liberal display from Illinois of sugar beets, mangel wurzels, and turnips, which were shown also by Maine, by Michigan, and by Washington; carrots by New Jersey, Illinois, Washington, and New York; Jerusalem artichokes by Illinois. Onions were on exhibition from Massachusetts, Minnesota, and Washington; radishes from New Jersey and from

the irrigated lands of the Rocky Mountains. Utah had onion and carrot seed.

Russia exhibited sugar beets, fodder beets, cartots, and turnips. Austria sent seeds of sugar turnips; Spain specimens of its beets. French methods of cultivation and selection of seed for ennobling beets and other plants were presented. Garlic was exhibited by Brazil and other countries.

Peanuts formed one of the groups into which North Carolina's exhibit was divided. There were many exhibitors from New Jersey, too, and representative or competitive displays from Illinois, Louisiana, and Virginia. Varieties of this valuable root crop raised in warm climates for oil or for food were shown from the whole round of the earth. Argentina had twenty-two exhibits; Brazil a good assortment; French Guiana, New Caledonia, and Tonquin showed their products; and there were peanuts from Mexico, from Curaçoa, from Paraguay, and from Liberia.

Some strange esculent roots were exhibited by the sister republics of America, such as the matarana and inhambú of Brazil and the makal box and macalitos from Campeachy, in Mexico. Costa Rica showed chayote root and potatoes in alcohol, and Mexico the wild potatoes that grow there.

The fifth group of exhibits, made up of products of the farm not otherwise classified, was not divided, but formed Class 32, including broom corn, pumpkins, squashes, peas, and beans as crops.

Brooms made from the broom corn extensively raised in the State were used in the decoration of the Nebraska pavilion. There were large exhibits of broom corn from Illinois and Missouri, and lesser ones from Michigan, Indiana, and Oklahoma. There was also a good exhibit of this plant from the Argentine Republic.

Peas were exhibited by a great number of Wisconsin farmers, and the farmers of Illinois and of Maine had large exhibits, while a select and diversified one was sent from New York. Utah was well represented too, and smaller exhibits were made by Michigan, Indiana, New Jersey, Virginia, Oklahoma, and Washington. Of the foreign countries, Russia made a considerable exhibit, and there were small ones from Algeria and New South Wales. The Canadian experimental farms sent samples of the peas and beans grown in the Dominion. The products of French culture were included in a representative exhibit of all the farm vegetables of France.

Beans were a prominent feature in the New York exhibit, which contained nearly a hundred varieties. California made a large exhibit of Lima



MILTON O. HIGGINS,  
Commissioner from Curaçoa.

and other beans, of which the crop there is fifty thousand tons a year. There was also a fine display from Ohio, but the largest and fullest of all was Wisconsin's. Michigan showed field, wax, pea, and Lima beans. The bean display of North Carolina was extensive and good. New Hampshire had a large exhibit of field beans; Maine and Massachusetts exhibited various kinds, and New Jersey a large variety, and there were exhibits from Indiana, Iowa, Kentucky, Oklahoma, and Washington. The largest of the State exhibits was eclipsed by that of Mexico, and the State of Ceara, in Brazil, had one almost as conspicuous, while other parts of Brazil sent some samples, and Ecuador, among other South American countries, made an exhibit. There



EXHIBIT OF BEANS FROM WISCONSIN.

was also a considerable display from Japan of its specific varieties of beans. There were several Russian exhibitors, and the agricultural academy near Moscow sent a collection of the Russian varieties. The Orange Free State showed its types, Spain sent French beans, and there was a small exhibit from Algeria.

There was a good exhibit of lentils grown in Wisconsin. Lentils were exhibited, with chick-peas and vetches, by Mexico and Ecuador; chick-peas and vetches by Spain also; and lentils by the Cape of Good Hope. The Orange Free State exhibited its Kaffir corn. Castor beans grown in the

United States were seen from New Jersey, Missouri, and Oklahoma; and they were exhibited also by Mexico and, grouped with oil seeds, by several other countries. Austria had an exhibit of shelled pulses. Brazil exhibited lupines.

The garden State of New Jersey gave evidence of its intensive and highly specialized cultivation by the remarkable variety of products raised there on an agricultural scale—not only the market vegetables, such as radishes, spinach, celery, table beans and peas, carrots, turnips, lettuce, eggplant, salsify, parsnips, and asparagus, or the ground fruits, such as tomatoes, cucumbers, citron, canteloupes, watermelons, squashes, pumpkins, and gourds, and the seeds of all these and of flowers, but herbs, like lavender, sage, anise, catnip, smartweed, boneset, and tansy. North Carolina produced the fruits of some peculiar cultures, as sunflower seeds, Kaffir corn, teosinte roots, and deer's-tongue. Vegetable seeds were exhibited from Ohio and New York. One large cultivator of Ohio exhibited a hundred and thirty-eight varieties of vegetables. Princess Anne County, Virginia, also contributed vegetables. California and Florida exhibited melons; Montana, tomatoes and vegetables of various kinds; California, fodder cabbage. Pumpkins and squashes were shown by California, Illinois, and New Jersey. There were numerous samples of okra from New Jersey. Canary seed and watermelon and vegetable seeds were shown by Mexico. There was a typical exhibit of the vegetables grown in New Caledonia.

The sixth group of products, preserved meats and food preparations, included the following classes: 33. Dried meats; jerked beef. 34. Smoked beef; hams and bacon. 35. Salted meats. 36. Canned meats, including fish, flesh, and fowl, pâtés, sardines, lobsters, oysters, etc. 37. Meat extracts; soups and food preparations. 38. Extracts of beef. 39. Milk, dried or in cans, evaporated or condensed. 40. Milk and coffee and similar preparations, in tin or glass.

Dried beef, hams and bacon, sugar-cured meats, salted meats, and other provisions were strikingly and plentifully exhibited by the packing companies of Chicago, and by their competitors in Omaha, Kansas City, Cincinnati, Boston, and New York. The packing houses of Armour and Swift attracted great numbers of sight-seers during the Fair. Their exhibits embraced all the edible parts of beeves, hogs, and sheep cured in every form. The North Packing and Provision Company, of Boston, and Nelson Morris & Co., of Chicago, were of like character. The Anglo-American Provision Company, of Chicago, displayed hog products. Canned meats and soups were exhibited by Armour & Co., of Chicago; the Armour Packing Company, of Kansas City; Burnham & Morrill, of Portland, who exhibited also baked beans, canned lobster, mackerel, clam extract, and chowder; the Fairbank Canning Company, of Chicago; the Franco-American Food Company, of New York, whose exhibit included game pâtés and other delicacies; J. H. W. Huckins & Co., of Boston, who showed sandwich meats and other

specialties; Libby, McNeill & Libby, of Chicago, one of whose specialties is potted meats; and F. Tanty & Co., of Chicago, who showed canned game, meat patties, and plum pudding. Henry Humbert & Co., of Brooklyn, had jelly and soup for the sick; the T. A. Snider Preserve Company, of Cincinnati, home-made soups and catsup; the National Pure Food Company, of Cincinnati, soups and plum puddings; Curtice Brothers, of Rochester, canned meats, plum puddings, catsup, and all the Northern vegetables and fruits; the American Ready Food Company, of Chicago, condensed soups; Elise Strauss, of St. Louis, various food preparations; and the Curtice-Olney Company, of



EXHIBIT OF BOVRIL, LONDON.

showed Edwards's desiccated soups and preserved potato; Maconochie Brothers, preserved fish, meats, soups, and vegetables. The Liebig Company had a large exhibit of canned and preserved meats. Jubal Webb exhibited hams, and Idris & Co. meat preparations.

Canada exhibited hams and bacon and canned meats; Mexico, dried and salted beef. Salami and salted meats, canned tunny, anchovies in brine, and other alimentary products of Italy were in the familiar packages. Prepared soup, canned meats, anchovies, and sausages came from Spain. There was an exhibit of prepared food for infants from Barmen, Prussia, and exporters of canned sausages, game, and meats, and Strasburg goose-liver pies, exhibited their savory commodities in considerable variety. In the French section were truffled liver pies, sardines in oil, and canned food in the greatest

Rochester, canned corn. The H. J. Heinz Company, of Pittsburg, showed fruit butter, and canned vegetables were shown by the Erie Preserving Company, of Buffalo; Jacob H. Groves, of Portland, and the Chipped Potato Company, of Travers City, exhibited potato chips; Leopold Schepp, of New York, prepared cocoanut; the Barnett Produce Company, of Chicago, sauerkraut. Cross & Blackwell had preserved meats, soups, fish, and vegetables, in the English section. Frederick King & Co. showed Edwards's desic-

variety, besides hams and spiced sausages. In the Swedish pavilion were her-ring, anchovies, caviare, pudding, fish balls, and preserved crawfish tails. Caley & Co. sent ox tongues, and the Prof. Kemmerich Meat and Extract Company, extracts of meat and preserved meats from the Argentine Republic. The Sydney Meat Preserving Company and the Australian Meat Company exhibited their products and the processes of preserving meat employed in New South Wales, whence other exhibitors sent egg powder and tomato sauce. Specimens of ham, preserved deer tongues, and canned meats were submitted by Russia, and smoked tongue, hams, and ham sausage by Brazil, in whose pavilion the Brazilian Extract of Meat and Hide Factory exhibited canned meat, tongue, and ox tails. Belgium showed canned goods. There were canned meats in the Japanese section. Salted and smoked fish were shown by Siam, salted egg and other food preparations by Johore. Costa Rica had prepared cocoanut. The Liebig Company and other establishments that work up for the world's market the carcasses of the cattle of the pampas exhibited preserved meat, ox tongues, sausages, meat meal for feeding, and other preparations.

American exhibitors of extract of beef were the Cudahy Packing Company, the Bovine Company, Libby, McNeill & Libby, Nelson Morris & Co., and Swift & Co. In the pavilion of Uruguay the Liebig Extract of Beef Company displayed its extract and various by-products of its immense works at Fray Bentos; Garcia, Villemir & Valdez, liquid beef extract. In the British pavilion Bovril, Coleman & Co. and the Liquor Carnis Company had meat juice and extracts and preparations therefrom. W. F. Schmoele & Co., of Antwerp, had extract of meat, and in the pavilion of New South Wales it was shown from great establishments in Sydney and Ramornie. Extract of beef was shown in the Japanese pavilion.

Condensed milk, which is consumed in the United States and exported in such quantities as to require four hundred million gallons a year, was appropriately displayed in the United States pavilion by the Gail Borden, Elgin, Helvetia, and Howell companies, which showed also evaporated and sterilized cream. The Matzoon Company, of Chicago, exhibited fermented milk foods; Markar G. Dadirrian, of New York, matzoon and matzol; and the American Lactose Company, of New York, milk sugars. Of the foreign exhibitors, H. Abel showed condensed milk in tins from Denmark; a French company milk sterilized and condensed.

The seventh agricultural group consisted of dairy and dairy products, classified as follows: 41. Milk and cream, with apparatus and methods of treatment. 42. Butter. 43. Cheese and its manufacture. 44. Dairy fittings and appliances—churns for hand and power, butter workers, cans and pails, cheese presses, vats, and apparatus.

The dairy exhibition was not one of dairy products alone, but of real dairying, and included a model dairy and dairy school, the application of standard tests, and valuable experimental tests and competitive trials. In



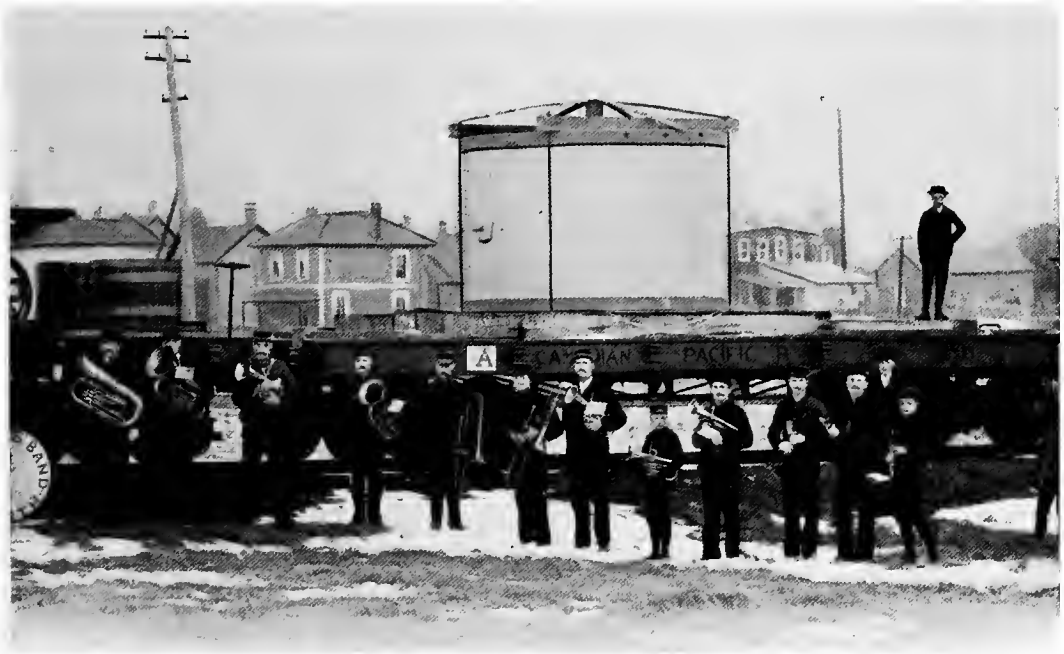
the dairy building were seen in actual operation all the processes and manipulations in the handling of milk and cream and the making of butter and cheese according to the latest and best methods under perfect conditions of temperature. The dairy products sent from all parts of the country for trials, held at different seasons during the Fair, were kept at the right temperature by coils of refrigerating pipes. In the model dairy a series of tests for comparing the relative merits of different breeds of cattle were made



SPECIMEN OF REFRIGERATOR CAR.

during the six months of the Fair. Twenty-five Jerseys and as many Guernseys and shorthorns, selected from among two hundred animals, the pride of the best herds of the country, after a preliminary competition in their several classes after their arrival, were pitted against one another to determine the comparative merits as dairy cattle of the different breeds. They were housed, fed, and cared for in stables on the grounds. The competing herds were tested in May in respect to their cheese-producing qualities, and in June, July, and August for butter making. The tests, besides the quantity and quality of the butter, took into consideration the nutritive value of the skim milk and buttermilk and the increase or decrease in the weight of the competing cattle. Representatives of other breeds were also tried and compared with the three principal classes. The American Jersey

Cattle Club selected the cows to represent their favorite breed from among thirty thousand registered Jerseys. The best shorthorns were brought out by the offer of prizes by the associated shorthorn breeders, and the admirers of Guernseys took like pains to get together the best cows of that type. The final contestants were chosen for their milking qualities shown just before the trials. The result of the cheese-making tests was a victory for the Jerseys, as they gave during the two weeks of the contest 1,329 pounds of milk, producing 1,450 pounds of cheese, while the Guernseys



MAMMOTH CHEESE, ON ITS WAY TO THE FAIR.

Exhibit of Agricultural Department; Canada.

yielded 10,900 pounds of milk and 1,130 pounds of cheese, and the shorthorns 12,180 pounds of milk and 1,070 pounds of cheese. The Guernseys, however, produced cheese at the least cost.

In the competitive tests of butter sent from the different States, flavor counted forty-five points, texture twenty-five, color fifteen, salting ten, and packing five in the maximum of one hundred. Cheese was judged on a similar system. American and Canadian cheeses offered for competition were required to be made of full new milk. The main classes were cheddar, flat, young America, domestic Swiss, brick, and dairy. The trials of the dairy breeds and of the exhibits, conducted in view of interested observers, afforded some of the most useful practical lessons of the Fair to American

farmers. Many new mechanical appliances were shown. From New York seven hundred and thirty-three exhibits of butter were forwarded for the trials of June, July, September, and October. Three fourths were from private dairies, and this did not maintain the average high standard of the creameries, which produced, in 19,497,357 pounds, fourteen per cent of all the butter made in the State in 1892. One fifth of all the butter exhibited was of high grade, scoring from ninety-five to one hundred points.

New York, whose factories produced 130,991,310 pounds of cheese in 1892, submitted, at four several exhibits, five hundred and sixty-four samples of all varieties. Cheddar and other cheeses of the make of 1892, with some new fancy cheeses, were sent in June, and in July, September, and October the cheeses of 1893 were forwarded, and nearly half the packages were of high grade and scored over ninety-five points. There were over seven hundred New York exhibitors of butter and cheese.

The New York State Commission did not select the dairy exhibits by competitive trial, as was done in several Western States. The Vermont commissioners were even less discriminating, and yet the butter exhibit of that State—samples from forty different dairies and creameries at four different times—ranked among the best. The exhibit of the Green Mountain Stock Farm, of West Randolph, is said to have obtained the highest score for dairy-made and that of the Franklin County Creamery, of St. Albans, for creamery butter.

Pennsylvania exhibited in July dairy and creamery tub butter and its famous fancy print. Iowa, after New York the most important dairy State, having seven hundred and twenty-nine creameries and one hundred and fourteen cheese factories, and a sale out of the State of 71,500,000 pounds of butter in 1892, was fittingly represented by the exhibits sent to the Fair in June and in September and October. Michigan and Wisconsin also took a prominent part in the exhibition of cheeses. Indiana had a good exhibit of farm butter and some factory butter. Fine butter was sent in from Illinois, Missouri, and New Hampshire in August. Minnesota, with one hundred and fifty-two creameries and fifty-three cheese factories, produced 27,200,000 pounds of butter and 1,400,000 pounds of cheese in 1892, which brought the best prices in the market. Nevada received medals for cheese, and had a creditable exhibit of dairy butter. The prominent dairy State of Nebraska had a varied display, an interesting part of which was butter in globules. The Kansas dairy exhibit proved that the climate, grasses, and water of that State are favorable for butter making. Out of one hundred and four exhibits, twenty-four secured diplomas, the October make especially scoring higher points than the products of the older dairy States, both in the West and in the East. A special exhibit was made in the United States section of butter, and his method of cheese manufacture by James B. Marquis, of Norwich, N. Y. ; one of cheese, by the Northwestern Butter and Cheese Company, of

Romeoville, Ill. ; one of fine butter in sealed tins for keeping or export by Simpson, McIntyre & Co., of Boston.

A hundred exhibitors sent the fine types of cheese produced in Canada in all their variety and perfection. The hugest cheese on earth, weighing ten long tons, was made for the Exposition and exhibited, with specimens of Canadian butter, by the Dominion Department of Agriculture.

A French company which supplies the hospitals of Paris and a German company of Mecklenburg exhibited prepared milk for infants, said to be almost identical with mother's milk. Another German exhibitor showed a new process for condensing and sterilizing milk.

Cheese took the lead of butter in the foreign exhibits of dairy products. French cheese makers exhibited, besides Camembert in numerous samples and an extensive display of Roquefort, Brie and various cream cheeses and the cheeses of Livarot and Coulommiers. With examples of cheese and butter, the national dairy school at Mamirolle showed its equipments for teaching dairy work. There was only one exhibit of English cheese.

In August a fine lot of Holland cheeses were sent over from Rotterdam, the makes of Hoorn, Gonda, Enkhuyzen, Purmerend, Edam, Schoonhoven, and Bodegraven. Mexico had numerous exhibits of its dry and butter cheeses. Brazil exhibited both butter and cheese, and cheese was sent by Uruguay and the Argentine Republic. The butter and dairy exhibit formed the most important part of the Danish section. The Danish butter was shown in tins sealed tight for export to hot countries. There was a small exhibit of German cheeses. Those of Lombardy and other Italian dairy districts were well exhibited. There was an exhibit of Spanish cheeses also. Switzerland sent milk, butter, and cheese.

English methods of making cheese and butter were exhibited by the London and Provincial Dairy Company, with improved churns and dairy appliances suitable for various climates. An Australian form of the churn was shown in the New South Wales exhibit. That Denmark is a country of progressive dairymen would be guessed from the dairy appliances it exhibited, including two milking machines and milk and cream controlling apparatus. Russia exhibited apparatus and methods of treating milk and cream, with dairy fittings and appliances. Swedish exhibitors brought cream and butter extractors, milk separators, milk cans, milk strainers, and cheese frames.



JAMES PERRENOUD,  
Executive Commissioner  
from Switzerland.

The dairy exhibit of Germany contained centrifugal churns, steam milk skimmers, and sterilizing apparatus.

The coloring matters used to impart the desired hue to butter and cheese were exhibited also by Wells & Richardson, of Burlington, Vt., by J. Strickler & Co., of Sterling, Ill., and, with rennet extract, by Christian Hansen's Laboratory, of Little Falls, N. Y. William Nicholls & Co., an English house, exhibited annotto in a fluid form. Extract of rennet was shown in the Swedish exhibit, and liquid rennet in the French. The Genesee Salt Company exhibited dairy salt.

The exhibits of dairy appliances included everything from a milk can to a steam creamery plant. Cornish, Curtis & Greene, of Fort Atkinson, Wis., exhibited creamery and dairy churns, hand and power butter workers, cream and cheese vats, oil-test churns, the Curtis-Babcock milk tester, separators, and engines and boilers. A variety of dairy machinery was exhibited also by the Davis & Rankin Company, of Chicago, whose specialty is hand separators. In the separator of Philip M. Sharpless, of Elgin, Ill., the bowl alone revolves, impelled by a jet of steam striking its side; the cream flows out at the bottom through one spout and the milk through another. The Vermont Farm Machine Company had on exhibition all sizes and styles of separators and butter extractors, with creamers, churns, butter workers, Babcock milk testers, and steam engines. The De Laval Separator Company, which has factories in New York, Illinois, and Sweden, showed its separators with capacities of from one hundred and fifty to thirty-six hundred pounds of milk an hour. Another form of separator was shown by the Columbia Company, of Avon, N. Y. Evans & Heulings, of West Chester, Pa., had dairy appliances. Creamers were exhibited by the American Manufacturing Company, of Waynesboro, Pa., and John Boyd, of Chicago; a cream cooler by Orin Leonard, of Belvidere, Ill.; cream raisers and cream heaters by Charles H. Dickson, of Margaretville, N. Y.; a milk cooler by Caroline W. Romney, of Chicago; milk aerators by the Upton Manufacturing Company, of Massachusetts, and by D. Ewing, of Coburg, and H. Fowell, of Belleville, in the Canadian section. N. S. Andrews, of Dubuque, Iowa, exhibited milk testers; P. Embree & Son, of West Chester, Pa., butter workers; and G. T. Tindall, of Toronto, a cream settler and automatic skimmer. The C. E. Dudley Company, of Grand Crossing, Ill., showed a self-washing churn, and churns of various forms and designs were displayed by the Baldwin Wooden Ware Company, of Lafayette, Ind.; N. S. Andrews, of Dubuque, Iowa; the Buckeye Churn Company, of Sidney, Ohio; Isaac T. Cross, of Watertown, N. Y.; the H. P. Deuscher Company, of Hamilton, Ohio; the Diamond Balance Churn Company, of Ballston, N. Y.; Joseph Jacque, of St. Louis; and Canadian churns, by the Erie Supply Company, of Dutton, Ontario. H. R. Worthington, of New York, exhibited vacuum pumps and condensers. E. U. Scoville, of Manlius, N. Y., had faucets for creameries. Cheese vats and cream vats were exhibited by John Boyd, of Chicago, and F. M. Hope, of

Piston, Ontario. The Ludington Wooden Ware Company, of Michigan, exhibited butter molds. Exhibitors of butter tubs and kegs were the Moseley & Pritchard Company, of Clinton, Iowa; the Creamery Package Manufacturing Company, of Chicago; Seaman, Cox & Brown, of Chicago; and Charles D. Filmore, of Nova Scotia. The Flint Cabinet Creamery Company, of Michigan, showed creamery supplies. Ice-cream freezers of many types were shown by the Magic Freezer Company, of Chicago; the Jack



COFFEE PARTY, OUTSIDE OF BRAZIL BUILDING.

Frost Freezer Company, of New York; Abraham Watson, of that city; and Wells & Richardson, of Burlington, Vt. The Thatcher Manufacturing Company, of Potsdam, N. Y., exhibited improved milk jars, jar fillers, butter and cheese crocks, and other dairy supplies, including butter color.

The eighth agricultural group, embracing tea, coffee, spices, hops, and aromatic and vegetable substances, was classified as follows: 45. Tea, coffee, cocoa, chocolate, and substitutes. 46. Hops—culture, statistics, etc. 47. Peppers, cloves, cinnamon, and other spices. 48. Tobacco in the leaf and tobacco not manufactured. 49. Machines and appliances for the curing of tobacco and for the manufacture of tobacco, cigars, cigarettes, and snuff. 50. Insecticides. Methods and appliances for the destruction of the tobacco

worm and other parasites. 51. Commercial forms of chewing and smoking tobacco. 52. Cigars, cigarettes, and snuff.

Tea overshadowed the other exhibits in the Japanese pavilion, where hundreds of exhibitors displayed the black teas and the natural green teas so well known in the United States. Instructive photographs accompanied the exhibit, representations of tea plantations and of the operations of picking, preparing, handling, and packing.

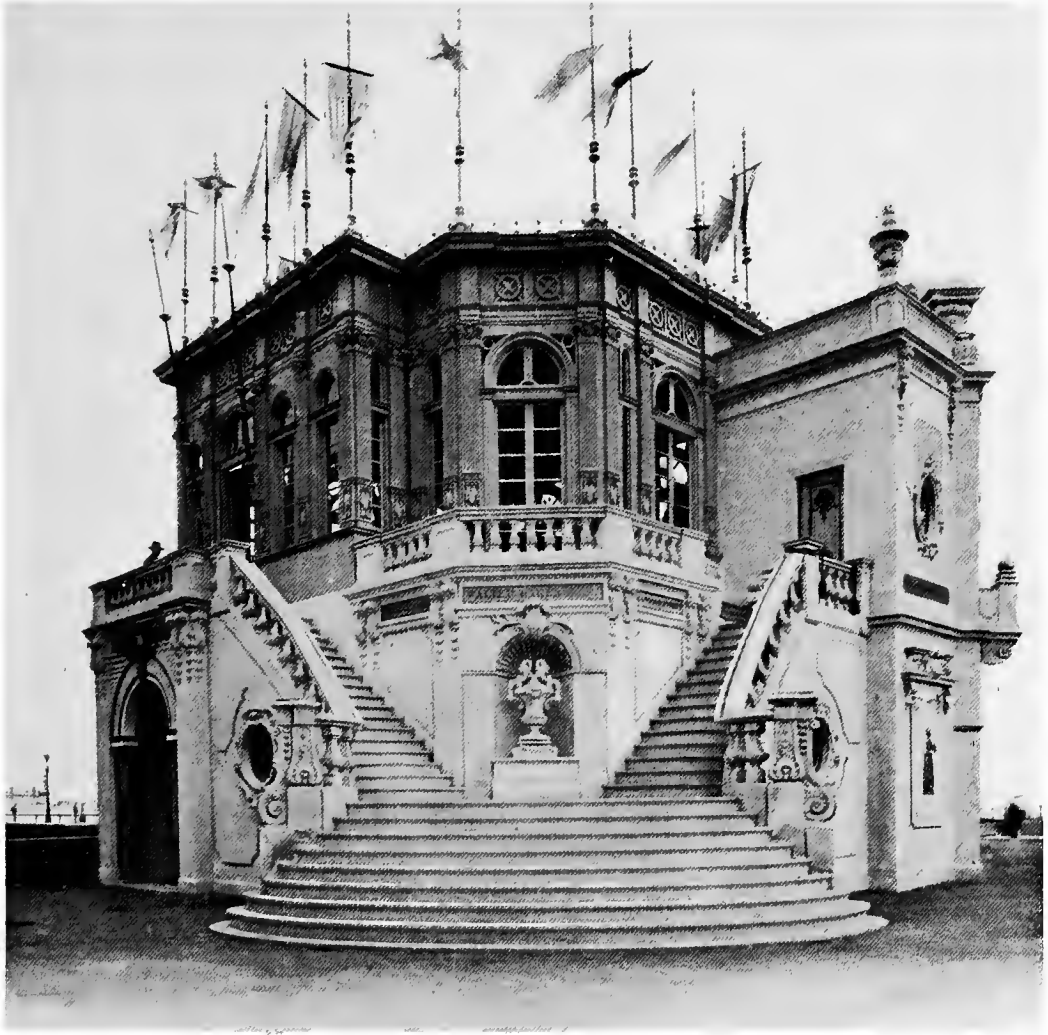
The Government of British India, which at first had not contemplated taking a part in the Exposition, appropriated money for the sole purpose of introducing Indian teas into America. There were over a hundred exhibits from Assam, Darjeeling, Cachar, Dosars, Sylhet, and Terai. The Indian Tea Association erected a characteristic Indian structure in which tea was sold or dispensed gratuitously by Hindu attendants in their picturesque garb. The Sylhet Tea Gardens had a special exhibit in the British pavilion, where Thomas J. Lipton also showed teas, as well as coffees. J. J. Grinlinton came as commissioner from Ceylon for the express purpose of promoting the sale in the United States of the highly developed and carefully prepared teas grown on the extensive plantations of that fertile island. The tea was served in the Ceylon pavilion by Cingalese attendants. The commission exhibited models to illustrate the cultivation of tea and of rice and cocoanuts. Tea was shown of different kinds and flavors from Java, of colors varying from pale green to deep black. The tea of Johore was exhibited, also tea grown in Tonquin and in New Caledonia, and some produced in Brazil. Mrs. J. M. Smith, of Fayetteville, had an exhibit of uncolored tea raised in North Carolina.

Samples of the stimulative Paraguay tea, or yerba mate, now a considerable article of commerce, were in the Paraguay pavilion, and Brazil and the Argentine Republic had numerous exhibits of the same product. From the Cape of Good Hope came the bush tea that is used there.

All the kinds and grades of coffee were displayed in the Brazilian pavilion, where there were many hundreds of exhibits of the aromatic berry produced in Brazil for the American breakfast table. Coffee trees in bearing from Brazil were placed in the Horticultural Building. There was a large exhibit of the superior coffees of Costa Rica, and one still larger from Guatemala, which sent nothing but coffee. In the Guatemalan Building hot coffee from the native berry was served free to all comers. Afternoon coffee was served in the Jamaican pavilion, where there was a fair exhibit of the quality grown on the island, both raw and manufactured. Porto Rico exhibited its product, and there were exhibits from Paraguay, the Argentine Republic, the French establishments of Diego Suarez, Réunion, New Caledonia, and Cayenne, and a good quality from Liberia. The coffee of Java, as well as tea, spices, and other products of the Dutch East Indies, was offered for sale in small packets in the Javanese village. The J. P. Dieter Company, of Chicago, exhibited roasted coffees, and H. A. Doane, of Philadelphia, pulverized coffee.



Chicory was exhibited in the Russian and Belgian pavilions. An English and two German houses exhibited coffee essence, and several German and Swedish makers coffee adulterations and substitutes. In the United States pavilion Gits & Van Hee, of Ghent, Minn., exhibited chicory root and chicory coffee. Chicory was shown also by Krembs & Co., of Chicago. The New York Condensed Milk Company had extract of coffee.



BUILDING OF WALTER BAKER & CO., DORCHESTER, MASS.

Exhibits of Cocoa and Chocolate.

Cocoa was exhibited from the principal producing countries, while in the exhibits of several manufacturing nations chocolate and cocoa preparations were conspicuous. They were most prominent in the Netherlands pavilion, where Bensdorp & Co., J. & C. Blocker, and A. Driessen made elaborate

exhibits of sweet chocolate, Dutch cocoa, and cocoa butter. Among the windmills on the grounds, the Blookers erected one made in facsimile of the mill with which the founders of the concern first ground cocoa beans in Amsterdam nearly a century ago. There were exhibits of Spanish chocolate and of chocolate as prepared in various American countries. J. S. Fry & Sons, of London, exhibited concentrated cocoa, chocolate, and chocolate confectionery; T. & H. Smith & Co., chocolate and cocoa prepared and preserved with milk. Chocolate made in Belgium was exhibited, also chocolate from Italy and the product of a Copenhagen factory. Mexico, Brazil, and French Guiana and Guadeloupe showed both cocoa beans and chocolate. There was raw cocoa from British Guiana, Costa Rica, Ecuador, Jamaica, Porto Rico, Trinidad, Colombia, and other countries. In the Liberian exhibit were sacks of cocoa. Uruguay sent chocolate and cocoa, with chocolate pastilles and cocoa cosmetic. In the United States exhibit, Walter Baker & Co., of Dorchester, Mass., displayed cooking chocolate and cocoa in a striking manner, and in a separate building offered breakfast cocoa and chocolate soda to visitors. Henry Maillard, of New York, exhibited chocolate and cocoa, besides chocolate confectionery, and Van Houten & Zoon, of Chicago, who also had a separate building, made a brilliant display of their cocoa. The Clark Coffee Company, of Boston, showed a combination of cocoa and coffee.

There were four exhibits of hops from New York, two from Illinois, and exhibits from Washington, Oregon, North Carolina, Pennsylvania, Wisconsin, and California. With the exhibit of New York, which raised in 1891 over half the hops grown in the country, was shown a series of photographs of the hop region at harvest time. In the foreign pavilions were hops from Austria, German hops from Nuremberg and Mayence, and Russian machine-pressed hops, which have found their way to the markets of England and the United States.

The Exposition revealed the fact that considerable quantities of spices and aromatic plants, such as grow in temperate and subtropical climates, are cultivated in some parts of the United States. California exhibited mustard, coriander, anise; Illinois, peppers grown by numerous planters; New Jersey, pepper also; Wisconsin, caraway; several States, manufactured products made of native pungent growths. Southern countries are, of course, the home of most plants of this character. Mexico exhibited various kinds of pepper and numerous other spices. Cayenne had a model of the Eiffel Tower built of the scarlet pods of the species of capsicum to which it gave the name. Cayenne pepper was largely exhibited from Jamaica also, another of whose products was pimento. British Guiana exhibited peppers and other spices. Pepper was exhibited by the Argentine Republic, and Costa Rica made an exhibit of pepper, cloves, and anise. Red pepper came from Brazil and from Tunis and other countries. In the Austrian pavilion was a good exhibit of the Hungarian paprika. There was black pepper from Cochin China and Annam. New Caledonia showed pimento and turmeric. Ginger was ex-

hibited by Trinidad and other West Indian islands and from New Caledonia ; cinnamon from Tonquin and from Brazil. Ceylon showed cinnamon, carda-



BUILDING OF C. J. VAN HOUTEN & ZOON, WEESP, HOLLAND, AND CHICAGO.

Exhibits of Cocoa.

moms, vanilla, cloves, mace, and nutmegs. Vanilla beans were exhibited by Mexico. Spain exhibited saffron, ground sweet pepper, and cumin. The

Persian Government furnished a collection of the spices of Iran. Jamaica had a good exhibit of the kola beans, a new culture in the West Indies that has begun to make headway, and of the powder made from them for the market. The Sultan of Johore sent the numerous spices of his little land. The J. P. Dieter Company, Chicago importers, with their ground and manufactured spices from Penang, exhibited sections of the alspice tree and cinnamon and other spices in their natural state. Durkee & Co., of New York, displayed spices in a fine pavilion of carved wood. Charles Gulden, of New York, showed prepared mustard.

Sauces and condiments were exhibited by Antonsantri & Co., of New Dorp, N. Y.; the H. J. Heinz Company, of Pittsburg; E. R. Durkee &

Co. and E. B. Miller & Co., of Chicago; and in the English pavilion by the Birmingham Vinegar Brewery Company, Cross & Blackwell, Maconochie Brothers, and Keen, Robinson & Belleville. Curry, chutney, and other Indian condiments were shown by Joseph Edmunds and other English purveyors, and by Harry & Co., of Calcutta, and Nowrojee Framjee, of Bombay. The exhibitors of tomato and other American catsups were Curtice Brothers, of Rochester, and the National Pure Food Company, of Cincinnati. E. McIlheny's Son, of New Iberia, La., showed pepper sauce and peppers. The H. J. Heinz Company, of Pittsburg, and Charles Richardson, of Fredericksburg, were prominent exhibitors of pickles.



DATO SRI AMAR D'RAJA,  
Commissioner from Johore.

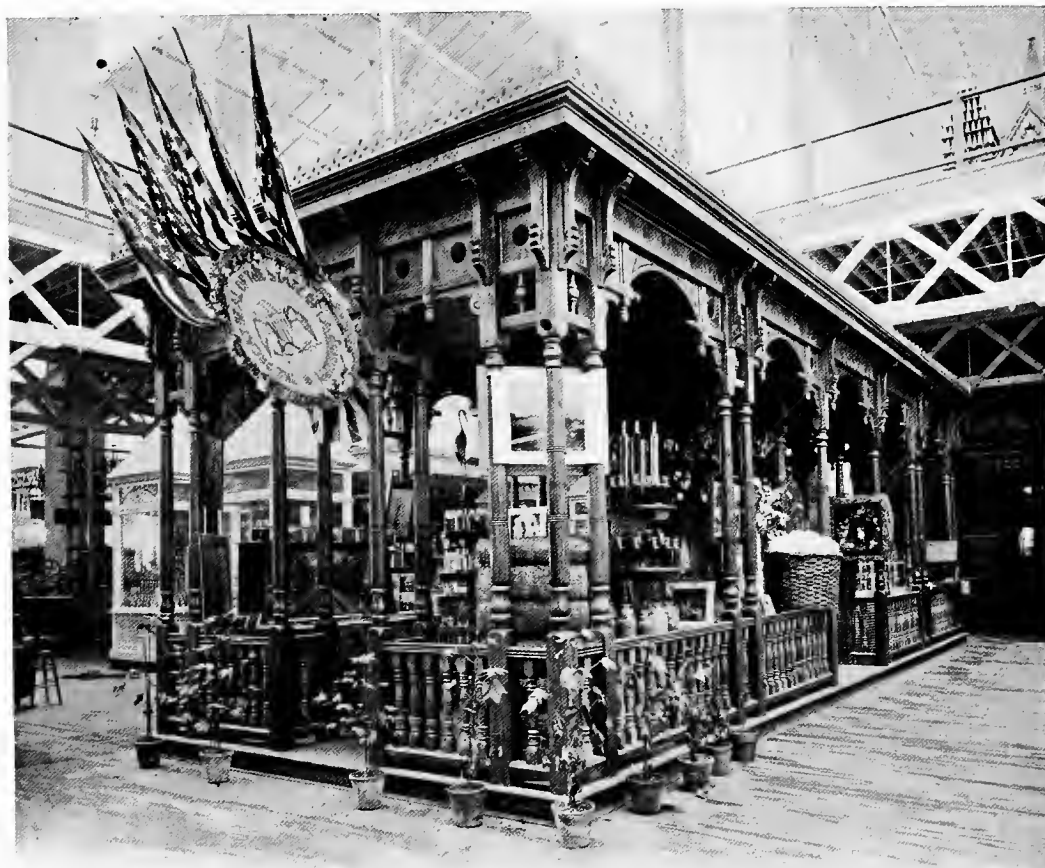
The importance of the tobacco crop of the United States could be inferred from the prominence that the tobacco-growing

States gave to it in their exhibits. Connecticut exhibited nothing but tobacco, and it gave the character to the exhibits of Kentucky and Virginia, and was no small part of those of Wisconsin, Ohio, West Virginia, and Louisiana. Kentucky, which raises more than half the tobacco crop of the United States, furnished a complete and elaborate exhibit of all the types grown there, filling a great part of the space allotted to the State. There were nearly two hundred exhibitors, many of whom showed the white burley leaf, which is much sought after in the markets wherever American tobacco grows, and is brought to perfection in Kentucky. Connecticut had one hundred and thirty-eight exhibitors of the Havana seed-leaf and broad-leaf tobacco. Many samples were shown of the tobacco raised in Massachusetts from Havana and Connecticut seed. Ohio had one hundred and forty-three exhibits of leaf tobacco,

grown from Dutch and Spanish, Ohio and Pennsylvania seed, including numerous samples of the white burley variety. Wisconsin had more than two hundred exhibits, Havana seed leaf with few exceptions. There were twenty-eight exhibitors from West Virginia and twenty-six from Virginia. Idaho, just beginning to raise tobacco, showed some promising samples, and so did Washington. Oklahoma displayed fine tobacco. New Hampshire had several exhibits, as also had New Jersey, and there were a few from Pennsylvania, from Missouri, and from Mississippi, and a fine exhibit from Illinois. The tobacco of Cuban type, now successfully grown in Florida, was exhibited by the Okechobee Drainage Company and by A. G. Chandler and G. B. Zoody. Louisiana exhibited the leaf and the manufactured Perique tobacco, and the manner of its cultivation and curing. Manufactured smoking tobacco was displayed profusely, and the exhibits of the cigar manufacturers were made very attractive to the eye. Julius Ellinger & Co. and Seidenberg & Co. exhibited cigars made in their New York and Florida factories. Other New York exhibits were F. A. Garcia & Co., Kerbs, Wertheim & Shiffer, Lozano, Pendas & Co., L. Ottenberg & Co., Sanchez & Haya, M. Stachelberg & Co., Jacob Stahl & Co., Carl Upmann, and V. M. Ybor & Manrara. William Graff & Co., of Wilwaukee; the Juan F. Portuondo Company, of Philadelphia; Eugene Vallens, of Chicago; and the Warren Company, of Flint, Mich., also had attractive displays of cigars. Exhibitors of cigarettes were the Consolidated Cigarette Company, of New York, and Kysiazi Frères and Nestor Gianacis, of Cairo, Egypt. Chewing tobacco was exhibited by the Blue Grass Tobacco Company, of Lexington, Ky., with smoking tobacco, of which the P. Lorillard Company, of Jersey City, and John W. Surbrug, of New York, made exhibits. Exhibitors of snuff were the Lorillard Company and Augustus M. Devoe, of Spottswood, N. J. Collective exhibits of cut Connecticut leaf tobacco were made by the Association of Connecticut Farmers and the New England Tobacco Growers' Association.

The tobacco raised in the Province of Quebec was well exhibited in the Canadian pavilion. Russian tobacco and cigarettes were exhibited not only by the manufacturers whose wares are exported to western Europe and to Asia, but by many whose sales are still confined to Russia. There was an exhibit of Greek leaf tobacco and cigarettes. Japan exhibited tobacco and cigars. Leaf tobacco, cut tobacco, and cigars and cigarettes were plentifully exhibited by Mexico. Honduras exhibited tobacco in the leaf and rolled into cigars. Leaf tobacco and cigars naturally formed a large part of the Cuban exhibit. Spain exhibited cigars. Samples of Argentine tobacco were shown in the leaf and in cigars, cigarettes, and commercial tobacco. Uruguay exhibited its product, and Paraguay had an ambitious display of seven kinds of tobacco. Ecuador exhibited tobacco, cigars, and cigarettes. There was a large exhibit of the kinds grown in Brazil in the leaf and manufactured into rolls, cigars, and cigarettes. Porto Rico sent some tobacco

and cigars, and Jamaica exhibited the leaf. Tobacco from South Africa was shown in the Cape exhibit. Cigarettes and tobacco from the other extremity of Africa were shown by Algeria. The British North Borneo Company exhibited leaf tobacco for cigar wrappers and cigars made entirely from Borneo tobacco, together with the peculiar products of the region, and postage stamps and coins issued by the company. The British Deli and Langkat Tobacco Company had wrapping leaf tobacco grown on its estates in



MISSISSIPPI'S COTTON EXHIBIT.

Sumatra, and English cigars wrapped in the same. There were tobacco and cigarettes from Siam. New South Wales exhibited the kind of leaf grown in Australia. In the exhibit of the French colonies tobacco was shown from Madagascar, Réunion, and New Caledonia. Snuff was exhibited by New Caledonia and by Curaçoa, Brazil, and Mexico.

Satisfactory examples were shown of the mechanical contrivances used in the manufacture of tobacco. The Baron Machine Company, of Baltimore, had a practical long-filler cigar-bunching machine. The Empire State Cigar Machine Company, of Philadelphia, and the International Cigarette

Machine Company, of Richmond, showed their ingenious machines. A plug and smoking tobacco machine was exhibited by the Cardwell Machine Company, of Richmond, Va. Kresl & Mallue, of Chicago, had an assortment of cigar molds and manufacturers' supplies. In the English pavilion the Rickards Machine Company showed appliances for rolling cigarettes, cheroots, and cigar bunches, and machines for rolling tobacco into coils or plugs. A cigar machine was seen in the German pavilion, and there was one from Cuba.

The ninth group of exhibits in this department was that of animal and vegetable fibers, of which the classes were : 53. Cotton on the stalk—its several varieties, long and short staples, shown by living examples, by engravings, photographs, etc. 54. Methods of planting and culture. 55. Machines and appliances for planting, cultivating, picking, ginning, and baling. 56. Cotton seed and its uses. 57. Remedies and appliances for destroying insects. 58. Literature, history, and statistics. 59. Hemp, flax, jute, ramie, and other vegetable fibers not enumerated, in primitive forms and in all stages for spinning. 60. Wool in the fleece, in sacks, and in bales. 61. Silkworms, silk in the cocoon, apparatus and appliances used in silk culture. 62. Hair as a textile material.

The exhibit of Mississippi, collected by seven ladies' Columbian clubs, was confined to cotton, but was a complete manifestation of the cotton-growing industry, including seed cotton, cotton bales, seed hulls, plants, and bolls, growing plants, cotton-seed oil and meal, and photographs showing the cultivation and manufacture of cotton. North Carolina had forty-five of lint, seed, and bolls. Louisiana had a collective exhibit of cotton and seed hulls, meal, and cake. Oklahoma showed the quality of cotton grown within its borders, and N. Luce, of Lincoln, exhibited cotton on the stalk from Merced County, California. Joseph H. Brinker, of West Point, Miss., impressed his exhibit of baled cotton on the minds of visitors by means of souvenirs consisting of miniature bales of cotton raised in 1863 by slave labor. The Imperial Caucasian Agricultural Society exhibited cotton of various kinds and cotton seed from the Caucasus. The French tropical colonies of Mayotte, Réunion, Tonquin, and Cambodia exhibited their growths. Among the Mexican exhibits of cotton was the wild cotton of the country. The Argentine Republic exhibited cotton with seed, and the product of Brazil and of every department of Paraguay was shown. Samples from Ecuador, British Guiana, and other American countries were also exhibited. Cotton planters were exhibited by the David Bradley Manufacturing Company, of Chicago, and the Deere & Mansur Company, of Moline, Ill. The Eagle Cotton Gin Company had in operation an improved machine for separating the seeds and preparing cotton for the market ; a model oil mill exhibited the process of extracting the oil and grinding the residuum into a fertilizer. The Yullett Gin Company, of Amite City, La., had cotton gins, distributors, press, etc. Munger's patent gins, with feeders,



condensers, suctions on the flue system of handling lint cotton, and self-packing presses, seed-blowing elevators, and saw sharpeners, were exhibited by the Munger Improved Cotton Machine Manufacturing Company, of Dallas, Tex., and Birmingham, Ala. Another gin was that of the Engelberg Huller Company, of Syracuse, N. Y., and still others were exhibited by the Chase Cotton Gin Company, of Milford, Mass. The Lispenard Wallis Company, of New York, showed a cotton picker. Bale covers were the exhibit of George B. Hussey, of Providence, R. I. Of the States of the American Union, California sent the greatest variety of fiber plants, and of the counties of California, San Luis Obispo had the most varied assortment, including flax, jute, ramie, ixtle, and alfa. Kentucky, which furnishes nine tenths of the hemp raised in the United States, made a separate department for this product. Illinois and Missouri made hemp exhibits, and there were numerous hemp exhibits from Japan. Of European nations, Italy and Russia were the chief exhibitors. Indian hemp fiber was exhibited by Mexico, Siam, and other countries. There were great bales of New Zealand hemp in the British exhibit. Combe, Barbours & Co., of Belfast, exhibited manilla hemp, sisal, jute, flax, and ramie in the various stages of manufacture into yarn and cordage. In the French pavilion were exhibited the textile products of the country, and fibers obtained from tropical plants. Jute was one of the exhibits of Florida, and was shown by several foreign countries.

In the exhibit of domestic wools, Ohio and Wisconsin were conspicuously represented, occupying entire sections and showing great diversity of products, from coarse carpet wools to high-grade combing wools, wools of long and short staple, wools in the fleece, in the grease, washed, scoured, and in every condition. In judging the samples of wool, a single fleece in its natural state, as clipped from the animal, was taken. The same conditions were applied to Cashmere and Angora fleecy hair and alpaca and vicuña wools. Wool sheep were classified as pure-bred fine, pure-bred middle, pure-bred long, and cross-bred. The exhibit of wool in uniform glass cases afforded a comparison of the products of every breed of sheep and of every wool-growing country. The hair of the Angora goat, similarly shown, revealed the importance of this young industry in some parts of the United States, as well as in British colonies. The long wool of Oregon was well exhibited. A fleece shown by C. Cunningham, of Pendleton, weighed forty-two pounds at shearing time, proving the value of the bunch-grass pasturage. Angora wool was shown by George Hovenden, of Hubbard. The wool exhibit overshadowed all others from Australia. New South Wales showed four hundred bales and hundreds of samples, in bins and in the fleece, of all kinds and qualities, from the finest merino to the heaviest English wools. Besides this exhibit there was one from Victoria containing a great variety of grades and varieties of both long and short wools, made by the woolgrowers of Australia and one from Queensland in the British pavilion. Samples of wool from

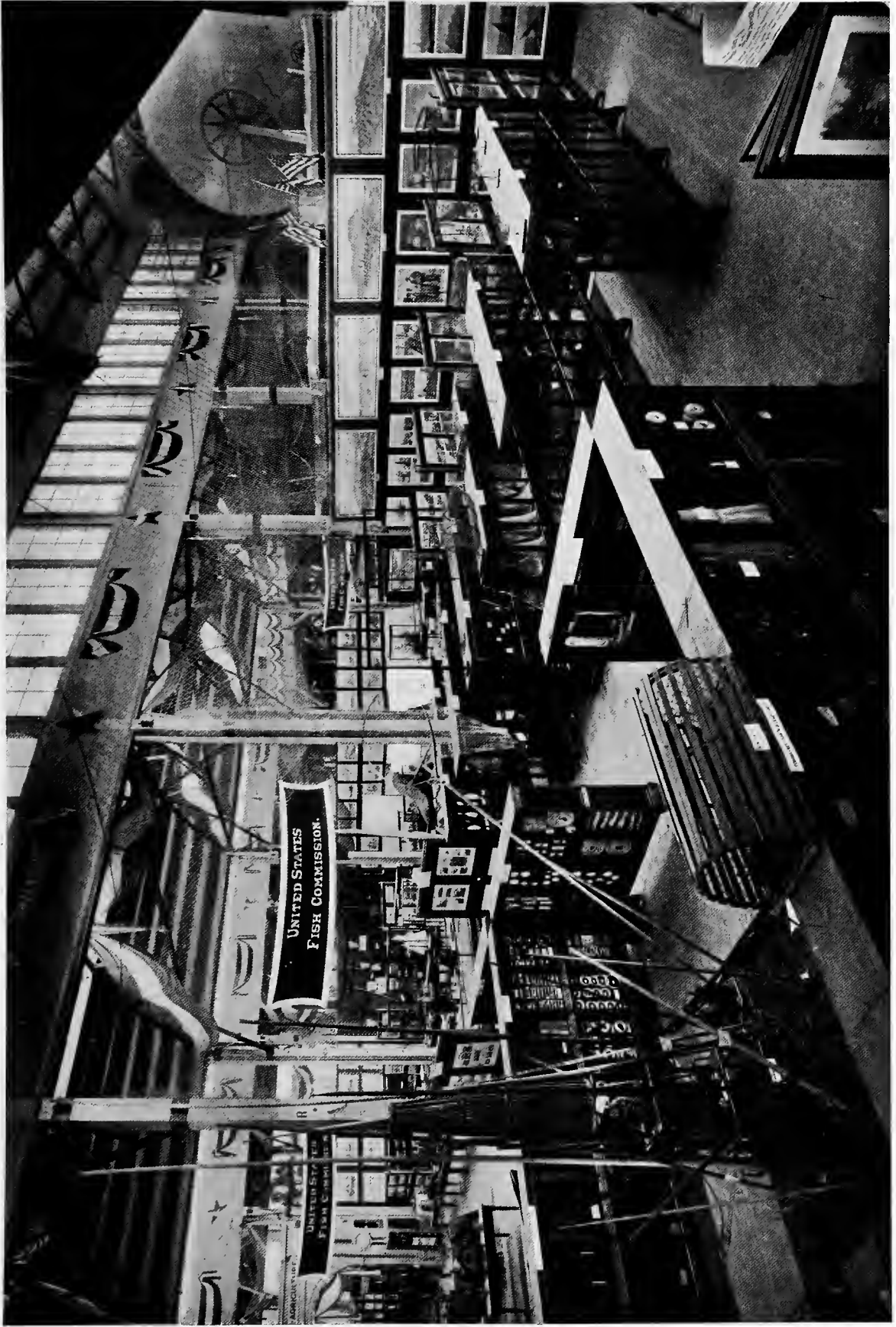


EXHIBIT OF THE UNITED STATES FISH COMMISSION.  
In the Government Building.



New Zealand were placed among the United States exhibits. Carl Grubnau, a Philadelphia importer, exhibited foreign wools, hair, and noils in great variety. Cape Colony showed a large lot of superior wool, in the fleece and scoured, also the valuable fleecy mohair from the Angora goat. Equally good were the specimens from the Orange Free State. France exhibited merino wool and wool grown in Algeria, and Spain sent some samples. Merino and other wools and camel's hair were exhibited by the Russian Government establishments and large proprietors. Long-wooled fleeces of fine staple were exhibited by Uruguay. Mexico showed a considerable vari-



OHIO'S AGRICULTURAL PAVILION.

ety. Wool in the fleece and in bales was conspicuous in the Argentine pavilion, and there was an excellent exhibit in the Brazilian building.

Japan made a large exhibit of silk cocoons, which were shown also in the French exhibit and the colonial exhibit from Indo-China, and in several other foreign exhibits. Mulberry branches were shown from Algiers, loaded with cocoons. Raw silk and cocoons were exhibited by Greece. Italy showed only some silkworm larvæ. Mexico showed cocoons and skeins and wild silk; Uruguay, cocoons; Brazil, cocoons, thread, and goods; Siam, spun silk. There were samples of silk produced in Russia and a comprehensive exhibit of the Caucasian sericulture station, embracing cocoons of Caucasian

grain, samples of the raw and manufactured silk, an exhibit of the local silk industry, and specimens of European and Caucasian silkworm plants. The progress made in the United States in this nice industry was best demonstrated in the exhibit of the Woman's Silk-Culture Association, of Philadelphia, comprising cocoons and reeled raw silk, sewing silk of all colors, and stuffs made of home-grown silk. Silk cocoons were exhibited also by California.

Horsehair was exhibited by the Argentine Republic, and Mexico showed horsehair made into cord.

Sixteen successful exhibits of flax from Minnesota indicated the gratifying progress made in the utilization of that fiber, largely produced there, where formerly it was wasted. Colorado exhibited flax in a special group. Placer and other counties of California, Oregon, North Carolina, Missouri, and Oklahoma exhibited flax and flaxseed. Linen fiber, thread, and handkerchiefs were shown by Brazil. Flax and linseed were well exhibited by Russia. The Okechobee Drainage Company, of Kissimee, Fla., exhibited the sisal plant and fiber, palmetto fiber, and bamboo, and Mrs. J. D. Moseley palmetto tapestry.

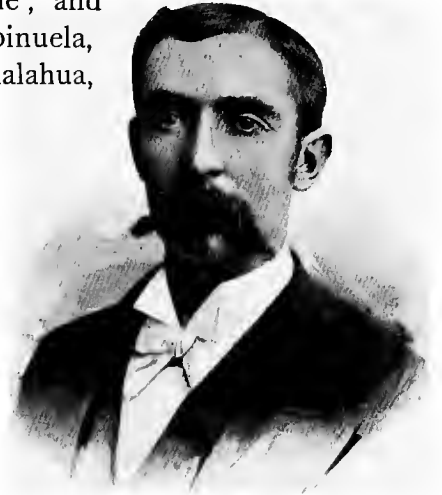
Ceylon exhibited coir and kitul fiber and seventy specimens of various vegetable fibers and articles made of them, notably ropes, mats, and basket-work from the cocoanut fiber; British Guiana, sisal, plantain, cocoanut, bamboo, palm, and curious bark fibers; Holland, the kapok of Java, which is admirably adapted for stuffing mattresses, owing to its lightness and elasticity. Brazil had a hut constructed from fibrous plants, with hats and other articles made of native fibers. Fibers of the maguey, with ropes, matting, and cloth made out of them, were a feature of the Mexican exhibit. In the Spanish pavilion was a hut into which were worked the fibers, indigenous and introduced, of the Philippines. Liberia showed, with curious fibers and woven objects, the fibers of the plantain and bamboo. Plantain fiber was found in the Japanese exhibit. Johore exhibited a collection of fibrous plants and textile handiwork and the curious reddish inner bark of a tree, largely used for clothing. Trinidad, Paraguay, and French Guiana prepared collections. Raffia fiber from Mayotte was exhibited by France. Fiber ropes and twines were worked with fine decorative effect into the artistic bamboo pavilion of Japan. Algeria showed samples of alpiste and of esparto and alfa grass in bales and made into cordage; Tunis had an exhibit of alfa. Ramie was exhibited by Spain, Mexico, Argentina, Brazil, Tonquin, and Cambodia. Aloe fiber was exhibited by Réunion and New Caledonia. The chief fibrous plant of Mexico furnished henequen, ixtle, and agave fiber of various sorts, besides which were shown cotton, banana fiber, and vegetable silk. Banana fiber was exhibited by Japan, and, with pita, this fiber led the exhibit of Jamaica and Turk's Island. Pita fiber from the Canaries was exhibited by Spain, which had also a good exhibit of esparto. Unfamiliar textile plants, leaves, barks, bast, etc., Argentina showed in a confusing variety—caraguata fiber,

twine, and sacking, chaguar leaves and nets, various fibers worked by the Indians of Gran Chaco, brooms of palm, esponja vegetal, cotton of Samohu, datil, absinthe fiber, pichano plants, curundig bast, guembepi fiber, canapina plant and fiber, escobadura plant, yica leaves and fiber, and quyryndiy. From Brazil also came many strange textile materials—tucum, grao de bodé, malva branca, piasaba, jangada, croatá, macambire, pacote, catinga, mutamba, mirim, pau branca, embiratanha, etc. Other curiosities were the vegetable wool and darnajaliua of Ecuador; the snake gourd of Japan; the silk grass, wild ochro, kakarally, mahoe, penguin, wadara, wina, and tibiseri of British Guiana; the miraguano of Porto Rico; the stems and leaves of the latania of Indo-China; the mandine of Cayenne; and the majagua, marshmallow, pochote, colotague, pinuela, acapan, jonote, lechuguilla, palm filaments, calalahua, patos, willow, and izote fibers of Mexico.

Pure and mineral waters, natural and artificial, constituted the tenth group of exhibits, which was subdivided into three classes: 63. Distilled water, for use in the arts and drinking. 64. Spring water; mineral water, natural and artificial. 65. Aërated waters.

Rohitsch, in Styria, and the bitter waters of the Franz Josef and Hunyadi springs, near Buda-Pesth, were attractively exhibited. Chalybeate and sulphuretted waters were shown from a score of springs in Spain. From France were shown the waters of Vichy and of the Bourbole spring; from England, waters from the Whistley springs in Wiltshire; from Canada, water from the St. Catherine's spring. Brazil showed mineral waters from various springs in Ceara and Minas Geraes; Costa Rica, the waters of several springs; the Argentine Republic, Luracatas water; Japan, the waters of Hyogo; Mexico, eighteen kinds of thermal and medicinal waters; Uruguay, waters of different compositions. The Government of Ecuador exhibited the mineral waters of that republic.

Mineral waters and sanitary baths were a conspicuous element in the German exhibit. The proprietors of thirty resorts joined in a combined exhibit, displaying Apollinaris water, the waters of the Ems, Harzburg, Fachingen, Neundorf, Kronthal, Friedrichshall, Gerolstein, Selters, and Schwalheim springs, and the baths of Baden Baden, Heligoland, and other resorts. The Carlsbad water of Austria was strikingly displayed, and the waters of the Bohemian Franzensbad, the arsenic springs of Levico in the Tyrol, the spring at Rohitsch recharged for the market and flavored with ginger root, sarsaparilla, and fruit sirups for cooling drinks, which are made also with the Excelsior, Shakopee, Allouez, and some of the other gaseous waters. Brown &



E. R. GROBLER,  
Commissioner  
from Orange Free State.

Logan, of Chicago, and John Morgan, of New York, had mineral-water exhibits. About a dozen British makers exhibited samples of artificial aërated and mineral waters, Belfast ginger ale, and sweetened and flavored sparkling beverages of many kinds, old and new.

The Waukesha Hygeia Company, which supplied the Exposition with drinking water pumped from its source in Wisconsin, made a striking display of its lithia water in gigantic bottles. The Poland mineral water of Maine was noticeably exhibited. Natural lithia waters were exhibited from Lithia Springs, Ga., Buffalo Lithia Springs, Va., and the Londonderry springs at Nashua, N. H. Other natural mineral waters were the gaseous alkaline water of St. Clair Springs, Mich.; water from the Ute iron spring of Manitou, Col.; water from Shakopee, Minn., from Janesville and Green Bay, Wis., from the Stafford spring in Louisiana, from Falmouth Foreside, Me., from Excelsior Springs, Mo., and from Woodbury, N. Y.; and the natural soda water of Soda Springs, Idaho, and that of Manitou, Col.

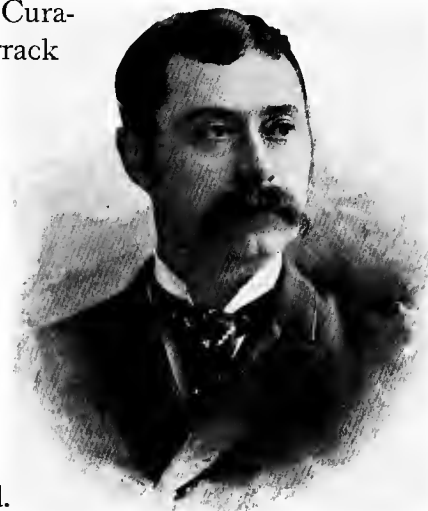
The eleventh group comprised whiskies, cider, liqueurs, and alcohol, and was subdivided as follows: 66. High wines—whisky and its manufacture. 67. Rum and other distilled spirits. 68. Alcohol—pure spirits. 69. Cordials and liqueurs. 70. Bitters and mixed alcoholic beverages. 71. Cider and vinegar.

Bernheim Bros., of Lexington, in a log cabin outside, exhibited the processes of distilling the Kentucky sour-mash whiskies, and in another building the Old-Times Distillery Company gave an exhibition of its methods of distillation. American whiskies were also displayed by the Large Distilling Company, of Pittsburg, the Mattingly & Moore Company, of Bardstown, Moore & Sinnott, of Philadelphia, Rheinstrom Bros., of Cincinnati, manufacturers also of liqueurs and bitters, and the Ulman-Goldsborough Company, of Baltimore; bourbon whisky by J. L. Lee, of Williamstown, Ky.; bourbon and rye, with rum and brandy, by the Cushing Process Company, of Boston; malt and rye whisky by A. Guckenheimer & Bros., of Pittsburg; rye whisky alone by Dallemand & Co., of Chicago, Hamburger Company, of Chicago, the Hannis Distilling Company, of Philadelphia, John Osborn, Son & Co., of New York, and Schuetz, Renziehausen & Co., of Pittsburg; Schiedam aromatic schnapps by Udolpho Wolfe's Son & Co., of New York; fancy drinks and cocktails by Alpha S. De Lissa, of Philadelphia; liquors in cases by Mihalovitch & Co., of Cincinnati; vermouth by Emilio M. Franchi, of New York, and P. C. Rossi, of San Francisco; orange cider by the Lockhart Chemical Company.

Hiram Walker & Sons, of Walkerville, Ontario, made an elaborate display of their Canadian whisky. In the British pavilion Scotch whisky was exhibited by nine distilleries, Irish by five, Welsh by one, and London gin by two. One Irish distiller had a round tower built of his bottles. German distillers exhibited gin and associated products, rye whisky from Holstein, and pure



spirit. In the Russian pavilion twenty-eight exhibitors displayed vodka and various grain liqueurs and cordials. Rum was conspicuous in the French pavilion, and was the chief alcoholic exhibit of Guadeloupe and the French islands of the South Sea. White rum was exhibited by Trinidad. Jamaica rum was seen in abundance, and rum from Porto Rico and Cuba was not less profusely displayed. In the British pavilion was Demerara rum. Besides mezcal brandy, aguardiente, and pulque, Mexico exhibited many native beverages extracted from plants or made from fruits, including sugar-cane brandy, quince liqueur, or membrillo, anise brandy and rum, sweet-bean brandy, cherry liquor, banana brandy, agave alcohol, zobo liquor, orange liqueur, mango brandy, mint liquor, tejocote, zazamora, mamzana, naranja, and blackberry brandy. Japan had a large number of samples of saki, or rice brandy. Germany exhibited cordials, stomach bitters, and aromatic liquors of various flavors. Spain had anisette and a great variety of aromatic liquors and hygienic cordials. The Netherlands exhibit contained Hollands gin, arrack, and various liqueurs and cordials, including Curaçoa, which was sent also from its native town. Arrack was sent from Johore and Siam, and from Ceylon, which showed a model of a distillery. There was an endless variety of spirits, alcoholic cordials, tonics, appetizers, and sweet liqueurs from France. Besides rum of many kinds, absinthes, and liquors of foreign types, such as Curaçoa, vermouth, and kummel, there were bitters and novel specialties, such as kina, coca, cherry ratafia, etc. The exhibit contained spirits and alcohols from grain, beet root, and molasses in all degrees of purity. Italian cordials and liqueurs were well displayed. Austria exhibited maraschino and other liqueurs, some of them flavored with paprika. The Argentine Republic made a remarkable showing of alcohol and rum from sugar cane and vermouth, fernet, and bitters of Italian type, and other liqueurs flavored with native herbs and fruits. Brazil exhibited, besides rum and alcohol, cashew, genipapo, coffee and fruit liqueurs, and various bitters. Costa Rica and Cuba exhibited chicha and liqueurs; Guadeloupe, quinine wine; Trinidad, Angostura bitters; Porto Rico, Tabasco pepper liquor, anise cordial, etc.; Uruguay, vermouth and other liquors; Jamaica, pepper wine, pimento cordial, orange sherry, and quinine bitters; Ecuador, elixir of coca, anisette, kirsch, and bitters; Paraguay, tafia and Paraguay bitters; Swedish arrack and other punches were prominently displayed. From Tunis were brought peculiar bitters and aperients, and from Algeria various liqueurs and wine cordials. New South Wales exhibited orange wine, peach liquor, waratah, native rose



GEORGE BIRKHOFF, JR.,  
Commissioner  
from the Netherlands.

liquor, lime-juice cordial, and aromatic and orange bitters. In the French and German pavilions were exhibits of distilling apparatus.

Burrell Bros., of Freeport, Ill., Curtice Bros., of Rochester, N. Y., and H. J. Heinz Company, of Pittsburg, Pa., were exhibitors of vinegar, which was shown largely by British manufacturers having breweries for malt vinegar, and in many examples by Spain and other wine countries and by Japan.

Malt liquors formed group twelve, which was divided into two classes: 72. Preparation of the grain. Malt and extracts of. 73. Beers, ales, porter, stout, etc.

Malt extract was exhibited by the Pabst Brewing Company, of Milwaukee, Robert Smith, of Philadelphia, and the Voigt Brewing Company, of Detroit; also by Hoff and other German exhibitors and by Canadian, English, Danish, Austrian, and Japanese brewers, accompanied usually by exhibits of malt. The George A. Weiss Malting Company, of Chicago, had an exhibit of barley malt.

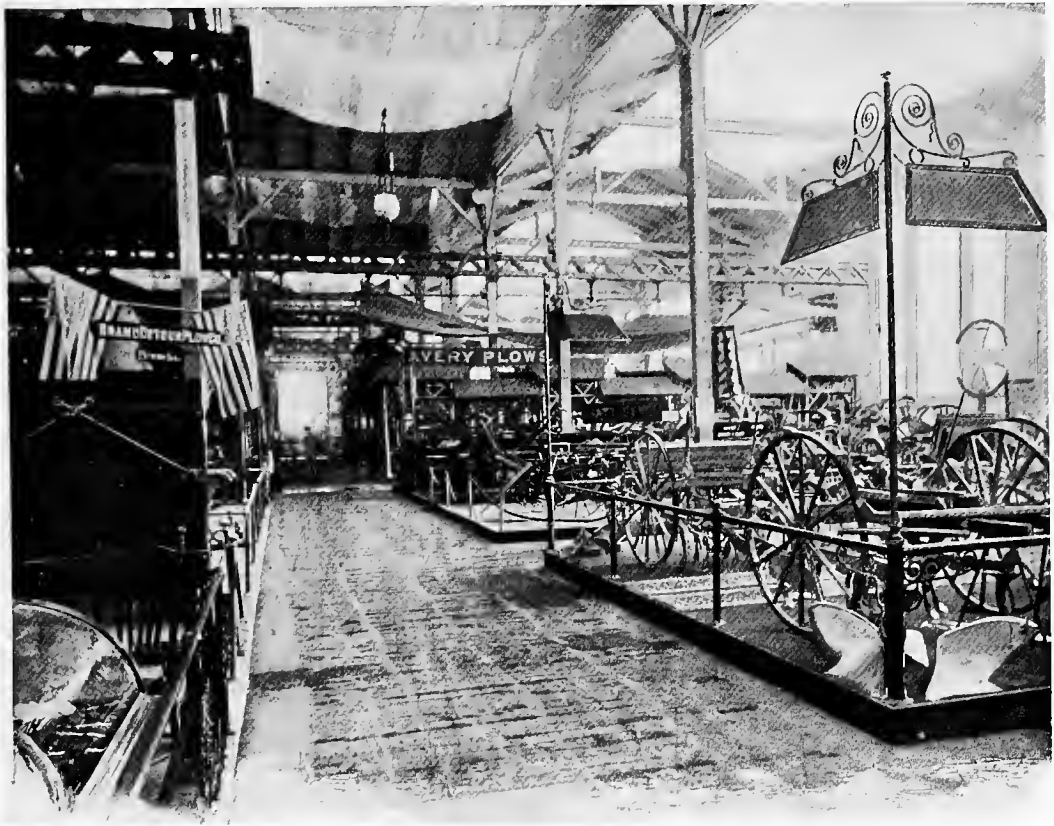
The Voigt brewery built its pavilion of bottled beer. The Anheuser-Busch Association, of St. Louis, exhibited lager beer. Other exhibitors of beer of the German type, light or dark, were the Barrett Brewing Company, of Cleveland, Beadleston & Woerz, of New York, Bergner & Engel, of Philadelphia, John F. Betz & Son, of Philadelphia, and the David Mayer Company, of New York, all of whom exhibited also ale and porter. Brewers who exhibited beer alone were C. A. Lammers, of Denver, the Lemp Company, of St. Louis, Liebmann's Sons, of Brooklyn, the Moerlein Company, of Cincinnati, the New Orleans Brewing Association, the North Western Brewing Company, of Chicago, the Pabst Company and the Joseph Schlitz Company, of Milwaukee, the Stroh Company and the Voigt Company, of Detroit, and the George Weidemann Company, of Newport, Ky. C. H. Evans & Sons, of Hudson, N. Y., and Robert Smith, of Philadelphia, exhibited only ale and stout.

Six Canadian brewers displayed their ales, porter, and beer. Ales, stout, and other malt liquor, the produce of English and Irish breweries and malt houses, with bottled beer from an East Indian brewery, were prominently exhibited in the British pavilion. Beer was the chief specialty in the German exhibit, where samples of Bavarian beer were shown from the breweries of Munich, Kulmbach, Bamberg, and Erlangen. The brewing processes and apparatus were exhibited. There were exhibits of Danish beer and Russian porter. The growing fondness of the nations for the German beverage was strikingly demonstrated by exhibits of beer from France, Italy, and Spain, and by eighteen exhibits from Brazil, four from Mexico, two from Costa Rica, and an exhibit from Ecuador. There was even an exhibit of barley beer from Japan, with numerous ones of the native beer, shoyu, brewed from the soy bean.

Group thirteen embraced the machinery, processes, and appliances of fer-

menting, distilling, bottling, and storing beverages, and was divided into the following classes : 74. Apparatus of fermenting—vats, cellars, etc. 75. Distilling—ordinary and vacuum stills, etc. 76. Rectifying apparatus and methods. 77. Machinery and appliances for bottling beer.

A malt-cleaning machine was shown by the Behringer Company, of Lansing, Ill. The Saladin Pneumatic Malting Construction Company, of Chicago, had grain malting in a germinating compartment to illustrate its process. The German-American Filter Company, of New York, showed apparatus for filtering beer. Olsen & Tilgner, of Chicago, showed a hydraulic mash machine and malt mill. August Stollstorff, of Chicago, had a revolving branding iron. Distillery pumps were shown by H. R. Worthington, and machinery for sealing bottles by the Crown Cork and Seal Company, of Baltimore. Stoppers and capsules were shown in the French pavil-



VARIOUS EXHIBITS OF AGRICULTURAL IMPLEMENTS,  
in the Annex.

ion, where apparatus for distilling alcohol from sugar beets and for various other distilleries was liberally exhibited. The German exhibit included a refrigerator and machinery for breweries, mineral-water machinery, beer filters and siphons, a circulating siphon, models of distilling and rectifying

apparatus, and machinery for bottling beer. Uruguay exhibited the plan of a great distillery.

The fourteenth agricultural group, that of farms and farm buildings, had the following subdivisions: 78. Farms and farm administration and management, shown by farms, or by maps, models, records, statistics, and other illustrations. 79. Irrigation; drainage methods, machinery, and appliances. Models of fences; construction of roads; literature and statistics. 80. Systems of planting, cultivating, harvesting, and fertilizing. 81. Systems of breeding and stock feeding. 82. Farm buildings, houses, barns, stables, etc., shown by reference to special examples or by models, drawings, or other illustrations; stable fittings.

An English exhibit that attracted much attention was that of the Brookfield stud of hackneys, coach horses, Cleveland bays, cobs, and ponies, with models of the stables and grounds and the harness department for high-stepping horses. In the French pavilion was a model barn, with stables, granary, and other farm buildings inclosing a court. The model of a farm near Paris was exhibited. A French engineer showed plans for drainage and irrigation works. Another exhibit was an apparatus for destroying insects. A typical Danish farmhouse was shown, and an exhibitor furnished models of the cultivating and harvesting implements used in Denmark. There were models in the French colonial exhibit of a Tonquinese water wheel, a Cambodian plow, and Annamese farm implements. The Argentine Republic showed the model of a gate and a horse corral. C. J. Buckley, of Dover Plains, N. Y., and George Jackson, of Mapleton, Ind., exhibited stable fittings.

The American Good-Road League called attention to its objects by sample sections of good country roads, with layers of bowlders, crushed stone, macadam, gravel, and soil.

In the fence exhibit were many new forms and devices, especially in wire fencing: The fence-weaving machine of Cochrane & Co., of Ionia, Mich.; the wire stretcher of T. J. Andre, of Wauseon, Ohio; the hedge and wire fence of Hunley, Harris & Co., of Richmond, Ky.; the tightener and fastener of A. L. Thompson, of East Avon, N. Y.; the gate and spike puller of Andrew W. Taylor, of Wayne, Neb.; the fencing of Mast, Foos & Co., of Springfield, Ohio; and the metal fence, post, and hooks of J. J. Crane, of Summertown, Tenn. Steel fences were shown by the Barnes Fence Company and Albert L. Bonnaffon, of Philadelphia; a permanent and portable fence by Elliot W. Allis, of Adrian, Mich.; and gates by Joseph G. Barber, of Brodhead, Wis., George E. Cornell, of East Saginaw, Mich., the Eureka Gate Company, of Waterloo, Ia., Peter Hack, of Michigan City, Ind., and W. R. White, of Bloomington, Ill. The American Well Works, of Aurora, Ill., showed a ditching machine.

Group fifteen, representing the literature and statistics of agriculture, was comprised in a single class: 83. Statistics of farms; reports of agricultural societies, etc.

The Association of American Agricultural Colleges and Experiment Stations arranged through a committee a collective exhibit that illustrated modern methods of American agriculture and the services performed by organized public effort in developing agriculture by the light of science. The Department at Washington joined with the colleges and aided in completing the exhibit, which occupied about a quarter of an acre in the Agricultural Building. The various institutions contributed each some special examples of the departments in which it excelled, making up together an exhibit of the entire work of a model agricultural college and experiment

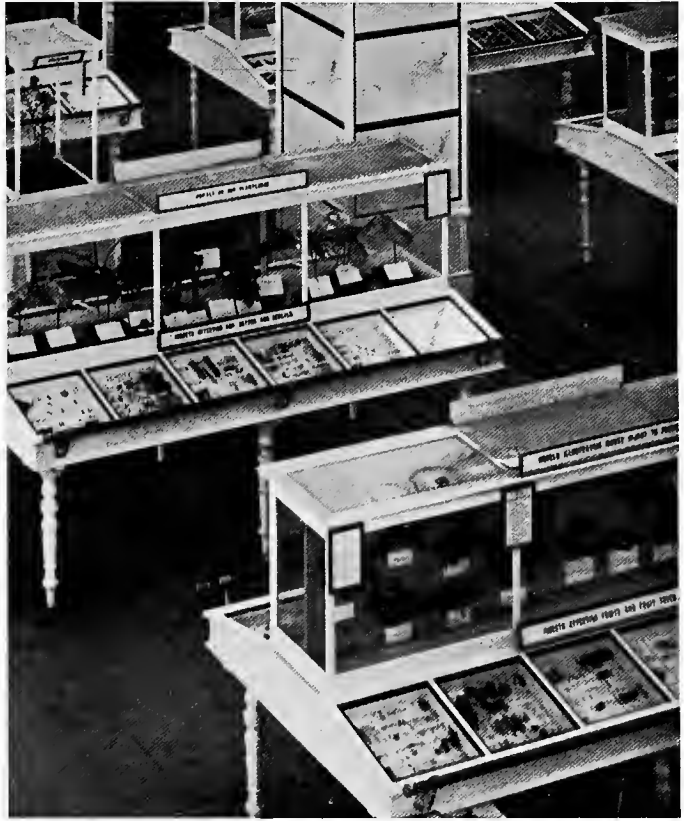


AGRICULTURAL LABORATORY,  
in the United States Government Building.

station as far as it is practically related to agriculture, including instruction in agricultural methods and experiment and research in crops, soils, botany, horticulture, entomology, feeding stuffs and animal nutrition, dairy solids, milk tests, and veterinary science. All this work was shown by means of botanical, chemical, and biological laboratories in regular operation. A staff of six attendants, officers of the several colleges detailed for a month each, gave information to visitors whose quest for knowledge was not satisfied by the very lucid labels and explanatory placards. The United State Office of Experiment Stations, which chronicles and publishes the progress of agricultural investigations at home and abroad in the Experiment Station Record, exhibited its methods of preparing the card index of experimental literature

and distributing the cards among the station workers of the United States. The publications of the stations and agricultural colleges were exhibited, and photographs of their equipments and of the officers and students engaged in the operations of the stations. Two of the working laboratories were chemical laboratories, one of them equipped for college instruction and the other for original investigation and original work. The work done by students with reagents in the analysis of milk, cereals, fodder, fertilizers, soils, and water, and with tests for poisons and food adulterations, was exemplified on successive days. Of the other two laboratories, one illustrated college and station work in botany and plant physiology and the other the work in zoölogy, especially economical entomology, and in dairy work. Bacteria found in milk and its products were kept in pure cultures, and demonstrations were made of their action on milk and butter. The collective exhibit was arranged in four divisions: Agriculture and horticulture; mechanic arts and engineering; civil engineering and instrumental drawing; and domestic and fine arts. The Agricultural College of California sent a collection of the rocks and minerals that constitute the bulk of fertile soils. The Maryland college had a collection of the soils of the State in glass jars, with mechanical analyses and statements of their natural adaptation to specific crops, and a soil map of the State, showing the distribution and location of the typical soils, with a scheme for their proper use and improvement. The Ohio college collected an assortment of tools and materials for drainage, with pictures of students laying drains and of crops on drained and undrained land contrasted. The relations of climate to tillage were shown by maps giving the average temperature and rainfall in all parts of Alabama at different seasons of the year, the frost lines, etc. A set of meteorological instruments, such as are furnished by the United States Weather Bureau to the agricultural colleges, was exhibited. The new Rhode Island college furnished drawings illustrating the different methods of plowing and cultivating and the standard implements now used, compared with those of other periods. The history and development of the plow from its earliest forms was shown by models contributed by Cornell University, with models of harrows, horse powers, thrashing machines, fences, and gates, demonstrating the need of a knowledge of practical mechanics for the selection and use of farming implements and machinery. The Tennessee college sent a complete set of grasses, which was supplemented by other collections from California, Oregon, and Colorado. The New Jersey college furnished a collection of two hundred pressed American weeds and their seeds, with information concerning them. Specimens of grain, forage plants, and other cultivated plants, sent from Colorado, Kansas, Missouri, New Mexico, and Oregon, were classified and arranged for comparison. Virginia sent a complete tobacco exhibit, with data regarding the nature and habits of the plant, its diseases, and insect enemies, the manner of preparing it for the market, and its various commercial forms. Kentucky furnished an exhibit of hemp and its

culture ; Vermont sent specimens and illustrations of the maple-sugar industry ; California contributed an exhibit of legumes and clover, which was supplemented by three new varieties of the soja bean from Japan, and by interesting millets grown in Massachusetts. A series of mounted specimens furnished by the Wisconsin college illustrated the various stages of the plant and root growth of corn, wheat, oats, timothy, and clover. The Maryland, Delaware, and New York colleges furnished the dissectible models used in teaching entomology and general zoölogy, and to crown the exhibit the Massachusetts college lent the life-sized image of an Arabian horse, showing three thousand parts and phases of anatomy, while Michigan sent skeletons of domestic animals, and Brown University a collection of stuffed birds of the species useful or injurious to the farmer. The Maryland and New York colleges furnished dissectible models of plants and exhibited



INSECTS INJURIOUS TO GRAINS AND FRUITS,  
shown in the United States Government Building.

methods of botanical study and investigation in physiological botany and vegetable pathology. Pictures and charts from Wisconsin illustrated a system of examining and judging domestic animals ; while the pure breeds of horses, cattle, and sheep were illustrated by portraits of representative animals. Instruction in dairying was exemplified by a collection of material and by pictures of dairy schools in Wisconsin, and cheeses were shown made by the students in Wisconsin and Maine, and butter from a Minnesota school. The Nevada college exhibited native grasses and a collection of specimens showing the effects of noxious insects on grain, leaf, or wood. The results of different kinds of feed in fattening live stock were shown by exhibits of grain and fodder, with the carbohydrates, fat, and protein contained in each, and by sections of meat disclosing the proportions and



distribution of fat and lean produced by different kinds of feed. In the Massachusetts exhibit were revealed the results of the Hatch experiment stations and the State Agricultural College; also the work of the State Board of Agriculture in exterminating the gypsy moth. The Massachusetts exhibits were elucidated by numerous photographic illustrations of crops and by literature dwelling specially on the advantages of intensive cultivation for the populous parts of the country. Samples of soil were furnished by Massachusetts, and by Utah, Nevada, and other States; also by France, the Argentine Republic, and other foreign countries.

All the States and most foreign governments furnished their agricultural reports and statistics. The agricultural bureau of the Department of Agriculture and Commerce at Tokio furnished a remarkably complete and systematic classification and catalogue of Japanese cultures and products.

The literature of French experimentation and instruction was enormous. Dr. J. H. Gilbert and Sir John B. Lawes furnished statistics of the results of experiments on the ennobling of grain on the Rothamstead experimental farm at St. Albans. Germany made exhibits of its public experimental stations.

The Canadian Government exhibited the cereals, root crops, etc., developed at its experimental farm at Ottawa. The Agricultural College of Ontario exhibited its results, and the Quebec institution showed what it had done for the culture of grain and tobacco. The French Government exhibited a model of what an agricultural school and experiment station should be, and in maps, charts, and tables elucidated the condition and history of agriculture in France, the history of prices, and the results of the agricultural training schools and experimental farms.

The sixteenth group comprised farming tools, implements, and machinery, and was subdivided as follows: 84. Tillage—manual implements—spades, hoes, rakes, etc. Animal-power machinery—plows, cultivators, horse hoes, clod crushers, rollers, harrows, etc. Steam-power machinery—plows, breakers, harrows, cultivators, etc. 85. Planting—manual implements—planters and hand drills, hand seeders, etc. Animal-power machinery—grain and fertilizer drills, seeders, planters, etc. Steam-power machinery—grain and fertilizer drills, seeders, planters, etc. 86. Harvesting—manual implements—scythes, rakes, forks, grain cradles, sickles, reaping hooks, etc. Animal-power machinery—reapers, binders and headers, mowers, tedders, rakes, hay elevators, hay loaders and stackers, potato diggers, corn harvesters, combined harvesters, binding twine, etc. 87. Preparatory to marketing—thrashers, clover hullers, corn shellers, winnowers, and apparatus for baling hay, straw, and other products, etc. 88. Applicable to farm economy—portable engines, windmills, chaffers, hay and feed cutters, vegetable and root cutters, feed grinders, corn mills, farm boilers and steamers, stump extractors, etc. 89. Traction engines and apparatus for road-making and excavating, with illustrations.

The display of American farm machinery reflected credit on the invent-

ors and manufacturers of Illinois, Ohio, New York, Pennsylvania, Iowa, Minnesota, Wisconsin, Michigan, Missouri, Virginia, Kentucky, and the New England and other manufacturing States, and revealed the great improvement that has been made and is constantly being made in mechanical aids to farming. Most of the exhibited machines were elaborately finished, and some were fancifully displayed, as in the exhibit of Planet, Jr., a model of the globe with the machines traveling round it. The Oliver Chilled Plow Company, the David Bradley Company, Deere & Co, and the Syracuse Chilled Plow Company occupied a square with their rival exhibits.

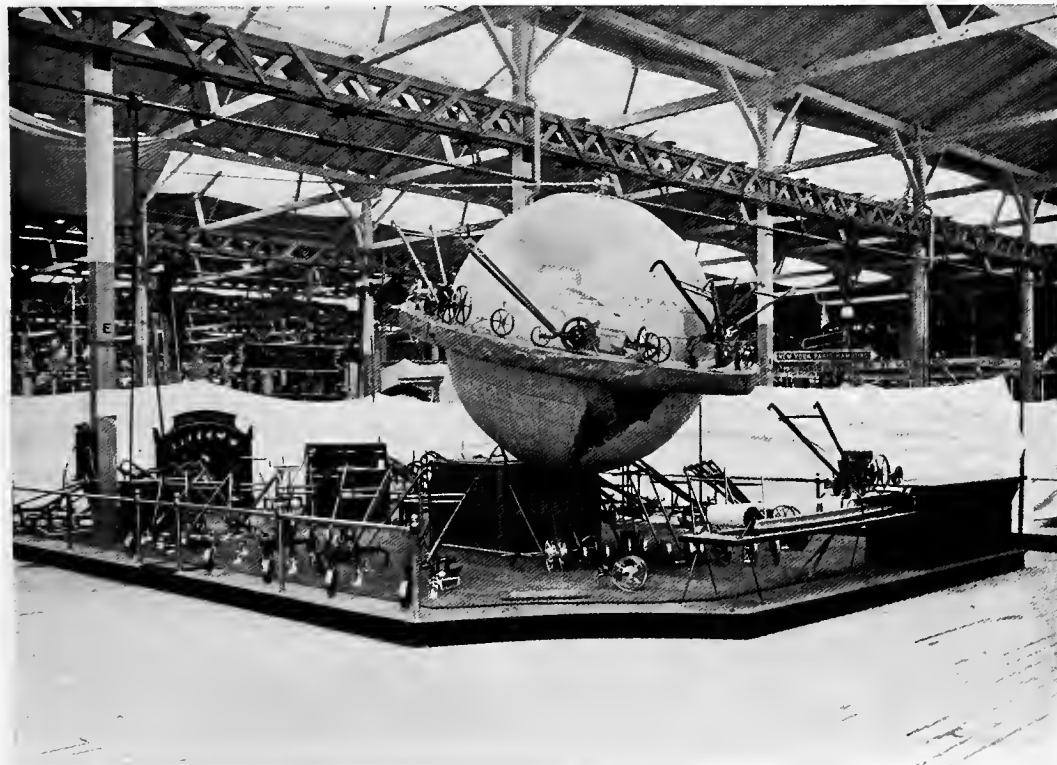


EXHIBIT OF S. L. ALLEN & CO., PHILADELPHIA.

The South Bend Company showed its plows all brightly nickel plated on a revolving dais. A steam plow and seeder was exhibited by the American Tillage Company. Some of the exhibitors of gang plows, riding plows, side-hill plows, etc., were the Bissell Works, Bucher & Gibbs, Gale Manufacturing Company, and the Moline Plow Company. Many of the combination machines were very ingenious, as the machine of S. L. Allen & Co. that plows, hoes, cultivates, and rakes in one operation. Similar devices were shown by the American Harrow Company and others. Cole Brothers, of Greencastle, Ind., showed prong plows. Rotary plows were exhibited by the Hancock Company, of Indianapolis.

Other exhibitors of plows, harrows, and cultivators were E. S. & F. Bateman, J. A. Bilz, Joseph W. Buchanan, Chattanooga Plow Company, Clipper Chilled Plow Company, Collins Company, Cutaway Harrow Company, Dayton Farm Implement Company, J. A. Everitt, Excelsior Harrow Company, Grand Detour Company, Heilman Company, John Lawrie, R. Lean & Son, Malcolm McLeod, D. H. Nash, Sandwich Enterprise Company, Morrison Manufacturing Company, Princess Plow Company, Sattley Company, Skandia Plow Company, and St. Joseph Manufacturing Company.

Land rollers were exhibited by Bucher & Gibbs, Oliver A. Smith, and the Superior Land Roller Company. S. L. Allen & Co. exhibited hillers, and Bowman & Allen a hiller for tobacco cultivation.

The combined fertilizer and grain drills were of many kinds. Craver & Steele had a grain hill and pea planter; the Sandwich Enterprise Company, a cotton planter; Avery Company, Haworth & Sons, and the Common-Sense Engine Company, planters and check rowers; Joseph P. Davenport, the Potato Planter Company, and others, potato planters; H. P. Deuscher Company, the Dowagiac Manufacturing Company, the Eclipse Corn Planter Company, Barlow & Co., Frank Bayliss, and others, corn planters; the Dayton Farm Implement Company, a combined harrow and seeder; B. F. Avery & Sons, planters and sugar land implements; S. L. Allen & Co., McSherry Company, Star Drill Company, Superior Drill Company, the Farmers' Friend Company, the Empire Drill Company, Bickford & Hoffman, the Champion Drill Company, Hayes Company, the Keystone Company, Brennan & Co., and others, fertilizer and combination drills; Kemp & Burpee, a manure spreader; Deere & Mansur, the Appleton Manufacturing Company, and others, seeders of various kinds; S. Freeman, & Sons, Johnson & Field, the Joliet Strowbridge Company, and others, broadcast sowers; John O. Bender & Co., Fuller and Johnson, and others, transplanting machines; the Stoddard Manufacturing Company, tobacco transplanters; and James A. Everitt, A. B. Farquhar & Co., E. S. & F. Bateman, and the large harvester works, other drills and seeders.

The emulous displays of the harvester companies added greatly to the beauty and interest of the machinery annex. The McCormick Company, which showed harvesters, reapers, binders, and mowers for the various American crops and for crops of other climes, including a corn harvester and a rice harvester, showed in a series of models the development of the reaper from the form invented by Cyrus H. McCormick in 1831. The Deering Company, who exhibited their twine-binding, frictionless, elevator reapers and mowers with ball bearings brightly gilded and polished, had models illustrating the development of the automatic binder and a model of a kind of reaper used by the ancient Gauls. They exhibited also corn-harvesting machines of four kinds—a combined cutter and binder, a picker and husker, a cutter and loader, and a hand husker. Osborne & Co. had their harvesting machines all in white. Aultman, Miller & Co., the New York and St.

Paul companies that bear the name of Walter A. Wood, D. S. Morgan & Co., and the Johnston Company made five displays of harvesters, which were well exhibited also by the Plano Company, the Sandwich Manufacturing Company, the Steel Platform Binder Company, the Esterly Company, the Milwaukee Harvester Company, the Tousley Company, John H. O'Hara, Warder, Bushnell & Glessner, and Whitman & Barnes. Exhibits of mowers were made by many of these concerns and by Adriaance, Platt & Co., Aultman, Miller & Co., W. S. G. Elliott & Son, Emerson Talcott &

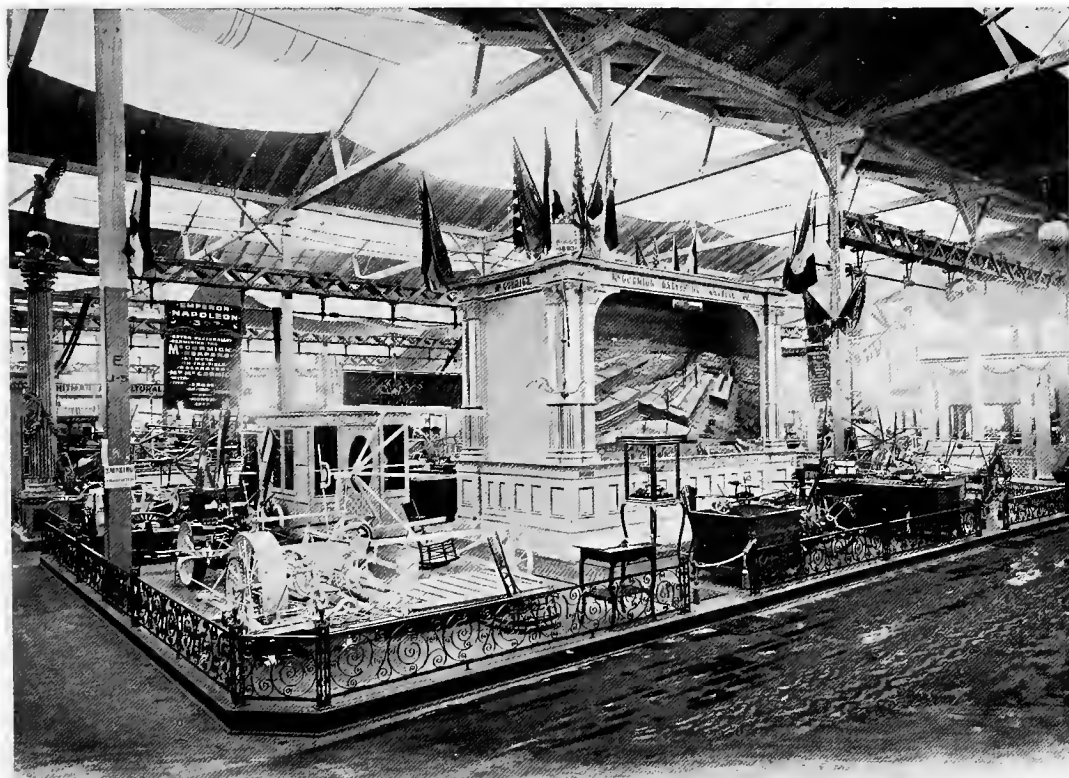


EXHIBIT OF THE McCORMICK HARVESTING MACHINE CO., CHICAGO.

Co., the Farmers' Friend Manufacturing Company, the Hall Company, and the Stoddard Company. Hay rakes were shown by the A. W. Coates Company, Sherman R. Nye, and others; a hay carrier by Joseph E. Porter; and loaders and elevators of various types by Deere & Mansur, the Keystone Manufacturing Company, Ward, Montgomery & Co., and the Superior Drill Company. The Columbian Cordage Company was one of the exhibitors of binding twine.

The Stoddard Company had, among other kinds, a hay rake for side delivery. Exhibitors of potato diggers were S. L. Allen & Co., the Dowden Manufacturing Company, Hoover & Prout, the J. McCallum Company,

and Judson D. Perry. The American Harrow Company exhibited bean harvesters.

Exhibitors of thrashing machines were Aultman, Taylor & Co., the Belle City Manufacturing Company, the Birdsall Company, A. B. Farquhar & Co., the Geiser Manufacturing Company, A. W. Gray's Sons, Heebner & Sons, Huber Manufacturing Company, Minneapolis Thrashing Machine Company, S. S. Messenger & Son, Robinson & Co., A. W. Stevens & Son, and the Westinghouse Company. Winnowers and fanning mills were exhibited by S. Freeman & Sons, Johnson & Field, J. L. Owens & Co., Heber Parish, and E. H. Pease. Nathaniel B. Higbie had an oats cleaner; Edward C. Moulton, a pea sheller; the Engelberg Company, a rice huller and a coffee huller; the Birdsall Manufacturing Company, and others, clover hullers; H. H. Perkins, the Appleton Manufacturing Company, and others, corn huskers. Exhibits of straw stackers were made by Aultman & Taylor, the Sattley Manufacturing Company, and the South Bend Stacker Company. Corn shellers for hand or power were exhibited by Robert Throp & Co., the Joliet Manufacturing Company, the Keystone Manufacturing Company, Nordyke & Marmon, and the Sandwich Manufacturing Company. Some of the exhibitors of hay presses were the Ann Arbor Manufacturing Company, W. H. J. Kappe, the Kinnard Press Company, Manchester Manufacturing Company, and the Midland Manufacturing Company. The Cardwell Machine Company had a press for cotton and wool, and other baling presses were shown by the Famous Manufacturing Company, the Hydraulic Press Company, the Quincy Baling Press Company, the Sandwich Manufacturing Company, and the Whitman Agricultural Company.

Some of the exhibitors of portable engines were Boyle & Calleton, P. K. Dederick & Co., A. B. Farquhar & Co., and the St. Johnsville Agricultural Works.

The exhibit of windmills was remarkable. They were of the most varied construction and for the most diverse purposes. There were windmills with stationary or tilting towers, windmills that revolved rapidly in a breeze and slowly in a gale, and among them all stood in strange contrast the old Dutch windmill of the Netherlands exhibit. Many were combined with machinery for grinding, cutting, pumping, etc. The exhibitors were the Air Motor Company, W. M. Aldrich, the Althouse Wheeler Company, the American Well Works, Baker Manufacturing Company, Olin W. Benster, the Challenge Windmill and Feedmill Company, the Decorah Windmill Company, the Eclipse Wind-Engine Company, Flint & Walling Company, the Globe Company, Heller, Aller & Co., T. C. Jacoby Company, Mast, Foos & Co., May Brothers, the Sandwich Enterprise Company, the Stover Company, Irett F. Tucker, and the United States Wind-Engine Company.

A bonemill was exhibited by Wilson Brothers, steam grinders by the Common-Sense Engine Company and F. C. Austin Company, conical grinders by N. P. Bowler, and other feed grinders and corn mills by Thomas

Cascadon, the Crown Point Manufacturing Company, the J. A. Field Company, the Foos Company, the Joliet Strowbridge Company, H. W. Straub, the Valley Iron Works, and Charles Kaestner & Co. E. A. Porter & Bro. had a cattle-feeding machine and corn and cob crushers. Stalk cutters were exhibited by the David Bradley Company and several others, ensilage cutters by the E. W. Ross Company and the Smalley Manufacturing Company, and hay and feed cutters by the Sterling Manufacturing Company and J. L. Townsend. Kring Brothers and W. Smith & Co. had stump extractors. Traction engines, many of them in combination with machinery, were exhib-

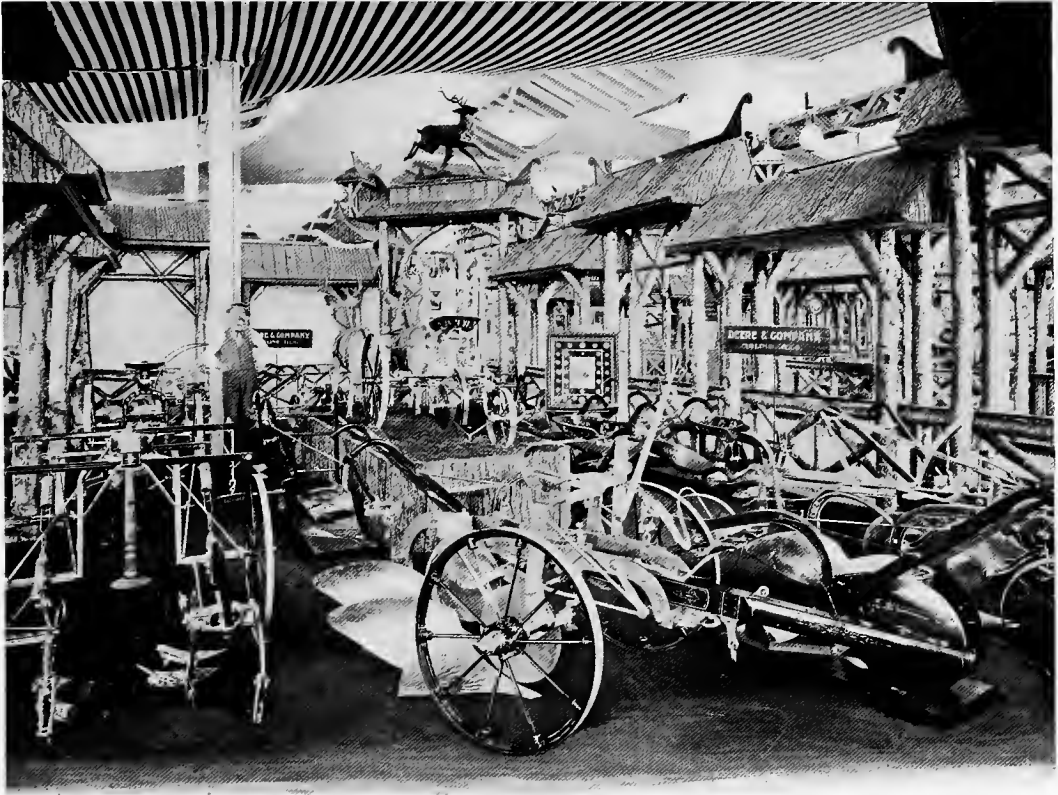


EXHIBIT OF DEERE & CO., MOLINE, ILL.

ited by the Aultman & Taylor Company, the American Tillage Company, Birdsall Company, Gaar, Scott & Co., Geiser Manufacturing Company, Hoover Manufacturing Company, the Minneapolis Thrashing Machine Company, John H. Roberts, Robinson & Co., H. W. Stevens, the Union Iron Works, and the Westinghouse Company. John Murphy exhibited brick pavement and John L. Pope another kind. John A. Chanler presented a new method of constructing roads, and John Jacob Astor a machine for blowing dust from the road. Road machines and rollers were exhibited by the F. C. Austin Company, the Climax Company, the O. S. Killey Company, R. C. Pope, and Russell & Co.; scrapers by the Western

Wheeled Scraper Company, and others. The American Well Works and August Pirch showed steam ditchers.

The Massey Harris Company and a score of other Canadian firms exhibited self-binders, cultivators, thrashing machines, hay carriers, etc. Novel pea harvesters and sap evaporators were shown. A steam thrasher with a tubular boiler and a furnace for straw had a novel device for registering the grain. The English and Continental manufacturers generally abstained from exhibiting. Hence the steam machinery that has been a prominent feature of European exhibitions was absent, and the farmers of the United States were deprived of the opportunity of studying applications of steam to farming, in which they are much behind the Europeans. Dairy appliances and creamery outfits were shown in variety, and ensilage cutters took up much space. There were interesting French mechanical contrivances and forms of implements—a thrashing machine, a double plow, a beet-root puller, a decorticating machine, and a forage press. Machines devised for manufacturing and preserving food preparations were exhibited in the French and German pavilions. German inventors exhibited steam agricultural machinery, a hoeing machine, machines for compounding and mixing manure, planters and diggers, and drills and fertilizers. There were two exhibits of agricultural machinery from Italy. New South Wales exhibited a double-furrow plow; Mexico, henequen-extracting machines, a seeder, and a triplex plow. In the Russian exhibit were various mechanical devices for testing and sorting grain, among them a centrifugal assorter; also machines for scutching flax. In the Ceylon exhibit was an irrigating machine.

The seventeenth group of agricultural exhibits was made up of miscellaneous animal products and of fertilizers and fertilizing compounds, and was divided into classes as follows: 90. Miscellaneous animal products—hides, horns, ivory, bones, scales, tortoise shells, glue, gelatin, etc. Animal perfumes—musk, castorium, civet, ambergris, etc., in their crude state, not manufactured. 91. Hair—for masons' use; for upholsterers—heavy felting, bristles, feathers, down, etc. 92. Fertilizers of living animals—guanoses, raw and mixed. 93. Fertilizers of fossil origin; commercial fertilizers—phosphatic, ammoniacal, calcareous, potash, salts, etc.

The American exhibits in this group were confined to by-products of the meat industry and fertilizers. Glue was exhibited by Armour & Co. and Swift & Co., with hair, horns, hoofs, and bones. The Michigan Carbon Works, of Detroit, had an exhibit of glue, with fertilizers and ammonia. The Crystal Gelatin Company, of Boston, McLeish & Co., of Buffalo, and Charles B. Knox, of Johnstown, N. Y., were exhibitors of gelatin. Glues and gelatin were exhibited by France, and Japan had a number of exhibits of its excellent bleached glue.

An immense variety of animal products was collected from teeming equatorial lands and wild, unsettled regions. Liberia sent fur skins and many other spoils of the chase. Valuable fur skins came from Cape Colony, and



ivory, notably one tusk of remarkable size. Ceylon sent tusks and teeth. Fossil ivory and molars of the mastodon came from Costa Rica, also tortoise shells. Algeria sent goat skins; the Argentine Republic, skins of a great many species of wild animals, together with hides and sheep skins. Notable in the Indian exhibit was musk in its natural state. Mexico furnished ambergris, with skins, and horns, and tortoise shell, which was seen from Indo-

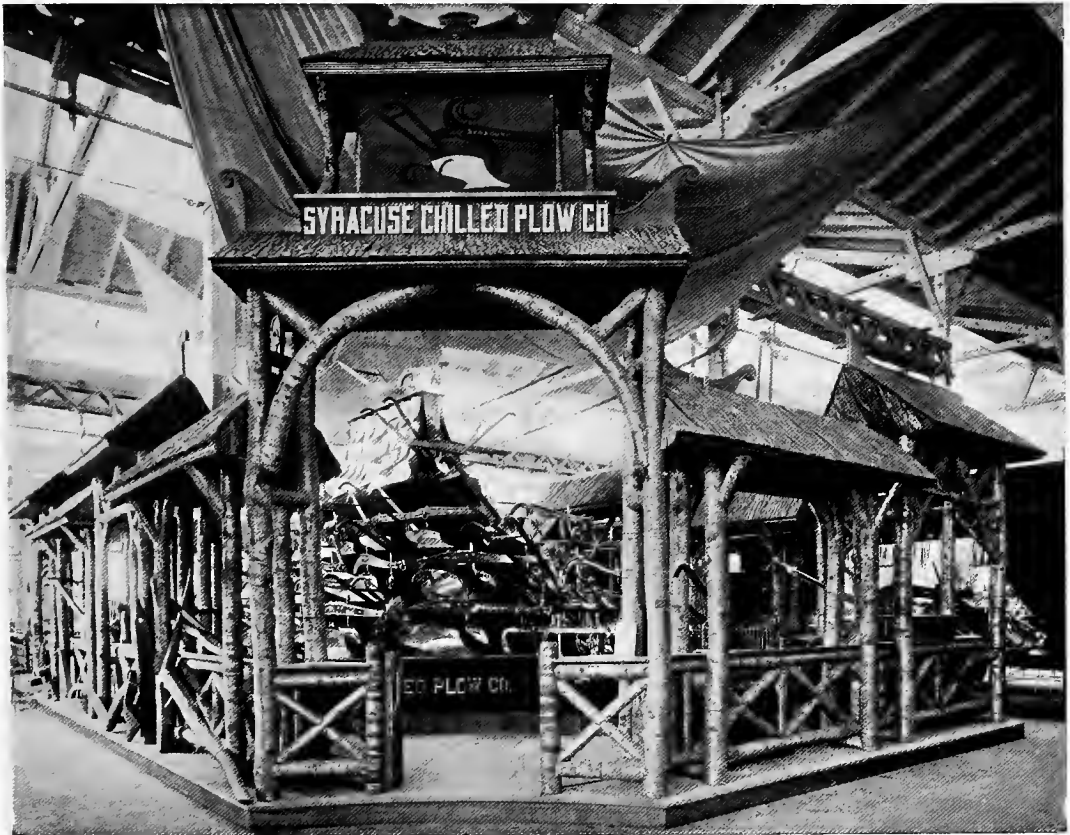


EXHIBIT OF THE SYRACUSE (N. Y.) CHILLED PLOW COMPANY.

China also, and elsewhere. Ecuador and several other countries had exhibits of bird feathers. Elephants' tusks came also from Annam, and tusks, teeth, and hides from Johore. Cape Colony's chief exhibit in this category was ostrich feathers, which came from the Orange Free State also. There were ostrich egg shells, too, from South Africa. A Vienna manufacturer exhibited a substitute for whalebone made of horn.

The Janesville Bone Fertilizing Chemical Works and the North Packing and Provision Company exhibited animal fertilizers, which were shown also by Chicago packing houses. William R. Grace & Co. exhibited nitrates of soda, potash, etc. Fertilizers having nitrate of soda for their chief constituent were shown with specimens of that material, and with growing plants invigorated by their action. Chili, though not well represented in other de-

partments, made a fine showing of the nitrate industry. Fertilizers, chemical manures, and alkalis were shown in the English pavilion alongside of the raw materials—Peruvian guano, phosphate rock, sulphur ore, coprolites, nitrate of soda, sulphate of ammonia, potash salts, fish guano, dried blood, and bones. Guano was exhibited by Cape Colony. The Argentine Republic had exhibits of guano, sulphate of chalk, phosphates, and nitrates from Patagonia. France exhibited phosphates and prepared manures. In the German section, the Kali Works, of Strassfurt, displayed in an imposing booth the potash and minerals in all the stages of manufacture into fertilizers. Russia showed fertilizing compounds, superphosphates, and various animal by-products, as glue, hair, bristles, bone black, ammonia, and lamb skins; also the phosphate rock and phosphorite found in large deposits in Russia.

Agricultural group eighteen consisted of fats, oils, soaps, candles, etc., and was subdivided as follows: 94. Animal oils and fats—lard, tallow, butterine, oleomargarine, lard oil, whale oil. 95. Vegetable oils, cotton-seed oil, olive oil, rape-seed oil, linseed oil, palm oil, etc., with the seeds and residues. 96. Soaps and detergent preparations. 97. Stearine, glycerin, paraffin, etc.; spermaceti, ozocerite, wax, candles, etc. 98. Lubricating oils, axle grease, etc. The Armour, Swift, Cudahy, and other large packing companies showed their lards and oils, margarine, butterine, stearine, etc., side by side with the processes of manufacture, preserving, packing, and transportation. Denmark exhibited margarine, as well as fine butter. Lard oil, stearine, and axle grease were exhibited by Mexico, besides beeswax and wax candles. New South Wales sent neatsfoot oil. Costa Rica exhibited tortoise and lizard; Cambodia, various animal oils. Exhibits of lubricating compounds were made in the United States pavilion by the Frazer Lubricator Company, Leonard & Ellis, William P. Miller Company, and the Wise Lubricating Company. Francis Baumer and Eckerman & Will exhibited candles and beeswax. Candles were exhibited by the Phoenix Company, and, with glycerin and fatty acids, by the M. Work Company. In the Russian pavilion were shown large candles of ornamental forms, such as are used in religious ceremonies. There was a handsome exhibit of painted candles from Japan. Austrian manufacturers exhibited paraffin wax, ceresine, and wax goods. Sealing wax and wax for floors were found in the French exhibit. Germany exhibited glycerin, wax and stearic candles, and various other articles. In the Russian pavilion bone oil, stearine candles, soap, and other grease products were shown.

American soap makers had large and attractive displays. In the United States pavilion the Kendall Manufacturing Company exhibited laundry soap and soapine; William Drezdoppel and Gross Brothers, soap; Everett Ward, soaps and soap powder; Ostrom & Lincoln Company, soaps and soap fixtures; the P. A. Balcom Company, of Denver, an original toilet soap; and the Wrigley Company, mineral scouring soap. Soap made from cotton-seed oil and from various other oils, with lechuguilla soap, were in the Mexican

pavilion. Uruguay exhibited soap and candles made by the Liebig Company. The Price Company, of London, displayed a variety of candles and toilet soaps. Cleaning compounds were exhibited by the Columbia Cleansing Compound Company, Charles Dall, the Electric Cleanser Company, George T. Johnson, T. H. Noonan & Co., and D. O. Wallace & Co.

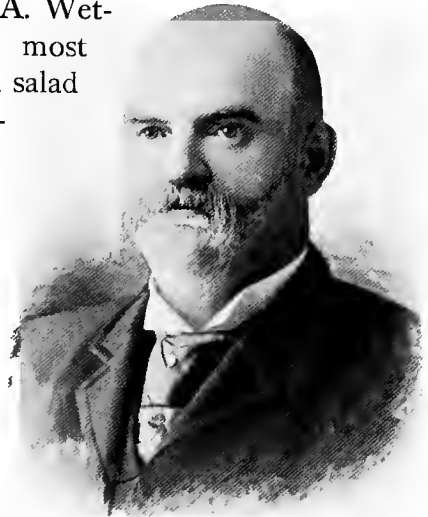
The American Cotton Oil Company made a display of cotton-seed oil and its products, embracing the winter and summer white and yellow refined oils, miners' oil, cooking and salad oils, and the culinary compound known as cottolene, a mixture of cotton-seed oil and beef suet.

George F. Hooper and Ralph R. Selby exhibited olive oil from California, and among the State exhibits it was shown by Mr. Selby and by F. Closs, E. C. Goodrich, J. L. Howland, Tiburcio Parott, Mrs.

Emily Robinson, Julius P. Smith, and Charles A. Wetmore. Olive oil occupied, next to wine, the most prominent place in the Italian exhibit. French salad oils were liberally exhibited. In the Spanish section were a hundred exhibits of olive oil. Greece sent a good exhibit, and there were oils from Algeria and a large assortment of table and common oil from Tunis. Uruguay and Mexico were among the countries exhibiting olive oil. Olive-oil soap was exhibited by Spain, Italy, Greece, Mexico, and Tunis.

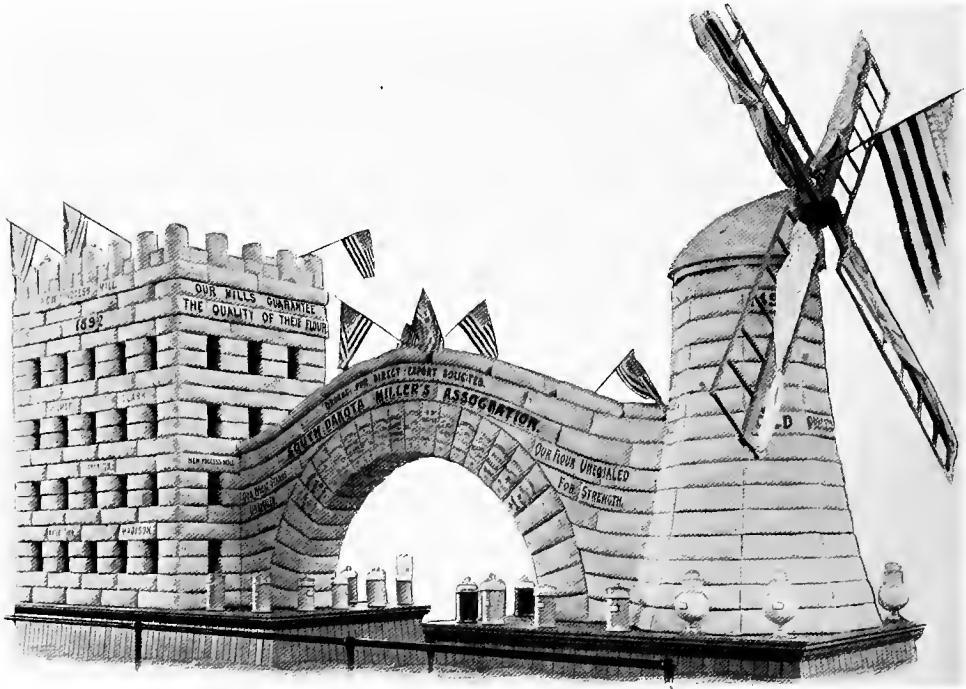
Flaxseed, the crop with which the rank new soil of the Red River Valley is commonly broken for cereals, was exhibited by Minnesota and the Dakotas. Wisconsin had twenty-three exhibits of flaxseed and one of rape seed. Rape seed and oil were largely exhibited by Japan. The National Linseed Oil Company presented an exhibit of oils, oil cake, and oil meal. Linseed oil was exhibited by Mexico. Castor oil was exhibited in the United States pavilion by the Baker Castor-Oil Company, and in the New Jersey pavilion by August Buckrow and Christian Heinecke. Exhibits of castor oil came from Brazil, Ecuador, Mexico, and Jamaica. France exhibited various vegetable oils from the penal colonies of Noumea and Cayenne, and palm and peanut oil from Indo-China. The great vegetable oil industry of Russia was represented by numerous samples of sunflower, mustard, linseed, and other oils, oil cake and oil meal, and eighteen exhibits of oil seeds besides a collection of the oil seeds of the Caucasus.

Palm oil and soap were exhibited by Paraguay. The Liberian exhibit of palm oil was accompanied with the gourds and strainers used in collecting it. Liberia exhibited nut oils also. Johore contributed cocoanut, palm, and other vegetable oils. Besides cocoanut oil, Ceylon showed cinnamon and



ISAAC N. CAMP,  
Member of the Directory.

citronella oil. Jamaica sent cocoanut oil and oil of pepper. The vegetable oils from Costa Rica included fig oil. Oil of sesame was sent by Mexico and by Japan, both of which countries had a rich assortment of vegetable oils. The Mexican exhibit included palmachristi oil, coco oil, and mixcay, cichite, and oyametl oils. Japan exhibited camellia oil and oil of peppermint and menthol crystals. Japan exhibited wax made from a native berry. Albert M. Todd, of Kalamazoo, had an exhibit of essential oils and crystalloids derived from peppermint, spearmint, wormwood, wintergreen, tansy, etc. A Queensland concern exhibited oils manufactured from various species of eucalyptus, with soap made from them, especially the citron-scented species (*Eucalyptus maculata*), which is said to possess medicinal virtues.



Samples of Flour from South Dakota.

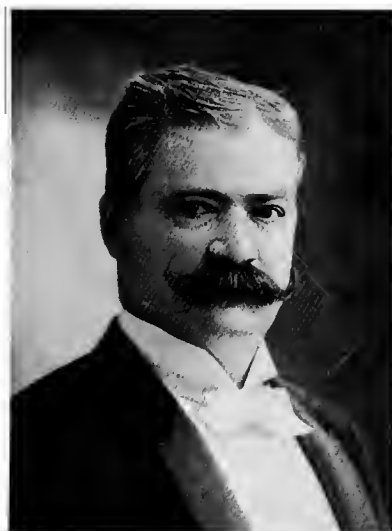


Stuffed capons exhibited by the Agricultural Experiment Station, Geneva, N. Y.

## CHAPTER II.

### THE LIVE-STOCK EXHIBIT.

Interest manifested by visitors in the exhibits—Appropriations for money premiums—Eagerness of breeders to secure choice animals—Conditions and rules laid down for exhibitors—Division of exhibits and assignments of time—Exhibits of cattle and horses—Exhibit of sheep—Goats—Exhibit of swine—Dogs—Poultry and pet stock—Fat stock.



WASHINGTON PORTER,  
Member of the Directory and of the  
Standing Committee on Agriculture.

THE live-stock exhibit was so important and attractive to farmers and stock-raisers that attendance increased twenty-five per cent after it was opened. The Exposition management offered \$150,000 in premiums, and the associations of breeders and amateurs added fully \$100,000 more. Not only were all the breeders eager to send their choicest stock, but wealthy lovers of the various breeds scoured Europe to secure the choicest animals that could be purchased. In the Exposition stables the horses were groomed and watched and exercised with the greatest care, and the cattle were brushed and combed, their tails crimped, and their horns polished every day. Ninety prizes were given for each of the fourteen breeds of cattle.

The exhibit lasted from August 22 to October 28. The live-stock exhibits were, excepting the dairy exhibits in the Agricultural Department, the only competitive ones. The plans and ar-

rangements were made and the conditions and rules laid down by representatives of about seventy live-stock associations of the United States. Provision was made for showing about three thousand animals at a time—first horses and cattle, then sheep and swine, and lastly poultry. Cattle and horses constituted the two principal divisions. Premiums were offered to all the well-known established breeds, and no animals were admitted that were not inscribed in the official herd and stud books. Cattle and horses were judged from August 22 till September 8, one or two classes of each on each day ; sheep and swine were judged from September 25, and poultry in October. Toward the end of October the lighter breeds of horses of the United States and Canada were elaborately exhibited by breeders. Jackasses and jennets formed a class in the horse exhibit, and mules a special class. Connected with the sheep exhibit a large collection of Angora goats formed a group.

The first live-stock exhibits to arrive were a string of Morgan horses and a herd of cattle from Vermont. These were followed by Canadian thorough-bred horses and pedigreed cattle, and at the end of the first week twelve hundred head of cattle and eight hundred horses were in their places.

The classes of cattle exhibited were the following : 1. Shorthorns. 2. Herefords. 3. Aberdeen-Angus. 4. Galloways. 5. Devons. 6. Jerseys. 7. Holstein-Friesians. 8. Ayrshires. 9. Guernseys. 10. Sussex. 11. Red polled. 12. Polled Durham. 13. Dutch belted cattle. 14. Brown Swiss. Other classes of exhibits in the cattle division were : 15. Sweepstakes by ages, open to beef breeds and limited to prize winners. 16. Sweepstakes by ages, open to first and second prize winners in dairy breeds. 17. Sweepstakes by ages, limited to first and second prize winners and open to all general-purpose breeds. 18. Grand sweepstakes herd, open to all beef breeds. 19. Grand sweepstakes herd, open to all dairy breeds. 20. Grand sweepstakes herd, open to all general-purpose breeds.

First, second, third, and fourth premiums were given to the best bulls of each breed three years or over, two-year-olds, yearlings, and calves ; for the best cows over four years old, three years old, two-year-old and yearling heifers, and heifer calves ; for herds consisting of a bull over two years old, a cow over four years and one under, and heifers two years, one year, and under one year old ; for the young herds, consisting of a bull and four heifers, all under two years ; for four animals of either sex under four years, the get of one sire ; for a cow and two of her produce ; and a sweepstakes and medal for the best bull and for the best cow of any age. The first and second prize winners of the different ages and of both sexes of the several beef breeds, and those of the dairy breeds, were eligible for sweepstakes by ages. Sweepstakes by ages were further offered to all general-purpose breeds. A grand sweepstakes consisting of four prizes for herds was open to all the beef breeds, and another was offered to young herds ; similar premiums were offered to aged

herds and young herds in the dairy breeds ; and others were open to all general-purpose breeds.

None of the States surpassed Canada's showing of blooded cattle, either in number of exhibits, diversity of breeds, or quality. A large proportion of the premiums went to Canadian breeders, especially for British breeds that are better established in the Dominion than in the States. The number of exhibits entered from Ontario and the other provinces of the Dominion was two hundred and thirty-four, while Illinois had one hundred and seventy-two ; Minnesota, one hundred and fifty-four ; Ohio, ninety-nine ; Missouri, eighty-three ; Indiana, seventy-eight ; New York, sixty-seven ; Pennsylvania, fifty-nine ; Iowa, fifty-nine ; Vermont, forty-nine ; Kansas, forty-two ; Nebraska, forty-two ; Kentucky, thirty-three ; Michigan, seventeen ; Maine, thirteen ; North Dakota, ten ; and Massachusetts, one.

In the shorthorn class there were two hundred and thirty-three exhibits. This favorite breed, preferred before all others on the stock ranges of the West and prized for beef and for improving the grade of native stock, and for milking also, is now as much American as it is English, having been bred and developed here for a hundred years so successfully that many fine breeding animals have been shipped from this country to Europe. The contesting animals came from Ontario, Kentucky, Indiana, Missouri, Illinois, and Minnesota. T. S. Moberly, of Richmond, Ky., took the prize for the best aged bull with Abbotsburn, and also the prize for the finest heifer ; H. F. Brown, of Minneapolis, had the finest herd ; J. & W. Russell, of Richmond Hill, Ontario, the best young herd ; and J. G. Robbins & Son, of Horace, Ind., the best herd of cows and the best cow of any age.

Other prize winners and exhibitors were W. B. Cockburn, W. C. Edwards, R. & S. Nicholson, John Morgan & Sons, John Isaac, John T. Gibson, F. Birdsall, W. G. Sanders, and H. & W. Smith, of Ontario ; J. H. Potts & Son, L. W. Brown & Sons, Green Brothers, O. W. Fisher, T. W. Hunt, and J. D. Varner, of Illinois ; T. W. Ragsdale and B. O. Cowan, of Missouri ; A. M. Kent, of New York ; Abram Renick, of Kentucky ; T. A. Alban & Son, of Ohio ; A. D. De Garmo, of Michigan ; and Thomas Andrews, of Nevada.

Of Herefords, a breed valued for beef and well introduced in the West, there were one hundred and forty exhibits. The bull Ancient Breton, belonging to H. W. Clough, of Elyria, Ohio, received the first premium, and the herd of the same exhibitor was adjudged the best, while Gudgell & Simpson took the prize for the best young herd. The best cow was Annabel, exhibited by W. S. Van Natta, of Fowler, Ind.

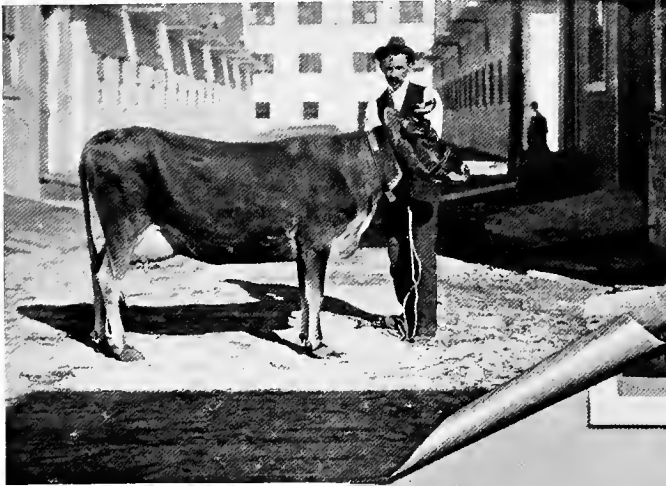
Other exhibitors and prize winners were C. E. Elmendorf and E. E. Day, of Nebraska ; Makin Brothers, of Kansas ; Thomas Clark, H. J. Fluck, and B. Todd, of Illinois ; G. S. Redhead, of Iowa ; Cosgrove Live-Stock Company, of Minnesota ; F. A. Fleming, of Ontario ; and H. D. Smith, of Quebec.



Missouri, Illinois, and Iowa breeders took the chief part in the competition for the prizes offered for Aberdeen-Angus cattle, a large breed of good milkers that can be easily fattened. Wallis Estill, of Estill, Mo., bore off most of the prizes. There were seventy-two entries in this class.

Robert Craik, of Montreal; Goodwin & Judy, B. R. Pierce, and J. J. Rodgers, of Illinois; A. M. Kent, of Jamestown, N. Y.; and W. A. McHenry, of Denison, Iowa, had exhibits.

The Galloways are another Scottish breed esteemed both as milk-



ers and as beef producers. Indiana, Minnesota, and Ontario were prominent as exhibitors of this class. The Brookside Farm, Fort Wayne, Ind., and Hugh Paul, of Dundee, Minn., received first premiums, while a Canadian breeder, William Kough, of Owen



DAIRY EXHIBITS.

Sound, received a number of lesser prizes. S. P. Clarke, of Dover, Ill., and W. McTurk & Sons, of Crystal, Iowa, also exhibited and took prizes in this class.

The Devons are English beef cattle not common in the United States, though the breed is cultivated in Canada, where there are such good strains that the Canadian exhibitor, W. J. Rudd, carried off most of the prizes from his competitors, A. E. Baker, of Beaver Dam, Wis.; John Hudson, of Moaweka, Ill.; and D. J. Whitmore & Co., of Casstown, Ohio.

The Jerseys head all the milch cattle in the United States, where they have been bred from the most select strains of the island stock—finer than in England for character and beauty, finer than in Jersey for milk and but-

ter, too fine, perhaps, for constitution and perpetuation. Numerous exhibits were entered from Missouri, Illinois, and Minnesota ; but Pennsylvania and New York had the finest animals. T. S. Cooper's herd, of Lehigh County, Pennsylvania, took about half the premiums. The prize for the best cow went to C. A. Sweet, of Buffalo, N. Y.

Jerseys were exhibited by Thomas Beer, the Franklin N. Billings estate, James A. Blair, J. C. Snell, and I. L. Clark, of Ontario ; A. H. Cooley, Latimer & Miller, La Veta Jersey Cattle Company, of Kansas ; C. F. Cobb, Moore & Warren, W. E. Matthews, and W. R. Reson, of Huntsville, Ala. ; Pittsford Farm, of New York ; Richardson Brothers, of Davenport, Iowa ; G. H. Shawhan, A. P. Foster, Rolla Olliver, Mrs. S. E. Hudson, Edgar Brewer, P. J. Cogswell, Kentucky Agricultural Station, C. I. Hunt, O. & C. T. Graves, D. L. Heinsheimer, Frank Eno, M. C. Campbell, and Mortimer Levering.

There were sixty-seven exhibits of Holstein-Friesland cattle. The exhibitors were J. C. McNevin & Son, of Winona, Ontario ; D. F. Wilbur, of Oneonta, N. Y. ; C. F. Stone, of Peabody, Kan. ; A. E. Riley, of Walled City, Mich. ; C. V. Seeley, of New Farmington, Mich. ; and W. Rood, of Binghamton, N. Y. D. F. Wilbur received the first premiums for bulls of all the ages, for heifers a year and under a year old, for a herd graded by ages and a young herd, and for four animals the get of one sire ; also the medals for the best bull of any age and the best bull under a year old. C. F. Stone received the premium for the best cow three years old, and A. E. Riley for two animals the get of one cow. The best cow of any age was Walled City Queen, bred by C. V. Seeley.

The Ayrshires rank only below the Jerseys for milking, their milk being esteemed especially for cheese rather than for butter, in which the Alderneys excel. The Canadians, who have given more attention to this useful race than to the Channel Island cattle, took nearly all the prizes in the Ayrshire class. The exhibitors were Thomas Guy, J. Yuill & Sons, W. M. Smith, and William Stewart, Jr., of Ontario ; Daniel Drummond and Thomas Irving, of Montreal ; Robert Robertson, of Quebec ; Thomas Watson, of Georgetown ; P. Beatty and J. H. Crane & Sons, of Ohio ; and C. M. Winslow and L. S. Drew, of Vermont. There were one hundred and twenty-nine exhibits in all. The largest number of prizes fell to Daniel Drummond.

In the Guernsey class forty-nine exhibits were entered. The exhibitors were W. D. Richardson, of Garden City, Minn. ; G. Howard Davison, of Millbrook, N. Y. ; A. J. Cassatt, of Berwyn, Pa. ; J. N. Greenshields, of Danville, Canada ; and Francis Shaw, of Wayland, Mass.

No Sussex cattle were brought to the Exposition.

The polled Angus is a hardy breed, valued equally for milk and for beef. Seventy exhibits of red polls were made by J. H. Gilfillan, of Maquoketa, Iowa ; J. S. & L. K. Haseltine, of Dorchester, Mo. ; V. T. Hills, of Dela-

ware, Ohio ; William Miller's Sons, of Wayne, Neb. Mr. Gilfillan obtained nearly all the first premiums.

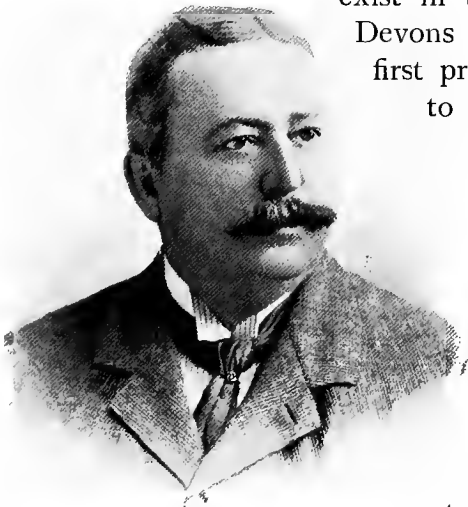
Polled Durhams were exhibited by J. T. and A. E. Burleigh & Dewey, of Mazon, Ill., and J. H. Miller, of Mexico, Ind.

Herd of handsome Dutch belted cattle adorn the rural landscapes of Pennsylvania, from which State came their only exhibitor, H. B. Richards, of Easton. These cattle, black, with a continuous broad, milk-white band encircling the body, are of medium size, fine boned, compact, and well built. The cows vary in weight from eight hundred to twelve hundred pounds, and the bulls from sixteen hundred to two thousand. Mr. Richards showed a herd of about forty head. The prize bull, Byron, was American bred.

The exhibitors of brown Swiss cattle were E. M. Barton, of Hinsdale, Ill. ; A. M. Kent, of Jamestown, N. Y. ; F. A. Squires, of Blue Earth, Minn. ; and Abe Bourquin, of Nokomis, Ill. Of the fifty-four exhibits, those of Mr. Bourquin took fourteen of the fifteen first prizes.

In Connecticut attention is still paid to the breeding and training of working oxen, and there are found as good teams as exist in the world. None could surpass the yoke of Devons exhibited by David Strong, to whom the first prize was given, while the others were awarded to his neighbors, John Ferris, Granger Brothers, and E. W. Lyon.

The Government of Trinidad exhibited in a special class a pure zebu bull and a young cow, bred on its stock farm at Port of Spain.



HARRY VINCENT,  
Commissioner from Trinidad.

In the sweepstakes by ages for the different classes V. T. Hills took first medals for cows four years old or over ; J. H. Miller, a medal for a bull three years old or over, a bull one year old and under two, and a heifer under one year ; C. Elmen-dorf, for a yearling heifer ; W. B. Cockburn, for a bull under one year ; J. & W. Russell, for a yearling bull and a heifer under a year ; W. T. Fluck, for a two-year-old bull ; T. S. Moberley, for a bull three years old or over ; W. A. McHenry, for a two-year-old heifer ; Wallace Estill, for a cow three years old or over ; Abe Bourquin, for a bull two years old, a cow three years old, and a heifer one year old ; D. F. Wilbur, for a bull under a year ; and J. H. Gilfillan, for a two-year-old heifer.

For the grand sweepstakes herd open to beef breeds, Green Brothers, J. H. Potts, H. F. Brown, and T. S. Moberley entered Durhams ; George S. Redhead, Thomas Clark, E. E. Day, and the Cosgrove Company entered

Herefords; Robert Craik and Goodwin & Judy entered Aberdeen-Angus; the Brookside Farm Company and William Kough entered Galloways; A. C. Riley entered Holstein-Friesians; J. S. & L. K. Haseltine, red polls; and J. H. Miller, polled Durhams.

The entries for the best young herd of beef cattle were: Shorthorns by Green Brothers, Abram Renick, J. H. Potts, H. F. Brown, and T. S. Moberley; Herefords by Thomas Clark, E. E. Day, and the Cosgrove Live-Stock Company; Aberdeen-Angus by Goodwin & Judy; Galloways by the Brookside Farm and William Kough; red polls by J. S. & L. H. Haseltine; and polled Durhams by J. H. Miller.

The herds entered in the grand sweepstakes for general merit were: Shorthorns by J. G. Robbins & Sons, L. W. Brown & Sons, and T. S. Moberley; Devons by A. E. Baker, D. J. Whitmore & Co., and John Hudson; Jerseys by George E. Shawhan and T. S. Cooper; Holstein-Friesians by C. F. Stone and D. F. Wilbur; Ayrshires by Thomas Irving; Guernseys by A. J. Cassatt; red polls by V. T. Hills and William Miller's Sons; Dutch belted cattle by H. B. Richards; and brown Swiss cattle by Abe Bourquin.

The competitors for the premiums put up for young general-purpose herds bred by exhibitors were: A. D. De Garmo, J. D. Varner, and T. S. Moberley with shorthorns; A. E. Baker and John Hudson with Devons; George H. Shawhan and T. S. Cooper with Jerseys; D. F. Wilbur with Holsteins; Robert Robertson with Ayrshires; A. J. Cassatt with Guernseys; V. T. Hills and William Miller's Sons with red polls; H. B. Richards with Dutch belted; and Abe Bourquin with brown Swiss.

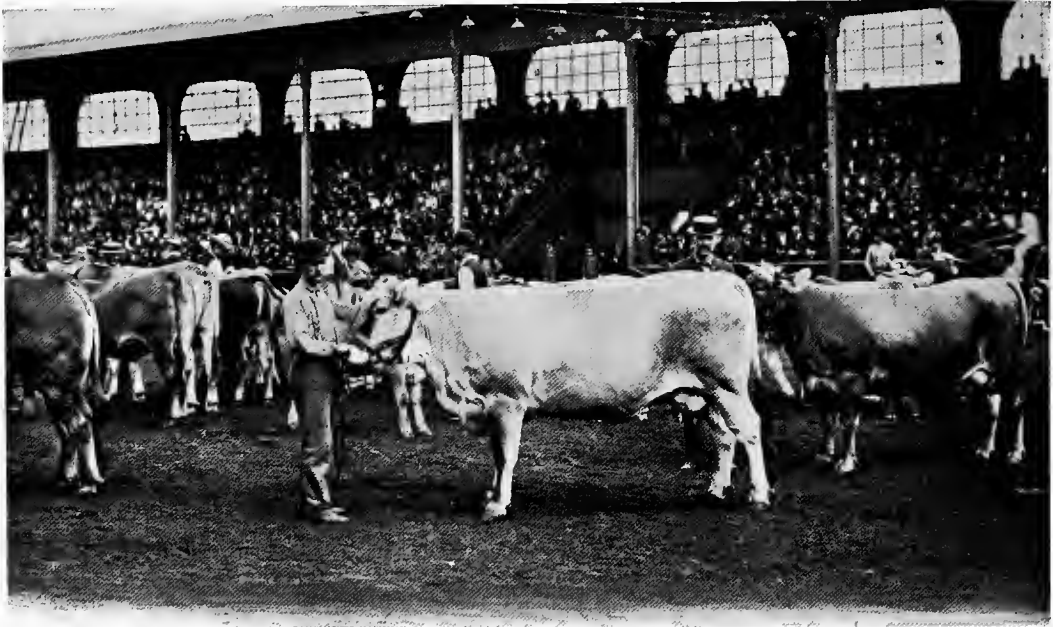
H. H. Clough, W. S. Van Natta, J. G. Robbins, and T. S. Moberley took the medals for grand sweepstakes herds, and J. & W. Russell, W. S. Van Natta, B. O. Cowan, and Wallace Estell for young herds. In the next class O. W. Fisher, Abe Bourquin, V. T. Hills, and William Miller's Sons received medals for herds graded by ages; and J. H. Miller, V. T. Hills, Abe Bourquin, and R. & S. Nicholson for young herds, all under two years.

The display of horses was the most important part of the live-stock exhibition. The highest types of thirty distinct breeds were brought together and could be seen and compared for some weeks before they were finally judged in the arena and then dispersed. New York and the Eastern and the remote Western States would have been better represented if another season had been chosen for judging, because many owners of valuable animals were loath to send them away from home at the hottest time of the year.

The breeds of horses for which prizes were offered were classified and numbered as follows: 21. Standard trotter. 22. Thoroughbreds. 23. French coach. 24. German coach, including Oldenburg, Hanoverian, Trakehnen, and Holstein. 25. Cleveland bay. 26. Percheron. 27. Clydesdale. 28. Shire. 29. French draft. 30. Belgian. 31. Suffolk punch.

32. Hackney. 33. Morgan. 34. Arab. 35. Americo-Arab. 36. French trotters. 36½. Russian horses. 37. Saddle horses. 38. Shetland ponies. 39. Jacks and jennets. *Special class.* Mules.

In the standard classes four graded prizes were offered severally for stallions and for mares under a year old, yearlings, two, three, and four years old, and five years old or over; three premiums, with a diploma, for a stallion and three of his colts under four years old, and for a mare and two colts of either sex; and sweepstakes for the best stallion of any age, the best



A HERD OF JERSEY CATTLE.

mare, and the best collection of two stallions and three mares under five years old, bred by the exhibitor.

While Canada was less eminent than in the cattle show, though still worthily represented, some foreign nations that took no part in the other live-stock exhibits sent examples of their favorite breeds of horses, and these were valuable and interesting accessions, because the breeds exhibited thus were such as are uncommon in the United States. Australia and the stock-raising countries of South America made no effort to exhibit cattle, horses, or sheep. The Germans, proud of their indigenous breeds that Americans have hitherto passed by, being attracted by the French and British types, made the most liberal display of horseflesh. The special predilection of Americans was betrayed by the great number of horses of French strains exhibited—greater than that of any other blood, and constituting nearly one fourth of all the horses shown. Next in numbers were the British breeds. A great many mares and fillies of the purest types were seen,

proving that these foreign breeds have become naturalized in the United States. The Russians sent some of the finest examples of their noble breeds, including a string of horses from the imperial stud. Among the American exhibits was one of the only distinct breed of heavy draft horse yet evolved in this country, the Conestoga, which came from the valley of that name, and is supposed to have derived its weight and strength from German sires brought over in early times. It is a large and muscular animal, standing sometimes seventeen hands high, and bears a resemblance to the English dray horse, but is more mettlesome and finer built.

Canada entered fifty-five exhibits in the various classes. Of the several States, Illinois had two hundred and twenty exhibits; Iowa, one hundred and thirty-seven; Michigan, seventy-five; Wisconsin, seventy-four; Minnesota, sixty-four; Vermont, fifty; Indiana, forty-seven; Missouri, forty-two; New York, thirty-nine; Kentucky, thirty-six; Nebraska, eighteen; Tennessee, four; and West Virginia, Ohio, North Dakota, Kansas, and Pennsylvania, one each.

There was a sufficient exhibit of American standard trotters, headed by Guy Wilkes, the trotting stallion that held the record. G. & C. P. Cecil, of Danville Ky., received the medal for a mare and two colts, the premium for the best collection, and first premiums for two-year-old stallions and yearling, three-year-old, and aged mares; J. R. Peak & Son for mares two and four years old; H. P. Watson for a three-year-old stallion; W. M. Rue for one five years old or over; and Jay La Dues for a stallion with two of his get.

Thoroughbred horses were exhibited by Robert Davies, of Toronto, who carried off both premiums for collections, the medal for a mare and colts, and premiums for stallions one, two, and five years old and mares two, three, and five years old or over; also by Thomas Irving, of Winchester, Ontario, winner of the first premium for a three-year-old stallion, and George S. Scagell, of Owen Sound, Ontario, and others.

The French coach horses exhibited were declared by the judges to be "all that the most enthusiastic admirers of the breed could hope for or desire." The best prizes went to M. W. Dunham's stud at Oaklawn farm, in Wayne, Ill., as in the other French classes, for this extensive and expert breeder of Percherons and other French horses entered five hundred exhibits, of which one hundred and eleven were prize winners. In this class Oaklawn had sixty-eight entries and took forty-nine prizes. Perfection, Lord, Lancier, Monaco, and Partisan won for this stud all the first prizes for stallions, except the yearling prize captured by Leonard Johnston, of Northfield, Minn., and the prizes for a stallion and colts and for a collection of stallions and mares also went to M. W. Dunham. Other exhibitors were E. B. Hoge, who took one of the premiums with a five-year-old; Ira L. Otis, winner of several premiums; T. S. & J. S. De Lancy, Willard & Fuller, Henry Balliet, Edward Miller, H. C. Farnum, Mathew & Groft, J. P. Mc-

Williams, who won five premiums; E. Knott & Co., W. B. Otto & Foster, the National Haras, of Montreal; and R. Ness and E. A. Globensky, of Canada.

There were ninety-two exhibits of German coach horses, including many from Germany, to compete with those of the German-American breeders of Illinois and Iowa and other amateurs of the strong and reliable German breeds. The German horses received more prizes than those of either of these States, though Ulfert Poppen, of German Valley, Ill., took more than any other individual exhibitor. The first prize for stallions went to Moltke, exhibited by A. B. Holbert, of Greeley, Iowa, agent for the Holstein Association, of Germany. This association obtained a first prize with the two-year-old Bodo, while C. H. Bulling, of Oldenburg, got the prize for three-year-olds with Althing.



AN ORLOFF TROTTER.

G. P. & H. Gerdes took first prizes with Oldenburg mares. The best mare of any age was a Hanoverian shown by C. Cordes. The American breeders who exhibited were Ulfert Poppen, Oltmanns Brothers, Jacob Heyl, of Milwaukee, J. Crouch & Sons, of Lafayette, Ind., Holbert & Lewis, E. Knott & Co., C. von Drathen, and T. Boekhoff. Mr. Poppen received the

premium for a stallion with three colts, Oltmanns Brothers for a mare and two colts, and Mr. Knott took premiums for stallions, and also gold and silver medals offered by the Oldenburg Coach-Horse Society, of Germany.

The Cleveland bay, sought after as a strong and showy coach horse, was exhibited mostly by Illinois, Michigan, and Canadian breeders. Stericker Brothers, of Springfield, and George E. Brown, of Aurora, carried away a large share of the prizes. Other exhibitors were B. F. Dorsey Sons & Co., of Perry; the Cleveland Bay Horse Company, of Paw Paw, which took two first premiums for mares; Samuel J. Acker, of Charlotte; P. L. Bordine, of St. Louis; Sutherland & Crowley, of Saginaw, Mich.; J. B. Sharra, of Mexico, and Robert M. Sharra, of Oswego, N. Y.; A. B. Holbert, of Greeley, Iowa; W. Hinckle Smith, of Armenia, N. D.; and Peter Arkell, A. C. McMillan, and Thomas Irving, of Canada. There were forty-eight exhibits of Cleveland bays.



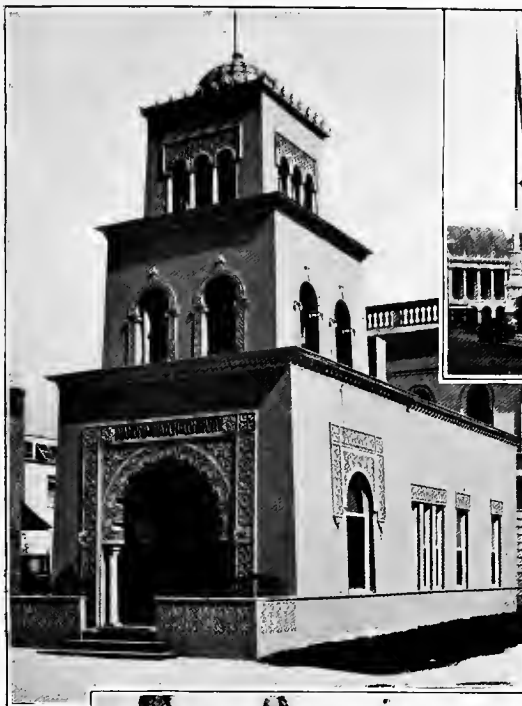
The Norman horse, with its vigorous limbs and massive neck and shoulders, with muscles perfectly distributed and beautifully proportioned, with the keen, ambitious zest with which it undertakes any task and spends its utmost efforts without flinching, is an exemplar of nervous energy and courage that appeals to Americans, especially the active, graceful, symmetrical Percheron, which is supposed to have a strain of Andalusian blood. Though the stolid, plodding British draft horse is more useful for some purposes, and is now properly esteemed, the Normans are more generally liked, and are very valuable for grading the American draft stock, which is already superior in form and spirit to the English cart horse from which it was derived. Norman Percherons were exhibited from the Northwestern States and Canada. M. W. Dunham showed a large number of horses and won twelve first prizes. His Introvable, the prize four-year-old, took the medal for stallions of any age; Fierabras took the prize for aged stallions; Cocardus for three-year-olds; Adrien for two-year-olds; Moreri for one-year-olds; Alcalde for colts; and Bertha for mares of any age. W. B. Otto, of Charlotte, Mich., took the medal for a mare and two colts. Other exhibitors were H. C. Farnum, J. L. Merritt, E. Woodman, and H. C. Waldron, of Michigan; H. A. Briggs, of Wisconsin; Mark M. Coad, of Nebraska; T. L. & J. L. DeLancy, Leonard Johnson, W. P. Baldwin, and Willard & Fuller, of Minnesota; E. F. Kleinmeyer, of Iowa; J. P. McWilliams, Ezra Stetson & Son, and Edward Hodgson, of Illinois; and Paul Wattiez, J. Beaubien, T. Doblé, Oliver Benoit, the National Haras, the Trappist Fathers of Oka, and the Mile-End Deaf and Dumb Institution, of Quebec and Ontario. Mr. Coad won a good number of premiums, and others went to Messrs. DeLancy, Briggs, Kleinmeyer, Johnson, and Beaubien.

The Clydesdale is prized, East and West, as one of the ablest working horses for farm or town. The number of exhibits—one hundred and eighty-seven, exceeding the Percherons and every other class—indicates the value placed upon the Scottish horses and the extent to which they are now bred in the West. N. P. Clarke, of St. Cloud, Minn.; Robert Holloway, of Alexis, Ill.; and R. B. Ogilvie, of Madison, Wis., were the chief competitors and divided the first premiums, Mr. Clarke obtaining the majority in the regular and Mr. Holloway in the special class. The former, who had several imported horses, won the prizes offered by the Clydesdale Horse Society for the best stallion and the best mare, while the latter received the awards for the best American-bred stallion and mare. Mr. Ogilvie won a special premium for a stallion and five colts. L. B. Goodrich, of State Center, Iowa, and John McKay, of Woodstock, Ontario, exhibited imported stallions. The Brookside Farm, W. Moffatt & Brothers, J. Crouch & Son, Parker Brothers, Herman von Biedenfeld, and A. G. Soderburg exhibited American-bred stallions, while Canadian stallions were shown by James Moffatt, Adams Brothers, Coursey Brothers, D. & O. Sorby, John Duff,

James Cherry, Robert Davies, Robert Ness, G. B. Stewart, the National Haras, Toussaint Dupuis, Homer Laberge, Samuel McGerrigle, Robert & John Turner, S. C. Johnson, R. B. Dundas, W. Innes, A. Bell, Alexander Cameron, William Philp, James Snell, James I. Davidson, and Alexander Cameron. Mr. Holloway's prize stallion, Prince Attractive, had been a prize winner in England also.

There were forty-nine entries of Shire horses, the largest and heaviest of the English types. The Illinois prairies are the American home of this useful breed, as well as of other heavy stock introduced from Europe. Burgess Brothers had the largest number and also the best exhibits in several classes. George E. Brown also showed many excellent animals. Other Illinois exhibitors were Charles G. Monroe and B. F. Dorsey Sons & Co., who showed single stallions, and A. W. Hopkins and A. G. Soderburg, who had mares. Edmund Stanfield & Sons showed some of the breeding stock that they have at Hillsdale, Mich., but apart from theirs the only exhibits from outside of Illinois were the stud horses of A. B. Holbert, of Greeley, Iowa, and John Carr, of Front River, Canada. In the contest between stallions of all ages, the imported Joturna, of B. F. Dorsey Sons & Co., was pitted against George E. Brown's Holland Major and Moulton Marquis, Burgess Brothers' Knowle Light of the West and Bar Me, Charles G. Monroe's Kokomo, John Carr's War-Boys' Fashion, A. B. Holbert's Echo Chief, and Stanfield & Son's Knowle Prince. The premium went to Mr. Browne, whose horse took further the sweepstakes given by the American Shire Horse Association. The sweepstakes for the best mare and four prizes for the best collections of mares, stallions, and colts went to Burgess Brothers. Greeley, Iowa, is the center for the Belgian horses, an admirable type that attracted much attention. Van Volsen Brothers & Vanderschuerm and A. B. Holbert were the prize winners. The Petersburg Association, of their town, gained a prize with Robert II, and J. Crouch & Sons, of Lafayette, Ind., sent Major to compete in the stallion sweepstakes with Van Volsen Brothers' Hercules and Bismarck II and Mr. Holbert's Glorieux and Bidel. Le Febure & Sons, of Fairfax, Iowa, had a pair of fine fillies.

In the class of French draft horses, M. W. Dunham's Negro was the best three-year-old and the best stallion of any age, and his stallions Saintonge, Milton, Brito, Alcala, and Leonidas were the best in their respective ages, while the sire of the last-named, the champion La Ferte, took the prize for a stallion and three colts. Several Oaklawn mares, too, were adjudged the best in their classes. E. Miller and William Fry, also of Illinois, had good mares, while E. T. Kleinmeyer, of Wilton Junction, Iowa, showed the imported Colored Gentleman and some of his colts, and V. C. Gidellon exhibited a Canadian stallion. There were ninety-four exhibits in the class. The gold and silver medals of the French Draft Association were awarded to Mr. Dunham's Negro and Saintonge, and the medals for mares to two shown by Edward Hodgson, of El Paso, Ill., who won, moreover, the diplomas for the



1. Diamond Match Company, Chicago. 2. M. de C. Menier, Paris. 3. Bernstein Brothers, Louisville, Ky.  
4. W. M. Lowney Company, Boston. 5. Hygeia Mineral Springs Company.

#### A GROUP OF EXHIBIT BUILDINGS.



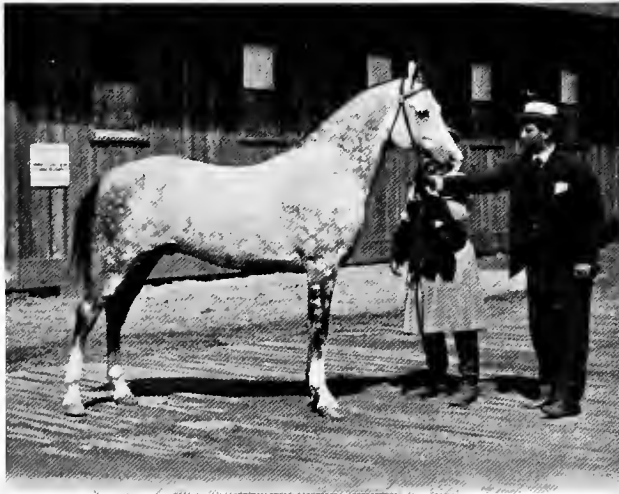
best stallion and three of his get and the best mare and colts. Several premiums were awarded to Edward Miller, and one first and four seconds to E. F. Kleinmeyer, while William Fry took the first premium for three-year-old mares.

The first animals led out before the judges were the docile Suffolk punches, a race that English and especially American breeding has made finer and more active than formerly, so that it has come to be esteemed one of the most valuable breeds of draft horses. The chief honors fell to Peter Hopley, of Lewis, Iowa, who received seventeen out of twenty-four chief prizes, first premiums, and cups and medals from American and British societies. His Blazer was pronounced a better stallion than his companion Connaught, or R. Ramsey's Nonpareil, or M. F. Reynolds's Venture, or Joseph Beck's young Canadian horse Ontario. Robert Ramsey had prize mares.

In the hackney class the amateur breeders of the Atlantic States made no exhibits. The best ones came from Nebraska and Canada, though Illinois and Indiana breeders showed very fine animals. In the sweepstakes, Nebraska was represented by A. L. Sullivan's Tip Top, Ontario by H. N. Crossley's Fireworks, R. Beith's Jubilee Chief and Ottawa, George H. Hastings's Star of Mepal, R. & J. A. Turner's Surprise, and S. C. Johnston's Sir Garnett; Illinois by Burgess Brothers' Ringmaster and Wenona Index, C. G. Monroe's American, and Stericker Brothers' Pontifex and Bective; Indiana by Thompson & Bland's March Past and Bentley Champion, L. W. Cochran's Expectation and King of England; Ohio by Jones & Daniel's Lord Darling; and Iowa by L. B. Goodrich's Dorrington. For a stallion and colts, Mr. Sullivan took first premium; for two-year-old and yearling stallions and an aged mare, Thompson & Bland, with other premiums; for a five-year-old and a stallion of any age and for the best mare of any age, Robert Beith; for a four-year-old stallion, Charles G. Monroe; for a stallion colt, Burgess Brothers. Other premiums went to George H. Hastings, R. & J. A. Turner, Stericker Brothers, H. N. Crossby, and L. W. Cochran. Gold medals for the best stallion and the best mare of any age, offered by the English Hackney Society, were awarded to Robert Beith's prize animals.

Abundant exhibits from Vermont, Kentucky, and other States of superb Morgans proved that this beautiful, proud, graceful, supple, fleet, high-strung, true American horse is not forgotten or neglected. There were sixty-six entries. The competitors for the stallion sweepstakes were: Joseph Battell's Denning Allen and Thought, George Senette's Morgan Chief, W. S. Bailey's Gratian, H. T. Cutts's Star Franklin, W. H. Taft's Black Hawk and W. H., Lester Fisher's Tamarlane, S. H. Saul's Meteor and Hill's Bonnie Morgan, W. A. Weed's Ben Hawk, E. T. Wilker's Norwalk, and F. C. Williams's Charlie Ray, from Vermont; L. L. Dorsey's Hendricks and Goldzil, and Hornsby Brothers' Indicator and Ingold, from Kentucky; Thomas Lafon's Charles Reade, from Missouri; Milton P. Funk's Tally and Barney, and the Morgan Horse Company's Sultan and Hillside Morgan,

from Illinois; Warder W. Stevens's Ingold and Bengold, from Salem, Ind.; and H. C. Brenneman's Black Hawk Chief, from Bethany, W. Va. Joseph Battell obtained medals for the best stallion and the best mare of any age; Hornsby Brothers, premiums for three-year-old and two-year-old stallions, and for mares one, two, and four years old, as well as the medal for a stallion and three colts; the Morgan Horse Company, the premium for a mare under one year; Ballard Brothers the first and Ross C. Kinsley the second premium for a four-year-old stallion. W. W. Stevens captured the medals for mare and colts and a collection of stallions and mares. Minor premiums went to Lester Fish, of Rutland, H. T. Curtis, of Orwell, W. H. Taft and H. C. Preston, of Vergennes, D. P. Smith, of Washington, J. H. George and W. S. Bailey, of Hardwick, and D. K. Wakefield and R. J. Cole, of Danville, Vt.



A RUSSIAN LIGHT-CAVALRY STALLION.

No Arab was admitted that was not certified by an Arab sheik as a pure-bred representative of one of the recognized families, the Kehilan, Seglawi, Hamdani, Abeyan, or Managhi; or, in case it was bred in the United States, that was not registered as of pure blood in the American Stud-Book. Jacob Heyl, of Milwaukee, made the only exhibits—the stallion Mirzah Saafy and three mares. One eighth or more of pure Arab strain qualified a horse as an Americo-Arab. The premiums were divided between the crosses of John B. Hall, of Toronto, and M. W. Dunham, of Wayne, Jacob Heyl's typical Arabs. George E. Bryant exhibited his Clay cross, and George Warren & Son another mixed breed. Jacob Heyl, of Milwaukee, received medals for the finest stallion and the finest mare.

French trotters of *demi-sang* were subject to the rules applied to coach horses, and were required to have an official record for themselves or their progeny equal to 2:40 or better. All applications were submitted to the French commissioners. The breeders of France offered a special premium for the best collection of French trotters. M. W. Dunham, who was the only exhibitor, entered the stallion Indre and thirteen others, with fifteen mares.

Most of the Russian horses exhibited were Orloff trotters. The Orloffs are descended from the White Arabian Smetanka, imported by Count Orloff

in 1775. The stallions Verbovstchik and Ouziadnik and the mare Zima, from the imperial stud, were sent by the Russian Government to Leland Stanford for his Palo Alto stud. The Grand Duke Dimitry exhibited five trotting stallions and two mares ; also two *demi-sang* Orloff saddle horses, bred as weight carriers, two Orloff-Arabs, two Russian Arabs, and a light-draft stallion. I. Alentieff, of Moscow, sent an Orloff trotter.

Forty-two saddle horses were exhibited by T. S. Harrison, A. F. Wycoff, L. M. Monsees, Cartwright & Ragsdale, J. A. Potts, G. Tom King, Henry R. Walker, R. T. Freeman & Son, D. L. Parish, and H. T. Cabbell, of Missouri ; W. F. Owsley, Joe Green, J. T. Crenshaw, John W. Kelly, T. S. Moberley, J. B. Castleman, W. L. Caldwell, and Rue & Owsley, of Kentucky ; and Edward Hodgson, C. B. Pratt, J. P. McWilliams, and C. B. White, of Illinois. J. T. Crenshaw, of Todd's Point, Ky., took the silver cup for trained saddle horses with his Monte Christo, Jr. First premiums were taken by Messrs. Castleman, Joseph Green, W. F. Owsley & Son, Harrison, White, Parish, and Potts & Son ; minor prizes by H. F. Cabbell, E. Hodgson, J. T. Crenshaw, Mrs. Mark M. Code, J. W. Kelly, J. P. McWilliams, and G. T. King ; and the medal for a stallion by A. F. Wycoff.

Eighty-five exhibits of Shetland ponies were made by J. M. Hoag, of Maquoketa, Iowa ; Robert & James Lilburn, of Emerald Grove, and J. M. Flowers, of Oconomowoc, Wis. ; E. F. & F. W. Hawley, of Pittsford ; and the Pittsford Farms, E. Woodman, and G. E. Gilman, of Paw Paw, and G. A. Watkins, of Detroit, Mich. E. F. Hawley received one first and six second premiums, while stallions owned by J. M. Hoag and Robert Lilburn and a mare of G. A. Watkins took first premiums. With the ponies was an assortment of carts and equipments. A string of Wisconsin ponies had some weanling colts not over twenty pounds in weight. Medals were awarded to Mr. Watkins for teams, double tandem, three and four abreast, and to Mr. Hoag for a team of eight. The latter took the silver cup of the Shetland Pony Club for a herd consisting of a stallion and four mares.

There were twenty-seven jacks and thirty jennets exhibited by W. L. Caldwell & Son, Luke W. Emerson, and E. W. McCormack, of Kentucky ; J. W. & J. L. Jones, of Tennessee ; J. C. Ray, L. Monsees, and C. G. Comstock, of Missouri ; Converse Brothers, Mason & Hill, and A. W. Hopkins, of Illinois ; and James Lilburn and J. M. Fowlers, of Wisconsin. Many of the prizes fell to Messrs. Converse Brothers, Hopkins, McCormack, and Jones ; the medal for a jack of any age to Mason & Hill ; first premium for a jack five years old and over to L. Monsees ; various premiums and the medal for a collection to Caldwell & Son. In the special class for mules nine animals were exhibited by Converse Brothers and Wallace Estill.

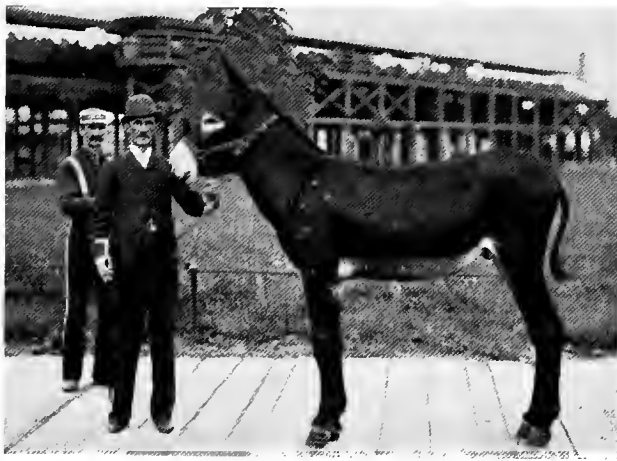
Sheep were required to have certificates of registration in the American flock books, except unimproved sheep that might be admitted for exhibition, not for competition, if they appeared to possess a historic or other interest. Premiums were offered for rams and for ewes three years old and over, two



years old, one year, and under one year old ; for a ram and three ewes, all under two years ; for a pen of five ewes, and for one of two rams and three ewes, bred by the exhibitor ; and sweepstakes for a ram and for a ewe of any age. All entries were required to have been shown since the first of April. The division contained the following classes : 40. Cotswold. 41. Leicester. 42. Lincoln. 43. Southdown. 44. Shropshire. 45. Oxford. 46. Hampshire. 47. Merino, selected for form of carcass and quality and weight of fleece. 48. Merino, selected for size of carcass, as well as for form and fleece. 49. Delaine Merino. 50. Dorset horn. 51. Cheviot. 52. French Merino. 53. Angora goats. 54. Cashmere goats.

For Cotswolds, George Harding & Son, of Waukesha, Wis., took the most first premiums ; J. G. Snell & Brother, of Edmonton, Ontario, had the

best pens ; Robert Miller, of Brougham, Ontario, showed the finest ewe ; and some small prizes fell to J. H. Woodford, of Paris, Ky., and one to George F. Davis, of Dyer, Ind.



A PREMIUM JACK.

In all the large breeds, the mutton sheep of English stock, when the breeders of Canada competed with those of the United States, as they did in every class that they did not have all to themselves, bore off

the prizes. James Snell, of Clinton, Ontario, and John Kelly, of Shakespeare, took the premiums for Leicesters, except one that went to William Newton, of Pontiac, Mich.

For Lincoln sheep, Gibson & Walker, of Denfield, Ontario, took the first premiums, while the minor ones fell to William Oliver, of Avonbank, William Walker, of Idlertown, and D. A. Campbell, of Mayfair, Ontario. In the Southdown class most of the first premiums went to John Jackson & Sons, of Abingdon, Ontario, and two to T. C. Douglas, of Galt, Ontario, while T. B. Bennington, of Grafton, Ohio, took one, and J. H. Potts & Son, of Jacksonville, Ill., W. E. Spicer, of Harvard, Neb., J. R. Harvey, of Burlington, Neb., and George F. Davis & Co., of Dyer, Ind., received minor prizes. The premiums of the American Southdown Association also went to Jackson & Sons, except one for a ram awarded to Mr. Bennington. In the Shropshire class, John Campbell, of Woodville, Ontario, and A. O. Fox, of Oregon, Wis., divided the first premiums, except two, one that fell to William R. Turner, of Shelbyville, Mo., while lesser prizes went to George Allen & Sons, of Allerton,

Ill., W. H. Beattie, of Wilton Grove, Ontario, George E. Breck, of Paw Paw, Mich., and Mortimer Levering, of Lafayette, Ind. For Oxford sheep, George W. McKerrow, of Sussex, Wis., took the most first premiums, as well as the silver cup given by the Oxford Down Sheep Breeders' Association, of England, for the best collection; Sid Conger, of Flat Rock, Ind., received a first premium for a ram; and Stone & Harris, of Stonington, Ill., had the best ewe and the best pens. William Newton, of Pontiac, Mich., took six first premiums in the Hampshire class; John Q. Gordon, of Mercer, Pa., took the premiums for the best pens, including a special prize from the English Hampshire Down Sheep Breeders' Association; E. A. Crawford, of Reading, Mich., received the special premium of that association for the best ram; William Newton, of Pontiac, Mich., took two premiums for rams; and James Court & Son, of Marshall, Mich., received several awards. The first premiums of the Hampshire 'Down Breeders' Association of America were awarded to Messrs. Kelly, Crawford, and Gordon.

In Merino sheep there was no competition from Canada, and the quality of the exhibits sustained the reputation of the American breeders, who are as careful and as successful in preserving the most valuable tribe of wool bearers as are those of Spain or France or Saxony. The awards given to Vermonters for Merinos of the purest type show that the flocks of the Green Mountains still rank with the finest in the world. That colonies of Merinos equally pure are found in various parts of the country was proved by the award of first premiums to New York, Illinois, Michigan, Missouri, and Kansas flockmasters. In this class H. C. Burwell & Son, of Bridport, Vt., took the highest premium for aged rams; Leroy Gage, who showed a two-year-old, for a ram of any age; E. Peck & Sons, of Geneva, Ill., for a yearling; L. E. Shattuck, of Stanberry, Mo., for a ram under a year; A. A. Wood, of Saline, Mich., for a ram and two ewes; C. L. Parrish, of Bridport, Vt., for a pen of five ewes; and W. E. Boyden, of Delhi Mills, Mich., E. D. King, of Burlington, Kan., and David Cossitt, of Syracuse, N. Y., for ewes. The special prizes of the National Sheep Registry Association were bestowed upon E. Peck & Sons for both rams and ewes. In the other class of Merinos, bred for size as well as fleece and type, L. E. Shattuck took the majority of first premiums, others going to E. Peck & Sons, E. D. King, and to J. H. Mead & Son, of West Rutland, Vt.

For Delaine Merinos also most of the first premiums fell to L. E. Shattuck, though H. G. McDowell, of Canton, Ohio, showed the best pens and A. C. McDowell the finest aged ewe.

Rutherford Stuyvesant, of Allamuchy, N. J., and J. A. McGillivray, of Uxbridge, Ontario, divided the choice prizes for Dorset horns. Thomas W. Hector, of Springfield-on-the-Credit, Ontario, showed some prize ewes; and William Newton, of Pontiac, Mich., and James T. Hudson & Sons, of Washington, Pa., received premiums for rams. Extra premiums offered by the American Dorset-Horn Association were awarded to T. S. Cooper, of Coop-

ersburg, Pa., for the best pen of ewes with sucking lambs, to Rutherford Stuyvesant for the best ram, to J. A. McGillivray for the best pens of ewes and of fat sheep, and to Thomas W. Hector for the best ewe.

William Curry & Son, of Hartwick, N. Y., took all the first premiums for Cheviots, excepting one that was given to H. H. Keim, of Ladoga, Ind.; and minor premiums were awarded to Van Dreser Brothers, D. F. Wilbur, and George Lough, New York breeders.

In the French Merino exhibit the imported animals of a Prussian breeder, F. von Homeyer, received all the first prizes, except those given to the lambs of P. C. Moulton, of Woodstock, Ohio.

The only exhibitor of goats was C. P. Bailey, of San José, Cal., who showed fine Angora bucks and does of all ages, bred by himself.

To enter swine, breeders were required to furnish proof of registration in



AN AMERICAN SADDLE HORSE.

the American records or English herd books. The classes in this division were the following: 55. Berkshire. 56. Poland-China. 57. Chester White. 58. Duroc - Jersey. 59. Small Yorkshire. 60. Essex. 61. Victoria. 62. Cheshire. 63. Other distinct breeds.

N. H. Gentry, W. E. Spicer, W. G. Riley, R. J. Lovejoy, Metcalf Brothers, and Q. N. Barker carried off the first prizes in the Berkshire class. Of the special premiums offered by the American Berkshire Association, Mr.

Gentry took four and Messrs. Spicer, Barker, Riley, and Metcalf Brothers each one. In the Poland-China class the prize winners were shown by S. E. Shellenberger & Co., Klever, Hadley & Hendricks, Mugg, Cunningham & Co., B. F. Dorsey & Sons, Willis E. Gresham, and R. S. Cook. Of the Chester White breed, Todd & Son, M. E. Newburn, and F. A. Branch made the best exhibits.

Of Duroc-Jersey swine, George W. Trone, of Rushville, Ill., showed the finest herd and the boar and sow that won the special prizes of the National Duroc-Jersey Record Association; Thomas Bennett, of Rossville, Ill., had eight prize exhibits; and O. Walter & Brother, of Lebanon, Ohio, C. H. Searle, of Edgar, Neb., and S. E. Morton, of Camden, Ohio, each gained

several prizes. The winning small Yorkshires were exhibited by D. T. Bascom and C. H. Williams, of Michigan, and Willis Whinnery, of Ohio.

In the Essex class, Mahan & Clevenger, of Malcom, Neb., won fourteen chief prizes; Joseph Featherston, of Springfield-on-the-Credit, Ontario, four; and M. H. Walworth, of Hillsdale, Mich., one. The sows of the two latter obtained for them also three of the special premiums of the American Essex Association, while the Nebraska firm took the other three. M. H. Walworth, George F. Davis, and H. W. Riley divided the premiums for Victoria swine; special prizes for the best boar and the best sow were given by the Victoria Swine Breeders' Association to animals shown by Mr. Davis and Mr. Walworth respectively.

New York breeders were the principal exhibitors of the Cheshire breed, and the first prizes were awarded to B. J. Hurlburt, excepting three that went to L. F. Doolittle, who showed the best sow, and one for Freeman & Button's fine boar. The Suffolk breed was exhibited by M. H. Walworth and A. C. Green, of Winchester, Ind.; improved Yorkshires by Joseph Featherston and J. E. Brethour, of Ontario, and a good boar by B. J. Hurlburt, of Clymer, N. Y.; Tamworths by Thomas Bennett, of Illinois, and a few by James Calvert and John Bell, of Ontario.

Prizes were offered for dogs entered in the stud books of the American or the Canadian Kennel Clubs, in the following classes: 64. Mastiffs. 65. Great Danes. 66. St. Bernards (rough-coated). 67. St. Bernards (smooth-coated). 68. Newfoundlands. 69. Deerhounds. 70. Greyhounds. 71. American foxhounds. 72. English foxhounds. 73. Bloodhounds. 74. Russian wolfhounds. 75. Dachshunde. 76. Bassett hounds. 77. Beagles. 78. Pointers. 79. English setters. 80. Irish setters. 81. Gordon setters. 82. Chesapeake Bay dogs. 83. Irish water spaniels. 84. Clumber spaniels. 85. Field spaniels. 86. Cocker spaniels. 87. Collies (rough-coated). 88. King Charles spaniels. 89. Blenheim spaniels. 90. Bulldogs. 91. Bull terriers. 92. Pugs. 93. Poodles. 94. Fox terriers (smooth). 95. Fox terriers (wire-haired). 96. Irish terriers. 97. Dandy Dinmont terriers. 98. Skye terriers. 99. Yorkshire terriers. 100. Scotch terriers. 101. Clydesdale terriers. 102. Toy terriers. 103. Whippets. 104. Black-and-tan terriers. 105. Bedlington terriers.

The poultry show brought out the finest stock in the United States and Canada. Exhibitors were limited to one cock, one hen, one cockerel, one pullet, and one breeding pen of a cock and four hens of each variety, and no bird was admitted that could not score eighty-five points according to the American standard of perfection. The following classification was adopted: 106. American. 107. Asiatic. 108. Mediterranean. 109. Polish. 110. Hamburgs. 111. French. 112. English. 113. Games and game bantams. 114. Bantams other than game. 115. Miscellaneous. 116. Turkeys. 117. Ducks. 118. Geese. 119. Ornamental. 120. Pet stock. 121. Minor pets.

Of American varieties, Sid Conger showed the finest barred and D. F.

Taylor the choicest white Plymouth Rocks ; William McNeil and George G. McCormick, of London, Ontario, black, and Charles McClave white Javas ; Charles McClave white, A. & E. Tarbox silver, and Ira C. Kellar golden Wyandottes ; and George Bogue, of Canada, and Jones Wilcox, of New York, American Dominiques. The same Canadian exhibitors had conspicuous exhibits of Asiatic fowls and of game and other breeds. Among the many exhibits of the standard Asiatic breeds were the light Brahmas of Dr. M. F. Lee and Sid Conger, the dark Brahmas of L. Sage, of London, Ontario, and A. G. Humphrey, the black Langshans of R. McCurdy, of London, Ontario, and J. F. Knox, of Buffalo, the latter's white Langshans, the buff Cochins of H. L. Harlan, the partridge Cochins of George D. Corlies and G. D. Holden, the black Cochins of B. F. Pace, and the white Cochins of Charles H. Andrews.

Some of the noteworthy exhibits of the Mediterranean varieties were the brown Leghorns of James Quolla, John Osmandson, and L. A. King, the white Leghorns of Knapp Brothers, C. E. Howell, and Bartlett & George, the black Leghorns of R. E. Haeger, the black Minorcas of L. Garrison & Co., the white Minorcas of C. W. Jerome & Co., the black Spanish of John Wilson and M. T. Burns & Co., and Edward Hoffman's blue Andalusians.

Polish fowls were exhibited by B. F. Bryant and others. Adam Bogue, of London, Ontario, showed the greatest variety—white-crested black, white, silver, golden, and bearded white, silver, and golden. William McNeil showed buff laced Polish.

The same large breeders exhibited Hamburgs, of which James Hazard also made a good display. James Murray and Richard Oke exhibited silver-spangled Hamburgs, and the latter, another breeder of London, Ontario, black Hamburgs. Of the French varieties, B. W. Parks, the Concord Poultry Club, and M. F. Burns & Co. exhibited Houdans, Richard Oke crève-cœurs, and William McNeil La Fleche. A. Bogue and William McNeil, of Canada, and Henry Hales, of New Jersey, were the principal exhibitors of English fowls—white, colored, and silver-gray Dorkings.

Games and game bantams were abundantly exhibited—black-breasted red game by William Barber, of Toronto, Charles Schild, and William McCloud ; brown red and golden and silver duckwing games by Mr. Barber ; red pyle by P. M. Orth & Bro. and the Canadian exhibitors ; white game by H. C. Osborn, G. W. Heath, and H. Kochensperger ; black game by Dr. H. P. Clark ; Sumatra game by C. J. Daniels, of Toronto ; black-breasted red Malay by L. Rootman ; black-breasted red game bantams by R. J. Rockafeller ; brown red and red pyle game bantams by William Barber and C. P. Earle ; golden duckwing game bantams by H. H. Krier ; black and white game bantams by C. P. Earle ; frizzle bantams by L. Rootman ; and Cornish Indian game by B. E. Rogers, E. C. Connor, Jacob Frisz, and C. H. Thornton. Dr. E. H. Witner, Richard Oke, William McNeil, Ira C. Keller, W. A. Gage,

Leslie Powlin, L. Rottman, J. F. Knox, Frank D. Lewis & Brother, and Dr. A. C. Treichler were exhibitors of bantams. Golden and silver Sebrights, rose-comb black, buff, white, and black Cochin, booted white Japanese, white Japanese, and white Polish were the varieties shown.

In the miscellaneous class Richard Oke showed sultans and C. S. Jackson silkies.

James Garvin, A. A. Mount, and Charles A. McClave exhibited turkeys, bronze and white. Charles McCabe showed Rouen, East Indian, crested white, white Muscovy, colored Muscovy, and gray Call; Knapp Brothers, Pekin; A. Bogue, the Aylesbury; and William Smith, the Cayuga ducks. Theodore L. Morgan exhibited Chinese brown, John Hord Toulouse, and Charles A. McClave Canadian gray and Embden geese.

In the class of ornamental poultry, Richard Oke had exhibits of golden, silver, and English pheasants; William Smith, pearl guinea fowls; and Charles McCabe, pea fowls and white guinea fowls.

In the class of pet stock, W. N. Richardson exhibited Belgian hares, J. H. Saunders Angora rabbits, and H. B. Donovan Himalayan and Dutch rabbits.

Minor pets were the common, wavy-haired, and Abyssinian guinea pigs of H. B. Donovan, Charles McClave's fitch ferrets, and M. M. Barger's white ferrets.

There was a very full exhibit of pigeons, in which H. B. Donovan, of Toronto, J. H. Whitman, George W. Eckert, A. M. Ingram, Dr. J. Burns, Andrew Muehlig, Woodward & Bjurman, Christopher Wagner, C. E. Ford, Oscar Seifert, R. A. Quarles, R. S. Groves, A. L. Love, and many others took part. The classification was as follows: 122. Carriers. 123. Pouters. 124. Pigmy pouters. 125. Barbs. 126. Short-faced tumblers. 127. Short-faced bald heads. 128. Long-faced tumblers. 129. Inside or parlor tumblers. 130. Jacobins. 131. English owls. 132. African owls. 133. Chinese owls. 134. Tail-marked owls. 135. Trumpeters. 136. Fantails. 137. Oriental frills. 138. Turbits. 139. Magpies. 140. Swallows. 141. Priests. 142. Nuns. 143. Dragoons. 144. Various. 145. Homers (open class). 146. Homers (record class).

In homing-pigeon contests, Lewis Turner's bird reached Washington first; F. Prinz's made the quickest flight to Philadelphia; L. Armstead won in the homing flight to Boston; Richard Stretton had a bird that made the distance of four hundred miles in the shortest time; Otto S. Kuehn's pigeon was the best for fifty miles; and Thomas J. Clarke won the race to New



P. GLOUKHOVSKOY,  
Imperial Chamberlain,  
Commissioner-General from Russia.

York city and a premium besides, because his bird made the distance within seventy-two hours.

The final division in the Live-Stock Department was that of fat stock. The classes of cattle were : 148. Shorthorn. 149. Hereford. 150. Aberdeen-Angus. 151. Galloway. 152. Devon. 153. Holstein-Friesian. 154. Other beef breeds. 155. Grades and crosses. 156. Range cattle. 157. Sweepstakes for first-premium animals. 158. Grand sweepstakes for the best steer or spayed heifer, shorthorn or graded. 159. Herds of the different breeds, consisting of steers or spayed heifers under three years old, between one and two years, and under one year old. 160. Herd sweepstakes.

In the exhibit of fattened cattle, John Hudson took premiums for Devons ; Hugh Paul for Galloways ; M. E. Jones for shorthorns ; W. S. Van Natta and Adam Earle for Herefords ; W. S. Niles for Aberdeen-Angus ; and M. E. Jones for grades and crosses. J. W. Cunnutt, of Greenfield, Ill., and A. A. Armstrong, of Fergus, Ontario, showed the heaviest steers without regard to age or breeding. M. E. Jones, W. S. Niles, and John Rutherford took the grand sweepstakes.

Sheep were classed in the fat-stock exhibit as follows : 161. Cotswold. 162. Leicester. 163. Lincoln. 164. Southdown. 165. Shropshire. 166. Hampshire. 167. Oxford. 168. Dorset horn. 169. Cheviot. 170. All Merinos. 171. Animals not eligible in any of the foregoing classes. 172. Grand sweepstakes.

In the show of mutton sheep, the premiums were awarded to John Rutherford for Lincolns, Oxfords, Leicesters, and Shropshires ; to William Newton for Dorset horns ; to both of them for Hampshires and Cotswolds ; to them and H. G. McDowell for all Merinos ; to them and J. H. Potts & Son for Southdowns. The last-named received the prizes of the American Southdown Association for fat stock and the sweepstakes for long wools and middle wools.

In the fat-stock exhibit for swine, prizes were offered for barrows between fourteen and eighteen, between ten and fourteen, and between six and ten months old, and for a pen of three barrows of the different ages. The following classes were constituted : 173. Berkshire. 174. Poland-China. 175. Chester white. 176. Duroc-Jersey. 177. Small Yorkshire. 178. Victoria. 179. Essex. 180. Cheshire. 181. Other distinct breeds. 182. Grades and crosses. 183. Pen sweepstakes. 184. Breeders' sweepstakes for five barrows of any age or breed fattened by the exhibitor.

Cass & Burns, of Buffalo, won the sweepstakes for five barrows of any age or breed and the premiums for Berkshires and for grades and crosses ; Thomas Bennett, premiums for Poland-China ; B. J. Hurlburt for Cheshire ; Thomas Taylor, of Waynesville, Ill., for Essex ; George F. Davis & Co. for Victorias ; and A. P. Chapman, of Sugar Grove, Ill., for small Yorkshires.



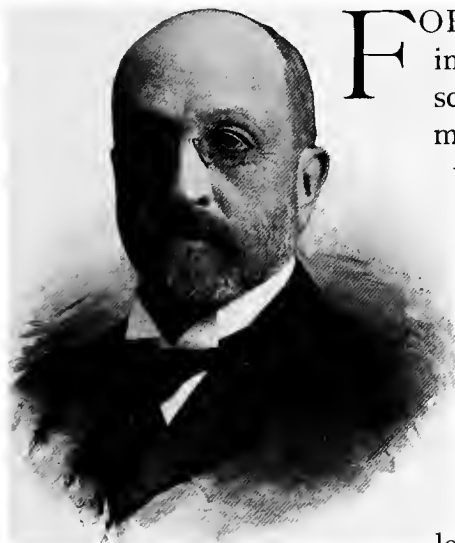


An aisle in the Forestry Building.

## CHAPTER III.

### THE FORESTRY EXHIBIT.

Subdivisions of the group—States and countries represented—Methods adopted in showing the timber—Display of forest botany—Collective exhibits—Wooden ware—State and foreign exhibits—Canadian exhibits—Mexican cabinet woods.



MARSHALL M. KIRKMAN,  
Member of the Directory and  
Chairman of the Committee  
on Transportation.

**F**ORESTRY and forest products, though constituting a separate department, were in the general scheme a group—the nineteenth—in the Department of Agriculture. This group was subdivided into classes as follows: 99. Logs and sections of trees; samples of wood and timber of all kinds generally used in construction or manufactures, either in the rough or hewed, sawed or split, including square timber, joists, scantling, plank and boards of all sizes and kinds commonly sold for building purposes. Also ship timber, as used in shipbuilding, or for masts and spars; piles, timber for fencing, for posts, for paving or for timbering mines. Miscellaneous collections of wood. 100. Worked timber or lumber, in the form of clapboards, shingles, sheathing or flooring, casings, moldings, stair rails, or parts of furniture. 101. Ornamental wood used in decorating and for furniture; veneers of hard and fancy woods; mahogany logs, crotches, and veneers; rosewood; satinwood, ebony, bird's-eye maple, madrona, black-walnut veneers, and other fancy woods suitable for and used for ornamental purposes. 102. Timber prepared in various ways to resist decay. 103. Dyeing, tanning, and coloring—dyewoods, barks, and various vegetable substances in their raw state, used for dyeing and coloring, such as logwood, Brazil wood, peach wood, fustic, sumac. Barks of various kinds, Brazilian, acacias, oak, hemlock, murici, bicida, gordonia. Galls, ex-

crescences, and abnormal woody products. Mosses used for dyeing and coloring. 104. Cellular substances—corks, and substitutes for cork of vegetable growth; porous woods for special uses, pith, rice paper, etc. 105. Lichens, mosses, pulu, ferns, and vegetable substances used for bedding, for upholstering, or for mechanical purposes, as teazles, Dutch rushes, scouring grass, etc., "excelsior." 106. Gums, resins, vegetable wax or tallow wax, including caoutchouc, gum senegal, tragacanth, Arabic, mesquite gum, myrrh, copal, etc. 107. Seeds and fruits, for ornamental purposes; vegetable ivory, coquilla nuts, cocoanut shells, ganitrus beads, bottle gourds, etc. 108. Medicinal—roots, herbs, barks, mosses, berries, etc. Miscellaneous products. 109. Wood pulp, for making paper and other objects. 110. Paper and wooden ware generally, as pails, tubs, platters, brooms, coopers' stock. 111. Basket industry—willow ware, etc. 112. Rattan, bamboo, and cane work in part. (For rattan furniture see also Group 90.) 113. Forest botany—distribution of forests, of genera, of species (maps). Wood sections and herbarian specimens of the economically important timber trees. Seed collections, not herbarium, etc. Illustrations of forest growth, typical trees, botanical features. Anatomy and structure of woods. (Veneer sections and photo-micrographs.) Peculiarities of forest growth—cypress knees, burls. Diseases of forest trees and timber. Injurious insects. 114. Timber culture—plant material—conifers, seedlings, and transplants. Broad-leaved trees. Seedlings, transplants of various sizes, cuttings. Seed collections and means for storing seed. Means employed in gathering and preparing seed and other plant material for the market, and seed testing. 115. Timber culture and cultivation. Implements for the cultivation of the soil. Special adaptations. Sowing machines and tools. Implements and machines used for planting. Implements used in after-culture. Means of protection against insects, animals, climate. Seed beds and other graphic illustrations of nursery practice. 116. Forest management—maps, plans, illustrations, calculations illustrating forest management. Instruments for measuring standing timber. Growth of different ages and soils. Graphic or other illustrations showing rate of growth. Graphic or other illustrations showing influence of various managements on tree growth. Statistics of lumber trade and of forestry. Exhibits showing relation of forests to climate. Literature and educational means. 117. Lumbering and harvesting of forest products. The lumbering industry. Logging and transportation. Implements, machines, plans, drawings, and statistical material. Loggers' tools, stump-pulling devices, marking devices, measuring tools. Loading devices, sleds, flumes, slides, rope tramways, railroads, methods of water transportation, rafts, booms, etc. The tan-bark industry. Other barks. The turpentine industry. The charcoal industry. 118. Preparation and manipulation of lumber. Dressing, shaping, and preparation of wood. Hewing of logs, spars, etc. Shaping of knees. Sawing and milling. Drying and seasoning of wood, steam bending, etc.

The uniquely constructed Forestry Building, described in Volume II, was

filled with a varied exhibit of forest products: Logs and sections of trees; worked lumber in the form of flooring, shingles, panels, etc.; dye-woods and barks, resins and gums; abnormal woody growths; wooden ware, such as tubs and barrels, and other commercial products and specimens of woods.



CENTRAL GROUP OF CHARACTERISTIC WOODS.

There were exhibits from twenty-five States of the Union, fifteen foreign countries, and thirty-one commercial firms.

In the center of the building stood a collection of the characteristic woods of all the exhibiting countries, and forming an arch over the group were two beautifully regular bamboo canes from Japan, each seventy feet long. In the middle was a mammoth California redwood trunk, fourteen feet in diameter,

in which was fixed an arrow indicating the diameter of the tree at the time when Columbus landed. The rings indicated that the age of the tree at the time when it was cut down for the Exposition was eight hundred and seventy-five years. The Argentine Republic showed as its representative tree the lapachio, an immense log, brown and dark red, and very heavy. New South Wales chose a rich red rosewood. Paraguay was represented by a very heavy wood of a fine yellow, called the tatayba. Siam put forward the Prado, a knotty wood of very irregular texture, very hard, and reddish brown. Trinidad selected the valuable fustic, a yellow dyewood. The characteristic woods selected by some of the States were : New York and Wisconsin, white pine ; Minnesota, black birch ; Nebraska, black walnut ; Oregon, larch ; Missouri, persimmon and mulberry ; West Virginia, yellow poplar ; Idaho, red cedar ; Pennsylvania, sugar maple.

Of the various methods adopted for showing the timber, none was more common or better for the purpose than to have a trunk three or four feet high, with the bark left on, sawed through the middle about one foot deep, and then diagonally, showing a transverse section on the top, a longitudinal section, and finally a diagonal section. One half of each section was polished, usually by the method of the Murphy Varnish Company. The tangential section, which usually shows a beautiful grain, was generally exhibited in polished panels. The usual method of polishing was not the French polish that is practiced in Europe, but a process that consisted in rubbing into the wood a siliceous substance and a gummy filler to fill up the pores, then cleaning the surface and preparing it with alcohol and shellac, next applying three coats of varnish and rubbing it in well, rubbing afterward with pumice stone and water, and finishing with an oiled cloth. If an especially fine surface is desired it is rubbed with rotten stone, and the luster is brought out by rubbing with the hand.

On the veranda were several immense logs, said to be each the largest of its species in the world. A black walnut from Kansas was seventy-eight inches in diameter at the base, forty-eight at the small end, and forty-seven feet long. A log of Mexican mahogany was forty-two inches square and forty-one feet long. Inside the building was the greatest of redwood planks, sixteen feet five inches wide, twelve feet nine inches long, and five inches thick, cut from a tree thirty-five feet in diameter and fifteen hundred years old.

The woods of the North American forests were all represented in the exhibits of the States and of Quebec, Ontario, and British Columbia, and in systematic order and convenient form they were shown in the Jesup collection from the American Museum of Natural History in New York. The following were some of the more valuable species of timber seen in this comprehensive collection : The yellow poplar of the Southern and Middle States, used for construction and interiors and especially for wooden ware ; the basswood, of which wooden ware and cheap furniture are made ; the

locust, valuable for posts, but subject to the attacks of the borer ; the sugar maple and many other valuable kinds ; the common holly of the South, of fine white grain, useful for cabinet work and turnery ; the hard *lignum vitæ* of Florida, used for sheaves and thrust blocks, and the black ironwood of that State, still heavier and more compact, but brittle ; the mahogany, found in Florida ; the sweet gum of the South, which takes a beautiful polish ; the black ash, used for furniture and cooperage, and numerous other valuable species ; the catalpa, light and soft, but lasting when used for fence posts and rails ; the scarce red bay, a beautiful cabinet wood of the South ; the red, the white, and the rock elm, useful for railroad ties, ship timber, posts, and barrel staves ; the sycamore, largest of the Atlantic forest trees, used for butchers' and tobacco blocks ; the black walnut, a beautiful dark cabinet wood ; the mountain laurel of the Pacific, used in shipbuilding and for crosstrees and cleats, and a rich brown wood for polished cabinet work ; the white walnut, a fine cabinet wood of the East ; the tough hickory, invaluable to makers of agricultural implements and carriage builders ; the numerous oaks, of which the white oak is most esteemed for shipbuilding, cabinet work, and other purposes ; the chestnut, useful for railroad ties and fences ; the beech, a material for chairs ; the valuable yellow birch, of which furniture and wheel hubs and boxes thin as paper are made ; the cherry birch, used in the maritime provinces for shipbuilding, and many other varieties ; the large Western alder, of which furniture is manufactured ; the tall poplar of the Eastern coast, ground into wood pulp ; the cypresses of the Pacific coast, very lasting in contact with water or moisture ; the coarse-grained, easily worked red cedar of California ; the compact Port Orford cedar, valuable for flooring, boats, and railroad ties ; the gigantic redwood, used in California for fencing, building, and shingling ; the valuable white pine of



LOGGING TOOLS EXHIBIT.

the Lake region, more largely manufactured into lumber, shingles, lath, etc., than any other American wood ; the yellow pine of the west coast, a tree almost as valuable, which attains a height of three hundred feet ; among thirty-three other species of pine, the Georgia pine, from which resin and turpentine are obtained ; among six species of spruce, the black and the white spruce, used for construction, shipbuilding, and piles ; the Canada hemlock, used for outside work, and the various other kinds, whose bark is rich in tannin ; the Douglas fir of the northern Rocky Mountain forests, which towers to a height of three hundred feet, and is largely exported for mine timbering and all kinds of construction ; the tamarack, in demand for export to England ; the black larch of the Northeast, good for ship timbers and telegraph poles ; the large Western larch, very durable when used for fence posts ; the Southern cabbage tree, impervious to the teredo when used in wharves ; and the tough and heavy hornbeam, from which tool handles and wooden cogwheels are made.

An important part of the comprehensive exhibit made in the Division of Forestry by the United States Department of Agriculture was its display of forest botany. Twenty of the most representative and economically important species of forest trees were exhibited in large cases bordered with flitches of the bark and containing cross sections of a mature and a young trunk, rough-sawed timber as it is used in construction, a finished and polished panel of the wood seen in transverse, radial, and tangential section, a large spray with flowers, mature foliage, fruit, and seedlings ranging from germination to four years old. The common and botanical names were accompanied with all the local synonyms and local designations, and the chief economic uses and quality of the wood, the specific gravity and resistance to strains were detailed, and the geographical distribution was shown by a graphic representation.

In another collection the botanical features and economic uses of two hundred and fifty American species were given in smaller compass. The seeds of two hundred important native forest trees were shown in groups of allied genera. On a terrace about fifty species of conifers were seen growing, ranging from the seedling that is just sprouting to young trees eighteen inches in height.

In the United States section were collective exhibits from some of the States and Territories, individual exhibits of wood manufactures, including many kinds of useful and ornamental wares, and exhibits of tools, apparatus, and processes, such as the lumber drier of A. H. Andrews & Co., H. M. Crittenton's log-thawing apparatus, Josephine Matthieu's apparatus for manufacturing charcoal, wood alcohol, etc., and the logging and lumbermen's tools shown by Morley Brothers and the Oshkosh Logging Tool Company. A cabinet collection of specimens of wood furnished by the Disston Land and Drainage Company and the native woods exhibited by the Plant System of Railroads, revealed the forest resources of Florida. The North-

ern Pacific Railroad Company had a collection of woods from the Northern forests in two cars in the Transportation Building. The Soper Lawson Company showed outside a stick of fir timber one hundred and eleven feet long. F. Korbel & Brothers, of San Francisco, exhibited samples of red-wood tanks. Cooperage products were shown by Todd & Roper, of Milan, Tenn. The Garrison Wood Turning Company exhibited balusters, spindles, and other specimens of turning. Lumber and shingles were shown in a special exhibit of Edwin S. Hartwell, and there were abundant exhibits of logs and lumber in the rough, which, in conjunction with the wood-working machinery and outfits for sawmills, gave an insight into the lumber industry of North America and did not fail to bring home to American agriculturists the facts as to the waste and neglect of our forest resources, and to impress the truth that the growing of trees is an important branch of agriculture. George W. Vanderbilt had an exhibit bearing on practical conservative forestry, consisting of working plans and maps of his forests in North Carolina and specimens of the commercial products. The Indurated Fiber Company exhibited pails, tubs, and kitchen utensils made from compressed wood fiber, that were light, strong, elastic, waterproof, free from odor, and presumably very durable. The Richmond Cedar Works showed pails and tubs of white cedar that had electrically

welded metallic hoops sunk in grooves. Tubs and pails made from Wisconsin lumber were shown by the Two Rivers Company, wooden pails by Burgland & Shead, and Richardi & Bechtold exhibited household wooden ware from Michigan. Cork and wooden ware were exhibited by the Redlich Company, the R. W. McCready Company showed cork and cork handles, and Armstrong, Brother & Co. had an exhibit of corks and cork specialties. The cork exhibit included all the uses of the material, from bath mats and life preservers to bottle corks and ornamental carving in



SAMPLES OF CEDAR MANUFACTURES.



cork, including a Chinese pagoda and a model of the Capitol at Washington. The collection of cabinet woods and veneers exhibited by the E. D. Albro Company contained knots and burls brought from many lands. The Compound Lumber Company exhibited hard-wood doors. Ladders, scaffolds, and brackets were shown by the National Ladder Company. The Piedmont Pulp and Paper Company, of West Virginia, had an exhibit of its products. In this and other exhibits the uses of paper pulp were exemplified by hammocks, rugs, and other useful articles, and by various kinds of paper made from the material. There was a handsome array of American basket work to be compared with the varied and artistic work of the Japanese and Europeans in this industry. R. B. Hough, of Lowville, N. Y., supplied wooden cards, shaved from American woods of various kinds, to be preserved as souvenirs and as specimens.

In the midst of the wedges and disks of wood from all countries that formed the central pyramid in the Forestry Building was an ordinary wood cutter's axe, interesting only for its associations. It was an axe that the English scholar-statesman Gladstone had lately used in felling trees at Hawarden, which had been sent to the Exposition at the request of F. S. Shurick, president of the Ritchie Lumber Company.

Some of the States and Territories that made no agricultural exhibits, and others that made a profuse display of their forest resources in their own buildings, placed their contributions to the general forestry exhibit in the space assigned to the United States. Good forestry exhibits from many of the States were seen in the structure of their State buildings, as well as in the exhibits that they contained. Thus the Kansas Building was entirely of Kansas material, and the Colorado, Maine, Massachusetts, Wisconsin, and Washington buildings were likewise of their own woods and stones.

The State Agricultural College of Colorado exhibited collections of wood sections, forest seeds, and herb plants. Arizona exhibited in the Forestry Building a monstrous pine log, specimens of moldings, and views of mill lumber yards, logging camps, and standing timber.

California's forestry exhibit consisted largely of sequoias. The rich dark-red of the *Sequoia sempervirens* was greatly admired. Most of these redwoods astonished visitors by their tremendous proportions, belonging to the living nature of an earlier world. One specimen had bark two feet thick. Besides redwoods, California exhibited walnuts, myrtle, laurel, oaks, yellow pine, white cedar, and other valuable trees of the western slope. The State exhibit consisted of a collection of woods, cork bark and acorns, pine cones for decoration, odd growths of buckeye, fir, madrone, and sycamore, and specimens of redwood showing curious formations of the grain; also photographs of forest scenes. Many of the best exhibits were found in the California Building, where the structural woods were abundantly exhibited in slabs and sections, and they were also worked into the pavilions of different countries. The structure of San Mateo County was supported by two huge

turned pillars of redwood, while a section of a large redwood log in the center formed a base for a greenery. The collection of products from Humboldt County was surrounded by an ornate inclosure of polished redwood, and within were displayed a section of a tree sixteen feet in diameter and a board from a large redwood burl. The collection of the State of North Dakota consisted of quaking ash, common thorn, balm of Gilead, wild cherry, black cottonwood, wild plum, diamond willow, choke cherry, bur oak, sand cherry, American elm, basswood, rock elm, white ash, white pine, prickly ash, red cedar, white birch, and box elder. Connecticut had a collection of timbers and one of curious growths in the United States section. Idaho exhibited sections of trees and planks cut from tamarack, yellow and white pine, and red cedar, also shingles, curious growths, and photographs of the logging industry.

In the collection from Louisiana were sections of timber, cypress planks four feet wide, magnolia planks, cypress knees, and specimens of gray and black moss. A pavilion was built of various Louisiana woods. Utah Territory sent a collection of interesting and valuable woods.

The Massachusetts Agricultural College furnished a collection of forty-seven sections of trees, cut, polished, and finished so as to show the grain, colors, and characteristics of the wood. The collection comprised butternut, wild black cherry, hemlock, white, black, pin, and red oak, red ash, bitternut hickory, hop hornbeam, white elm, white pine, willow, pitch pine, swamp white oak, white-heart hickory, large-toothed poplar, chestnut, shellbark hickory, white ash, yellow birch, tupelo, scarlet oak, hornbeam, canoe birch, American aspen, basswood, balm of Gilead, red maple, sweet birch, and sugar and silver maple. Individuals sent specimens of chestnut, oak, sassafras, balsam fir, white spruce, gray birch, red cedar, buttonwood, beech, slippery elm, hackmatack, wild red cherry, rock chestnut oak, northern cypress, and cottonwood.

The forestry exhibit of New York was exceedingly interesting because it was so complete and well prepared. It consisted of one hundred species. The specimens had all been cut within a few months, and quickly seasoned. With each were shown specimens of foliage, flower, and fruit, or artificial imitations. The bark of each tree was exhibited in thin sections, radial, transverse, and tangential, cut by R. B. Hough with a machine of his invention. The exhibit showed the chief woods of New York to be white pine, black spruce, ash, and hemlock. The log specimens numbered eighty-seven. Photographs showed the trees in full summer leaf, and when denuded of leaves in winter, accompanied with printed descriptions of the wood and the uses to which it is adapted, and a map exhibiting its habitat. In the windows were sections of the woods so thin as to allow light to pass through, the transverse sections one four hundredth of an inch in thickness.

Pennsylvania exhibited as its useful forest trees sugar maple, oak, basswood, cottonwood, cherry, pine, chestnut, walnut, sycamore, hickory, poplar,

sassafras, chinquapin, ash, birch, cucumber, hemlock, locust, dogwood, plum, crab, aspen, white pine, black cherry, American linden, sweet birch, Eastern hemlock, green ash, and American beech. Henry Howson presented a collection of woods, Samuel Brugger another containing ninety-three varieties native in Center County, Miss Grace Anna Lewis paintings of forest leaves, and J. T. Rothrock photographs of trees.

Ohio, though pretty well denuded of its forests, had an exhibit containing eighty-four sorts of timber. It was intended to form the nucleus of a



NEW YORK STATE'S EXHIBIT.

permanent collection in the State University, consisting of a series of frames containing cross and longitudinal sections of the wood, pieces of bark, twigs showing conditions in winter, leaves, flowers, and fruit, also a series of polished panels showing radial, diagonal, and tangential sections. The common woods of the State were seen to be oaks and pines. The State Board of Managers exhibited prepared specimens of pawpaw, maple, elder, redbud, coffee nut, locust, plum, haw, blackthorn, sourwood, ash, elm, hackberry, sycamore, hickory, birch, beech, oak, chestnut, black willow, aspen, and pine; also collections of native medicinal roots, barks, and plants. Samples of cherry, persimmon, white maple, sweet buckeye, sumach, and other woods were contributed by Ohio citizens.

The Michigan State exhibit consisted of sections of trees and curious specimens of forest growths. The Agricultural College at Lansing furnished a collection of specimens of timber with indications of the breaking strain, also cases of insects that prey upon forest trees. L. Le Valley furnished a collection of forest-tree seeds. There were numerous exhibits of manufactured products from Michigan forests: Sulphate fiber of the Alpena Company; wood alcohol and acetate of lime of the Elk Rapids Iron Company; hickory handles of the American Handle Company; Franz Kerms's wooden hames; cant-hook and pick handles of Morley Brothers; the combination step and chair ladders of Storms, Earl & Co.; wood carving of the Waddell Company; neck yokes and whiffletrees of M. Wood & Co.; the shoe lasts of Williams Brothers; wooden shoes of the Grand Rapids Company; wooden mallets and cooper's tools and baseball bats and croquet sets of J. F. Helenberger; Job Cheeseborough's rake and fork handles; stepladders of the Cummer Company; E. Germaine's wooden pulleys; the washing machines of the Michigan Company; candy and tobacco pails of the Sutton Company; W. F. Thompson's butter firkins; C. L. King's berry boxes and baskets; F. Baumeister & Son's white-ash splint baskets; the cooperage stocks, staves, etc., of J. F. Hasty & Son; decorative molding and veneer panels from Grand Rapids firms; Charles Hebard & Son's white-pine plank; and J. F. Hall's pine and cedar shingles. Near the model sawmill was the Michigan logging camp, a great building of split logs, with chinks filled with plaster, forming a very interesting part of the forestry exhibit of that State. The house was built of eighteen-inch hemlock logs, saddled to fit into one another at the corners, where each projected a few inches. The roof was built of six-inch limbs cut through longitudinally, with some of the heart taken out, giving them a concavo-convex form, which were laid like curved tiles, the edges of the upper ones resting in the channels of the lower layer. The building was divided into a kitchen, with long tables set with tin plates and pewter mugs, and the sleeping room, where the lumbermen occupied the bunks arranged three deep along the wall, three men in each bunk. Outside was a logging train, consisting of an engine and low cars resting on center-swivel four-wheeled trucks, with which the logs are brought to the camp. In winter a level trench, eight feet wide, is flooded with water to form an ice track, on which the logs are drawn on sledges by teams of horses. The idea of lumbering in the great Northern forests was vividly carried out by the load of fifty eighteen-foot white-pine logs before the door, chained together on the very sled on which they were drawn out of the forest down to the Ontonagon River, on such a specially prepared ice incline, by a single pair of horses, although the load weighed one hundred and forty-four tons and contained thirty-six thousand feet of lumber, which it took nine railroad cars to haul to Chicago. This feat of lumbering was accomplished by the employees of Thomas Nestor's estate.

Indiana occupied a section, in which were displayed specimens of native woods, and maps showing the distribution of trees in the State.

West Virginia made a good exhibit of its rich and varied forest resources. The structural and abundant timbers—spruce, beech, chestnut, birch, red and white oak, and gum—were shown in huge blocks from each of the three chief districts. The commonest lumber, yellow poplar, was said to be worth seventeen dollars a thousand in the towns. Beautiful specimens of ornamental woods were shown in polished panels, such as dogwood, honey locust, red cedar, Spanish oak, butternut, quartered sycamore, the white and



WOOD MANUFACTURES FROM MICHIGAN.

other poplars, cherry, white ash, calico wood, and curly beech. A table was made of eighty-two panels of native woods. C. F. Millspaugh showed a forest map of the State that he had prepared, and A. D. Hopkins an interesting collection of beneficial and injurious insects, with sections showing their work. In the State collection were two hundred and fifty specimens of timber, all polished and finished so as to show the grain, colors, and characteristics of the wood. There was a State exhibit of poplar wheels, shingles, staves, and lath; also one of tan bark. The exhibit of log specimens were tree of heaven, beech, black walnut, magnolia, white basswood, Frazer's magnolia, prickly ash, holly, grape, red maple, box elder, sumach, locust, redbud, honey locust, roundwood, crab, mountain ash, service, hercules club, haw, sweet gum, rhododendron, buckeye, purple buckeye, striped maple, thorn, witch-hazel, dogwood, sour gum, laurel, fringe tree, spicewood, persimmon, hocksberry, coffee tree, sycamore, white hickory, red hickory, water beech,

black willow, aspen, cottonwood, pitch pine, blister pine, red cedar, silver bell, sassafras, red elm, white elm, mulberry, butternut, mountain alder, river birch, ironwood, laurel chestnut, and Spanish, swamp, and bur oak. The Devercaux Lumber Company exhibited poplar wagon sides; the Parkersburg Mill Company, wainscoting, planks, and case, brush, and implement handles; the Parkersburg Veneer Company, panel veneers; A. G. Giffen, panels; J. L. Rumberger Company, hardwood boards and planks, and spruce and hemlock laths and shingles; and the Standard Oil Company, oil barrels and staves.

In the Virginia exhibit were collections of woods from Bedford, Giles, Hanover, Madison, and Shenandoah Counties. Atkins Brothers, who exhibited locust hubs and handles, had a collection of Virginian woods. Mrs. Margaret H. Drewry sent a remarkable section of a cypress log, and L. M. Pugh one of curled maple. John G. Hurkamp and Warner, Moor & Co. exhibited sumach and quercitron bark, and John R. Venable laurel root.

The North Carolina exhibit of polished planks was accompanied by photographs of the timber trees and the methods of felling them. The most important wood was the long-leaf pine, used for buildings and ships. The plentiful red cedar and cypress are useful material for water buckets, and the sycamore for cigar and tobacco boxes, as it may be cut very thin.

Fine cabinet woods were the beautiful Spanish and chestnut oaks, also curly poplar, white and black walnuts, red cherry, and sweet gum. Figured and curly ash, post oak, shingle oak, scarlet oak, palmetto, white linden, holly, the Savannah short-leaf pine, curly poplar, variegated and plain black walnut, curly and plain pine, yellow wood, holly, wild cherry, mountain cherry, yellow pine, yellow birch, sassafras, black gum, red oak, yellow poplar, buckeye, sorrel tree, swamp maple, locust, mulberry, persimmon, white elm, willow oak, overcup oak, sour woods, holly, table-mountain pine, service berry, chestnut and tulip poplar, white linden, mulberry, and juniper were some of the samples shown. Different counties sent specimens of Turkey, white, black-jack, and red oak, hop-hornbeam, shagbark hickory, white ash, wild cherry, red maple, bull bay, red sweet gum, water ash, red cedar, rhododendron, lupeto gum, beech, dogwood, cottonwood, persimmon, red oak, locust, black gum, cucumber, mountain birch, white oak, sugar tree, walnut, balsam, bastard balsam, and magnolia. Wallace Brothers, of Statesville, exhibited medicinal barks.

Kentucky citizens and firms furnished a very complete exhibit of the woods of that State—oaks of various kinds, yellow poplar, red and black birch, ash, willow, walnut, chestnuts, basswood, cherry, alder, hornbeam, poplar, elm, thorn, maple, ironwood, cottonwood, sassafras, beech, ash, pines, persimmon, holly, sycamore, pawpaw, pecan, plum, red birch, magnolia, witch-hazel, spice wood, sturtia, sorrel tree, hawthorn, crabapple, buckeye, sheep-berry, osier, redbud, aspen, hemlock, hackberry, leatherwood, chinquapin, barberry, laurel, mulberry, service berry, hazlenut, box elder, osage orange, cedar,

coffee tree, ailantus, balm of Gilead, rhododendron, black haw, mountain and smooth sumach, huckleberry, swamp dogwood, Indian arrow, silver-leaf poplar, red sassafras, black gum, white and yellow sweet gum, wild black cherry, chicken grape, yellow wood, shiny willow, blue plum, black willow, yellow birch, prickly ash, water, clammy, yellow, common, and privet locust, hop-horn-beam, shellbark, southern, mocher nut, paper, mulberry, white, and black

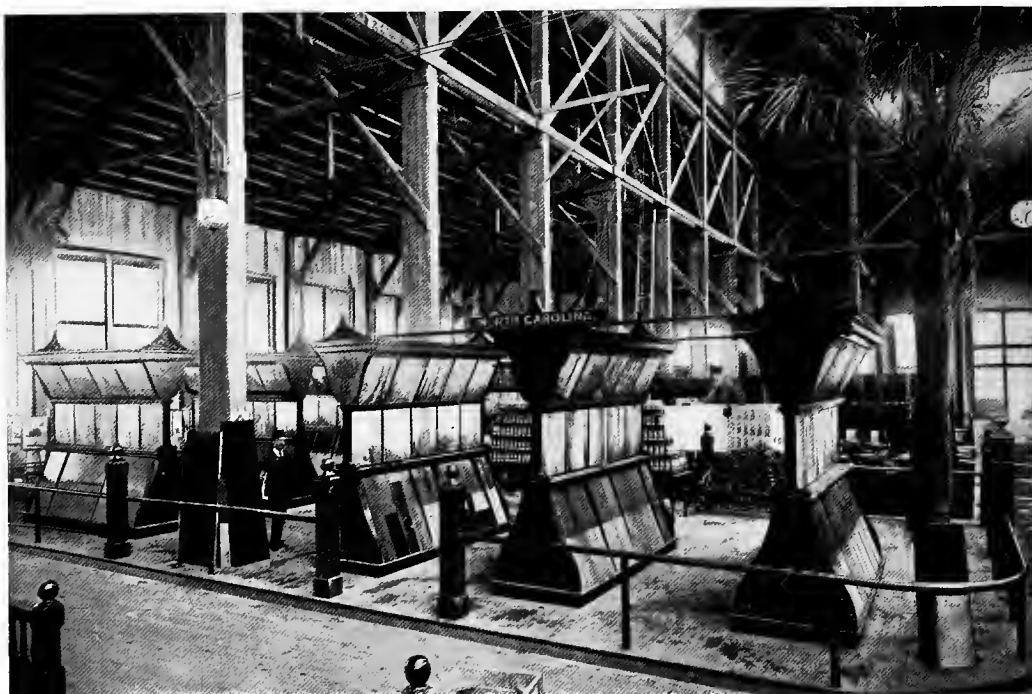


EXHIBIT OF NORTH CAROLINA.

hickory, beech thorn, red buckeye, butternut, buttonwood, red cedar, flowering dogwood, green ash, honey locust, black sugar maple, and white mulberry.

Missouri exhibited its timbers in polished panels: Black hickory, prized for axles; cottonwood, the common cheap lumber, selling for three dollars a thousand; the sweet gum, worth ten dollars, for interiors. There were beautiful panels of honey locust, dogwood, sassafras, and other woods. Of some of the less common varieties, trunks were shown of prodigious growth: Aromatic sassafras three feet in diameter; black-hearted persimmon and orange-colored mulberry two feet and a half through; cypress six, and oak seven, feet in diameter. The varieties exhibited included black, red, scarlet, bur, pin, cow, laurel, willow, and white oak, black and white walnut, black cherry, ash, hickory, white elm, red, silver, and sugar maple, sycamore, tulip tree, cottonwood, cypress, gum, planetree, elder, honey locust, mulberry, hornbeam, persimmon, hazlenut, wild plum, sassafras, crabapple, holly, cucumber tree, hercules club, service berry, blue ash, aspen, buckeye, catalpa, dogwood, lin-



den, poplar, red bud, willow alder, haw brunichia, bittersweet, hackberry, ratan, Caroline rose, prairie rose, blackberry, saw brier, sheepberry, strawberry bush, sumach, waahoo, button bush, chokeberry, cissus, corkwood, cross vine, foresteira, grape, greenbrier, wild hydrangea, arrowroot itea, kinnikinnick, and pipevine.

The Minnesota State exhibit consisted of sections of logs, with their ages inscribed on them, specimen planks and boards, ornamental woods and veneers, forest seeds, unique burls, illustrations of windbreaks, statistical maps, and photographs of logging operations. Commercial exhibits were : L. Z. Rogers, ornamental woods ; Wheaton & Reynolds, walnut and cottonwood planks, veneers, etc. ; J. H. Wilcox, white-pine plank ; Boyce Brothers, hardwood flooring and wainscoting ; H. F. Brown, siding, flooring, wainscoting, and shingles ; Johnson & Hind, panels ; Barnard & Cope, furniture stock ; Minneapolis Wooden Ware Company, pails and tubs. R. Alexander showed a desk composed of many kinds of wood.

In the Nebraska exhibit, J. Sterling Morton had a specimen apple tree, showing twenty years' growth. A seventeen-year-old catalpa, an ailantus one year old, and an eight-years' Scotch pine seedling were remarkable examples of rapid growth. A map showing the distribution of forest trees was the work of Charles E. Bessey. A collection of Nebraska woods was contributed by Robert W. Furnas. The State Commission exhibited disks of polished wood. The University of Nebraska had a herbarium and a collection of injurious insects. Various citizens contributed specimens of white pine, black walnut, hackberry, white cottonwood, box elder, white elm, wild black cherry, green ash, Kentucky coffee tree, honey and black locust, wild grape, red cedar, diamond willow, crabapple, balm of Gilead, bur oak, buffalo berry, ironwood, cork elm, paper birch, yellow bull pine, and linden. The collective State exhibit comprised in addition prickly ash, poison oak, dogwood, pawpaw, pineberry, larch, yellow cottonwood, red haw, soft maple, Lombard poplar, sycamore, white willow, apple, black ash, linden, white poplar, black oak, Austrian pine, white walnut, buckeye, red birch, wild plum, red mulberry, pecan, white hickory, slippery elm, chinquapin oak, chestnut, hickory, osage orange, shellbark hickory, black cherry, honey locust, redbud, white ash, balsam fir, white spruce, minor plum, black locust, and red elm.

The State of Washington exhibited mostly evergreen timber. One log of yellow fir was twenty-four feet long and six feet square. There was also a board of extraordinary breadth. Red-cedar shingles were shown, and there was a huge slab of red cedar. A model house contained twenty specimens of different kinds of timber. The State exhibit of timbers comprised yellow, white, balsam, and red fir, Western ash, red alder, black-berried elder, red and Alaska cedar, crabapple, red-berried wild cherry, Western flowering dogwood, upland willow, black birch, Garry's oak, white, Alaska, Western, yellow, tamarack, and scrub pine, spruce, river willow, trembling aspen, Western yew, red haw, cottonwood balm, Hooker's willow, large-leaved and vine maple,

Western hemlock, lovely fir, Western giant larch, madrona laurel, holly-leaved barberry, pencil cedar, wax myrtle, silver-leaved willow, common sumach, Western osier, dogwood, hazelnut, choke cherry, heart-leaved willow, black haw, and yellow fir.

Oregon made but a small exhibit of its magnificent timber, which it exports to Europe and South Africa, and also ships east at the rate of ten

million feet a month. The Douglas fir, the chosen material in European shipyards for masts and spars, almost as light as pine and almost as elastic as hickory, withstanding a tension of two thousand pounds per square inch, is cut from the great forests that cover the foothills and sold for ten dollars a thousand feet, to be exported to Europe. Samples were shown of this and of the tide-land spruce, also abundant and worth the same price for construction, and the choice Port Orford cedar, redolent, lustrous, and lasting, worth fifty dollars a thousand feet. In the collection of commercial woods exhibited by the State was spruce log that was ten feet in diameter twenty-five feet from the butt, and there was a block of yellow fir six feet in diameter. Noble and silver fir, hemlock, ash, maple, black willow, sugar pine, manzanilla, cedar, yellow pine, mahogany, and quaking asp were exhibit-



BURLS AND ORNAMENTAL WOODS FROM MINNESOTA.

ed by individuals, with curious petrifications and fungous growths, wax curiosities, collections of woods, cones, and alpine mosses. George Anderson exhibited a beautiful redwood burl. Mrs. A. C. Blood had an exhibit of cedar fish-net floats; H. M. Lambard turned samples of myrtle wood; William Pfunder, medicinal bark; Tichenor Brothers, cedar shingles; the Willamette Lumbering Company, yellow fir; the Row Lumbering Company, sugar pine. The Young's River Pulp Mill showed paper stock manufac-

tured from spruce without the use of chemicals. A small house erected by the State manager was composed of thirty-five varieties of native timber.

The Government showed a collection of the native woods of Alaska.

The three Canadian exhibits conveyed an imperfect idea of the immense forest resources of the Dominion. Ontario exhibited its commercial timber trees in trunks cut to show the surface in the three regulation sections, and in planks and polished panels. The principal kinds were : Red pine, very abundant and commonly quoted at ten dollars a thousand ; white pine of the highest quality, perfectly free from knots, worth twenty or thirty dollars for doors and sashes ; soft maple, an abundant material for flooring, selling for fourteen dollars ; tamarack, bought for rough outside work at ten dollars a thousand ; basswood for ordinary interior finishing and cheap furniture, selling at twelve dollars ; elm, still more desirable for common furniture because it is so readily stained ; red oak, valued at eighteen dollars, for lasting floors and wainscoting ; and black ash and black birch, largely used now as substitutes for the disappearing black walnut.

Quebec exhibited the common trees of Ontario of smaller sizes and quality. The prices of the standard sorts of lumber at the mills were lower : White pine, eight dollars and ninety cents ; white spruce, five dollars ; white cedar, five dollars and a half ; tamarack, five dollars ; red oak, ten dollars ; black cherry, twelve dollars.

The British Columbian exhibit was remarkable for the large timber shown. The Douglas fir is one of the chief resources of this rich country, where it grows to such size that planks of perfectly straight grain are cut a hundred and twenty feet long and four feet wide. The trees rise straight as masts two hundred and fifty to three hundred feet from the ground. They are cut off about fifteen feet above the ground, because the roots stand several feet out of the soil, and where they join the trunk the accumulated pitch makes the wood hard to cut. A single log sometimes furnishes 25,000 feet of lumber. One was six feet and a half thick at the butt, four feet at the top, and one hundred and thirty-six feet in length. The Australians import this strong light lumber from British Columbia to timber their mines. In the exhibit of the almost equally important and quite as remarkable white spruce was a plank five and three quarters feet wide, cut from the part of the trunk that was forty-eight feet above the ground. British Columbia exhibited also the red cedar, very soft, but taking a high polish, and hence used much for interior work—a wood very easy to work, having a uniform texture and growing to a great size, so that thick planks of smooth surface can be sawed from the log.

Mexico exhibited many curious and beautiful cabinet woods, including violet wood, mountain ebony, roble, black checker wood, and many other kinds. There were some fine mahogany logs from Vera Cruz and Campeachy, remarkable for beauty of grain and color as well as for size. Bamboo cages, baskets, and pliable reeds were among the exhibits. Numerous

exhibitors showed chewing gum. A number made exhibits of zacaton root. The variety of gums and resins was extraordinary, including caoutchouc, pliable reed resin, liquidambar, turpentine gums, mesquite, cactus and mezcal resin, cuajote and chaca resin, zapote, huizache gum, vegetable wax, ocote, copal resin, and giolillo. Among the dyeing and tanning substances were orchilla, dragon's blood, lechuguilla weed, and chucum, redwood, jacob, and tepehuaje tan barks. The medicinal substances were still more numerous,



CANADA'S FORESTRY PRODUCTS.

including sarsaparilla, capomo, great mullein, saltrunnet, coastecomate, valerian root, chocolate seed, jabonete, cualatxla, wild huizache flowers, St. Ignacio bean, ciruelillo root, and coacojul.

Nicaragua had a large exhibit of useful and ornamental woods.

The Philippine Islands were seen to be the source of interesting and valuable forest products, some well known and some unfamiliar.

The space of Spain was mostly taken up by fine exhibits of woods from the colonies. The mother country sent a large display of cork, with samples of licorice, dyewoods, and moss from Teneriffe, and the valuable products of the tropical colonies. The collection of woods from Cuba disclosed the riches of its forests. Three great logs of mahogany were among the marvels of the department. Porto Rico also contributed fine specimens of woods.

Trinidad, in its full and beautiful display of commercial timber, offered

new cabinet woods of elegant texture for the consideration of American decorators. The list included red cedar, black poui, balata, fiole wood, galba, tapama, yellow savoneke, carapa, luenrier, soapberry, yellow and black olive, mussorah, Spanish ash, yellow acoma, augelin, pigeonwood, tagoon mangrove, conta bandeo, pois dut, wild avacawta cajuea, genapa, and wild guava. The value of some of these woods for industrial purposes was demonstrated by samples of spokes of balata wood, fellies of tampana wood, cogs of roble, axe handles of guava and acoma woods, tool handles of purple-heart and locust, and caropa shingles. There were fish-net floats of a native growth as light as cork. The dyes exhibited were turmeric and annatto. Indian baskets and matting of native material were strong and durable.

The display from British Guiana was remarkable for its fine-grained and beautiful, but little known, woods well adapted for the cabinetmaker's art and for structural timber suitable for shipbuilding, and durable kinds for railroad ties. More than a hundred useful kinds were exhibited. The names of some of these, which were ranged in large pillars round the booth in the Agricultural Building or shown in polished slabs, are black greenheart and purple-heart, monkey-pot, hackia, crabwood, pakoorie, hooboo-balli, yellow cironballi, wamara.

Brazil had an immense display of timber, with especially fine cabinet woods, many of which are not common to commerce. Among these the dark and heavy woods predominated. They were displayed in a rustic pavilion composed of trees whose interlocking branches formed the walls.

Paraguay was represented in the exhibition chiefly by woods and forest products. There were three hundred and twenty-one varieties of useful and ornamental timber from one to four feet in diameter, besides dyestuff, medicinal plants, and barks for tanning and other purposes.



WOOD SPECIMENS FROM MEXICO.

The Argentine Republic sent a magnificent collection of construction and cabinet woods and dyewoods. The fancy kinds were worked into globes, wheels, and other shapes to display their beauty. Several woods were dense enough to sink in water. The display of barks, fruits, sawdust, etc., for tanning and dyeing was astonishing in variety, and not less so were the medicinal products of the Argentine forests.

French makers displayed the most elaborate wood mosaics, ornamental floors, and decorative woodwork, formed by the combination of minute tablets of various woods. Algeria, which has a large export of cork and a million acres of young trees, made cork the main feature of its exhibit.

German scientific forestry was illustrated by models and engravings showing the methods of planting and the care of the natural forests.

A pavilion in the Swedish section for the exhibition of the enormous wood-pulp and paper industry of that country had a base formed by sections of the trees from which the pulp is made, from which rose pillars composed of pressed pulp.

The Russian Institute of Forestry showed samples of timber and articles made from wood by peasants. The Administration of the Imperial Appanages exhibited specimens of all the Russian woods and the manufactured products and the methods and appliances of arboriculture and practical forestry. Medicinal herbs were shown by private exhibitors.

The conservators of forests in British India sent from each province or circle collections of timbers, dyeing or tanning substances, gums and resins, medicinal barks, fruits, or roots, or artistically wrought woods—many woods and resin from Jubbulpore; ornamental woods and dyestuffs from Oudh; bhabar grass, resins, oils, pitch, and turpentine from the forestry school at Dehra Dun; timbers, oils, and resins from Assam; barks for dyeing, gums, and resins, and medicinal barks, gums, fruits, seeds, and roots from the central circle; timbers, dyeing and tanning barks, roots, seeds, nuts, fibers, gums, and resins, and oil-bearing nuts and seeds from Madras, and collections of timbers and oils and resins from Bombay. From this last province came also cane picnic baskets and a splendid lot of wood carvings—Indian clubs, carved teak easels, blackwood picture frames, teapoys, and flower stands, sandalwood glove boxes, and elephants carved from ebony. From Mandalay was brought a carved teak doorway, and from Rangoon an exhibit of bamboo. The Inspector General of Forests sent a wonderful carved mantelpiece of shisham, redwood, walnut, boxwood, blackwood, and very old teak, perhaps two thousand years old. Specimens of the padouk wood of the Andaman Islands were very richly carved. The Bombay-Burmah Trading Corporation exhibited in the British section squares and planks of teak timber and samples of railway wheel blocks, railway keys, and flooring and wood paving. The British Commission illustrated by means of a map the system of protecting forests from fire in the Northwestern Provinces.

There was an interesting display of ornamental woods and teak carvings, bamboo, fans and baskets, cordage, edible bird's nests, nuts, and medicinal roots from Siam. An exhibit was sent also from Johore of polished segments of its beautiful woods, with an elegantly carved model of the Sultan's palace. The exhibit included a good display of rattan and copal.

The Japanese exhibit was noteworthy as being the only exhibit of the native woods of that country that has ever been made. There was a



FORESTRY EXHIBITS FROM SIAM.

bamboo pavilion that was a marvelous example of skillful and artistic construction. The exhibit of the Department of Agriculture and Commerce comprised timber and planks and worked timber and furniture materials, ornamental and fossil woods, barks and galls for tanning and dyeing, vegetable wax and resins, and miscellaneous; also baskets and bamboo canes and bamboos. The forests of Japan and their management were shown by maps and illustrations, and there were many pictures of forest growths, and scenes, woods, and flowers. Ajiro works of bamboo, bamboo cups, canes, and delicate carvings, bamboo baskets of innumerable designs, baskets of sago palm, carved umbrella handles, lacquer, rattan work, bamboo boards, wooden water pipes, traveling cases, toothpicks, and writing paper, were some of the special exhibits.

The exhibit of New South Wales was remarkable for gigantic growths



and for the value and variety of the timber resources revealed. Some of the sequoias and other immense trees pictured in photographs rival the big trees of California.

The Australian exhibit was inclosed in a stockade of planks, some of them several feet wide and all nine feet high, polished two thirds of their length. The varieties included myall, rosewood, red bean, onionwood, bloodwood, and many others peculiar to the island continent.

Slabs and logs of its timber trees, samples of Cape gum, and several varieties of bark used in tanning represented the forest resources of Cape Colony, where the forests are carefully preserved.



A fragment of the group on the Peristyle.



A view in the Nursery, on the Midway Plaisance.

## CHAPTER IV.

### THE HORTICULTURAL EXHIBIT.

Group embracing viticulture and its manufactured products, methods, and appliances—Display by States and foreign countries—Group including pomology, with its manufactured products, its methods, and appliances—Lessons learned in regard to the keeping and transportation of fruits—Attractive and novel arrangement of exhibits—Group embracing floriculture—The rose garden—Orchids—Rhododendrons and azaleas—Chrysanthemums—An old New York garden—A Japanese exhibit—Generosity of private collectors—Palms, tree ferns, etc.—Wild flowers and weeds—Fungi—Group embracing culinary vegetables—Exhibit of the New York Experiment Station—The Palace of Plenty—Models of vegetables in wax and *papier-mâché*—Group including seeds, seed testing, and distribution—Group of arboriculture—Nursery exhibit—Group embracing appliances, methods, etc.—The grottoes and other novel exhibits.



WILLIAM P. KETCHAM,  
Member of the Directory.

**H**ORTICULTURE, viticulture, pomology, floriculture, seed raising, and arboriculture—the components of this department—verged so closely upon the Agricultural Department that at some points it was convenient to let them overlap by having exhibits in each department include articles that logically appertained to the other. Group 20, which led off the Horticultural Department, embraced viticulture and its manufactured products, methods, and appliances, and was subdivided into classes as follows: 119. The vine and its varieties, shown by living examples, by cuttings, by engravings, photographs, etc. 120. Methods of planting, staking, and training the vine. 121.

Vineyards and their management. 122. Grapes for the table. 123. Grapes for wine making. 124. Grapes for drying—raisin-grape culture. 125. Methods of and appliances for cultivating, harvesting, curing, packing, and shipping grapes. 126. White wines. 127. Red wines, clarets, Zinfandel, Burgundies. 128. Sherries, Madeira, port. 129. Sparkling wines. 130. Methods of expressing the juice of the grape; of fermenting, storing, racking, bottling, and packing; wine cooperage. 131. Brandy of all kinds; methods and apparatus for the production of brandy. 132. Literature, history, and statistics of viticulture.

Alameda County, California, had in the United States pavilion an exhibit of California vines in bearing, both wine and table varieties. Korbel Brothers and D. M. Pyle had other exhibits. The California Viticultural Association made a comprehensive presentation of the wine-growing industry of that State by means of photographs of vines and vineyards, illustrations of methods of pruning and training, maps, literature, and statistics. The Italian-Swiss Agricultural Colony and other California companies produced views of their vineyards. George West & Son placed in the California Building grape vines of the Black Prince variety that were forty-one years old. T. V. Munson showed the vine as it grows in Texas, and A. F. Rice exhibited seedling grapes from Griswoldville, Ga. In the New York exhibit the State Commission presented photographs of vines pruned and trained in the various styles used in the State, typical vines on a trellis (illustrating the original and the modified Kniffen system and the renewal system of training), and documents on the literature, statistics, and history of viticulture in the State. Charles Wagener exhibited grape stock and a grafting saw, and the Rochester Radiator Company a wire hook for vines. E. G. Coleman and F. N. Randall, New York nurserymen, showed methods of staking and training vines, and J. P. Onstott methods practiced in California. G. E. Ryckman showed a vine fastener used in his vineyard at Brocton, N. Y. In the French section a powder for the treatment of mildew, pulverized sulphur, and twine with coating for grafting were exhibited.

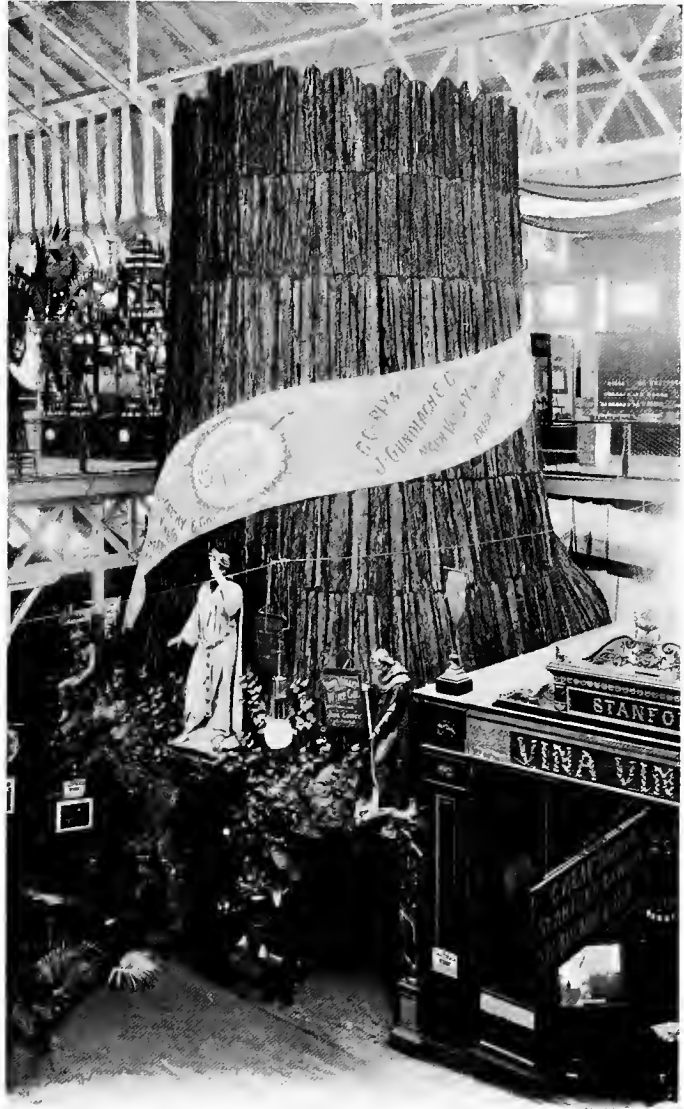
Eating and wine grapes from Ohio were exhibited by Duroy & Haines, C. Hommel, the Lake Erie Wine-Growers' Association, and the Lenk Wine Company, and from Texas by T. V. Munson, of Denison; California, New Mexico, North Carolina, Pennsylvania, New Jersey, and Oklahoma had representative exhibits of both table and wine grapes, and table grapes were shown from Illinois by A. H. Gasten and the Illinois Horticultural Association, from New York by the Chautauqua and Northeast Grape Union, from Georgia by George Albaugh, from Idaho by Louis Delsol and Robert Schleicher, from Nebraska by the State Horticultural Society, from Utah by T. H. Woodbury, and from California by A. B. Humphry, J. Keiser, Natoma Vineyard, John Rock, and H. Overacker. The Italian-Swiss Colony exhibited California varieties of wine grapes, and the Pleasant Valley and Urbana Companies those grown in New York. In the State pavilions were

twenty-six exhibits of grapes from Kentucky, nineteen from Colorado, six from Missouri, four from Minnesota, three from Idaho, and exhibits from New Mexico, New York, and Oregon. Fresno County, California, exhibited fifty-five varieties of grapes. A cluster of the Muscat variety, cut from a two-year-old vine, weighed seven and a half pounds. Kern, Sacramento, San Mateo, and the wine and raisin counties of Southern California had grapes of every kind and of all the colors — white, green, amber, golden, flesh, wine, purple, and black. W. H. Phillips sent a grape vine from Santa Barbara that was thirteen inches in diameter.

The State of Kansas exhibited seventy-seven and Illinois seventy-two varieties of grapes. In the Oregon exhibit were bunches of Black Hamburg grapes weighing nearly twelve pounds; a bunch of Flame Tokay grapes (from the vineyard of G. A. Dunlap) weighed nine and a half pounds, the same weight as a cluster shown in the New York exhibit by David M. Dunning. New York produced the greatest number of new varieties—contributed by the State Ex-

periment Station at Geneva, D. S. Marvin, J. S. Copley, Elwanger & Barry, W. H. Millspaugh, and others. Raisin grapes were exhibited by Russia, and wine grapes on their branches by France.

In the New York pavilion Atwater, Armstrong & Clark, of Rochester, showed a fruit crate, and McMath & Morgan, of Penn Yan, and Sherman &



EXHIBITS OF WINES IN THE CALIFORNIA BUILDING.

Brown, of North Collins, grape baskets. Improved grape sacks were shown in the French pavilion.

Among wines of a hundred sorts, one could scarcely find the kind expressed from wild grapes that diplomats drank at President Jefferson's table and affably compared to the wines of Burgundy. No such opportunity had occurred, nor would soon occur again, for the wine growers of the United States to demonstrate what they have learned within a short period of the art of wine making, and have accomplished in the East in developing vintage grapes from the native varieties by selection and cross-fertilization, and on the Pacific slope in the acclimation of European varieties, the choice and preparation of soils, and methods of cultivation.

In the California State Building fifty-three exhibitors displayed three hundred and one varieties of wines, of thirty-three distinct types. A thousand bottles of exhibition wines were served out each week to lunchers on the roof garden of the building. In the United States pavilion California claret was exhibited by F. Albertz, A. Brunn & Co., C. Carpy, John Crellin & Son, the Cupertino Wine Company, and H. Lefranc; Cabernet by I. De Turk, M. M. Estee, E. E. Goodrich, C. P. Howes, and J. C. Merithew; Medoc by Fiburcio Parrott; Burgundy by I. De Turk, the Napa Valley Company, and others; Zinfandel by I. De Turk, G. Migliavaccai, and others; white Burgundy by the Ben Lomond Company and J. A. Stewart; Riesling by Beringer Brothers, F. Haesters, and others; Hock by Ewer & Atkinson and C. C. McIver; Sauterne and Haut Sauterne by C. Carpy & Co., John Crellin & Son, C. P. Howe, J. A. Stewart, and others; Chablis by H. W. Crabb and C. C. McIver; Moselle by C. C. McIver; Sherry and Port by C. Carpy & Co., the Margherita Vineyard, J. C. Merithew, J. L. Rose & Co., and Charles Stern & Sons; Malaga and Angelica by F. Albertz; Muscat by Beringer Brothers; champagnes by H. Lefranc. H. W. Crabb had Burgundy, Hermitage, Claret, Riesling, Chablis, Malaga, Tokay, and Port; J. Gundlach & Co., Chateau Gundlach, Chambertin, Cabernet, Sauterne, Semillon, Sherry, and Tokay; Haraszthy, Arpad & Co., Claret, Chateau d'Orleans, Cabernello, Sauterne, Muscat, and champagnes; A. G. Chauché, Chablis and Jurançon; F. Billings, Sauvignon, Traminer, and Semillon; Julius P. Smith, Cabernet, Claret, Zinfandel, Malbec, Haut Sauternes, Tokay, and Angelica; George West & Son, Claret, Haut Sauternes, Port, Sherry, and Frontignan; Charles A. Wetmore, Sauterne Souvenir, Chateau Yquem Souvenir, and Margaux; Louis Zierngibl, Burgundy, Zinfandel, Carignan, Cabernet, Angelica, and Port; Otto Norman, Cabernet and Gutedel; F. Korbel & Bros., Zernosek; J. L. Beard, Golden Chasselas; Italian-Swiss Agricultural Colony, Barbera, Mataro, Zinfandel, and Chianti. Besides the above, Paul O. Burns & Co., Robert H. Delafield, the Germain Fruit Company, Jarvis Wine and Brandy Company, C. S. C. Johnston, Joseph Matthews, William Palmtag, the St. Hubert Vineyard, and Leland Stanford exhibited white and white dry wines and sweet wines; C. A. Bald-

win, C. M. Hammond, Lillienthal & Co., H. B. Wagoner, and William Wehner had dry wines; and H. Boettcher, Frank L. Fowler, and Steinke & Bruning had sweet wines.

New Mexico had a collective exhibit of dry and sweet wines and brandies, and in the State building four exhibits. Wines of the East were exhibited by the commissioners for North Carolina and New Jersey. In the North Carolina pavilion six exhibitors showed their wines, of whom C. W. Garrett & Co., of Medoc, Garrett & Co., of Weldon, and W. J. Green had



MISSOURI'S HORTICULTURAL EXHIBIT.

all kinds and also brandy. Pennsylvania made a collective exhibit of dry, sweet, and sparkling wines, which were shown also by the South Shore Wine Company.

The varieties exhibited by New York and Ohio included Port, Claret, Champagne, Madeira, Angelica, Sherry, Riesling, Tokay, Sauternes, Muscatel, Catawba—sweet, dry, and sparkling—Ives's Seedling, Norton's, Iona, Delaware, Diana, Niagara, Isabella, and Concord. New York is the leading State in the production of American champagne, and is only surpassed by California in the amount of still wines. The Pleasant Valley Company, Germania Wine Cellars, Urbana Wine Cellars, and H. T. Dewey & Son, who have long devoted their energies to the making of champagnes, also

the Hammondsport, Keuka, and other companies that have recently taken it up, made a great display of this new American product, the demand for which is rapidly increasing. The same companies exhibited their still wines alongside of those of the Brotherhood Company, which brought out wines over fifty years old from its cellars in Orange County, and those of Fuller & Skinner, E. G. Ryckman, and the Brocton Company, representing the Chautauqua district; the wine of the Helvetia Company, Crescent Company, Columbia Cellars, the Hammondsport Vintage Company, and the Empire State Company, on Keuka Lake; H. T. & J. D. Henderson, on Seneca Lake; and the Irondequoit Company, makers of medicinal wines, George Miller, and J. T. Thompson. There were more exhibits from New York than from other States of currant, elderberry, blackberry, and raspberry wines. Ohio wines of the same type were shown by the Lake Erie Fruit and Wine Growers' Association, of Sandusky, the Sweet Valley Company, of Kelly Island, and Engels & Krudwig, the Lenk Company, and A. Wehili & Son; and sparkling wines by C. Hommel and M. Hommel, of Sandusky. The Speer Wine Company, of Passaic, showed New Jersey wines, dry and sweet, and John Bannier, Claret from southern New Jersey. The Monticello Wine Company, of Charlottesville, Va., exhibited dry red and white wines. Christian Xander, of Washington, D. C., had Claret and sweet wines. Missouri wines—white, red, and sweet—were exhibited by the American Wine Company, and dry sorts by the Mount Pleasant Company, of Augusta, and the Stone Hill Company, of Herman. E. A. A. Dorion, of Havana, Ill., and Charles W. Robinson, of Detroit, Mich., had sweet wines. Virginia showed some good wines from Manassas; North Carolina, the Scuppernong and other varieties.

Unfermented juice of the grape was exhibited by H. T. Dewey & Sons and the Speer Company, besides whom C. J. Kendia and E. Smith, of New York, had the white kind, and W. B. Gleason the red.

Canadian wines were exhibited from five vineyards. Mexico had eleven exhibits of red, three of light white, and two of sherry wine. There were fifteen exhibitors from the Argentine Republic of both white and red wine, fourteen of white alone, and ten of red wine; one showed grappa wine. From Chili there were sixteen exhibits of dry wines of the claret, hock, port, and sherry types. Japan had two exhibits of wine. Peru made a representative exhibit of dry and sweet wines. In the pavilion of New South Wales thirty wine growers of Corowa, Inverell, Wagga Wagga, Albury, and other places exhibited a surprising list of wines, including claret, Hermitage, Riesling, Verdelho, Shiraz, Muscatel, Verdot, Madeira, Tokay, Malbec, Sauterne, Chablis, Hockheimer, Aucarot, Gouais, and Kaludah. There was a well-selected representative exhibit of Cape wines.

The Spanish wine exhibit was the most extensive. There were pyramids of bottled ports and sherries and towers of bottles resting on a base of casks



and barrels. Near the dry, nutty, brown, or golden sherry of Xeres were the heavy, dark Valencian wines, and great quantities of the bright ports of the mountain districts, sweet yet light. Out of twelve hundred exhibitors, fewer than a hundred exhibited white wines, sherries, Madeira, Malaga, Malvoisie, sparkling wines, and other exceptional sorts; all the rest had the Spanish red wines. From costly sherry over a hundred years old to the ordinary sound and healthy claret which the country people can get for a cent a bottle, every type and variety of Spanish wines were represented, and the visitors were adequately impressed with the fact that this country produces wines of many kinds, most of all the lighter kinds not usually associated with its name, and that it is able to export five times as much as France. The exhibits were systematically arranged by regions and provinces.

Italy, Portugal, and Greece made government exhibits. Italy exhibited all its types of wine, including the heavy bodies, still and sparkling wines of the northern mountains, the clear, well-tempered Chianti of Tuscany, the rougher clarets of the Apennines, Marsala and the Sicilian country wines, and the various

choice vintages of Vesuvius and the Neapolitan islands. The list of Italian exhibitors had sixty-five names. All the thirty-nine Portuguese exhibitors showed ports, besides which ten had red wine and claret and nine had white wines. Russia's growing vineyard interest was represented by twenty-two exhibits of red and white wines and eight of sparkling wines.



TANK SHOWN IN THE CALIFORNIA BUILDING.

There were twenty-five exhibitors of the various wines of Greece and the Ægean Islands.

France made a thorough exhibit from all its districts and famous vineyards, and showed the products and features of its wine industry. The makers and sellers of champagne from Reims, Epernay, and other centers made the most ostentatious display. There was a towering bottle to call attention to the Reims exhibit. Though sparkling champagnes predominated, the Burgundies (red and white), the clarets and Medocs, and the white wines of Sauterne and the Gironde were well exhibited by Bordeaux, Paris, and Nancy firms. Sparkling wines of the Côte d'Or were exhibited with the Nuits, Baune, Bune, Lambray, and Sorbet. Special kinds from the Gironde were Le Monteil, Chateau d'Issan, Canon Fronsac, Mouchit, Chateau Franc Pourret, Moulis, and Denabre, besides Hermitage and St. Emilion. From Yonne came sparkling Chablis, red Fancy, and other white and red wines. Indre-et-Loire was represented by red Bourgueil and white Vouvray, both still and sparkling. The wines of the Rhone, Gard, and Landes were also represented. Var had white and red La Garde; Saône-et-Loire, Macons and Montrachet; Aude, Rock Ste. Marie, and red wines from French *carrignans* grafted on American stocks; Charente Inférieure, Muscat and white and red Saujon; Loire, Chateau Volan; and the Hérault district, Lunel and white and red Montpellier.

In the collective exhibit of German wine growers two hundred and seventy firms and vineyards were represented. There were numerous exhibits of sparkling wines, not the familiar sparkling hock alone, but richly flavored mixed wines made to vie with French champagnes. Select exhibits were made from the choice vineyards on the Rhine, at Johannisberg, Rudesheim, Nierstein, Deidesheim, Oppenheim, Bingen, Winkel, Lorch, Geisenheim, Worms, Coblenz, Oberingelheim, and at Hockheim on the Main. There were many exhibits of Moselle wines from Trier, Traben, Mulheim, and Trabach, and of Lauffen, Esslingen, and other wines of the Neckar. Assmanshausen was well exhibited, also the less known wines of Wurzburg, Kreuznach, Neusstadt, Wiesbaden, and Saarburg. There were many exhibits of the wines of Lorraine and Alsace. The Bacharach of Rhenish Prussia, and the Flonheim, Laubenheim, and other light wines of Hessia were shown, and a full exhibit was given of the Offenburg of Baden and all the hearty red wines of Wurtemberg, Franconia, and the Rheinpfalz.

Gundlach & Co. exhibited representations of the appointments and the cooperage system of their vaults in San Francisco, and Korbel Brothers a cooperage tank. In the German section were two exhibits of cellar furnishings. The French made exhibits of vats of various kinds, plans of storehouses, clarifying substances, and prepared tissues for filtering. Russia showed apparatus for bottling.

California brandy was shown by Ferdinand Albertz, Barton Estate, Beringer Brothers, H. Boettcher, Paul O. Burns & Co, Carpy & Co., H. W.





JAPAN'S EXHIBIT IN THE HORTICULTURE BUILDING.

Crabb, Isaac De Turk, Ewer & Atkinson, Gundlach & Co., Italian-Swiss Colony, Jarvis Company, Korbel Brothers, Margheretta Vineyard, the Napa Valley Company, W. Palmtag, T. Parrott, L. J. Rose, J. P. Smith, Leland Stanford, Charles Stern & Son, H. B. Wagoner, and Walden & Co.; brandies made in the East by the Brocton Company, the Crescent Company, J. M. Emerson & Sons, J. P. Feltzer, the Germania Wine Company, the Hammondsport Vintage Company, the Irondequoit Company, the Pleasant Valley Company, and G. E. Ryckman, of New York; by Duroy & Haines, Fuller & Skinner, the Lake Erie Company, the Sweet Valley Company, and A. Wehili & Son, of Ohio; and by the State of New Jersey and the Speer Company. There were nine exhibitors of cider brandy from New York.

In the French pavilion were a large number of exhibits of Cognac, Champagne, Amargnac, and Charente brandies, pressed grape brandies, cherry brandies, and Normandy cider brandy. Greece had numerous exhibitors of grape brandy, with mastic, citron, and cedrat liqueurs, Chartreuse, and raki. There was an exhibit of Italian brandy, and samples were shown of the Cognac made in Saxony and in Holland. Australian, Portuguese, Russian, Mexican, and Peruvian brandies were also shown.

Besides wines, Spain had a large exhibit of brandies made in the style of Cognac, the production of which has grown rapidly since the loss of the French vineyards and the inability of the French distillers to supply the genuine product.

Group 21 took in pomology, with its manufactured products, its methods and appliances, and was classified as follows: 133. Pomaceous and stone fruits—pears, apples, plums, peaches, nectarines, apricots, cherries, etc. 134. Citrus fruits—oranges, lemons, limes, shaddocks, etc. 135. Tropical and subtropical fruits—bananas, pineapples, guavas, mangoes, sapodillas, tamarinds, figs, olives, etc. 136. Small fruits—strawberries, raspberries, blackberries, gooseberries, currants, etc. 137. Nuts—almonds, pecans, chestnuts, filberts, walnuts, etc. 138. Casts and models of fruits; imitations in wax, etc. 139. Dried and evaporated apples, peaches, pears, and other fruits. Prunes, figs, dates, etc., in glass or boxes. 140. Fruits in glass or cans, preserved in sirup or alcohol. 141. Jams, jellies, marmalades. 142. Fruits glacéd. 143. Cider, perry, vinegar, and expressed juices of berries. 144. Methods of crushing and expressing the juices of fruits and berries. Apparatus and methods of desiccating; apparatus for making vinegar, etc. Cider mills and presses. 145. Methods for preserving all fruits by cold storage or chemical appliances; their keeping, packing, and shipping. 146. Literature, history, and statistics.

Valuable lessons were gained from the Exposition in regard to the keeping and transportation of fruits. It was demonstrated that apples can be kept longer than has been supposed, without freezing or even a low temperature, if they are handled with extreme care, and that their flavor is unimpaired by cold storage, though pears usually lose in flavor. New York

exhibited one hundred and one varieties of apples and several varieties of pears and quinces that had been kept over winter. Of autumn apples, the Pound Sweet and Fall Pippin remained in good condition on the plates through the month of May, and of the winter varieties Boiken, Granite Beauty, Blue Pearmain, and Tallman Sweet to the beginning of July, twenty-five other varieties nearly as long, and Tompkins County King till the middle of July. Newtown Pippins that had not been in a cold room lasted two months after being opened. Swaar, Russet, Spitzenberg, Ben Davis, Spy, Red Canada, Fallwater, and twenty other late apples taken out of storage on August 1 kept through the month. Of Illinois apples kept



J. M. DO ONTEIRO RIBEIRO,  
Commissioner from Portugal.

in cold storage, the Jonathan remained sound from the middle of May till near the end of July and the Ben Davis till late in September. Of pears, the Bartlett, Clapp's Favorite, Seckel, and early varieties in general, lost flavor when kept longer than six weeks at a temperature of thirty-six degrees; Anjou, Bosc, and Lawrence stood cold storage better, and Winter Nelis opened on May 1 retained flavor and appearance till the middle of June, while Beurre Gris and Josephine de Malines did almost as well. Ellwanger & Barry opened late in June pears that had not been in cold storage, of which the Black Worcester, Provost, Bergamot, Royal d'Hiver, Doyenne Jamin, Clapp's 64, Bergamot Heitrich, Duchesse de Bordeaux, Fox No. 7, Madame Hentin, and P. Barry did not begin to spoil for six days, and the Pound kept nearly two weeks.

Apples of the crop of 1893 began to arrive from New York in the early autumn. The New York Experiment Station exhibited eighteen varieties of apples illustrating the results of scientific cultivation. G. T. Powell exhibited Cranberry Pippin, Fameuse, and Fall Strawberry apples, and the Experiment Station exhibited Seckel and White Doyenne pears to show the efficacy of the Bordeaux mixture (a solution of four parts of sulphate of copper mixed with three of lime) against the scab. Ellwanger & Barry made the largest exhibit of pears, sending sixteen varieties on August 12 and larger assortments when other varieties ripened, forwarding on October 4 one hundred and twenty-five different varieties.

In the pomological exhibit of Illinois were ninety-five varieties of apples, seven of crab apples, four of quinces, and thirty-one of pears. Kentucky exhibited one hundred and fifty varieties of apples, twenty-five of pears, and four of quinces. Among the apples were many new varieties of merit, as might be expected from the State that originated the Ben Davis apple. Maine had

a fine representative exhibit of apples. Pennsylvania had a collective exhibit also. Idaho exhibited apples of fine growth and quality. Nevada had a fine collection of apples and pears. The Kansas State exhibit embraced nearly a hundred varieties of apples. The State of Washington had a notable exhibit of large and handsome apples, pears, and quinces. The Oregon pomological display was unexcelled, and the fruits of that State were much admired for their size, color, flavor, and shipping qualities. One of the big red apples weighed an ounce and a quarter over two pounds, measuring sixteen and a half inches around. There was a pear that was nine and a half inches long and weighed four pounds, lacking an ounce.

There were shown from the Oregon crop of 1893 one hundred and thirty-five varieties of apples, three of quinces, and twenty-four of pears. There were numerous exhibitors of the delicious apples of Minnesota. Missouri exhibited apples and quinces, crab apples, and a great variety of pears of superior excellence. California quinces were exhibited by Ellwood Cooper, of Santa Barbara.

Illinois exhibited forty-two varieties of peaches. From early in August till November, Niagara and Orleans Counties and other districts supplied fine New York peaches of twenty-seven varieties. The earliest peaches of the crop of 1893 to arrive at the Fair were sent by W. McPheeters, and the latest by James L. Talbott, both Kentucky growers. The largest shown were Kentucky peaches measuring eleven and five eighths and twelve inches, grown by Mrs. L. Shanston and F. W. Spreen. Kentucky had thirty-three varieties on exhibition. A fine new plum peach was shown by David L. Talbott, of Kentucky. Peaches of great size and beauty came from Oregon in eight varieties; specimens of the Salway variety from Max Pracht's orchard measured fourteen inches in circumference. Kansas had a small exhibit of peaches. Peaches and plums were exhibited from Minnesota.

E. Smith & Sons and the Experiment Station at Geneva supplied apricots from New York in fourteen varieties. Apricots of three varieties were shown from Illinois. Oregon showed three varieties of apricots, four of nectarines, and two of *Pruni simoni*, of which fruit specimens twice as large as any others seen and of superior flavor were sent from the orchard of George A. Dunlap.

New York made a fine display of the leading varieties of plums and some new varieties, including the lately introduced hardy Russian and Japanese plums, which are proof against the black-knot fungus; also fine specimens of the wild red and Chickasaw plums. Illinois had twenty-five varieties of plums. The plums and prunes of Oregon excelled all others in size and flavor. A dozen Pond's seedlings, grown by G. W. Cochrane, weighed six and a half pounds. W. P. Watson exhibited a fifteen-inch twig that held fifty-six well-developed silver prunes, and Samuel T. Malchorn showed Golden prunes gathered from one-year-old trees. Oregon's assortment embraced ten varieties of plums and eight of prunes. Plums of many



kinds were exhibited from Missouri, and peaches, apricots, nectarines, and cherries.

Cherries of seven varieties were shown in perfection from Illinois. The Oregon cherries elicited the greatest admiration, especially the new varieties developed there, such as the Hoskins, Waterhouse, Black Republican,



EXHIBITS FROM COLORADO.

Lewellyn, and, above all, the Bing, some of which measured three and three quarter inches in circumference. Fourteen kinds were shown. Cherries from Missouri were exhibited by the Agricultural College at Columbia.

Illinois exhibited persimmons in three varieties; Kentucky, four varieties of Japanese persimmons. California made a good display of Japanese per-

simmons. There were eighty exhibitors of the fruits of Colorado and over a hundred exhibitors of Idaho's fruits. Fresh fruits from Washington State were received in good condition from the farms of Dr. N. G. Blalock.

Collective exhibits of pomaceous and stone fruits were made in the United States pavilion by Arizona, Arkansas, California, Colorado, Florida, Idaho, Indiana, Iowa, Kansas, Kentucky, Louisiana, Maine, Minnesota, Missouri, Montana, New Mexico, New York, South Dakota, Utah, Washington, and by Berrien County, Michigan, the Illinois Horticultural Society, the Lompoc Exhibit, Santa Barbara, California, Michigan State Horticultural Society, Nebraska State Horticultural Society, the New Jersey Board of Agriculture, the Northern Pacific Railroad Company, Ohio State Horticultural Society, the Oregon State Board of Horticulture, and the Wisconsin Horticultural Society. The Albaugh Georgia Fruit Company and the Ohio Fruit Land Company showed peaches and pears; A. H. Gaston, of Lacon, Ill., apples, pears, and stone fruits; J. B. Morris, Joseph W. Powell, and L. W. Porter, all of Lewiston, Idaho, various fruits; the National Fruit-Growing Company, of San Francisco, a collection of California fruits; Lompoc Valley Association, California apples; John Rock, California cherries. Placer, Sacramento, Los Angeles, and other counties helped to give a continuous display of the deciduous fruits of the different sections of California as they ripened during the season of the Fair. Fresno, Kern, Tehama, Shasta, San Mateo, Sacramento, and other counties showed their apples, crab apples, pears, quinces, and their fresh cherries, peaches, prunes, apricots, and strawberries alongside of their oranges and lemons. The Fresno County exhibit contained twenty-two varieties of peaches, eighteen of plums, fourteen of pears, twelve of apples, four of quinces, five of cherries, four of persimmons, eight of apricots, five of figs, five of pomegranates, sixteen of olives, five of oranges, and four of lemons. The continuous exhibit of Placer County impressed visitors with the fact that in some of the counties of northern California the deciduous fruits, and even oranges, ripen from three to five weeks earlier than in the extreme southern counties.

A collection of citrus fruits, with other fruits and nuts, was placed in the United States pavilion by the State of California. Other collections were exhibited by the El Cajon Valley Association, Edward Dunham, J. H. F. Jarchow, W. C. Kimball, John Scott, and Ernest Watson. Lemons and limes were shown by Ellwood Cooper, and oranges and lemons by G. W. Garcelon. Other exhibitors were A. D. Bishop, A. Scott Chapman, W. Chippendale, Clark Brothers, J. T. Gordon, M. N. Gulick, E. M. Hatch, E. W. Holmes, E. W. Jenney, S. La Rue, S. M. Marshall, R. W. Meacham, A. C. Rogers, H. K. Snow, and E. S. Thacher, who displayed the varieties of oranges, the shaddocks and pomeloes, lemons, and limes that grow in California. The counties of southern California in which the cultivation of citrus fruits is the leading industry displayed them in striking forms that

attracted universal attention. Los Angeles County had in the California Building a globe, eight feet in diameter, covered with six thousand two hundred and eighty oranges, and in the Horticultural Building an orange tower containing nearly fourteen thousand, and a Liberty bell besides, formed of forty-five hundred.

every fifteen days.

the largest contributor to chard, transported with plants, and set out in Bernardino County ges shaped like its and had a complete and anges and lemons. new Riverside Coun- The lemons of C. F. in the exhibit of Placer, San Mateo, counties of north- good showing of Santa Clara showed in length. Some were the Wash- oranges, Tange- ranean Sweet, and various Brae, Lisbon, ons were ties, and of raguan and citron of shown, with kinds of pomelo, and The citrus Florida were collective State house oranges

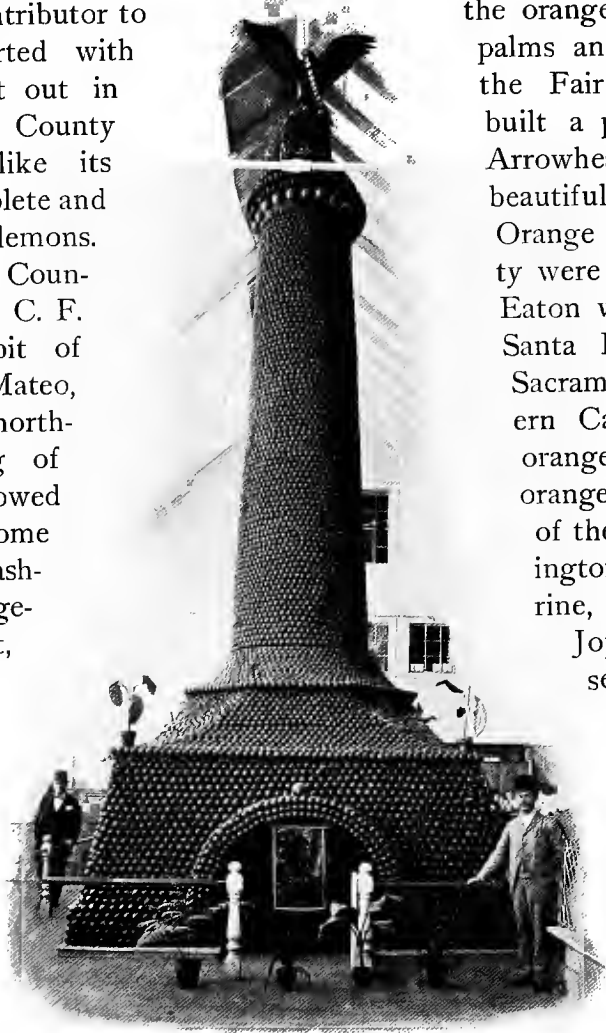
were exhibited in the Canadian pavilion and trees bearing fruit from the greenhouse of Charles Zellar & Sons in the New York pavilion.

Not southern California alone, but the whole Pacific coast exhibited semitropical fruits in rare perfection. Oregon showed two varieties of pomegranates and two of figs. Fresno County, California, had a fine display of figs. Placer County showed clusters of them resembling bunches of grapes. Guavas, loquats, mangoes, custard apples, cherimoyers, etc., came from Santa

These structures were renewed

Los Angeles County was the orange and lemon or- palms and other tropical the Fair grounds. San built a pyramid of oran- Arrowhead Mountain, beautiful exhibit of or- Orange County and the ty were not far behind. Eaton were conspicuous Santa Barbara County. Sacramento, and other ern California made a oranges and lemons. oranges clusters a yard of the varieties shown ington and other navel rine, Malta, Mediter-

Joppa, Mandura, seedlings. Bonnie and Sicily lem- common varie- limes the Nica- Mexican. The commerce was the various shaddock, grape fruit. fruits of shown in a exhibit. Hot- and lemons



CALIFORNIA'S ORANGE TOWER.

Barbara, Los Angeles, and San Diego. The southern counties contributed clusters of dates, prickly pears, bunches of bananas, etc., to a pyramid of fruits in jars.

Olives came from many parts of California. California olives and olive oil were exhibited by Ellwood Cooper, Tiburcio Parrott, and Charles A. Wetmore ; by F. A. Kimball, who had pickled and dried olives ; and by W. C. Kimball, who had olives put up in glass. Santa Barbara County made olive oil the chief feature of its exhibit. A tall obelisk was built of bottles of virgin oil, furnished by Ellwood Cooper, and the oils of Ralph Selby were strikingly displayed. Olives and oil were also prominent in the exhibits of Ventura, Kern, and other counties. Olive branches loaded with berries were shown by Santa Clara County.

The gooseberry, a fruit that has not thriven hitherto, is now being cultivated successfully by keeping the soil shaded and spraying with sulphide of potassium to prevent mildew. New York exhibited twenty-one established varieties, besides one hundred and seventy new seedlings from the Experiment Station. F. Argyle and Nicholas Phalen showed promising new varieties from chance seedlings. Gooseberries of five varieties were exhibited by Illinois. Oregon exhibited several varieties.

Twenty-six established varieties of currants were exhibited from New York. Jacob Moore showed several hundred new seedlings, mostly from seed of the cherry currant fertilized by the white grape. In the Illinois exhibit were nine varieties ; Oregon showed four.

Illinois exhibited ten varieties of raspberries and eleven of blackberries. Charles Mills succeeded in transporting Mills's seedling, Gregg, and Kansas blackcap raspberries, and Joseph T. Thompson the Columbian red raspberry, from New York to the Fair. C. W. Wilmeroth & Co., of Chicago, had an ever-bearing raspberry.

New York exhibited many strawberry plants in bearing, including hybrid seedlings that are being tested at the Geneva station. Among the exhibitors who shipped strawberries, L. J. Farmer sent sixty-seven varieties. In the Illinois exhibit twenty-two varieties were represented. The famous red, juicy, and luscious strawberries of Oregon, shown in six varieties, surprised everybody by their keeping qualities. They are so prolific that a single stalk, presented by W. P. Watson, contained four hundred and eighty-three berries. F. W. Loudon, of Janesville, exhibited Wisconsin strawberries.

Illinois showed three varieties of mulberries and some cultivated papaws and May apples. Huckleberries and elderberries were exhibited by Oregon. Minnesota and Oregon were the principal exhibitors of cranberries.

The Missouri Agricultural Experiment College exhibited strawberries, mulberries, currants, dewberries, raspberries, gooseberries, and blackberries. A collective exhibit of small fruits was made by the growers of Missouri. Washington exhibited small fruits in solution. Collections of small fruits were also exhibited by New York, Minnesota, and other States.

Over four hundred Canadian exhibitors combined made an astonishing display of the fruits of the Dominion : Apples of American and native Canadian, European, and Siberian varieties ; crab apples of every type ; pears of many sorts ; excellent quinces ; native and cultivated plums in variety ; May apples, dewberries, and other wild fruits ; blackberries, raspberries, and strawberries of rare quality ; high-bush and other cranberries ; and excellent gooseberries in great plenty and variety.

The State of California exhibited a collection of the nuts that flourish in its soil. Ellwood Cooper also exhibited California nuts in the United States



HORTICULTURAL PRODUCTS OF CANADA.

pavilion, and George W. Ford and Joseph Sexton exhibited English walnuts. Walnuts of three varieties were found in the Placer County exhibit in the California Building, with pecans, hazelnuts, chestnuts, and almonds. San Mateo County had a great variety of nuts, and Butte, Santa Clara, and other counties of northern California showed almonds and other nuts, which were prominent also in the exhibits of the southern counties. Los Angeles made the largest walnut display. The Los Nietos and Ranchito walnut growers filled the sides of a huge glass prism with large English and Persian walnuts of various kinds. Orange County had a large exhibit of English walnuts. Ventura County showed twenty-two varieties of almonds in one case. A. T. Hatch, who has almond ranches in Tehama and five other counties, took the

leading part in exhibiting the almond ; his contribution in the State collection of nuts embraced eighty-six varieties. The pecan nuts of Texas were exhibited by F. A. Swindon and, with photographs, by E. E. Risien ; those of Louisiana, with photographs, by B. M. Young. Oregon showed a great variety of nuts, including English walnuts of four kinds, butternuts, black walnuts, hard-shelled and soft-shelled almonds, hazelnuts, filberts, American and Spanish chestnuts, three kinds of hickory nuts, and Brazilian beechnuts. Illinois exhibited pecans and chestnuts. Idaho also exhibited nuts.

In the Canadian pavilion were butternuts, walnuts, and Kentish cobnuts. The New South Wales commissioners exhibited a collection of nuts. In the Spanish pavilion were numerous exhibits of almonds, chestnuts, filberts, and other nuts. Mexico had exhibits of its nuts. Japan and Trinidad showed their varieties of chestnuts and Chili its walnuts and filberts.

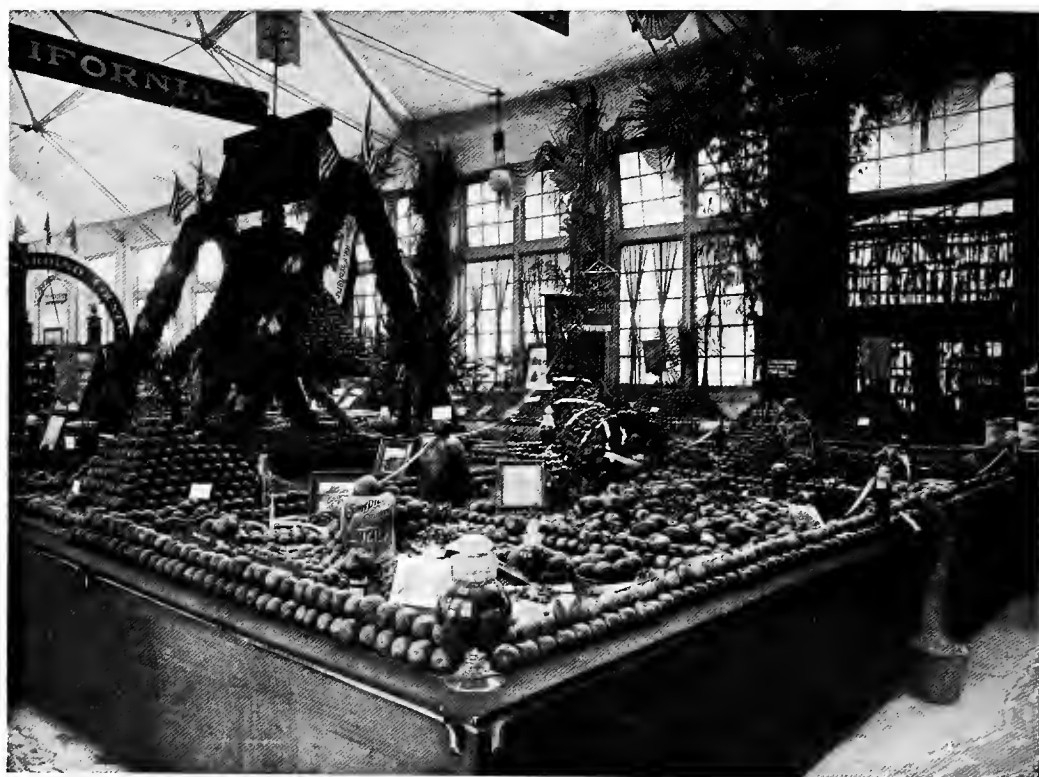
Casts and models of fruits were exhibited by the Nebraska Horticultural Society and similar bodies, to illustrate the products of the region. I. G. Hubbard, of Nikomis, Ill., had wax models of the peaches that he raises, and Mrs. Stanley Potter, of South Haven, Mich., exhibited the models that she makes for the use of nurserymen, seedsmen, and museums.

Dried fruits and raisins were a prominent feature of the California exhibits. The State Board placed a full collection in the United States pavilion. Some of the exhibitors of California raisins were the El Cajon Association, the Holt Raisin Company, H. R. Ellis, the Escondido Company, Griffin & Skelly, J. P. R. Hall, W. Harvey, Loud & Gerling, John P. McFarland, Noble Brothers, D. M. Pyle, and D. S. Sheldon. J. P. Onstott exhibited seedless raisins and the fresh grapes. Fresno County indicated its leading industry by a pyramidal pile of small boxes of raisins, of which twenty-five thousand were distributed as souvenirs. Photographs illustrated the cultivation of the raisin vineyards and the stages in the production of raisins. The raisins themselves were seen in the forms and brands under which they are sent to market, such as clusters, four-crown, three-crown, and two-crown layers, loose raisins of three grades, seedless Sultanas, Thompson seedless, and Zante currants. Ventura and other southern counties displayed raisins, San Diego especially, which had a pyramid formed of sections of boxes of raisins.

Santa Clara County, the prune orchard of America, which produced twenty million pounds in 1891, while the rest of the country produced nine million, set up in token of its chief distinction a mounted knight in armor, composed, horse and man, of dried French and silver prunes. The Saratoga Packing Company had a collection of prunes, which were well displayed also in some of the associated and individual exhibits. Oregon made a special feature of its large, well-flavored, and neatly packed dried prunes. Dried figs were exhibited from California by J. P. R. Hall and others. There were exhibits of California dates, dried and packed. Various dried fruits were exhibited by B. F. Allen, S. H. Barrett, the C. P. Barrows Company, R. F.

Cunningham, Mary A. Davis, the J. H. Flickinger Company, O. Handy, E. J. Knapp, A. Lusk & Co., T. J. Mellen, P. B. Myers, M. Reidy, the Riverdale Fruit Company, and Lewis Walker ; sun-dried peaches by H. Culbertson ; sun-dried figs by W. H. Ferry ; dried prunes by C. C. Thompson ; and dried pears by W. R. Walker. Other exhibitors of dried or evaporated California fruits were the El Cajon Association, the Escondido Company, J. P. R. Hall, A. D. Haroks, and the San José Packing Company. These exhibits included, besides grapes, figs, and prunes, dried or evaporated nectarines, peaches, plums, apples, pears, cherries, citron, loquats, and great quantities of dried apricots.

The State of Idaho exhibited a collection of dried fruits. Evaporated fruits of Missouri were exhibited by George A. Dietz, and those of Indiana



SAMPLES OF FRUITS FROM CALIFORNIA.

by D. Stutzman. The evaporating industry of New York was well represented. Michael Doyle & Co. exhibited evaporated Rochester pippins and other apples, chopped apples, sun-dried apples, apple waste, dried plums, cherries, blackberries, and whortleberries, and evaporated peaches and red and black raspberries ; A. B. Williams, evaporated apples and raspberries, red and black ; the Genesee Fruit Company, evaporated apples.

Canned fruits in glass, often almost as rich in hue and full in form as if kept in a special preserving liquid, were seductively displayed ; with beautiful



jellies, by State boards or horticultural societies of California, Idaho, New Jersey, Missouri, Minnesota, Florida, New York, Washington, Oregon, and Utah. The Colorado ladies clubbed together to give an exhibit of fruit in preserves and jellies. The ladies of Kansas joined in an elaborate and extensive exhibit of jellies. The counties and World's Fair associations of California made similar displays.

New York and California bore out their character as the horticultural poles of the country by the exhibits of their canning and preserving industries. The New York State exhibit contained twenty-three varieties of preserved fruit, besides fruit juices, jams, and jellies. Gordon & Dilworth and Curtice Brothers produced samples from their extensive factories of all kinds of fruit in glass and tins, with jams, jellies, and marmalades made of fruits raised in New York and imported from abroad. Mrs. J. F. McCready exhibited preserved cherries and peaches and sweet pickles. In the Maryland Building was a collection of fruit preserves made by the Belmont Company; also an exhibit from Mrs. Edward Henrix of peaches from 1891 preserved by a new process. The Ritter Conserve Company, of Philadelphia, C. H. Godfrey, of Benton Harbor, Mich., and the American Manufacturing Company, of Chicago, were some of the commercial exhibitors. C. E. Backwith, D. C. Bass, A. G. England, W. B. Harlan, and E. J. Stanley displayed the fruits of Montana in glass. Gordon & Dilworth and others exhibited brandied fruits. I. G. Hubbard exhibited preserved peaches from Illinois and David Reis Delaware peaches. The Butters Manufacturing Company, of Denver, had preserves and fruit butters. Charles P. Mattocks, of Portland, Me., had canned apples. Lyons, Kinsie & Geis, of Chicago, and Joseph A. Wilson, of Chester Depot, Vt., showed fruit jellies. E. Jamison showed preserved Florida fruits and jellies. Fine jellies were shown in the Maine exhibit.

Exhibitors of California fruits, canned or preserved in sirup, were the Flickenger Company, of San José, Lusk & Co., of San Francisco, the Fresno Canning Company, the Sonoma Preserve Company, the San José Dried Fruit Company, the Oakland Preserving Company, the Germain Fruit Company, and the San José Fruit Packing Company. H. T. Hatch, Mrs. J. C. Joplin, Charles A. Maul, and the National Fruit-Growing Company exhibited California fruits in glass; L. E. Allen, of San Diego, figs in sirup, guava jelly, and fig marmalade; the South California Packing Company, orange marmalade; Mrs. O. Schnabel, California jellies; Bishop & Co., of Los Angeles, bottled fruits and crystallized fruits. There were several exhibitors in California of candied and glacéd fruits, which were shown from the eastern part of the country by the Philip J. Ritter Conserve Company.

Cider was exhibited by the Genesee Fruit Company and the Michigan Cider Company; cider and vinegar by F. C. Johnson, of Kishwaukee, Ill.; vinegar by Curtice Brothers and others; fruit juices and sirups by Gordon & Dilworth, Smith & Painter, of Wilmington, Del., and the Welch Grape

Juice Company, of Vineland, N. J. Ferdinand Albertz showed California grape sirup.

The apparatus and appliances exhibited were few. The Michigan Cider Company, P. P. Mast, and the Hydraulic Press Company showed cider mills and presses; the Ripley Company, of Sherman, N. Y., a cider purifier; D. Stutzman and George A. Dietz, fruit evaporators; I. G. Hubbard, an orchard packing bench; O. L. Danforth, a fruit gatherer; and Thomas Cogswell, of San Diego, improved fruit baskets.

Floriculture made Group 22, divided as follows: 147. Roses. 148. Carnations. 149. Orchids. 150. Rhododendrons, azaleas, etc. 151. Chrysanthemums. 152. Dahlias, gladioli, etc. 153. Ornamental bulbous flower-



EXHIBIT OF CURTICE BROS. & CO., ROCHESTER, N. Y.

ing plants. 154. Pelargoniums, zonal, and show. 155. Bedding plants and flowering annual plants. 156. Climbing plants. 157. Perennials and flowering shrubs not otherwise mentioned. 158. Miscellaneous annuals, phlox, asters, etc. 159. Palms. 160. Ferns. 161. Ornamental leaf plants. 162. Cactaceæ. 163. Aquatic plants. 164. Native wild plants and flowers. 165. Ornamental grasses and reeds. 166. Rare exotic plants. 167. Cut flowers. Floral designs, pressed flowers, leaves, seaweeds, and bouquets. 168. Plants grown for commercial purposes. 169. Receptacles for plants, flowerpots, plant boxes, fern cases, tubs, jardinières, plant and flower stands, ornate designs in flower stands. 170. Literature, history, and statistics. 171. Miscellaneous.

In the exhibition of plants and flowers and their artistic arrangement

New York took a leading part. One of the six greenhouses filled with costly collections of plants was a model rose house, such as roses are raised in for the market by New York florists, in which roses were in bloom from June till November. The plants in the exhibits received the same treatment that is usually given in the best commercial and private establishments, and the implements and appliances used were of the latest improved designs turned out by New York makers. Ernst Asmus exhibited the new roses Madame Caroline Testout and Kaiserin Augusta Victoria; John C. May, the Mrs. W. C. Whitney, with a collection of American roses. The collective State exhibit consisted of over a thousand plants of the *Perle des Jardins*, *Meteor*, *Waban*, *Hermosa*, *Sombreuil*, *Devoniensis*, *La France*, *Antoine Verdier*, *Étoile de Lyon*, and many other varieties. In the international rose garden, New York had a thousand blooming tea roses of fifty choice varieties. That State made the only continuous display of cut flowers, and on New York and Manhattan days the florists of Long Island and the Hudson River were especially liberal in their contributions of *Bride*, *Catherine Mermet*, *Meteor*, and other showy roses and cut carnations. In these displays Ernst and Rudolph Asmus, Burns & Raynor, David Deans, Edward Horan, Frank McMahon, Julius and Theodore Roehrs, John H. Taylor, C. W. Ward, and John Young took part.

In the last days of June and the early days of July the rose plantations were in full bloom. The rose garden was bounded by a trellis covered for most of its length by the wonderfully profuse bloom of the *Pride of Washington*, furnished by the Dingee & Conard Company. The *Baltimore Belle* made but slight show on another part of the trellis. Among the exhibits were thirty varieties of hybrids from Pitcher & Manda, ten from Ohio exhibitors, three from Dingee & Conard, two each from E. Asmus and Robert Craig, fifteen varieties of hybrids and seventeen of teas from Nanz & Neuner, fifty-nine of hybrids and sixty-seven of teas from California exhibitors, twenty of teas and polyanthus from E. G. Hill & Co., and four of teas from John M. May. The California roses were very strong and free blooming, the *American Beauty* and *Mignonette* particularly. Robert Craig showed the *Ulrich Brunner*, a semi-double rose, very beautiful in the bud. J. C. Vaughn showed the new *Clothilde Soupert*. The most abundant display in the rose garden was the collective exhibit of ten German growers, comprising five hundred varieties, of which the *Merveille de Lyon*, *Pride of Waltham*, *Captain Christy*, *General Jacqueminot*, *Jean Liabaud*, *Anna Alexieff*, *Anne de Diesbach*, *Auguste Neumann*, *Baroness Rothschild*, *Étienne Levet*, *La France*, *Mrs. John Laing*, and *Souvenir de Paul Neyron* were noticeable among the low hybrids; *Franziska Kruger*, *Honore Defresne*, *Reine Nathalie*, *Sunset*, *Marie Guillot*, *Grace Darling*, *Souvenir de Victor Hugo*, *Perle des Jardins*, *Viscountess Folkestone*, *Gloire de Dijon*, and *Kaiserin Augusta Victoria* among the teas; and *Marie Baumann*, *Victor Verdier*, *Lady Mary Fitzwilliam*, *Fisher Holmes*, *Sappho*, and *Alfred Co-*

lombe among the standards. Alexander Dickson & Sons, of Newtownards, Ireland, originators of new varieties, had a collection of twenty-three different roses that were remarkable for novelty and decided merit, the most striking varieties being the Margaret Dickson, Earl of Dufferin, Madame Plantier, Jeannie Dickson, Marchioness of Dufferin, and the moss roses Blanche Moreau and Celine. The Boskoop Association had one hundred and forty-



PART OF THE FLORIDA SECTION.

four varieties in the garden, M. Jeurgisson sixty varieties, and E. Seyderhelm, of Buda-Pesth, thirty varieties of standards. Elsewhere on the Island there were about sixty varieties of standards from Boskoop, Holland. Ellwanger & Barry showed a fine lot of Marshall P. Wilder, and W. C. Strong had a bed of Dawson and Rosa Wichuriana. In the French collection of plants near the Woman's Building G. Boucher had two hundred varieties of standards and many low plants, L. Paillet a hundred varieties of standards, and Levavasseur & Son an exhibit of *Rosa rugosa*. In the New York exhibit, behind Horticultural Hall, Gabriel Marc & Co.

had a collection of imported standards. About the California Building were tree roses six or eight feet high and in full bloom. With the exception of the plants of Nanz & Neuner and Vaughn's Clothilde Soupert, all the hardy roses were budded, growers preferring budded plants for strong growth and quick results, setting them out deep enough with the bud three inches below the surface. The standard roses were a surprise to many. The rose is budded four or five feet high upon a straight, slender stock,

which is stripped entirely of its leaves after the bud begins to grow, and in the plants exhibited the buds, which were of two seasons' growth, appeared as a compact head on an apparently dry cane. Manetti stocks may be used, but both German and French growers commonly bud on seedlings of the *Rosa canina*. The standards are more appropriate for the formal gardening of Europe than for the natural forms preferred in the United States, and, moreover, they are hard to protect in winter in this climate.

When the Exposition opened there were eighteen thousand orchids in the greenhouses, representing fully half the four or five thousand known varieties. A large number of the specimens were collected in Mexico and Central America and brought to Chicago still clinging to the original branches and bark. Don Joaquin Bernardo, Minister from Costa Rica, procured two thousand such specimens from his country. Most interesting among the orchids were the charming species of Venezuela, distinguished for delicacy of coloring and singularity of form, which were seen in extraordinary variety, bedded among palms and ferns. In the latter part of June the chief bloom in Horticultural Hall was in the orchid collection of Pitcher & Manda, in which Cattleyas, Cypripediums, Oncidium, and later Anthuriums were conspicuous. A great many rare and costly specimens came from private collections in Philadelphia, Jersey City, Albany, and other cities. Dr. Charles W. Zarenga, a Chicago collector, H. W. Buckbee, of Rockford, Ill., and the New Jersey nursery of Pitcher & Manda contributed choice specimens. Siebrecht & Wadley, of New York, had an individual exhibit.

A large part of the display of rhododendrons and azaleas on the Island was contributed by New York propagators—C. H. Joosten, F. W. Kelsey, and Parsons' Sons Co. The most interesting rhododendrons were the recent achievements of French gardeners, who pay much attention to the development of these jewels of the lawn, and the beautiful varieties sent over by the Horticultural Society of Ghent. Holland and Great Britain had liberal exhibits of the forms produced by their floriculturists. European florists were the principal exhibitors of azaleas, as these plants are prized for outdoor cultivation in Europe, whereas few varieties are hardy in the United States. Of Indian or house azaleas, C. Vuylsteke, of Belgium, and Otto Olberg, a Dresden florist, had competitive exhibits numbering seventy-eight and one hundred and seventy-eight named varieties respectively. Of the hardy or Ghent azaleas the Boskoop Nursery, of Holland, showed one hundred and sixteen varieties.

Wierd chrysanthemums of innumerable neutral tints, with petals curling or drooping or writhing like the Gorgon's locks, gave character to the sheet of white and yellow and purple blooms that decked the Island in the autumn. Special exhibits of American forms of this Protean flower were made by H. W. Buckbee, of Rockford, Ill., Elmer D. Smith, of Adrian, Mich., and Henry E. Standen, of Haverford, Pa. Cut flowers in ten varieties were

sent by Julius and by Theodore Roehrs, of New York city. E. G. Hill & Co., Indiana florists, had an interesting collection.

In August and September the Island was resplendent with regal dahlias and brilliant spikes of the gladiolus. John Lewis Childs, of New York, planted two thousand bulbs of his own variety of the gladiolus, which flowered after his clumps of *Iris Kaemferi*. E. H. Cushman, of Euclid, Ohio, had an exhibit in the dome. W. W. Willmore, of Denver, planted dahlias on the lawn. C. H. Allen sent gladiolus spikes of fifty improved varieties to the Horticultural Congress.

Lilies from all parts of the United States and from Belgium, Holland, and Great Britain covered acres of ground on the Island. Germany made a



AN EXHIBIT BY PITCHER & MANDA, SHORT HILLS, N. J.

profuse and varied display of crocus and other flowering bulbs. Dutch florists sent remarkable collections of their latest achievements in tulips and other bulbs for which they are famous. Calla lilies from California were set out in beds on the lawn and around the State building. German hyacinths preceded the pansies and geraniums on the lawn. Chinese primroses of all colors and varieties that arrived in 1892 from parts of America, England, Germany, France, and Italy began to blossom in early winter, and these were followed by rich-hued Persian violets. The cinerarias that blossomed in Lent were followed by calceolarias and English primroses, and after these came the European pansies, of which plants, brought from New York, Pennsylvania, New Jersey, and other States, even from Great Britain, Belgium, France, and Italy, broad beds were in flower on the lawn in the later spring.

Anton Shuetz, of Wisconsin, and Emil Stebe, of Philadelphia, were prominent exhibitors of geraniums.

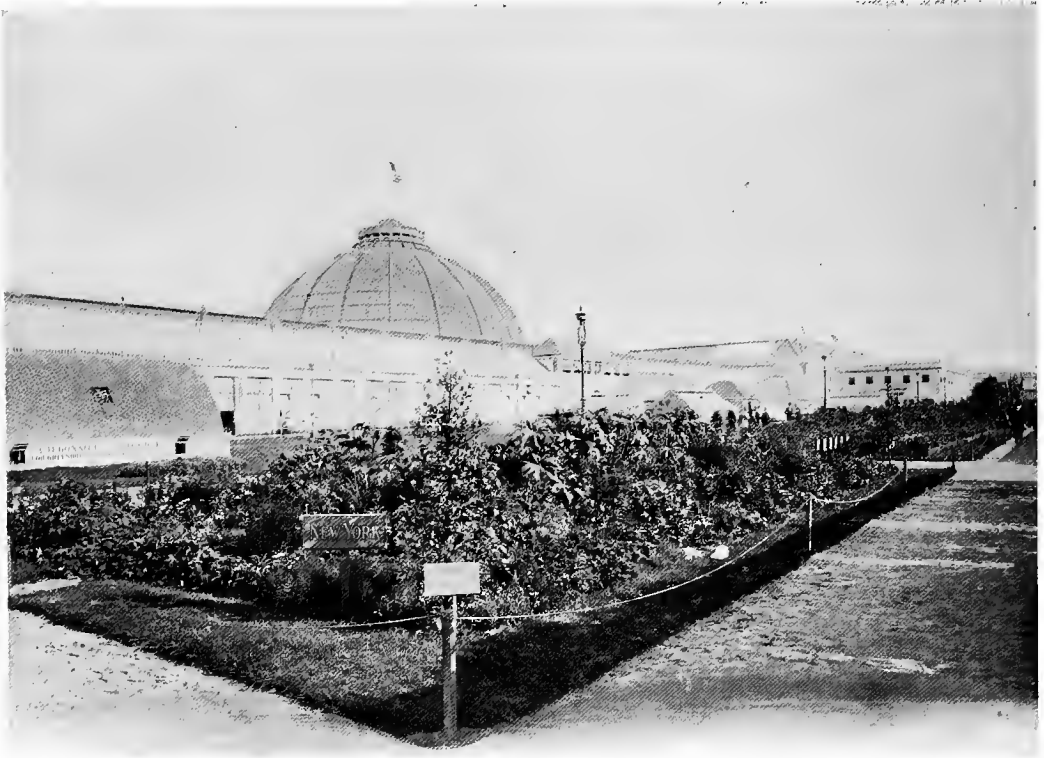
The largest displays of pansies were from W. A. Burpee and D. Landreth & Sons, of Philadelphia, H. A. Daacke, of New York, and James Vick & Sons, of Rochester. The Sherwood Hall Nursery, of San Francisco, set out a border of sweet peas of sixteen varieties on the Wooded Island. B. A. Elliott, of Pittsburg, and Ellwanger & Barry, of Rochester, had diversified exhibits of herbaceous plants on the Island. Some of the principal exhibitors of bedding plants on the lawn were Frederic M. Benham, of Chicago, Henry A. Dreer and John Gardiner & Co., of Philadelphia, R. & J. Farquhar, of Boston, Henry S. Rupp & Sons, of Shiremanstown, Pa., and J. M. Thorburn & Co., of New York. William Nilsson displayed some fancy plants; in the east curtain R. Douglas & Sons, Mrs. S. P. Gardner, and George Miller had non-hardy kinds, which were shown in the dome by Mrs. Mark E. Reeves, of Richmond, Ind., and D. B. Woodruff, of Macon, Ga., and in the greenhouse by Goode & Co., of Chicago. There were collective exhibits of flowering annuals from Missouri, New Mexico, Pennsylvania, and other States, and an expansive exhibit from the New York Florists' Club.

Germany had half an acre filled with garden flowers. Begonias, cannas, phlox, and zinnias adorned the grounds with massed blooms in their seasons. On the summit of the Island was a magnificent bed of sunflowers. New Jersey had an interesting collection of snapdragons and other insectivorous plants. Strange forms of plant life were numerous on the Island. Vilmorin, Andrieux & Co., of Paris, exhibited varieties of pinks, coreopsis, calendulas, snapdragons, marigolds, and Eschscholtzias of new forms and colors.

An interesting and memorable part of the floricultural display was an old New York garden, with its graveled walks and English beds and borders filled with old-fashioned flowers that bloomed during the entire season: English daisies, mignonettes, marigolds, zinnias, verbenas, petunias, and heliotropes; fuchsias and geraniums of varieties now seldom seen; phlox, larkspur, Jacob's ladder, dusty millers, Joseph's coat, and heartsease; hollyhocks and foxglove; old cabbage and moss roses; patches of thyme, rosemary, and lavender; monkshoods and snapdragons and columbines and Canterbury bells; the flower-de-luce, the day lily, the plantain lily, lilies of the valley, and tiger lilies; sweet William, polyanthus, wallflowers, primroses, and auriculas; sunflowers, sea pinks, Indian pinks, and clove carnations. At the close of June the Canterbury bells made a fine show. The next most conspicuous plant was *Ceananthera Youngi*, used for dense borders by Rhea Brothers and B. A. Elliott—a strong herb with lustrous foliage and a profusion of bright-yellow flowers. Stocks and aquilegias were much used for filling in borders. The greatest display after the rhododendrons was that of peonies by Cannel, of England, B. A. Elliott, Ellwanger & Barry, and Pitcher & Manda, and in the Japanese section.



Upon two sides of the Woman's Building the yellow and brown pealike flowers of the *Cytisus*, or *genista*, were conspicuous till the middle of June. They were exhibited by Croux, of Sceaux, and Moser, of Versailles, who had, besides low plants, a group of standards on laburnum stocks. *Kalmia latifolia*, the American mountain laurel, was exhibited by several European growers. Perennial phloxes were shown by a number of exhibitors, coming into bloom in the beginning of July. The Colonel Flatterer and Beauty of Mirande varieties in B. A. Elliott's beds were remarkably handsome.



THE "OLD-FASHIONED GARDEN."

The blooming honeysuckles and other climbing plants that were trained over the fences framed in flowers the flowery parterre. Frederic M. Benham made a special exhibit of climbing annuals, and Dingee & Conard Company, of Pennsylvania, showed a collection of climbing plants.

A reproduction of a section of the imperial garden at Tokio showed the typical features that make a Japanese garden a poetic microcosm—the little pond, alive with goldfish and fringed with water lilies and ornamental aquatic plants; the rustic bridge and rocky path; statues of animals on the sides of the miniature hills, between which were groups of sago palms; vases here and there filled with curious orchids and other plants; and a rustic wall inclosing the whole, covered with morning-glories and creepers and sur-

mounted by native evergreens. Elsewhere the Japanese had dwarf cedars, cherries, apples, and other trees in pots and urns, and ferns trimmed in the shape of fishes and quadrupeds. A dwarf cedar that had lived three centuries did not survive the change of climate, but a dwarf pine one hundred years old was in good condition. England exhibited holly and yew trees, and France and Austria had specimens of lawn shrubs and trees, which New York, Pennsylvania, and California exhibited in great variety. The Illinois display included fine specimens of the bay laurel. American growers of evergreens and shrubs who exhibited were George Achelis, of West Chester, Pa., Dingee & Conard Company, Samuel C. Moon, of Morrisville, Pa., and W. M. Samuels & Co., of Clinton, Ky. John R. & A. Murdock, of Pittsburgh, exhibited camellias. Some of the finest ornamental evergreens and shrubs came from Holland.

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bition thanks were due to the public spirit of the amateurs of New York, Philadelphia, Jersey City, Albany, and other cities, who with some misgivings allowed the treasures of their conservatories, many of them raised from seed and tended through several generations of the owners' families, to be taken by rail to Chicago, where they were set up under the great dome, and in a few days began to put forth new leaves. About a quarter of the dome space was occupied with the New York exhibit of palms, tree ferns, and foliage plants, contributions of G. Bergmann, William Brown, William Bayard Cutting, Charles A. Dana, James Dean, William Dins-

France exhibited tree peonies as  
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JAPANESE STUNTED TREE.

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more, the late Jay Gould, P. B. Meissner, Mrs. Charles L. Pratt, Brooklyn's Prospect Park, Louis Schmutz, Frederick Scholes, and James Weir & Sons, besides the collective exhibit of the New York Florists' Club. J. M. Thorburn furnished strange creepers to complete the design, which was a triumph of artistic gardening, presenting a dale in the tropics, with the trees and shrubs placed in natural groups on a mound descending to a water course fed by a falling cascade, with the spreading tops of the fan and sugar palms and arching kentias and arecas above and groups of dracænas and ferns below, interspersed with the brilliantly variegated foliage of crotons, joined by overhanging arches of the breadfruit vine, interwoven with a lacework of



CONSTRUCTION OF DOME PLATFORMS.

creepers, and garlanded with parasitic mosses, epiphytal orchids, and strange aroids. The flora of every tropical country was represented by its choicest and most curious exemplars—rare foliage plants of Andean heights and valleys, carnivorous plants of the Indian jungle, the traveler's tree of Madagascan deserts, the enormous banana tree of Abyssinia, the beautiful bromeliaceous plants of tropical America, the strange forms of Australian fern trees, date palms from Africa and southern Asia, graceful arecas from the Norfolk Islands and Mauritius, cycads from Japan, and caryotas from Ceylon. The

palms whose fronds crowned the scene were forty and fifty feet high. The combined collection of crotons from the conservatories of Mr. Gould and Mr. Cutting was the richest and rarest ever assembled.

Pennsylvanian amateurs, not less generous than the New Yorkers, united in a wonderful collection of palms and decorative exotics. Many fine specimens were loaned by George W. Childs, A. J. Drexel, Mrs. Charles Wheeler, Charles Dissel, Charles J. Clark, Captain Vandergrift, Mrs. Henry Tilge, Allegheny Park, and Girard College. The florists Robert Craig and Henry A. Dreer added extensive contributions. Bonn & Dressel and Julius Roehrs sent the gems of their greenhouses in New Jersey. Some fine tropical plants were brought from the Botanic Gardens in Cambridge, Mass., and choice examples from the White House in Washington, including the "crown of thorns."

California had various species of fan, club, and date palms, with banana trees, phoenix palms, and sago palms, planted around the State building and in the nursery on the Midway Plaisance. There was an Australian feather palm (*Seaforthia*) from San Diego. Joseph Sexton & Son, of Santa Barbara, had two blue palms. A Canary Island palm of unusual size stood near a pair of date palms, male and female, that were forty feet high. Ontario had a collection of eighty different palms and ferns, mostly from the Botanic Gardens at Toronto, including the rare and curious *Sabal Anderson*. The Government House, Exhibition Park, normal schools, and even the Central Prison, as well as citizens of Toronto, John Haskins and D. S. McPherson, added contributions. Richard Dale, of St. Augustine, Fla., and Anna B. Nichols, of Laredo, Texas, sent choice collections of native palms and semitropical plants. The ladies of Galveston made a collection of oleanders, gardenias, ficus, peccas, etc.

There were rare and beautiful plants from the Botanical Garden of St. Louis, and Trinidad provided a collection of its tropical plants.

A magnificent display of tree ferns came from New South Wales, some of them forty feet high, with low ferns at their feet, and Australian mosses and grasses covering the ground, and native creepers winding between. The unexampled collection in the fern house included stag ferns seven or eight feet high and as many in diameter, clinging to sections of teak trunks whose life they had sapped. There were curious South Sea Island ferns. A specimen of *Adiantum farleyense* came from Purdue University, Indiana; other remarkable ferns from Girard College and Fairmount Park, Philadelphia. Henry A. Dreer, of Philadelphia, Elmer D. Smith, of Adrian, Mich., and the New York florists George Bennett, G. Bergmann, E. Kaufmann, J. M. Keller, Kretschmer Bros., and P. B. Meissner contributed their collections to make the exhibit complete and representative of all zones and regions.

Pennsylvania and New York made very extensive exhibits of cannas, in which over five thousand varieties were shown; the Pennsylvania examples, exhibited by H. A. Dreer and Robert Craig, were all French varieties, a score

of which were perfectly new. Great Britain exhibited many remarkable cannas and begonias. Indiana showed a fine collection of begonias. A part of the New York exhibit was a portable greenhouse, designed for the use of amateurs, which was filled with a collection of Rex begonias, comprising many beautiful varieties never before exhibited. A good collection of Rex begonias was furnished by E. G. Hill & Co., of Richmond, Ind. The tuberous-rooted begonias from New York, bearing many thousands of delicately tinted blossoms, many of which were six inches broad, the only flowers under glass in the early fall, filled the greenhouse, having replaced a splendid collection of gloxinias. Pennsylvania occupied a large space in the greenhouses with tuberous begonias, gloxinias, lilies, and other plants that were started at



CANNAS SHOWN BY F. R. PIERSON & CO.  
TARRYTOWN, N. Y.

intervals and placed in Horticultural Hall when in flower. George W. Childs's collection of fancy calladiums was the finest and largest ever exhibited. Mrs. E. Beck and W. G. Saltford loaned beautiful specimens of dracæna; the crotons of New York collectors have been already mentioned. Mrs. Fisher Howe had foliage plants in the dome, also Charles A. Dana and

Mrs. Charles A. Pratt. Frederick Scholes and James Dean had good exhibits. Some of the nurserymen who made notable displays of ornamental leaf plants and shrubs were Charles Amman, George Bennett, William L. Brown, Alexander Burns, Ellwanger & Barry, P. B. Meissner, Parsons' Sons & Co., Louis Schmutz, F. A. Spaulding, Charles Zeller & Sons, of New York, the Bloomington Phoenix Nursery, of Illinois, and Bonn & Dressel, of New Jersey.

Mrs. Ann C. Hurd and J. R. Bather lent cacti from their collections. The women of San Diego contributed a collection of the *Cactaceæ* that grow in California. There were curious cacti from the United States Botanical Garden at Washington. Arizona Territory exhibited all its native species. Texas loaned a fine collection of American cacti, yuccas, and agaves. The Spanish bayonet and the desert *Cactaceæ* were characteristic ornaments of all the Californian displays. An Indiana century plant put forth its marvelous stalk of yellow flowers in the dome. Mrs. E. M. Ashley furnished a collection of yuccas from Colorado and O. D. Seavey one from Florida. Mexico

exhibited cacti, forty or fifty species, singly and in groups, some no bigger than a peach and some that a barrel would not hold. Noteworthy among these was the elephant's tooth cactus, with flowers like roses and with crimson fruit ; also the fig cactus, bearing yellow flowers and a fruit on which the cochineal insect feeds. A. Blanc, of Philadelphia, had a valuable collection of cacti containing four hundred varieties, half of them *Cereus*, *Echinocactus*, *Mamillarias*, and *Phyllocactus*. Anna B. Nichols, of Laredo, and William Tricker, of New York, furnished the water plants that adorned the fountain on the front lawn, superb *Nelumbiums*, surrounded by fragrant *Nymphæas* of forty species from every quarter of the globe, with many new cultivated varieties of aquatics and all the wild species that grow in New York lakes. There was a specimen of the *Victoria regia* in New York's tropical landscape under the dome ; also a Madagascar lace plant, and overhanging the tank were graceful vines of the bird flowers, *Aristolochia*, *Ornithocephala*, and the *Aristolochia gigas*, with enormous flowers, shaped like a pelican. Purdue University and E. D. Sturtevant, of New Jersey, had interesting collections of aquatics in the south court.

Wild flowers were planted on the Island and exhibited in the dome and curtains. Most of the States sent herbaria of their flora, especially the Western States. Some of the most interesting collections were made by individual botanists. Mrs. S. B. Walker, of Colorado, spent months exploring Rocky Mountain peaks and valleys to complete a collection of over a thousand plants. W. M. Bickford had a large collection of the wild flowers of Montana. J. Francis Drake, M. W. Gorman, and E. W. Hammond furnished Oregon herbaria. The Royal Botanical Garden, of Berlin, had a collection of the alpine plants of Europe and Asia. The Orange Judd Farmer Company, of Chicago, had in the Midway, picturesquely grouped in the corner of a rail fence, a very complete collection of the noxious weeds of the United States.

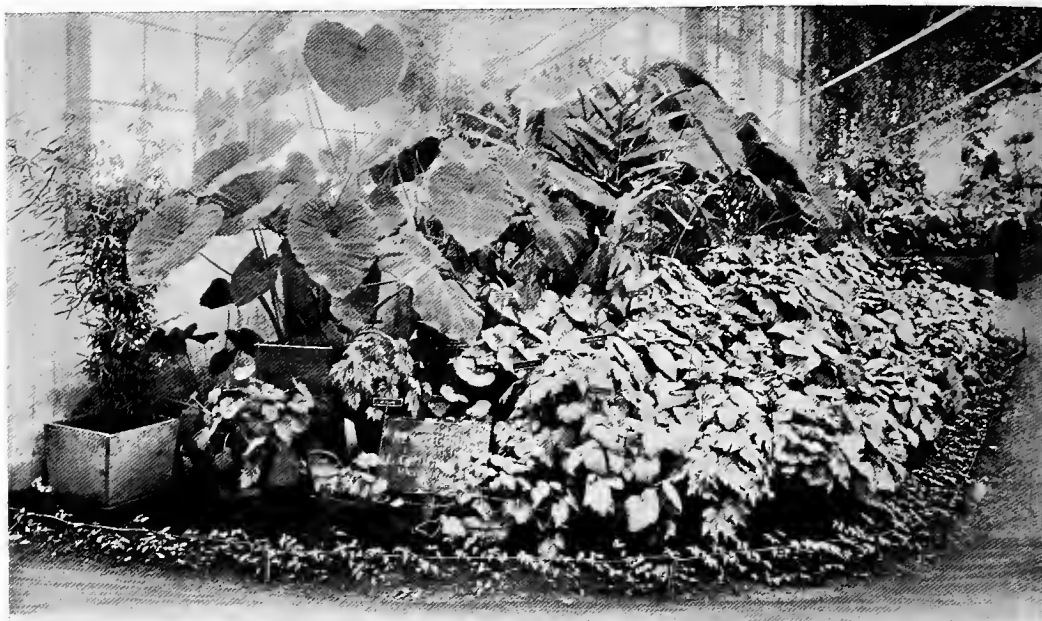
Charles H. Peck, New York State Botanist, made an exhibit of dried specimens of the fungi of New York, comprising sixty-one edible species, sixty-three species inhabiting or injuring wood, eighteen species parasitic on cultivated and useful plants, and six species injurious to noxious weeds and animals. The Department of Agriculture and the Agricultural Experiment Stations had exhibits of specimens and models, but less complete. The cultivation of mushrooms was exhibited by John Thorpe.

There was an interesting exhibit of moss fungus, rust, blight, mildew, and other microscopic foes to vegetation.

Ornamental grasses were used for decoration in various exhibits. Peter Henderson & Co. exhibited seedling plants of many species, and Martin Klein made an exhibit of new and unnamed plants. Besides the heaths and everlasting flowers of the Cape of Good Hope, the ornamental grasses were well exhibited. California made in its own building a great display of Pampas grass.

Many rare exotic shrubs and plants were brought from the Botanical Gardens at Washington. Robert Craig, of Philadelphia, John Curwin, of Villa Nova, Albert Fuchs, of Chicago, and W. J. Gordon, of Cleveland, had many curious and precious plants in the dome and curtain. A. M. Todd, of Kalamazoo, exhibited a collection of living plants of the kinds from which essential oils are obtained, among them the camphor tree. Of this California exhibited other specimens, together with many curious examples of Asiatic flora.

New York had several decorative designs in bedded plants on the grounds. The most remarkable was Eileen Donlan's harp of Brian Boru, made of shamrocks brought from Ireland. H. N. Small & Sons exhibited



REX BEGONIAS FROM E. G. HILL & CO., RICHMOND, IND.

a design of the Capitol at Washington in cut Cape flowers, of which A. Heinman exhibited a large assortment. E. Kaufmann, W. C. Krick, P. Muller, and F. Netschert exhibited designs for florists and artificial flowers. The Brunswick and Stecher companies, of Rochester, exhibited flower plates.

Baskets, jardinières, vases, pots, and other receptacles for plants were exhibited by Gilbert Bennett & Co. and J. C. Vaughan, of Chicago; A. H. Hughes, E. Jansen, and Reed & Keller, besides the Florists Club, of New York; and Ernest Kaufmann and Emil Stebe, of Philadelphia. Jeanette B. Marsh, of Baltimore, exhibited original balconette windows.

The twenty-third group embraced culinary vegetables, and was divided as follows: 172. Leguminous, cereal, and fruitlike vegetables: Beans, peas, okra, peppers, tomatoes, cucumbers, squashes, pumpkins, melons, etc. 173.



Radiaceous and tuberous vegetables: Beets, turnips, carrots, potatoes, radishes, etc. 174. Vegetables cultivated for their leaves and sprouts: Cabbage, lettuce, rhubarb, spinach, endive, asparagus, etc. 175. Miscellaneous culinary vegetables not included in the above. 176. Vegetables dried or in cans or glass. 177. Pickles, champignons, truffles, chutney, mustard, etc. 178. Methods for preserving vegetables by cold storage or chemical appliances, their keeping, packing, and shipping.

The New York commissioners gave special prominence to the vegetable exhibit in view of the commercial importance of truck farming in their State and the excellence of its products. In May a collection of choice asparagus, spinach, lettuce, celery, beets, beans, cress, tomatoes, cucumbers, and cauliflower was shipped from the hothouses of Long Island and the Hudson. The Experiment Station at Geneva made a scientific exhibit of vegetables as they ripened during the season, and in September the New York Agricultural Society forwarded a large part of the exhibits of the State Fair. In the summer New York had the only exhibit of fresh vegetables.

Florida made an exhibit of its early tomatoes, cucumbers, and other vegetables. Vermont was one of the few States that displayed fresh garden vegetables. There was a comprehensive display of vegetables from Canada, made by the governments, experimental farms, and horticultural associations of all the provinces.

The New York Experiment Station made an exhibit of eighteen varieties of pole beans and thirty-three of bush beans, besides five of bush Lima beans. It had fifty-seven varieties of peas from the New York station, while in the Illinois exhibit were eleven varieties.

Okra of two varieties was exhibited by New York. The greatest number of exhibits of this vegetable came from New Jersey. The Geneva Station showed sixteen kinds of peppers, sixty-one of tomatoes, thirty-four of cucumbers, twenty-two of squashes, and thirteen of muskmelons. The Albaugh Company exhibited Georgia melons.

The New York exhibits of market beets comprised twenty-two varieties from the Experiment Station, which exhibited sixteen varieties of garden carrots and six of turnips, with sixty-seven of radishes. G. H. Davidson exhibited the Long Red beet, Danvers carrot, and White Egg turnip; G. C. Howard the Blood Turnip beet, two varieties of carrots, four of turnips, and seven of radishes, besides salsify, celeriac, mangolds, parsnips, cauliflower, chicory, eggplant, kohlrabi, and an especially fine display of celery.

The New York Experiment Station exhibited seventy varieties of potatoes, Charles W. Ford thirty-six, A. Bonnell twenty-three, and T. Lane ten; H. A. Barton and J. M. Johnson showed the Early Ohio, C. W. Rice the American Bell, and Orra Christy Lee's Favorite. The New York exhibits of cabbages were the Brunswick by G. Howard Davidson, two varieties by G. C. Howard, red and white kinds by S. G. Howard, and three new varieties from the experimental farm, which ex-

hibited five varieties of cauliflower. Illinois exhibited nine varieties of cabbage and two of kohlrabi. Thirty-six varieties of lettuce were shown from the New York experimental farm, also three varieties of Swiss chard. Luther Hasbroeck had an exhibit from New York of the Red Wethersfield onion, E. D. C. Tracey one of that and the Yellow Danvers variety, and the Geneva Experiment Station sent twenty-seven improved varieties. The New York Improved eggplant was the variety sent from the experimental farm at Geneva. With radishes and other vegetables of fine size, appearance, and flavor, grown at an elevation of six thousand feet, Idaho ex-



SEEDS EXHIBITED BY J. C. VAUGHAN, CHICAGO.

hibited excellent eggplant. Colorado had a good illustrative exhibit. The size and quality of the vegetables grown on the irrigated plateaus of the Rocky Mountains surprised all visitors, and still more the mammoth growths of the Pacific States. Washington had a potato weighing fifteen pounds. California made a profuse display. Orange County showed vegetables of remarkable size—beets, squashes, celery, and cucumbers. Santa Clara County exhibited asparagus, cucumbers, peppers, onions, and tomatoes; San Obispo County, peas, beans, onions, etc.; Los Angeles County, beans, onions, squashes, potatoes, and beets; Ventura County, twenty-five varieties of beans. Enormous specimens from Los Angeles and other counties filled a structure called the Palace of Plenty, such as a cabbage stalk as high as a man's shoulder, strings of peppers, immense beets, mangolds, and squashes, a castor-bean stalk three feet in circumference, a pumpkin three feet through

and weighing four hundred and ninety pounds, a watermelon weighing a hundred and twenty-five pounds, double-jointed peanuts containing four kernels, and Yellow Dent corn nineteen and a half feet high.

Several States and foreign countries had facsimiles in wax or other materials of their culinary vegetables. Peter Henderson's seed exhibit was accompanied with models of vegetables in *papier-maché*. Germany had models that were astonishingly true to nature in form and color, representing turnips, parsnips, and other vegetables, and even the leaves of lettuce. Not less remarkable were the models sent over by the Yokohama Gardeners' Association.

The Argentine Republic had thirty-three exhibits of beans. Trinidad exhibited beans and peas; Mexico, bean vetch, black beans, onions, garlic, turnip and other seeds, and Tamalayota pumpkin; Chili, white beans. Spain had a comparatively large display of kidney beans, lentils, black beans, peas, potatoes, sunflower seeds, and its capers and large sweet onions. Germany exhibited asparagus and plumosus plants. France had characteristic exhibits of mushrooms and truffles, asparagus, green peas, and mustard; and Russia exhibited mustard.

Canned vegetables were exhibited, with pickles and sauces, by Curtice Brothers, of Rochester, N. Y., Charles P. Mattocks, of Portland, Me., and other Eastern canners and by California firms, of whom A. Lusk & Co. showed preserved asparagus and W. R. Baker condensed vegetables. There were several exhibits of canned vegetables and pickles from Canada. In the New York State exhibit were canned asparagus, baked beans, catsup, corn, cauliflower, Chili sauce, mustard, peas, pumpkins, steamed and stewed rhubarb, squash, string beans, succotash, and tomatoes. France exhibited canned vegetables and pickles; Germany, canned vegetables and preserved asparagus; Russia, dried and preserved vegetables and tomatoes; Spain, preserved and canned vegetables and preserved cucumbers; Japan, canned mushrooms and the species of edible fungus called Shiitake; Trinidad, dried yams; Mexico, pickled Chittipiguin peppers, nanches, and olives; Jamaica, preserved tree tomatoes and pickled peppers; the Argentine Republic, canned tomatoes and mustard pickles. Other special exhibits in the United States section were vegetables in glass by the American Manufacturing and Patent Company, of Chicago; pickles, sauces, and catsup by the Butters Manufacturing Company, of Denver; evaporated vegetables by George A. Dietz, of Olden, Mo.; canned vegetables by C. H. Godfrey, of Benton Harbor, Mich.; pickles by H. J. Heintz & Co., of Pittsburg; canned vegetables by the San José Dried Fruit Company; vegetables in glass by the San José Packing Company; and evaporated vegetables by D. Stutzman, of Ligonier, Ind.

Harry & Co., of Calcutta, and Nowrojee Framjee, of Bombay, sent assortments of Indian condiments, such as chutneys, curry paste and powder, and pickles, with preserves, jams, and jellies. Joseph Edmunds and Cross

& Blackwell, of London, exhibited similar preparations. The Birmingham Vinegar Brewery had a variety of condiments. Table sauce was exhibited from Ceylon and the savory sauces of Japan were shown. Trinidad and Jamaica exhibited the chutneys, sauces, and pickles that they make.

Group 24, embracing seeds, seed testing, and distribution, had the following subdivisions: 179. Display of vegetable and flower seeds grown in different latitudes. 180. General display of flower and vegetable seeds by seed houses or growers. 181. Methods of growing, harvesting, and prepar-

ing flower, vegetable, tree, and shrub seeds.

182. Seed warehouse methods of burnishing and packing for the retail trade. Work of packing, etc., in operation. 183. Method of testing vitality of seeds, as practiced by different seed houses. 184. Tree and shrub seeds and seeds used for condiments and medicines.

General seed exhibits were made by F. Barteldes & Co., of Lawrence, Kansas, H. W. Buckbee, of Rockford, Ill., Henry A. Dreer, of Philadelphia, Peter Henderson & Co., of New York, the Michigan Seed Company, of South Haven, Pitcher



NURSERY EXHIBIT OF LOUIS PAILLET,  
PARIS, FRANCE.

& Manda, of Short Hills, N. J., and J. C. Vaughan, of Chicago. Maryland exhibited vegetable seeds of varieties that were originated and developed in the State. H. A. March, of Anacortes, Wash., who alone has succeeded in growing cauliflower seeds by outdoor cultivation, exhibited these and other kinds of seed.

Group 25 was the group of arboriculture, comprising the following classes: 185. Ornamental trees and shrubs. Methods of growing, transplanting, etc. 186. Fruit trees and methods of raising, grafting, transplant-

ing, pruning, etc. Means of combating insects and other enemies. 187. Nurseries and the nursery trade.

In the nursery exhibit, distinct from the ornamental plantations on the Island and lawn, George Achelis, Ellwanger & Barry, P. S. Peterson, the Phoenix Nursery Island, and the Wisconsin Horticultural Society had ornamental trees, shrubs, and evergreens; David Hill, George Pinney, and the E. H. Ricker Company exhibited coniferæ; and A. H. Gasten, catalpas. Martin Klein had fruit trees; the Stewart Pecan Company, nut trees; Philip Walker, pear seedlings; and the E. H. Ricker Company and the Huntsville Wholesale Nurseries, miscellaneous nursery stock. California transported citrus trees successfully and planted them around the State building in company with olive, pepper, and camphor trees and a bearing date palm, and in the north court—where about thirty orange and twenty lemon trees, with ripe fruit of the winter's crop still clinging to them amid the green fruit and abundant blossoms of the current season—were set out in orchard fashion and grew and bore fruit to the close of the Exposition. Between them were guava shrubs and some bearing fig trees. Another orchard in the California nursery of the Midway contained two dozen lemon trees, of the Agnes, Bonnie Brae, Eureka, Lisbon, and Villa Franca varieties, and four dozen oranges, comprising Hart's Tardiff, Mediterranean Sweet, Navel, Oonshiu, and Tangerine, together with limes and citrons, loquats freighted with yellow fruit, guavas, and a Mission olive tree sixteen feet high. This nursery contained also rare rose trees, Bird-of-Paradise trees, golden arbor vitæ, grevilleas, Phoenix and fan palms, pepper trees, eucalyptus of several kinds, pomegranates, Japanese laurel, umbrella trees, young redwoods, habrothamnus, libonias, and pittosporums, with polygalas and veronicas of several species, azaleas and rhododendrons, California lilac, Oregon grape, salal, and salmon berry. There was also young nursery stock, consisting of apricots, plums, prunes, figs, almonds, chesnuts, and walnuts in considerable variety.

Group 26 of the Horticultural Department embraced appliances, methods, etc., and contained the following classes: 188. Hothouses, conservatories, methods of construction, management, and operation. 189. Heating apparatus for hothouses and conservatories. 190. Seats, chairs, and adjuncts for the garden and conservatory. 191. Ornamental wire work, trellises, fences, borders, labels for plants and trees, etc. 192. Garden and nursery administration and management. Horticulture and arboriculture, as arts of design and decoration. Laying out gardens, designs for the laying out of gardens, and the improvement of private residences. Designs for commercial gardens, nurseries, graperies; designs for the parterre; treatment of water for ornamental purposes; cascades, fountains, reservoirs, lakes; formation and after-treatment of lawns. Garden construction, building, etc. Rock-work grottoes; rustic construction and adornment for private gardens and public grounds. Planting, fertilizing, cultivating, and appliances.

Carmody & Moninger, of Evansville, Ind., erected a model greenhouse on the lawn, with heating and ventilating apparatus. H. B. Hardt, of Chicago, had a model conservatory, and Hitchings & Co., of New York, a greenhouse and palm house, with section of an iron greenhouse and improved heating apparatus and boiler. Another form of conservatory, with heating apparatus, was exhibited by A. Rendle, of Philadelphia, and Thomas W. Wethered Sons, of New York, had a villa conservatory.



A CORNER IN THE JAPANESE GARDEN.

Lord & Burnham, of Irvington, N. Y., had another artistic greenhouse. A greenhouse boiler was shown by the New York Central Iron Works, of Geneva.

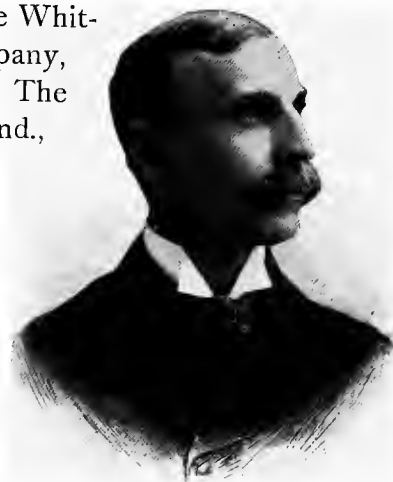
Roome, Stabb & Co., of New York, had a portable summerhouse, and one of woven wire was exhibited, with chairs and other wirework, by Sedgwick Brothers, of Richmond, Ind. Gilbert & Burnett, of Chicago, and the Falls City Wire Works, of Louisville, also exhibited wirework. Spriesterbach & Leissner, of Pittsburgh, showed the model of a music pavilion. Terra-cotta posts were exhibited by W. H. Lawrence, of Milton, Pa., and steel posts by the International Steel Post Company, of Chicago. The Orange Judd Company had a historical exhibit of fences. Cross & Rowe, of Bedford, Ind., had stone vases and garden ornaments.

Frank H. Heissenger, of New York, showed architectural plans of greenhouses and of gardens and parks. N. Jonson Rose showed plans for parks and gardens, and F. Von Holdt, of Denver, for parks and cemeteries. Other plans and sketches were exhibited by J. W. Elliot and Berthold Frosch, of Pittsburg. Pitcher & Manda exhibited designs for gardens.

A grotto under the mound in the central dome space, constructed by Keith & Allabaugh, was a reproduction of some of the chambers of the great cave near Deadwood, with real stalactites and stalagmites that visitors were willing to pay to see. A grotto, with cascade, was exhibited by Emil Stebe, of Philadelphia. Abendroth Brothers, of Port Chester, N. Y., exhibited vases and fountains, and John C. Johnson, of Atlantic City, N. J., a grotto with a fountain of aërated water. The Portland Lawn Sprinkler

Company exhibited sprinklers that travel automatically either in a straight line or a circle, watering a strip ten feet or fifty feet broad, as desired. Spray pumps of various patterns and materials were shown by the Bean Manufacturing Company, of Hudson, Mich., the Carrol Pump Company, of Chicago, the Deming Company, of Salem, Ohio, the P. C. Lewis Company, of Catskill, N. Y., and F. E. Myers & Brother, of Ashland, Ohio. Wirt & Knox Company, of Independence, Mo., exhibited a hose reel. Mrs. W. R. Strong, of Whittier, Cal., showed a storage reservoir. Peter Henderson & Co. exhibited sprinklers, with their lawn mowers and sweepers. Lawn mowers with grass receptacles or carriers were exhibited by Samuel B. Arment, of Bloomsburg, Pa., Glennon & Krause, of Chicago, and the Supplee Hardware Company, of Philadelphia. Chadburn & Caldwell exhibited lawn mowers of various styles. Other exhibitors were the Caldwell Company, Graham & Passmore, and the Whittman & Barnes Company. The Thompson Company, of Elkhart, Ind., had sweepers and rollers. The Daisy Implement Company, of Pleasant Lake, Ind., showed various garden implements. Charles S. Mann, of San Francisco, exhibited an ingenious tree pruner; Stevenson & Thomas, of North Bend, Neb., a baler for nurserymen; and Judge Trogden, of Paris, Ill., a transplanter.

The educational, scientific, and industrial results of a great exposition are difficult to compute. Not only were the millions who visited this department benefited by it, but it was peculiarly valuable to the botanist, the specialist in any of the various branches of horticulture, the pomologist, the viticulturist, the florist, the nurseryman, the landscape gardener, the dealer in and manufacturer of horticultural implements and appliances, the seed grower, and the market gardener. Not only to school children, but to grown people, the great exhibit of horticulture was an object lesson after the most approved manner, and in accordance with the latest educational ideas. No department of the Exposition occupied with the mere handiwork of man could produce so vivid a conviction of the vastness of the earth, and the variety of its different regions, as did this collection of strange and dissimilar plants. It was an advanced geography lesson on a grand scale, giving instructions on many points of climate, soil, people, commerce, and industry, and it was reasonable to suppose that there would result broader conceptions and a spirit more cosmopolitan and less provincial in its interests and prejudices. Lessons were learned in private economics. Unlimited possibilities were shown to the cultivator of the soil in an industry new and



WILLIAM BORNER,  
Member of the Directory.



comparatively unknown to our agricultural population. Those who were lamenting the disappearance of free land in the West were shown how it was possible to produce a better living from a few acres than from a quarter section. Those who were seeking homes had information concerning many localities spread before their eyes which they could not have secured by months of traveling. The popular taste was educated, and a love for the beautiful rather than a greed for the profitable was disseminated. The possibility that every cottage might have a tasteful collection of flowers in the yard or in the windows with but slight expense was demonstrated. In place of the crude style of ribbon beds and mere blotches of color in flower growing was shown the beauty of a plant as an individual. The universal delight felt in the simple natural beauties of the island went far toward spreading a wider demand and more refined taste for public parks and gardens. The wonders that may be accomplished with simple materials and in a limited time were fully demonstrated. Everywhere appeared the most delicate varieties of plants transported from the farthest portions of the earth. Among the largest trees in the building were great feathery ferns from the native forests of Australia. The transplanting of forest trees fifty feet in height and two feet in circumference demonstrated that it was not necessary to begin planting in childhood in order to enjoy in old age. Health and added satisfaction in life lay also in the long rows of delicious fruit. The vastness of the production suggested that for the heavy food of our meat-eating nation might be substituted a more wholesome and less costly diet of Nature's providing.

Visitors from abroad, although they had learned much in their thousand-mile ride across the continent, found still more surprising evidences of the vastness of the nation, and the wonderful variety of its resources, on viewing the fruits and plants of the South and of California. Indeed, many of our own people added a long list to their vocabulary of American fruits when they saw the pomelos, guavas, citrons, sweet lemons, and kakis from those States; the medlars, dates, olives, and pepinos from California; the strange orangelike quimquats, the avocados, and the cocoanuts from Florida; and the Japan plums, which were not really plums, from many portions of the Gulf States. And there were many other surprises. Almonds were shown in different stages of their growth, ripe with the hulls partly removed; Madeira nuts were shown from States as far north as Kentucky and New York; and pecans from Louisiana, Mississippi, and Texas were a revelation in their numerous varieties and the magnitude of their production. Most instructive were the numerous object lessons of these Southern fruits in the different stages of their growth: cocoanuts in bunches, olives upon branches, pineapples growing in boxes, and orchards of orange, lemon, and lime trees in the nursery and in the courts. A beginning could not be made in telling of the instructive lessons from foreign countries, in the literature which they distributed, as well as in the specimens on exhibition. Distant regions, as

well as portions of the United States, showed themselves in a new light as horticultural countries. Southern Russia made claims of rivaling France in wines, and Chili showed vast progress in this and related industries. The seedless raisins from the latter country were the greatest surprise of their



DISPLAY OF MEXICAN CACTI.

kind to specialists. It was interesting also to see how closely some of the distant countries, as Australia, resemble our own in the list of ordinary fruits and vegetables.

Specialists, no doubt, received the most advantage, although indirectly through them the whole world is benefited. In their preparation for the competition they redoubled their exertions and outstripped their previous successes. After meeting men of kindred pursuits from countries the most advanced and most dissimilar in their several industries, after talking with them, observing their methods and products, receiving the inspiration that comes from contact with the masters of their art and from the organization of associations universal in their reach and momentous in their import, they left the Exposition different men, and an influence went throughout the world which is incalculable in its ultimate results. Some countries showed themselves more apt than others in taking full advantage of their opportunities. The Japanese Government had a corps of specialists among us taking notes. Mexico showed a commendable interest, while the best

horticulturists of some of the European countries no doubt most perfectly mastered the lesson of the Exposition. Excellent evidence was adduced as to the influence of climate and environment upon variety and species, upon the shape, size, and quality of the fruit, and a good opportunity was offered to observe the effects of cross hybridization. The wide range of country to which a few varieties have proved themselves adapted was illustrated by displays, for instance, of the Ben Davis apple from widely separated northern and southern localities; of *vinifera* varieties of grapes from the lower Rio Grande; of Chinese varieties of peaches, such as the *peen-to*, and varieties of sand pears in the extreme northern part of the United States; and of Japanese plums from the East, which are almost revolutionizing the plum culture of that region; to say nothing of figs from Nevada and subtropical fruits of many kinds from unexpected districts, even as far north as Oregon.

The pomologist learned other lessons of importance. He saw, in the collections from widely separated localities, a new opportunity for correcting his nomenclature. He found fruits become almost unrecognizable because of the new conditions under which they had grown, so much so that new names have been insisted upon; but when they were placed beside the fruit of other localities such similarity was proved between them as demonstrated their identity. The peculiar tendency of the northwestern fruits to become elongated and narrow and corrugated at the apex was everywhere seen. The same tendency was shown in the so-called "Five-crowned Pippin" from New South Wales, which was shown to be in reality the Newtown Pippin. While some of the varieties of fruits from the Northwest reach two or three times their ordinary size, as the Blue Pearmain apple, others, as the Ben Davis, were smaller than ordinary. As a rule, it was shown that apples from the South reach a greater size than those from the North, but are of a duller, poorer color. The fruits from the irrigated lands of the West, while highly colored and of superior appearance and size, did not equal the others in flavor. The russet in Colorado had become a bright yellow. The fruit from the Northwest was a revelation to dealers, and will cause many of them to turn their attention in that direction. European countries showed the superiority of their packing and preserving methods; lemons from Italy, for instance, remained in good condition six months after they were picked. Fruits that had been preserved in antiseptic fluids enabled exhibitors to bring them over great distances and to prolong the exhibiting period far beyond that of previous expositions. Tender berries ripening at the beginning of the season were kept six months instead of three or four days.

The florist also found most surprising success in shipping delicate plants, such that after going half around the globe they were as perfect as though they had come but a few miles. The winemaker saw many examples of the best methods of bottling wines from all parts of the world, and thus

received suggestions that otherwise he would have been obliged to travel through many countries to obtain. Interesting results were shown in crossing the American and *vinifera* species of vines, which may prove of the utmost importance to the Eastern United States, as it has long been doubted by experts whether anything but the native grape would grow in this region. The various methods of training grapevines were illustrated, showing the contrast between training on trellises in the East and cutting back to a single stump, as in the West. For the first time in America the French methods of pruning trees were fully shown. Not only that of training on trellises, but especially the growing of pear, apple, peach, and other kinds of trees to a flat shape against a wall may be imitated with profit in the colder parts of the United States, where many tender varieties of these fruits might be grown under this treatment. The importance to the specialist of the horticultural work of agricultural colleges and experiment stations was proved by many exhibits. The New York Experiment Station alone showed about 140 varieties of fungi, most of which were edible, and 173 varieties of gooseberries and 40 varieties of radishes labeled with their proper names. The exhibit of this station showing the difference between pears that had been sprayed and those growing beside them without this treatment was very instructive.



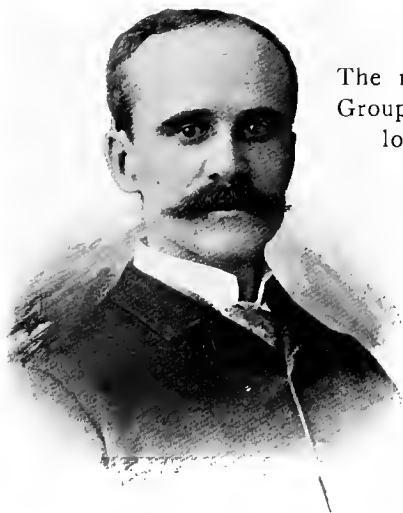
Canned Vegetables exhibited by Gordon & Dilworth, New York.



Part of the main aisle of the Mining Building.

## CHAPTER V.

### THE MINING EXHIBIT.



MARK L. CRAWFORD,  
Member of the Directory.

The revelation of mineral wealth, machinery, and processes—Group of minerals, ores, native metals, gems and crystals, and geological specimens—Group embracing mineral combustibles—Group including building stones, marbles, and ornamental stones—Group composed of grinding, abrading, and polishing substances—Group comprising graphite and its products, clays and other fictile materials and their direct products, asbestos, etc.—Group of limestone and artificial stone—Group including salt, sulphur, fertilizers, pigments, mineral waters, and miscellaneous minerals and compounds—Group comprising the metallurgy of iron and steel—Group embracing aluminium and its alloys—Group composed of copper and its alloys—Group including the metallurgy of tin, etc.—Group covering the metallurgy of zinc, nickel, and cobalt—Group comprising the metallurgy of antimony and other metals—Group confined to the extraction of silver and gold by milling—Group relating to the extraction of gold and silver by lixiviation—Exhibits

having to do with extraction of gold, silver, and lead by fire—Things connected with quarrying and working stone—Placer, hydraulic, and drift mining—Tools and appliances of underground mining, timbering, and supporting—Boring and drilling tools and machinery, and apparatus for breaking out ore and coal—Apparatus for pumping, draining, and hoisting—Moving, storing, and delivering of ores, coals, etc.—Apparatus for crushing and pulverizing—Group of sizing appliances—Assaying apparatus and fixtures—Group devoted to the history and literature of mining and metallurgy—Originals or reproductions of early and notable implements and apparatus.

THE mining and metal industries, though ranking in commercial importance only below general manufactures in this and other economically developed countries possessing mineral wealth, never before constituted a separate department. The attention duly bestowed on this de-

partment resulted in a representation of the mineral resources of the United States in particular with such a fullness and multitude and manifold diversity of examples as to open the eyes of engineers as well as laymen to the extent, growth, and future of these industries. The mineral wealth shown by the neighboring countries, north and south, was almost as great a revelation, and not less that of New South Wales, whose mines turn out *per capita* three times the American production. The iron and coal industries of Prussia, Saxony, and Bohemia, the Russian works in the Urals, the skill of English smelters in treating complex and refractory ores sent from all parts of the world, the collieries of Great Britain and the Continent, the quarries of Italy and Greece, the protective precautions for the safety of miners required in German mines, the artificial stone of France and Germany, the silver mines of South America, the methods and arrangements of European mines and furnaces—these were among the things that were brought before the understanding by means of representative samples and instructive models and pictures more vividly than could be accomplished by actual sight of the works and operations. New mechanisms and processes were fully presented for exhibition purposes, but not altogether to the satisfaction of technologists who would like to see their performance or perhaps test what they could do with their own ores and materials. The ores and minerals of nearly every mining region of the earth and the metals and mineral products in all stages of manufacture were exhibited far more completely than in previous expositions. Not alone was the industrial and economic aspect of the mineral kingdom brought to view more comprehensively, with a more impressive abundance and variety, than ever before, but the greatest collections of scientific geology and mineralogy and the choicest specimens of a thousand cabinets of the rare and curious and beautiful were gathered to form a Plutonic microcosm. The American section was, however, only in respect to gold and silver and some minor metals, a fair representation of the mining and metallurgy of this country, which now leads the world not only in extent of production, but in technical capacity and skill. The most important branches of American metallurgy were not represented, since the principal iron and steel firms made no exhibits. There were no models of special furnaces and plant, nor diagrams illustrative of the results of different processes, nor collective exhibits of the principal iron and steel manufacturing districts.

The first group in the department, No. 42 of the Exposition, was that of minerals, ores, native metal, gems and crystals, and geological specimens. It was divided into two classes: 290. Collections of minerals systematically arranged. 291. Collections of ores and the associated minerals. Diamonds and gems, rough, uncut, and unmounted. Crystallography. Specimens illustrating the formations of the earth, systematically arranged.

Remarkably full and comprehensive general collections of minerals and geological specimens from all parts of the globe were from the Ward Natural

Science Establishment in Rochester, N. Y. Prof. Orton loaned the collection of minerals and fossils in Ohio University. Among others, George F. Kunz, Tiffany & Co., Prof. Egleston, and George L. English & Co., of New York, brought collections of minerals, of meteorites, of precious stones, and the like.

Mrs. J. C. Carrera exhibited a collection of the minerals of New Mexico; Joseph Grandelmeyer and E. G. Morrison, those of Nevada; T. R. Sorin, the minerals and ores of Arizona; the Northern Pacific Railroad, the economic minerals found along its route; and the New York Mineralogical Club, the rocks and minerals of Manhattan Island. Collections of Pennsylvania minerals were shown in systematic arrangement by Dr. D. Heber Plank and Dr. John Schoenfeld.

New York maintained its reputation as the pioneer of American geological science by erecting an obelisk presenting in order the formations of the State from the Laurentian up to the Carboniferous.

In the German section was a systematic collection of natural crystals, with models of crystalline forms showing the interior lines of contact. Mexico had several collections of minerals, fossils, and crystals.

George F. Kunz, among other mineral collections, loaned one of meteorites, and one came from the Ward Natural Science Establishment. In the California Building was a meteorite weighing one hundred and twenty-eight pounds.

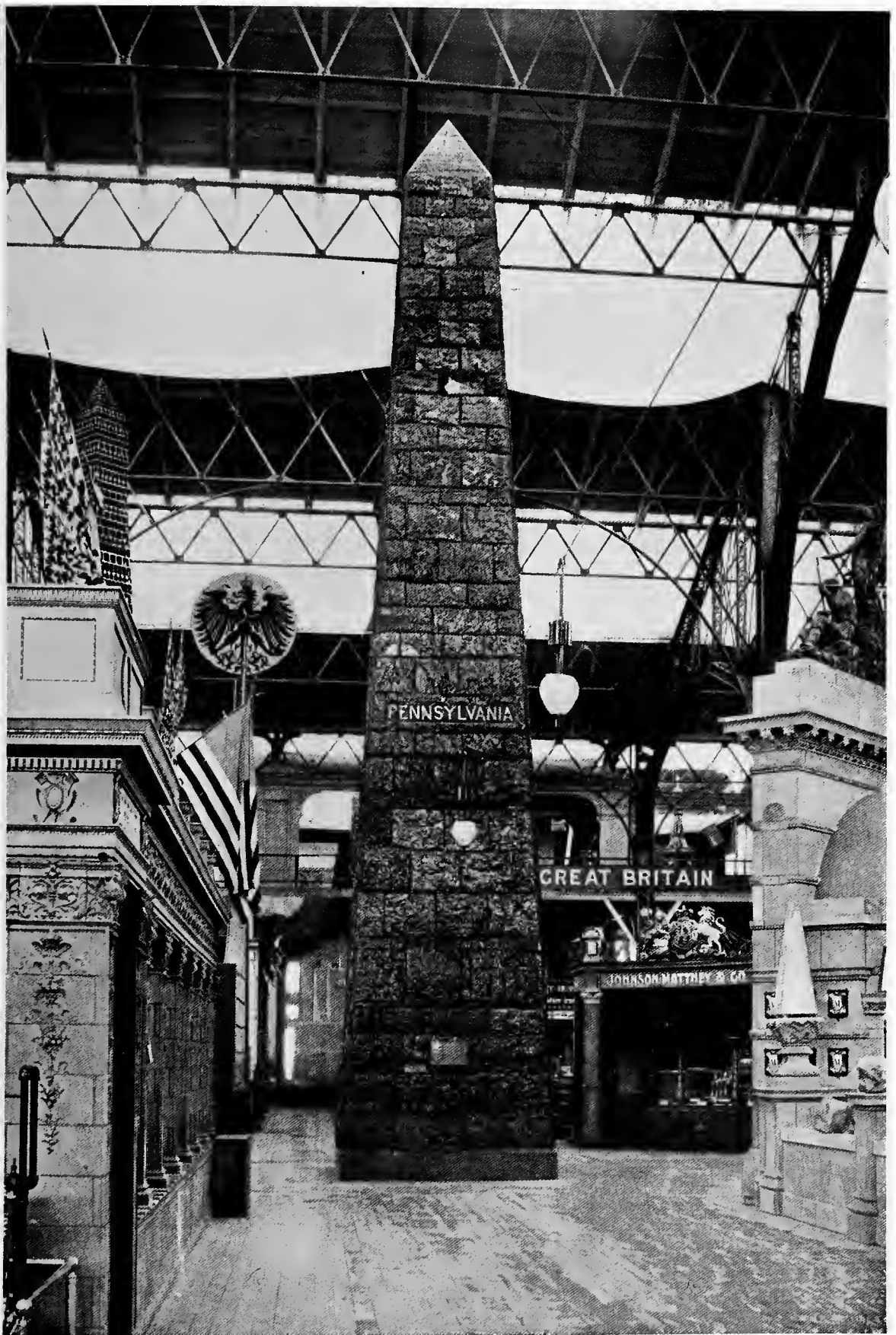
In the British section Johnson-Matthey & Co., who were the first to melt platinum and make it into laboratory vessels, exhibited a unique collection of rare metals, in which were platinum, iridium, osmium, rhodium, ruthenium, and palladium, pure and in alloy with gold, silver, and other metals. A nugget of platinum weighed one hundred and fifty-eight ounces. A heavy platinum ingot was shown, and there was a large lump of melted iridium. In the Russian exhibit was seen a fine collection of rare metals from the Urals. John Holland, of Cincinnati, exhibited native alloys of iridium with platinum and osmium. Waldron Shapleigh loaned a collection of ores and salts of the rare earths.

Nearly every State and many counties, mining districts, and individuals sent collections of minerals occurring within the State or lesser locality.

A display of minerals covering the resources, geology, and physical aspect of the whole of Canada was made by the Dominion Geological Survey. Ontario's exhibit of its minerals contained fifteen hundred and fifty-seven specimens.

The New England States, poor in metals themselves, contributed much of the metallurgical science and invention for the utilization of the riches of other States. Besides the granite, marble, and building stones that the Eastern States possess in abundance, and have great skill in working and handling, Massachusetts exhibited corundum, emery, graphite, and various ores and gems.





PENNSYLVANIA'S COAL COLUMN.

In the Mines Building.



Ohio's inclosing colonnade was constructed entirely out of the minerals of the State.

Iron, zinc, and galena ores were shown by Wisconsin, with extracted iron, copper, zinc, and lead.

Virginia exhibited all the ores of iron, with manganese, lead, and zinc ores, coal, barytes, ochers, asbestos, mica, onyx, marbles, slate, sandstones, and many building stones.

From North Carolina came iron, tin, copper, lead, and the precious metals, paint ores of various kinds, coal, granite, slate, and ornamental stone.

Besides zinc, lead, and iron ores, Missouri exhibited silver and copper ores, with many economic minerals, and calcite, dolomite, and syenite building stones.

Kansas exhibited lead and zinc and copper ores.

Utah's mineral exhibit contained specimens from all the principal mines, including gold, silver, lead, copper, zinc, antimony, manganese, nickel, cobalt, bismuth, iron, tellurium, quicksilver, selenite, gypsum, plumbago, salt, coal, asbestos, talc, and gems.

Wyoming, besides coal and iron, exhibited tin ore and stream tin, newly discovered gold ores, copper ore, asbestos, gypsum, sulphur, polished agate, and marble.

Washington showed, besides gold and silver ores, copper ore, magnetic-iron ore, and coal.

Oregon's collection was a surprising revelation of the mineral resources of that State, which has many extensive and admirably situated deposits of superior iron ore, numerous promising copper mines, and one of the largest mines of nickel ore in the world, though it is hard to reduce. There were specimens of platinum and iridium in the collection, found in placer gold mines, and cinnabar.

Besides silver ores, Mexico exhibited interesting and valuable ores of iron and copper, cinnabar in calcite, quicksilver ore, meteoric iron, smectite, pyrite, etc.

Nickel ores, chrome, and cobalt from New Caledonia were shown in the French court.

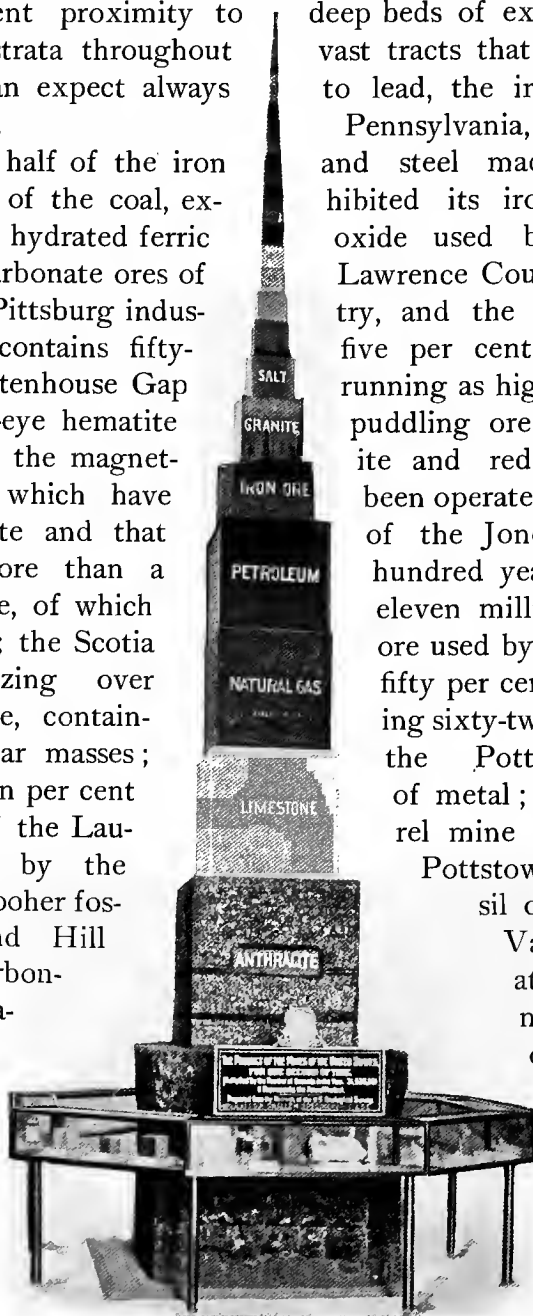
Among the Russian exhibits were raw and concentrated gold and silver-lead ores, copper ore and matte, zinc ore, pyrolusite and other ores of manganese, and nickel and cobalt ores, with extracted metals from them all; also a fine and multiform display of iron ores, and of pig and malleable iron, fine steel, and machinery, hardware, and cutlery made of Russian iron and steel.

A monument erected by the Government showed the actual average quantities of the different minerals produced every second in the United States, tapering from a cube at the bottom, five feet in diameter, representing bituminous coal, through the anthracite cube next, and limestone, natural gas, petroleum, iron ore, granite, and salt following in dimin-

ishing sizes, up to one of barely an inch standing for asbestos, resting on the scarcely discernible cube representing gold ore, with silver ore only a few blocks below. In commercial importance, as in general utility, iron ore ranks first among the metalliferous minerals of the United States, where it lies in convenient proximity to rich veins and strata throughout now leads, and can expect always tries of the world.

duced more than half of the iron States, as well as of the coal, enough, including hydrated ferric Company; the carbonate ores of the basis of the Pittsburgh indus- stone ore that contains fifty- magnetite of Rittenhouse Gap cent; the bird's-eye hematite near Adamsburg; the magnet- Durham mines, which have erstown magnetite and that been worked more than a wall magnetic ore, of which raised since 1840; the Scotia Company, analyzing over dywine magnetite, contain- found in lenticular masses; yielding fifty-seven per cent manganese ore of the Lau- hematite, shown by the Shade Gap and Booher fos- Schoenberger, and Hill Bedford Slope carbon- Rock Hill Compa- actitic hematites ty; the soft fos- bonates used by pany; and foli- with chalcopy- pignite, from ty, exhibited Schoenfeld.

collective exhibit of the still worked magnetite, hema- siderite. But New



CUBES SHOWING SIZE OF AVERAGE PRODUCT PER SECOND OF MINERAL RESOURCES OF THE UNITED STATES.

deep beds of excellent coal, in such vast tracts that the United States to lead, the iron-producing coun-

Pennsylvania, which in 1892 pro- and steel made in the United hibited its iron ores very thor- oxide used by the Allentown Lawrence County that were once try, and the still valuable buhr- five per cent of metallic iron; running as high as sixty-eight per puddling ore; fossil ore mined ite and red hematite of the been operated since 1727; Boy- of the Jones mine, which has hundred years; the rich Corn- eleven million tons have been ore used by the Carnegie Steel fifty per cent iron; the Bran- ing sixty-two per cent of metal, the Pottstown magnetite, of metal; the hematite and rel mine and the Beartown

Pottstown Company; the sil ores, Sandy Ridge, Valley hematites, and ate, used by the ny; the brown stal- of Lycoming Coun- sil ore and car- the Logan Com- ated iron ore, rite and iron Chester Coun- by Dr. John New York's

contained samples ores of the State: tite, limonite, and York's ore beds,

excepting the richest, and many in Pennsylvania, are now neglected for the deposits of the nearer Western States, where some of the richest and most tractable Bessemer ores can be easily mined, in some instances merely scooped from their beds into the cars.

Michigan brought samples of its richest iron ores. The varied exhibit included the Bessemer hematite of the Gogebic range and soft blue and red hematites and specular ores of other localities, with specimens of pipe, kidney, and needle ores.

In the Minnesota pavilion twenty-one mines on the Mesaba Range exhibited Bessemer ores ranging from sixty-three to seventy per cent of iron. The specimens were arranged with care, and the State collection included the ores of the Vermilion Range. The Chandler Company had a large pyramid of hard and soft ores from its mine, and the Minnesota Iron Company erected a similar pyramid of its hard red specular Bessemer ore.

In the Virginia exhibit was a huge lump of the iron ore that is almost a natural steel.

West Virginia had a great variety of iron ores.

The Wyoming Central Association and the Laramie Railway and Iron Company exhibited a complete series of hard and soft hematites, some of them remarkably pure, that occur in at least five great lenticular deposits in chloritic and micaceous schists.

Washington made exhibits of its abundant bog iron and of veins of magnetite in Iron Mountain, which in some places are a hundred feet thick.

In the Oregon exhibit were products from nine magnetic and hematite iron mines.

Nova Scotia exhibited brown hematite, spathic, and specular iron ores from undeveloped mines; Quebec, besides lake ore containing forty per cent of iron and bog iron, showed its unworked hematite, loadstone, chromic, and titanite ores. Ontario exhibited a variety of hematites and magnetites, with limonite and other ores.

New South Wales brought specimens of its still unworked magnetic, hematite, and brown iron ores.

Manganese ore was exhibited from a deserted pit near Ironton, Pa., and from a promising deposit recently discovered in Caernarvon Township, where it lies underneath a stratum of red hematite. There was also an exhibit of French manganese.

The nickel mines and furnaces of Lancaster County, Pa., exhibited a lump of nickel ore containing nearly three per cent of metal. Several Oregon mines exhibited nickel, among them the Excelsior, which contains ore assaying over ten per cent. in masses said to be as great as any except those in New Caledonia. The soft, amorphous, light-green Oregon ore is a nickel-magnesia silicate, called garnierite, which is difficult to work on account of the excess of silica. An interesting specimen of nickel sulphide came from St. Louis County, Mo.

There were fine zinc ores in the Kansas exhibit, with extracted zinc. The ores of Missouri were of many beautiful colors, from black to yellow and white. Arkansas showed a variety of zinc-carbonate ores.

Lead was well exhibited by Missouri. There was a lump of galena from the Joplin mine consisting of perfect cubes of almost pure lead. A monument was constructed of lead from all the smelting works of the State. Kansas exhibited fine samples of galena and metallic lead.

In 1893 the United States was still the largest producer of gold, as well as of silver. The mining and reduction of the precious metals ranked among



WEST VIRGINIA'S PAVILION.

the mineral industries only below the coal and iron interests, and in the Exposition gold and silver were more magnificently displayed than either coal or iron. The collections of California, consisting of over a thousand specimens, included nearly three hundred specimens of gold quartz from twenty-five counties, eighty-five of silver ores from twelve, copper ores from fifteen counties, quicksilver ores from fifteen, iron ores from twenty-one, thirty specimens of chrome ores, platinum, manganese, zinc, lead, and tin ores, antimony, and economic minerals, such as borates, gypsum, sulphur, salt, graphite, asbestos paint and packing, pottery clay, kaolin, and magnesite, with many petrifications and rare minerals. In John Hatch's collection of

over four thousand specimens of California minerals were many beautiful specimens of free gold and silver ores. Gold was made the prominent feature, as became the State that has given to the world over \$1,300,000,000 worth of the metal and still produced \$17,000,000 in 1892. In the State building were samples of all the valuable gold ores and auriferous gravels, more numerous, if less systematic, than the exhibit in the Mines Building. A nugget from the Blue Wing mine of Nevada County weighed thirty ounces. There were beautiful specimens of leaf, wire, and crystallized gold in quartz from the mines in Butte, Tuolumne, Amador, Placer, and other counties. The finest specimen of wire came from the Green Mountain mine. J. A. Goodwin loaned a quartz crystal inclosed in two almost perfect fern leaves. With rich specimens of quartz from the Delhi mine was a nugget showing the fern-leaf crystallization in a very perfect form. One piece of quartz contained \$1,200 worth of gold. Several beautiful specimens had been taken from the Doe & Daggett mine.

As a visible sign of its production of the noble metals, Montana set up a statue of Justice cast from silver 0.999 fine, refined by the National Smelting and Refining Company, which was valued at \$75,000, and rested on a golden plinth worth \$225, made of metal from the Spotted Horse mine. In the exhibit were nuggets from fifty ounces down, gold dust and scales, and ores from which gold protruded. Henry Elling exhibited choice specimens of placer gold, and T. H. Kleinschmidt two hundred examples of crystallized gold. The Atlantic Cable mine sent huge blocks of ore from which the gold stood out on all sides. Remarkable quartz crystals, wire silver, and blende, with interpenetrating pyrite and selenite crystals, came from the Lexington mine, rhodochrosite crystals from the Moulton mine, and from the Atlantic Cable mine pyrrholite containing free gold and specimens of gold associated with montanite, malachite, limonite, and chalcopyrite. The Granite Mountain mine had a piece of ruby silver assaying ten thousand ounces to a ton, also bimetallic ore carrying nine hundred and thirty-seven ounces. The Elkhorn mine had fifty specimens of native crystal silver. The Anaconda mine exhibited rich sulphide ores in which scale silver was plainly visible.

Twenty-five hundred specimens from Idaho, made up of contributions from every mine in the State, included gold nuggets and wire silver, iron ore from the Narragansett mine so hard that it has been cast into dies for stamp mills, copper ores of Bear Lake containing seventy-five per cent of metal, specimens of cinnabar, palladium ore that is associated with free milling gold in the Esmeralda mine, perfect cubes of galena containing seventy-five per cent of lead and one hundred and thirty ounces of silver to the ton, sulphur ore nearly four fifths pure, samples of salt, aluminium clay from Kootenay County containing forty per cent of the metal, a bright-colored rock from Lewiston that cuts glass like a diamond, and the valuable form of zircon called ruby sand. Specimens of native silver from the Delamar and Poor-



man mines and of silver-bearing lead ores from the Cœur d'Alene region were very interesting.

In Oregon's exhibit twenty-five silver properties were represented, and four hundred and twenty gold quartz mines, besides many placer mines.

South Dakota, which claimed to lead all the States in the opening of new gold mines, exhibited remarkable specimens of gold ore.

Nevada displayed the Comstock ores and many fine examples of native silver and gold in its collection of over five thousand specimens.

Washington showed many large gold nuggets and specimens of gold and silver ores.

Michigan showed silver ores and gold ore from Ishpeming that assays ten thousand dollars per ton. From the earlier Eldorado of the country North



PRECIOUS ORES EXHIBITED BY CALIFORNIA.

Carolina exhibited gold ore and nuggets and silver ores. Kentucky also displayed gold and silver ores.

Nova Scotia exhibited some fine gold in quartz.

British Columbia exhibited auriferous quartz and alluvial gold. A quantity of pure gold was placed alongside of a pan of dust as adulterated by the Chinese. There was also an exhibit of silver-lead ore from the Kootenay district.

The Canadian collection included gold ore from the Lake of the Woods and Port Arthur, gold in iron pyrites, associated with copper, and free in mispickel from Marmora, and silver from Silver Mountain.

Of the Mexican mines, the Batopilas made the most extensive exhibit of

native silver ores. There were nearly three hundred exhibitors of Mexican ores, silver lead and galena of various kinds, silver iodide, argentiferous copper-lead ore, lead carbonate, iron oxide, copper, and other ores, gold-silver ore, vein ore, sulphureous silver, ruby silver, etc. Various kinds and qualities of gold ore were shown also.



PART OF THE CANADIAN SECTION.

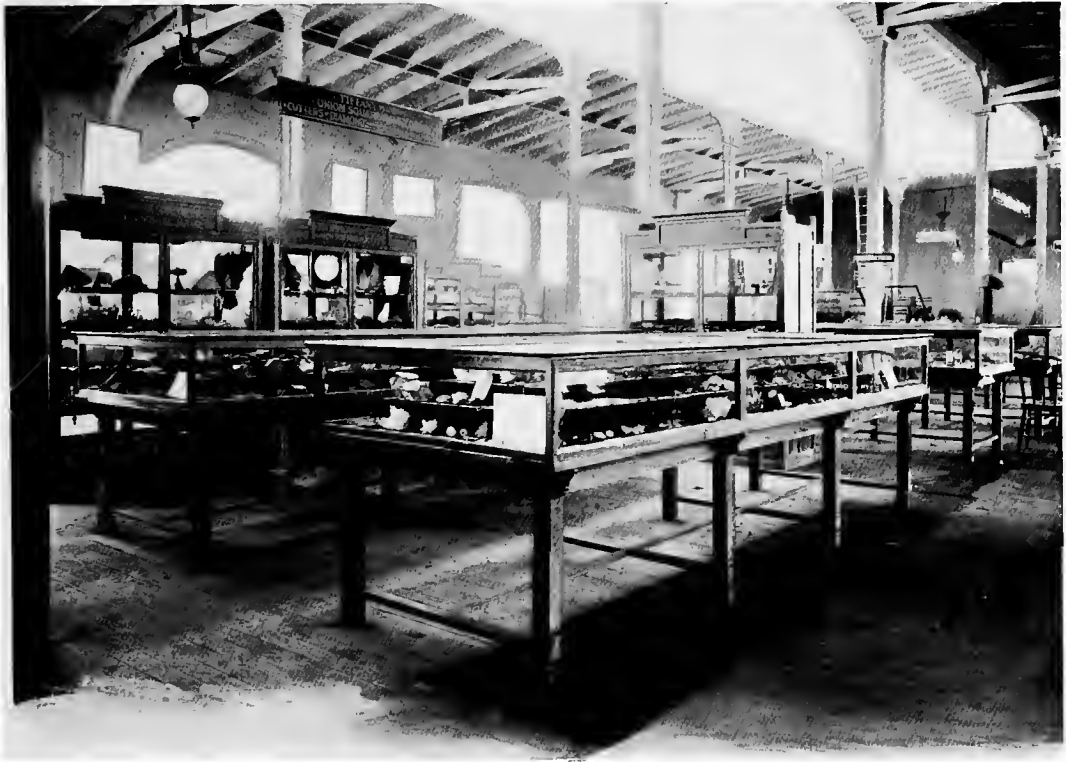
In the magnificent mineral display of New South Wales were specimens of all the gold ores of the colony, some consisting of blocks weighing several tons. Large samples of the refractory ores of the Barrier Range were brought in the hope of finding new machinery that would give better results than have been attained with these complex sulphides, more difficult to work than any of the American, that underlies the easily managed carbonates. No adequate

provision had been made, however, for testing ores on a large scale. Rough blocks of native silver ores from the Broken Hill mine supported cases containing the finer ores, above which rose a silvered column supporting Atlas and the silver globe under which he bent, the whole representing the average annual production during the six years of the smelting operations of the mine—about six thousand ounces. Extensive collections of hand specimens represented other silver lodes discovered in New South Wales. There were many strange and beautiful specimens of silver and ores, particularly crystallized carbonates, cupriferous ore carrying native silver, and kaolin carrying native silver and silver iodide and manganese. The exhibit included also a collection of remarkable gold nuggets, one of which contained three hundred and thirteen ounces of fine gold, and another, coming from the Mother Shipton mine, two hundred and fifty-eight ounces. There were beautiful specimens of crystalline gold and a fine example of gold in ferruginous quartz.

Though this country is so small a producer of precious stones that our lapidaries receive nearly the whole of their materials from abroad, yet the beautiful crystalline and highly colored minerals, many of them distinct in hues or texture, some even peculiar in their nature and composition, as seen collected at the Exposition, roused hopes that the working of such fine stones into graceful ornaments may become a considerable branch of decorative art in the United States. In Montana's exhibit were products of a mine of precious stones that an English company had begun to exploit—viz., sapphires and rubies that are more brilliant than the Oriental gems, but lighter in color. Idaho exhibited the opals of the recently opened Owyhee mine, together with quartz crystals and amethysts, onyx, and also sapphires. The Wisconsin pearls could be viewed in all their colors and sizes in numerous collections. Minnesota showed a specimen of Lake Superior amethyst weighing three hundred pounds. New York showed beautiful specimens of quartz and fluorite. North Carolina's exhibit of gems included spinels and beryls of all shades, hiddenite, rubies, sapphires, emeralds, garnets, amethysts, quartz of various colors, and topaz. Amethysts and agates were exhibited by Michigan, with chlorastrolytes, a beautiful mineral found in Isle Royal and nowhere else except in Spain. Exquisite deep-red garnets came from Washington State. Utah had some of unsurpassed color and luster, besides white, pink, and pale-blue topaz, gorgeous malachite, opals, onyx, agates, rock crystal, and wood opals. Colorado showed numerous ornamental stones suitable for jewelry, including agate, onyx, jasper, chalcedony, carnelian, and jet. In the Californian collection were diamonds picked up in ancient river beds.

Tiffany & Co. and George L. English loaned collections of cut and uncut gems and precious stones; George W. Landenberger, rare specimens of amethyst and topaz; and A. B. Crim, crystals and carbon and liquid inclusions.

A special exhibit of the gem stones of Canada, made by a Montreal jeweler, contained beautifully marked agates, tourmalines, jade, albites, sodalites, and quartz-asteria. New South Wales had a great variety of gem stones, including diamonds, small but brilliant, fine steel-blue Brazilian shade, found in alluvial deposits in the New England district in association with gold and tin; emeralds of good color, found in a very hard matrix, a recent discovery; the singular and beautiful harlequin and cameo opals; sapphires, topaz of rare beauty, beryl, cairngorm, zircon, amethysts, and garnets, found in the tin leads of the New England district, and onyx of peculiar markings. Brazil displayed various fine gems, and a curious elastic



GEMS EXHIBITED BY TIFFANY & CO., NEW YORK.

stone that is common in Minas-Gereas. In the Japanese exhibit were rock crystals a foot in length, crystallized stibnite quite as large, and topaz crystals of extraordinary size. Russia made a splendid exhibit of the precious stones and the malachite and other decorative minerals of the Ural Mountains and Siberia.

One of the greatest popular attractions of the Exposition was the exhibit of the diamond industry of Cape Colony. An entire washing plant was set in operation, and all the workings of the De Beers mine at Kimberley were practically demonstrated. Tall Kaffir miners washed out the diamondiferous blue earth, of which, unpulverized and pulverized, one hundred and fifty tons

had been imported. The stones that were found were passed over into another department, instituted with the aid of Tiffany & Co., where diamond cutters and polishers were at work with their wheels, shaping the gems into brilliants. There were facsimiles of the De Beers diamond of four hundred and twenty carats, and of the fine Litkio diamond, weighing two hundred and five carats. Ten thousand carats of uncut diamonds were shown, one of which weighed two hundred and eighty-two carats, and a large quantity of very fine cut and polished ones. There was an interesting exhibit of gravel from the Vaal River, and other special diamondiferous minerals; also a unique collection of crocidolite.

Group 43 embraced mineral combustibles—coal, coke, petroleum, natural gas, etc. It was divided into the following classes: 292. Coal—anthracite, semi-bituminous and bituminous; coal waste, “slack,” coke, and pressed coal. 293. Asphaltite and asphaltic compounds—uintaite, wurtzilite, grahamite, albertite, bitumen, mineral tar, amber. 294. Petroleum—illuminating and lubricating oil. 295. Natural gas—methods of conveying and using.

Pennsylvania, which in 1892 produced somewhat less than forty-seven million tons of anthracite and forty-two million of bituminous coal, when the whole production of the country was one hundred and sixty million tons, made a commensurate showing, and a thoroughly interesting one, of its coal-mining industry. The Lehigh Valley Coal Company, besides displaying the Franklin red ash, the Baltimore white ash, and the Mammoth vein coal in all merchantable sizes from lump to culm, erected an anthracite coal needle, fifty-four feet high, of alternate courses of coal and slate, reproducing the strata of the Mammoth bed in their natural order and thickness. Samples of Lehigh coal from the Buck Mountain and Wharton veins were shown by Coxe Brothers & Co. The Philadelphia & Reading Company exhibited Shamokin, Locust Mountain, Schuylkill white and red ash, Shenandoah, Mahanoy, and Lykins Valley anthracite in commercial sizes.

The H. C. Frick Coke Company exhibited a vein section of the Connellsville coking coal that is the mainstay of the furnace industries of Pennsylvania, and is shipped to all parts of the United States and to foreign ports, of which seventy thousand of the original eighty-eight thousand acres remain unmined. A perfect working model of the plant of the firm showed the entire process of coke manufacture.

Glen Fisher coal was shown by the Standard Coke Company. Sections were exhibited of the Bernice semi-bituminous coal bed, the Berwind White mines in Jefferson and Clearfield Counties, the Shaner and Monongahela gas coal beds, the Jumbo mine of Washington County, and the Woodland red-ash coal from Clearfield County.

Maryland made a good exhibit of its coal resources. In the Virginia pavilion was a great mass of almost smokeless coking coal. The coal fields of Ohio were adequately represented.

Coal and coke formed the most prominent feature in the exhibit of West

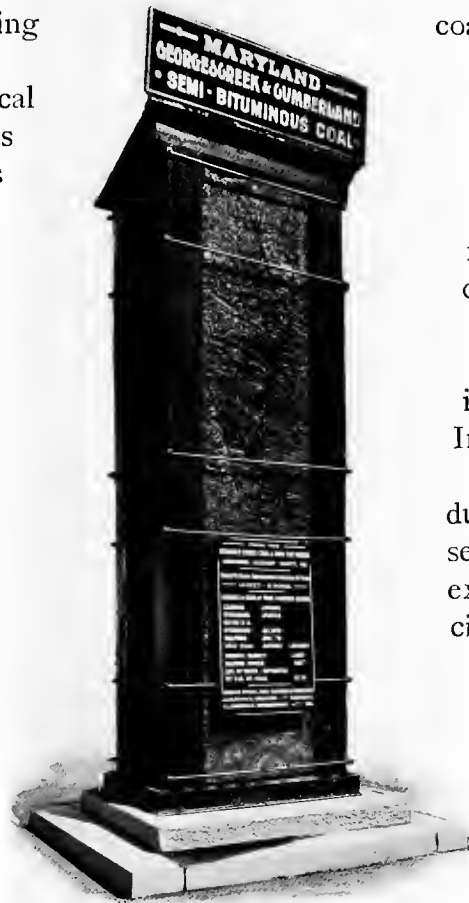
Virginia, rich as that State is in coal of the same character as the Connells-ville seams and the beds that underlie eastern Kentucky. Missouri showed up its coal industry well. The Indiana block coals, extensively used in the central West, were represented by large blocks, and there was a great polished slab of cannel coal, with broken coal and coke made from the same. Pyramids of Kansas coal stood near the State building. Illinois made a scientific exhibit of its coal measures.

A turreted arch of shining cannel coal gave entrance to Kentucky's exhibits. Besides this coal, of which that State has the largest area known, were exhibited many varieties of superior steam, coking, gas, and domestic coals from the western fields, and the excellent coking coal of the Elkhorn and other eastern seams. Iowa constructed a chamber of a typical coal mine, lining it with samples of its characteristic coals. Columns and blocks of the formations, and models of extensive mines revealed the importance of the industry in that State. South Dakota brought a few specimens from its great undeveloped coal fields. The mining companies that work the beds of Indian Territory made a good display. Utah, now a considerable coal producing State, exhibited semibituminous varieties of bituminous and anthracite coals. Montana exhibited its coals, abundant, but inferior, resembling lignite.

Wyoming, rather Penn- the surround- its mineral re- a liberal exhibit ores. A twenty-

represented the two the Cambria Com- mined entirely by machinery and furnish the northwestern railroads and the mines of the Black Hills with coal and coke. Other columns represented seams of Rock Springs and other non-coking, semilignite coals.

Of three hundred and ninety-seven companies and firms that took part in the technical display of coal, sixty represented Pennsylvania, forty-one West



SHAFT OF COAL FROM MARYLAND.

resembling sylvania than ing States in sources, made of its coal and four foot pyramid seams worked by pany, which are

Virginia, forty Illinois, thirty-two Kentucky, thirty-one Ohio, thirty Missouri, nineteen Alabama, fifteen Iowa, thirteen Washington, twelve Colorado, eleven Indiana, Kansas, Tennessee, and Utah severally, ten Montana, nine Wyoming, eight New Mexico, six North Dakota, five Michigan, Indian Territory, and Virginia, three Arkansas and Maryland, two apiece Oregon and California, and one each Nebraska and Texas.

In the Washington Building was a column of semi-bituminous coal, probably the largest blocks ever mined, twenty-six feet long and five feet square in section, and weighing twenty-five tons, taken from the Roslyn



SMOKELESS STEAM COAL FROM CARDIFF, SOUTH WALES.

mine. A lump of cannel coal from Lancashire, England, weighed nearly twelve tons. Maryland exhibited one from the George's Creek mines that was fifteen feet high and three by four feet in horizontal section, weighing about ten tons.

Two monuments of coal at the entrance of the British Columbian exhibit directed attention to the Vancouver Island coal measures. Large specimens of lignite were shown from the Alberta field in the Northwest Territory, one of them from a seam that presents a face of three hundred and twenty square feet. Nova Scotia exhibited the coals of Cumberland and Pictou Counties and Cape Breton Island. Mexico exhibited several varieties of soft coal and anthracite from Sonora.

An archway of coal—next to gold the most important mineral product of the colony—led into the pavilion of New South Wales, the pillars showing both quality and width of seam. Most of the bituminous coal was good



for coking. The petroleum cannel coal, or kerosene shale, yields about one hundred and fifty gallons to the ton of kerosene, of all the varieties and grades produced in America. Germany showed samples of coal from the royal mines of Saarbruecken and Silesia and the Westphalian private mines. Japan sent samples of hard and soft coal. Russia exhibited anthracite and bituminous coal, coke, and lignite. Great Britain, France, the Cape of Good Hope, Brazil, Ecuador, and the Argentine Republic exhibited coal. J. J. Kyle, of Buenos Ayres, showed coal ashes containing vanadic acid, and also prepared vanadite of ammonia.

The Reading Compressed Fuel Company, of Mahanoy City, Pa., exhibited compressed block compounds of anthracite coal dust and of Clearfield bituminous coal with coal-tar pitch, and one of Texas lignite and Venezuela natural pitch. A Welsh company showed samples of black fuel. In the German section was a model of machinery for making briquettes from lignite. France also exhibited manufactured fuel. A compound to promote combustion of coal was exhibited by the Northwestern Land and Coal Company, of Boston, Mass.

Asphaltum and oil from Kern and Ventura Counties were shown in the California Building. In the exhibit of the Canadian Northwest Territory were specimens of the natural tar sands found on Athabasca River in a formation one hundred and fifty feet thick, which is so saturated with oil that it oozes out and forms pools at the foot of the river bank. Utah, which possesses various mineral oils and deposits of elaterite, albertite, wortzilite, and uintahite, had an exhibit of gilsonite, a substance that is nine tenths asphaltum, and is valuable for lacquers and varnishes. With samples of asphalt from Trinidad, there was a model of the pitch lake and its surroundings. In the Spanish section was an exhibit of Cuban asphalt, which has not yet been introduced into commerce, though it contains seventy per cent of bitumen. Italy and Ecuador had exhibits of asphaltum and bitumen. Mexican asphalt was shown also.

The Standard Oil Company made the completest possible exhibit of petroleum and its products, including three-hundred-degree illuminating oil, lantern and headlight oils, and all high-grade and common illuminating oils; lubricating oils for engines, cylinders, harvesters, sewing machines, bicycles, ice machines, marine engines, etc.; valve oils; axle grease and coach and car oils, including black oil tested for zero temperatures; stove and street lighting gasoline and gas naphtha; ointments and mineral soap; and composite mining and domestic candles and paraffin candles. The exhibit contained a collection of all the crude oils produced in the country, besides a full series of derivatives and by-products, and also models of all the appliances used in drilling and piping and in storing and distributing oil. The Eclipse Lubricating Oil Works, of Franklin, Pa., had an exhibit of all the Pennsylvania crude oils, with its own refined and lubricating oils and the burning oils and waxes distilled from tar by the Atlantic Refining Company. The Harris

Company, of Providence, exhibited lubricants. Crude oils were exhibited by New York, Ohio, and Kentucky, Louisiana. West Virginia had a good display of petroleum, both crude and refined. Wyoming sent from its undeveloped oil fields samples of heavy lubricating and fuel oils. Samples of natural lubricating oils were exhibited from two Colorado wells, and a fuller exhibit of the already important petroleum industry of the State was made by the Rocky Mountain Company, of Pueblo. The Imperial Oil Company, of Canada, exhibited the product of the Petrolia oil fields in Ontario, containing less illuminating but more lubricating oils and paraffin than the Pennsylvania petroleum. Argentina, Ecuador, and Mexico showed samples of their



EXHIBIT OF THE STANDARD OIL CO.

crude oils. In the Russian section, Nobel Brothers made a comprehensive display of Russian petroleum and its products, the Russian-American Naphtha Company exhibited fifty-eight different petroleum products, and the Schmidt Laboratory had a series of the lubricating oils.

Group 44 included building stones, marbles, ornamental stones, and quarry products, consisting of a single class: 296. Building stones, granites, slates, etc., rough hewn, sawed, or polished—for buildings, bridges, walls, or other constructions, or for interior decoration, or for furniture. Marble,

black, white, or colored—stalagmitic marbles, onyx, brecciated marbles, silicified wood, agates, jaspers, porphyries, etc., used in building, decoration, statuary, monuments, vases, or furniture.

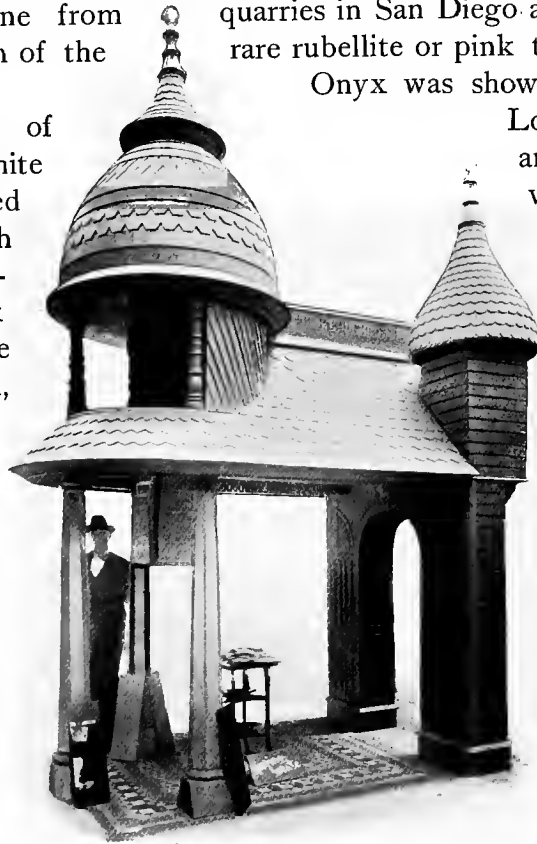
Many States had complete collections of their constructive and ornamental stones cut into cubes or slabs, with one face polished as highly as possible and the others dressed in various ways to show their characteristics. Granites and marbles were a prominent feature in the exhibits of Maine, Massachusetts, New Hampshire, Vermont, and Connecticut. Vermont had no exhibit except stones, which were displayed within a classic portico built of beautiful marbles. New York's pavilion had bounding walls made of its marbles, while within were ranged uniform blocks of all the building, ornamental, and commercial stones quarried in the State. Pennsylvania showed more than a hundred kinds. Besides limestones, granites, and sandstones of many qualities, there were dark-gray and blue marbles, siliceous oölite, verde-antique marble, and recently discovered black and statuary marbles. There was an important exhibit of roofing slate and school and blackboard slates, with pyrophyllite, or pencil slate, from Lycoming County. North Carolina had a good exhibit, consisting of limestone of various kinds; marbles, white, gray, blue, and mottled; granite, pink and gray; and gray and brown sandstone.

Within a parapet of ornamental stones, entered through a gateway of red sandstone, Michigan had a remarkable collection, including marbles of many colors, serpentine, and verde antique. Great columns of red sandstone marked the corners of Wisconsin's space, which was entered through an arch upheld by pillars of polished red marble. The exhibit included granite, jasper, and serpentine. Ohio had its ornamental stones built into its pavilion. Tennessee's display consisted largely of marbles and ornamental and building stones, which were arranged in a pyramid. Kentucky also displayed fine marbles and valuable building stones. Indiana had a pavilion built of the light-gray limestone which that State exports, with columns of its granite at the gate. Minnesota had a gateway constructed of building stones, and inside was a systematic exhibit of a hundred varieties. Among the granites was seen the speckled Rockville variety. The slate of Cloquet was shown, and the brown stone of Duluth. There was jasper, highly polished and dull red. Most interesting was a large quantity of the pipestone of the Indians from the only existing quarry, which is on the national reservation, near Pipe Stone City. Missouri's pavilion had a base of syenite granite and panels of onyx. Sandstone, limestone, and marble were shown in variety. Kansas exhibited two hundred squares, comprising useful and highly polished ornamental stones. Oregon exhibited serpentine and various handsome characteristic building stones. Washington's exhibit was also fine and interesting. That of Idaho included alabaster and marble, and granite of special kinds. A circle of columns made of different marbles was a striking feature of the Colorado exhibit, which was surrounded by a parapet of polished onyx.

A block of azurite on a base of malachite was in Arizona's exhibit. The Drake Company made a fine display of the petrified wood of the Territory.

To enter the California section one passed through a portico constructed of building stones, with columns of white marble from the Coulton and Inyo quarries, rising from a pedestal of light granite resting on a dark granite base; the arches were of gray sandstone, with pilasters of beautifully veined California onyx and panels of variegated marbles. The peculiar landscape onyx from San Luis Obispo County is equal to the Mexican in texture and superior in softly blended shades of color. In the California Building was serpentine from quarries in San Diego and Amador County; also a column of the rare rubellite or pink tourmaline of San Diego County. Onyx was shown from the New

Pedra quarries of delicate pearly white with pink and red cracks or brownish pable of a remarkable white and pink petrified wood were Mexican pavilion, attractive exhibit garnet stone, a limestone streaked in which are imnets of a rich the Argentine ited many mental stones. ing and monu- of Ontario, number of tro- ed the granites sing and Thun- tricts, beautiful red jaspers veined green, gray, pink,



ROOFING EXHIBIT OF THE OLD BANGOR SLATE CO., BETHLEHEM, PA.

Lower California, of and greenish tints, veins; it has no stains, and is cable polish. Onyx, marbles, and seen in the where the most was the new rose white siliceous with vesuvianite, bedded large garcolor. Brazil and Republic exhibit beautiful orna-

The build- mental stones built into a phies, includ- of the Nipis- der Bay dis- serpentine, deep- with green, black, and white struc-

tural marbles, and richly clouded and banded ornamental ones. The exhibit of the Dominion Geological Survey contained specimens of mottled serpentine, of dolomite shading from pure green to white, and of the so-called fossil trees found near Kingston. Great Britain exhibited Scotch granite worked into ornamental shapes and porphyry that is brought from Egyptian quarries and worked up in England. Polished slabs of purple, red, black, and gray marbles were exhibited by New South Wales. The crocidolite of South Africa was shown in its natural state and fashioned into ornamental objects.

In the Italian section were specimens of all the noted statuary and ornamental marbles of that country. An ancient font of Claudian marble was loaned by a Roman church. Italy had also a great mound of alabaster blocks, with statuettes cut out of the stone. Greece exhibited marble from Scyros. In the German exhibit were polished agates worked into globes and bowls, and one, supposed to be the largest in the world, made into a clock.

Group 45 was composed of grinding, abrading, and polishing substances, forming but one class : 297. Grindstones, hones, whetstones, grinding and polishing materials, sand, quartz, garnet, crude topaz, diamonds, corundum, and emery in the rock and pulverized and in assorted sizes and grades.

The largest exhibit of abrasives was that of North Carolina, embracing corundum crystals, gravel, and sand, topaz and sapphire corundums, pink and black corundum, white quartz sand, bronzite, albite, massive and pulverized granite, millstone grit, and whetstone. Ohio exhibited whetstones, with molding sand and glass and fire sands. Placer sand was exhibited by Wyoming, and molding sand by New York. West Virginia exhibited grindstone, whetstone, millstone, and calc-spar ; Kentucky, Michigan, and Louisiana, grindstones ; Missouri and Montana, oilstones and tripoli rock ; Colorado, grindstones, whetstones, and hones ; Idaho, steatite and olivine and pumice stone ; Massachusetts, corundum crystals, emery, and margarite ; Virginia, soapstone. From Maine was shown the quartz used in sandpaper. Canada exhibited garnet, grindstones, and emery sand ; France, emery, grindstones, and molding sand ; Germany, emery wheels and stones and polishing powder ; Great Britain, emery files and slabs and grinding tables for granite ; Greece, emery from Naxos ; Mexico, grindstones, tripoli, silex, white sand, and emery in the rock ; New South Wales, oilstones and tripolyte ; Spain, pumice stone from Teneriffe. The Abrasive Material Company, of Philadelphia, showed a very pure, hard, and infusible amorphous corundum from Chester County, Pennsylvania. Exhibits of emery wheels were made by the Norton Company, of Worcester, Mass., and the Tanite Company, of Stroudsburg, Pa. The latter company had an educational exhibit of emery in all natural conditions and manufactured forms, with examples of corundum from the Southern States and from Ceylon. The Carburundum Company, of Monongahela, Pa., exhibited the new abrasive material that it had just begun to manufacture, which is prepared by treating sand and carbon in a close furnace with a powerful electric current. Carburundum was recommended as a substitute for the diamond. Crushed steel was a polishing material for stone and glass shown by the Pittsburg Crushed Steel Company.

Group 46, comprising graphite and its products, clays and other fictile materials and their direct products, asbestos, etc., was subdivided into the following classes : 298. Crude graphite in blocks and in powder. 299. Graphite and compounds for coating iron. 300. Graphite lubricants. 301. Electrotypers' graphite. 302. For pencils, crayons, etc. 303. Graphite crucibles and melting pots. 304. Clays, kaolin, silex, and other materials for the

manufacture of porcelain, *faïence*, and of glass, bricks, terra cotta, tiles, and fire brick; various examples. 305. Refractory stones for lining furnaces, sandstone, steatite, etc., and refractory furnace materials. Mica; kidney, sheet or ground. 306. Bauxite clay for the manufacture of aluminium. 307. Asbestos, crude and manufactured. 308. Meerschaum.

Graphite from near Phoenixville and from Pikeland, Pa., was exhibited in the crude state and prepared in various forms by the American Plumbago Company, David Jones, and the Penn Plumbago Company. J. A. Holmes exhibited North Carolina graphite. E. G. Davis and H. A. Weeks showed graphite in the Massachusetts pavilion. There were also exhibits from Michigan and Montana. The Ontario exhibit contained specimens of graphite that is found in workable quantities in three counties. A block of graphite from Ceylon weighed two hundred and sixty pounds. Good plumbago came from the State of Washington. The Walker Mining Company had an exhibit of Quebec plumbago in the crude and manufactured states; some of the specimens from the quarry at Graphite City contained thirty-six per cent of carbon in the form of disseminated graphite. Lithographic stones were shown from Madoc and Marmora.

The Joseph Dixon Crucible Company, of Jersey City, had the most varied exhibit of manufactured graphite, including facings, lead pencils, stove polish, paints, electrotyping graphite, and lubricants that were almost pure carbon. Graphite retorts and crucibles were exhibited by that concern and by Robert J. Taylor & Son, of Philadelphia, and the Walker Mining Company. Some excellent crucibles came from Japan.

The Exposition revealed the abundance and variety of valuable fictile materials in the country, and the rapid progress made in their utilization. Kaolin was exhibited from New Jersey, Indiana, Massachusetts, Missouri, New York, Kentucky, North Carolina, West Virginia, Louisiana, Oregon, and Colorado. The same States and Tennessee, Michigan, Utah, and Montana exhibited a variety of potter's clays, as well as Pennsylvania, New York, Ohio, Iowa, Missouri, Illinois, and Idaho, which showed examples of earthenware and *faïence* made from their clays. New Jersey made a very full exhibit of its pottery and stoneware, and terra cotta and brick clays, glass sand, greensand marl, fire and retort clays, and foundry sand and gravel. Louisiana had an interesting exhibit of potter's clays, chalky kaolin, and the clay that is used in imitation meerschaum. The main exhibit from Illinois was its clays and shale, with their products—stoneware, Rockingham and yellow ware, terra cotta, sewer pipes and drain tiles, paving and building bricks, flue linings and fire brick. Ohio's exhibit of materials and of pressed, vitrified, and ornamental bricks, encaustic tiles, stoneware, and many special products, coming from one hundred and forty manufactories, was more varied and extensive. In artistic tiling, Pennsylvania, New York, and New England excelled. Among Pennsylvania's exhibits were chinaware made by the Brandywine Summit Company from kaolin and feldspar, the brick of the

Griffen Company, with kaolin used in the enamel, and the glazed and embossed tiles of the Star and Beaver Falls Companies. Indiana had a large exhibit of clays and clay products. The many industrial clays of New York were adequately displayed, with samples of its important brick manufacture. Its pagoda of terra cotta was eclipsed by Missouri's terra-cotta pavilion inclosing a considerable variety of material and wares. One hundred and fifty exhibitors from Kentucky brought together an extraordinary assemblage of materials. Siliceous and micaceous clays, white and yellow sand, marls, argillaceous and magnesia shales, pipe clay, fire clay, clays for pottery, tiling, and



SAMPLES OF THE MINERALS OF IDAHO.

brick of all sorts, clays gray, yellow, and purple. Minnesota, Michigan, Tennessee, Oregon, Colorado, and Idaho exhibited clay and bricks; Kansas and Kentucky, vitrified bricks; Indiana, Missouri, Arizona, Montana, and other States, fire clay; Missouri, Pennsylvania, and New York, brick shale; Colorado, Iowa, and Montana, silica; New Jersey, New York, and other States, glass sand; and Missouri, glass sandstone. Pennsylvania had a particularly fine exhibit of glass sand and sand rock. The Macbeth Company, of Pittsburgh, showed these materials with the salt cake and limestone used in win-



dow glass and lead oxide and pearlash for flint glass. Pennsylvania had also a full and instructive exhibit of the various kinds of flint and soft clays used in making fire brick and the sand and stone used for lining furnaces, cupolas, and Bessemer converters.

A native mineral soap was a product of Nevada. West Virginia showed excellent fire brick and glass sand, and the Globe Mineral Wool Company exhibited a fibrous fire-proof product of the glass manufacture, resembling asbestos. There was a sample of fuller's earth from Utah. Talc was exhibited by Utah and New York. Pennsylvania and North Carolina showed fine samples of pyrophyllite. Austria exhibited a variety of fire-clay material. Great Britain showed specimens of its products, such as the blue-ball and other pottery clays. Kaolin, fuller's earth, raw and manufactured, and fire clay and fire bricks of various kinds. France had a good exhibit of molding sand and refractory materials. Kaolin, brick, potter's clays, modeling clay, talc, etc., were exhibited by Ontario, with steatite, soapstone, and lithographic stone. Virginia, Pennsylvania, and North Carolina had exhibits of soapstone. Mica was exhibited by Pennsylvania, Colorado, Utah, Arizona, and South Dakota. New Hampshire made a profuse display, including a massive table and pillars of mica; and North Carolina gave an interesting exhibit from its valuable mines of Muscovite mica within a pavilion built of mica. Of the wonderful mica of Idaho, sheets ten by twelve feet were shown, thin as tissue paper and without a flaw. Sheets of perfectly clear mica from the Lake Girard mine were shown in the Ontario exhibit, with the amber and white micas supplied for electrical machinery.

Spaeter magnesite basic bricks from Veitsch, Styria, attracted attention because they can stand long exposure to the air without slacking like dolomite bricks. Cyrus Borgner and others exhibited American fire brick and clay retorts.

Bauxite clay was exhibited from Alabama, Georgia, and Louisiana. In the California Building was aluminium ore containing forty-three per cent of the metal.

The States exhibiting asbestos were Virginia, Pennsylvania, Montana, Nevada, Oregon, and Utah. The Salt Mountain Company, of Blue Ridge, Ga., showed asbestos that is ground and used in the manufacture of building materials and packing and has been tried in paper. Specimens were shown from a mine recently discovered in Idaho. Quebec leads the world in the production of the finest asbestos of all varieties. Large boulders of serpentine rock from that province showed interwoven veins of asbestos. A complete fireman's suit and helmet illustrated the uses of the material. The H. W. Johns Company, of New York, had looms in action weaving the cloth, with bolts of the product and a theater curtain of asbestos. Blue and white varieties of asbestos were exhibited by Cape Colony.

Group 47, that of limestone and artificial stone, had the following subdivision: 309. Lime, cement, and hydraulic cement, raw and burned, accom-

panied by specimens of the crude rock or material used ; also artificial stone, concrete, and beton. Specimens of lime mortar and mixtures, with illustrations of the processes of mixing, etc. Hydraulic and other cements. 310. Beton mixtures and results, with illustrations of the processes. 311. Artificial stone for building purposes, building blocks, cornices, etc. Artificial stone mixtures for pavements, walls, or ceilings. 312. Asphaltic mastics and mixtures, asphaltic sand, asphaltic limestone. 313. Gypsum, crude and boiled, calcareous, plasters, mastics, etc.

Pennsylvania exhibited cement and its manufacture, with many kinds of limestone for the manufacture of lime and for fluxes, as well as for building and masonry. West Virginia exhibited hydraulic limestone cement materials and products very thoroughly. Cement rocks and hydraulic limestone were shown by Kentucky. Kansas exhibited the cement made in the State. South Dakota had a turret of the Portland cement that is made at Yankton. The American Cement Company exhibited numerous kinds of cement. New York made a display of Portland cement and cement rock and of hydraulic limestone, burned and fresh. Kentucky had a large display of hydraulic, fossiliferous, argillaceous, siliceous, phosphatic, and crystalline limestones and magnesia hydraulic shale. Maine had numerous exhibits of limestone and lime. Ohio had still more, with marble dust and Portland cement. Limestone and calcite were shown by Montana, and raw and burned lime by Virginia, Idaho, Colorado, Iowa, and Louisiana. New South Wales showed hydraulic cement of high grade. German cement and artificial stone were shown in structures having the semblance of real limestone and sandstone, and also cast into all kinds of sculptural figures, one of which was a copy of the Germania statue. A Berlin exhibitor had machinery for testing Portland and hydraulic cement according to the formula prescribed by the Prussian Government. In the British section were exhibited concrete pavement, Portland and other cements, and artificial stones. Cement was liberally shown in the French court. Italian cement was shown in the form of colored and decorated tiles.

Gypsum and plaster were exhibited by Michigan, Virginia, and Iowa, and by Kansas, which made a feature of its natural cement plaster, whereof the Acme Company, of Salina, constructed a cottage. Crude gypsum was shown by New York, Ohio, Montana, California, Colorado, and New Mexico. There were exhibits also from Cape Breton and Ontario and a striking one from New Brunswick, which possesses, in the Cathrae quarry, one of the largest deposits in the world. Asphaltum and pitch stone were brought from Idaho, and bituminous limestone and sandstone from Kentucky. The Trinidad Asphalt Company exhibited asphalt pavement ; the Warren-Scharf Company, of Cincinnati, showed with its exhibit the method of making ; and the Barber Company, of New York, had a complete technical exhibit of natural asphalt and its compounds and of asphaltic cement and paving. The Warren Chemical Company showed asphalt roofing material.

Group 48 comprised salts, sulphur, fertilizers, pigments, mineral waters, and miscellaneous minerals and compounds. It was divided into the following classes: 314. Salts from beds or from brines. 315. Niter and other nitrates. 316. Sulphates, alums, and other salts. 317. Sulphur and pyrites for the manufacture of sulphuric acid. 318. Boric acid and its salts; borax. 319. Pigments, iron oxides, ochers, vermilion, etc. 320. Mineral fertilizing substances, gypsum, phosphate of lime, marls, shells, coprolites, etc., not manufactured. 321. Mineral waters, artesian-well water, natural brines, saline and alkaline efflorescences and solutions.

There was an interesting display of the rock salt and deposits of New York. Louisiana's mineral exhibit consisted chiefly of salt; the New Iberia mine had a heroic statue of Lot's wife carved out of rock salt. Ohio exhibited methods of preparing salt for the market. Kansas had a noteworthy exhibit of rock salt. Michigan made many exhibits from its mines and wells. The salines of Utah, California, and Texas were also represented in the departmental display, as well as the salt works of Nevada, Illinois, West Virginia, and Virginia. The collective exhibit embraced every kind and grade produced in the United States.

Salt from Warwick, Ontario, ran ninety-seven per cent chloride of sodium.

With the co-operation of W. R. Grace & Co., Chili, Peru, the Argentine Republic, Colombia, Ecuador, Costa Rica, Honduras, Venezuela, and Bolivia made a complete exhibit of the various kinds, qualities, and grades of nitrate. Chili's exhibit contained specimens of all the deposits in the great nitrate fields.

Sulphate of sodium, often mixed with carbonate, was a notable product of Wyoming, where are large lakes of this natural soda, which Stephen Padden & Co. calcine and sell to glass-makers, who prefer it to soda ash or English salt cake.

Wyoming exhibited alum among its minerals. Alum stone from New South Wales, yielding from sixty to eighty per cent of pure alum, was shown from a recently discovered deposit.

France exhibited samples of the pure natural carbonate of magnesium, of which only one mine exists.

Sulphur was shown from Montana and Idaho, and in blocks and powders from Italy. Greece exhibited brimstone ore and powdered sulphur. Japan exhibited refined sulphur.

The California Building contained borax from the vast deposits of Death Valley, in Inyo County.

Utah showed ozokerite, a mineral wax, useful to protect articles from the action of air, water, and acids, and elsewhere mined only in Austria.

The wealth of the United States in mineral colors was never so fully appreciated as when they were brought to the Exposition from a great number of untouched sources. Even Pennsylvania, besides the raw and burnt yel-

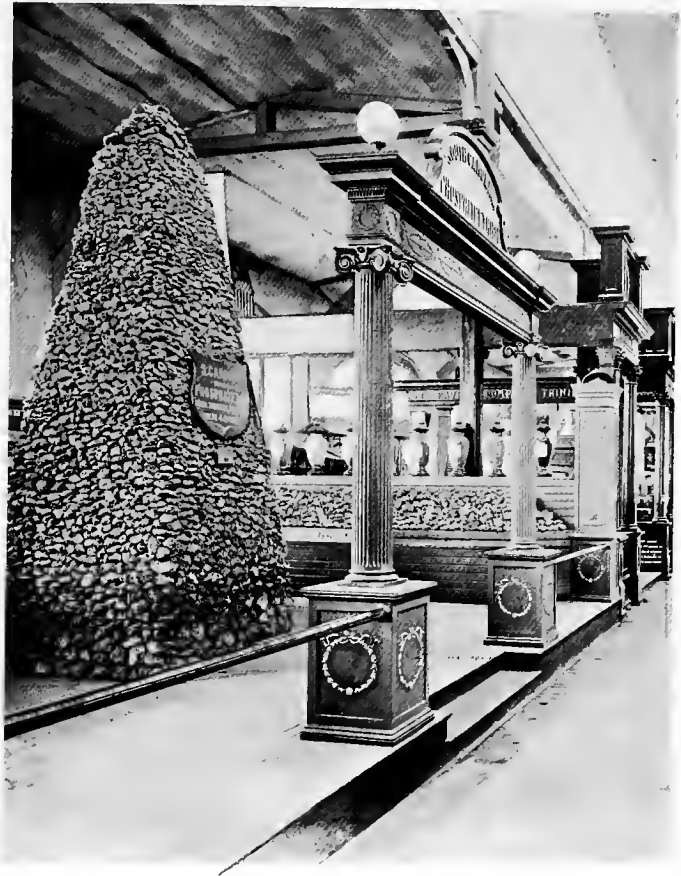
low ochers and gray and brown ochers, the Venetian red, Spanish brown, raw and burnt umber, mineral black, slate paint, metallic brown, raw and burnt sienna, and red oxides that have long been produced, exhibited valuable paint iron ores newly found in Lycoming and in Caernarvon Township, where they underlie the recently discovered vein of manganese ore. Chromium ores from Lancaster and Chester Counties were exhibited by William Glenn, of Baltimore, Md. New York exhibited its abundant mineral paints. Kentucky and Missouri showed various ochers; Wisconsin, hematite ocher and mineral paints; Kansas, the golden ocher of Saline River; Montana, yellow and red ochers.

Paint ores shading from light yellow to rich yellow, red, and purple were shown from New South Wales, together with kalsomine of delicate tints.

South Carolina and Florida made elaborate displays of their phosphates. The crude phosphates from the river beds and under the dry land of South Carolina, and Florida's exhibit of phosphates, crude and ground into fertilizers, were accompanied by collections of the remarkable fossil remains that are found whole.

Dark green and brown crystals of apatite from Ontario contained from seventy to ninety per cent of phosphate of lime. The rock of Ottawa County, Quebec, makes a fertilizer containing between eighty and ninety per cent, which is sent to England, while the low grades are shipped to the United States.

In Group 49 belonged the metallurgy of iron and steel, with the products. It was subdivided into classes as follows: 322. Ore mixtures, fluxes, and fuels. 323. Blast furnaces—stacks, stoves, blowing apparatus and arrange-



PHOSPHATES FROM SOUTH CAROLINA.

ment. 324. Pig iron, cast iron, and mixtures. 325. Cupola furnaces. 326. Direct processes—sponge and blooming plant and apparatus. 327. Puddling—furnaces and appliances. 328. Bessemer machinery—details and arrangements. 329. Basic process and apparatus. 330. Open-hearth steel—plant and apparatus. 331. Crucible steel—plant and apparatus. 333. Manganese iron and steel, chrome steel, aluminium steel, tungsten steel, other forms of steel. 334. Iron and steel. Bars, rods, sheets, wire.

The Chestnut Hill Company showed, in a sample furnace charge, its usual mixture of Pennsylvania ores and the proportions of coke, coal, and limestone. The Rockhill Company showed another mixture for pig iron, and the Logan Company the proportions of soft fossil ore, flux, and charcoal used in its cold-blast Greenwood furnace. The Lehigh Zinc and Iron Company illustrated the manufacture of spiegeleisen from Franklinite ore, which is first burned in a furnace till the zinc is extracted in the form of the best oxide, and then the residuum is used as ore for the spiegel furnace.

The Weimer Machine Works exhibited blast-furnace plans. Seth Boyden, of Newark, demonstrated his process for making sheet iron; G. A. Bicknell, the chemical process of puddling; Henry M. Howe, the effect of heat treatment on steel; George B. Tennant, the metallurgy of iron and steel; the Illinois Fluor Spar Company, fluor spar and its processes; the Abner Doble Company, of San Francisco, tests of the effect of tempering the heads of steel tools subject to blows and shocks.

Furnace slags were shown by A. D. Elbers, and mineral wool and insulation materials made from it by the Western Mineral Wool Company, and, with its curious process of manufacture, by the Chicago Fire-Proof Covering Company.

The Cambria, Bethlehem, and other furnaces exhibited pig iron. The Tyler Tube and Pipe Company showed charcoal blooms and boiler tubes. Oregon showed charcoal pig from the Oswego works and from Gold Hill and Rafferty's mines. In a departmental display of furnace products the Carbon Iron Company, Rogers, Brown & Co., Bicknell & Hall, Howe, Brown & Co., the Swartz Company, and others were represented. The Easton Testing Laboratory had an exhibit of cast iron. The United States Car Company, of Anniston, Ala., showed pig iron, with coke and flux, and also puddled balls; the Alan Wood Company, sheet iron and steel; McConway and Torley, small iron specimens; Schoenberger & Co., blast-furnace products; the W. Dewees Wood Company, steel sheets and plates and planished sheet iron in stovepipes and the like; S. J. Meeker, malleable iron and gray iron, and brass castings; Charles E. Lipe, samples of welding bronze and iron; the Trenton Iron Company, iron and steel wire. The Magnolia Anti-Friction Metal Company exhibited metal for use in machinery bearings, with specimens of bearings scarcely worn that had been in use for years.

The Crescent Steel Company showed open-hearth steel and crucible steel; the Chrome Steel Works and the Bethlehem Company, chrome steel;

the Carpenter Steel Company and others, various specimens of steel ; San-  
 anderson Brothers, tool steel ; James H. Lancaster, direct-process steel ; Ellwood  
 Ivins's Tube Works, steel tubing ; the Pottstown Company, steel blooms,  
 plate, and nails ; the Solid Steel Company, steel castings ; George B. Ten-  
 nant, Bessemer products and open-hearth steel. The Chrome Steel Works,  
 besides welded iron and steel plates for safes, showed worn-out cams,  
 dies, wheels, etc., with the histo-ry of their service ; Singer,  
 Nimick & Co. added to their exhibit of tool steel saw  
 blanks, spring steel, bicycle drop forgings, watch  
 springs, and other finished products of their cus-  
 tomers. The Ellwood tomers. The Ellwood  
 made of every metal, Ivins seamless tubes,  
 most to the width of of all sizes, down al-  
 of any desired thick- a hair, with walls  
 to the thousandth ness, were accurate  
 of an inch.

Nickel steel  
 the Bethlehem  
 had bars twenty-  
 nickel that had  
 quarter of an inch  
 bent double. There  
 seventeen - inch  
 for a battle ship,  
 hardened plate,  
 inches thick, that  
 derful behavior of  
 the impact of  
 dents, but no  
 in contrast with a  
 armor plate in  
 it that was shat-  
 directions. The  
 ny showed steel  
 projectiles made  
 Sterling process.  
 the United Iron  
 Stumm Brothers  
 ing & Co. was  
 in the massive por-

tubing surmounted by a bronze figure of a man supported by bronze  
 dragons, was a fountain formed also of tubing of different sizes, adorned  
 with bronze figures, symbolizing work in iron. At the outer boundary of  
 the space stood two tall obelisks formed of castings, and near these were  
 structures reaching to the roof that were made of rails and tubing, beside



STEEL CABLES  
 SHOWN BY GEORG HECKEL,  
 SAARBRUCKEN, GERMANY.

was exhibited by  
 Company, which  
 seven per cent  
 been nicked a  
 deep and then  
 was a section of  
 barbette armor  
 and a tested case-  
 ten and a half  
 proved the won-  
 nickel steel under  
 shot, showing  
 crack or fracture,  
 compound steel  
 the Krupp exhib-  
 ited in many  
 Sterling Compa-  
 armor - piercing  
 by the Wheeler-

The display of  
 Works of the  
 and Rudolf Bock-  
 magnificent. With-  
 tal, formed of iron

which were masses of iron and steel castings and models of apparatus of the rolling mill at Neunkirchen and of the dwellings, baths, restaurants, and hospitals provided for the employees, and of the foundry at Halberghuette. The background, simulating masonry covered with mosaic, was made of products of the slag-cement factory of Erhart Brothers. The forged steel rails and rolled iron that were artistically worked into the towering trophy were bent cold into curved shapes, to show the tenacity of the material. Many of the best exhibits of manufactured iron and steel came from Germany. The Mannesmann works of Prussia and Bohemia exhibited seamless pipes, useful for artesian and oil wells, rolled from solid blocks by a patented spiral process by which the iron was twisted into a tough, fibrous form. Other German exhibits were ornamental moldings of rolled iron and steel, anti-friction metals, fine steel wire from Nuremberg, welded tanks and pipes, and spring steel from Cassel. Among the exhibits of the Krupp establishment were soft steel castings, remarkably homogeneous in structure and having great capability of elongation; railroad ties with segments cut out to show the method of fastening by means of retaining-rings; spoke wheels of cast steel and forged iron; the stem casting, stern post, and rudder of a man-of-war, each cast in one piece; a ship's propeller with its shaft, weighing one hundred and three tons, parts of which were forged solid by hydraulic pressure from ingots over four and a half feet in diameter; another hollow shaft forged solid from ingots of crucible steel and milled on a lathe, exhibiting a breaking load of thirty tons to the square inch, elongation of twenty-six, and contraction of fifty-five per cent; a boiler head of Siemens-Martin ingot iron rolled out an inch and a half thick, with a diameter of nearly thirteen feet; and a boiler plate sixty-five feet long and weighing nearly sixteen tons.

Austria exhibited the Poldi crucible steel in a pagoda built of it and containing the various manufactured forms, some of them fractured to show uniformity of structure. A Bohemian exhibitor showed scythes made from his steel that cut paper like a razor. The quality of Bohemian iron was shown in a plate one twelfth of an inch thick and a hundred and sixty feet long by a yard wide.

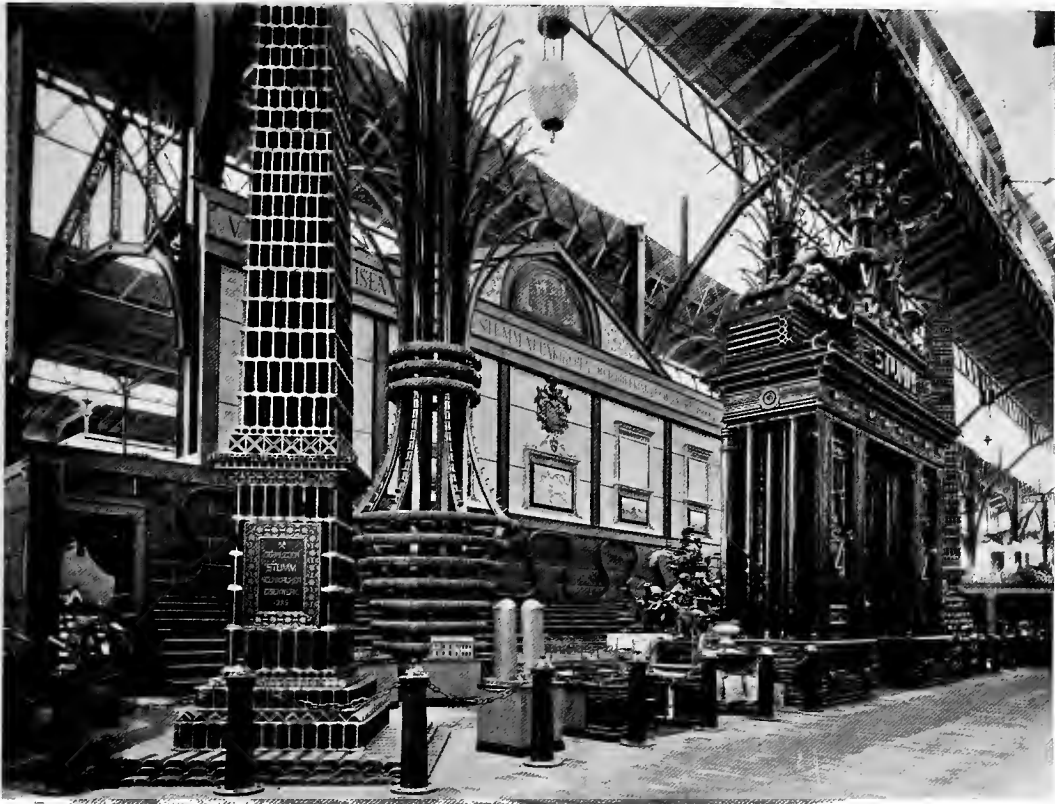
In the British section Jessop & Sons showed Sheffield steel, and the Low-moor Company bars, plates, rivets, and axles.

The Swedish exhibit consisted largely of charcoal iron, in making which most of the ore is calcined in Westman's furnace to expel the sulphur and make the ore porous. Some castings are run direct from the furnace in cupolas. English is mixed with Swedish pig. Swedish wrought iron is generally refined in hearths.

Group 50, to which aluminium and its alloys were assigned, was divided as follows: 335. Aluminium, pure and commercial; ingots, castings, bars, rods, wire, sheets, and partly manufactured. 336. Aluminium alloys. 337. Aluminium alloy wire and wire cloth. 338. Process for the extraction of aluminium; electric reduction and results.



The metal was shown in ingots and other forms by James W. Richards and by the Pittsburg Reduction Company, which also exhibited aluminium in composition with iron, gold, ferro-manganese, tin, and copper. Joseph M. Hirsch and George Wight, of Chicago, were other exhibitors of aluminium and its alloys. The Scoville Manufacturing Company and the Passaic Art Casting Company exhibited manufactured products. The Pittsburg Reduction Company illustrated with models the process of manufacturing aluminium.



EXHIBITS OF STUMM BROTHERS, AND RUDOLPH BOCKING & CO.,  
NEUNKIRCHEN, GERMANY.

The Pennsylvania Salt Manufacturing Company exhibited the manufacture of alumina from cryolite.

Group 51 comprised copper and its alloys—metallurgy. The classes under it were: 339. Native copper, and the methods of extracting, melting, and refining it. 340. Copper ores and their treatment by fire. Copper smelting. Pneumatic processes. Converter system. 341. Copper extraction in the "wet" way. 342. Copper in ingots, bars, and rolled, with specimens illustrating the various stages of production. Copper and zinc. Brass

industry and products regarded as materials of manufacture. 343. Copper and aluminium, aluminium bronze.

The exhibit of copper mining and reduction was one of the most thorough and modern in the department. In the ore exhibit none of the beautiful cupriferous minerals of the country were wanting. The Copper Queen Company exhibited all the Arizona varieties of carbonates, oxides, and native copper, together with lovely silver incrustations. The Calumet and Hecla mines of Michigan made one of the most extensive exhibits of copper ever seen, including huge masses of the richest ores, conglomerates, and amygdaloids, obelisks of native copper ranging from fifty to five hundred pounds, with wire and sheets made from the native metal, one lump of native copper weighing eighty-five hundred pounds, a collection of copper alloys, and the metallic product in all forms—ingots, bars, sheets, cakes, wire, and rag, nail, and fan copper. Rods were seen bent out of shape and even tied into knots without cracking or splintering. In a mound of wire were shown sections welded by an electrical process that enables homogeneous wire to be produced of an indefinite length. The Michigan State collection of ores contained almost every known formation of the metal. In the Pennsylvania court were copper ores from South Mountain, Cornwall, and Gettysburg.

Ores and reduction samples were shown by the Baltimore Smelting Company, the Boston and Colorado Company, of Argo, and the Chicago Copper Refining Company. George Wight showed siliconized copper; Randolph & Clowes, seamless drawn brass and copper tubing. E. J. Ball, of England, exhibited collections of ores and alloys.

Copper ores from the eastern townships of Quebec contained nearly forty per cent of sulphur, which makes them valuable in the United States for the manufacture of sulphuric acid. Cape Breton exhibited gray-copper ores, sulphurets, and carbonates. The Canadian Copper Company exhibited great lumps of the Ontario ores, in which copper occurs as chalcopyrite and nickel as pyrrhotite, both forming a breccia in a matrix of black diorite. British Columbia showed rich oxides and carbonates of copper from the Kootenay district. A stack of copper ingots encircled with burnished bands, rising from a base of copper ores, afforded an idea of the importance of New South Wales among copper-producing countries. There were piles of copper ore from South Africa. Japan showed ores of copper associated with silver and gold, cuprite in quartz gangue, pyrites, and native copper.

The Department of Mines and Mining made a thorough systematic exhibit of the metallurgy of copper. The Hunt-Douglas, the Welsh, and the Argo and Anaconda processes were illustrated by diagrams. Bisbee, Williams & Co. exhibited a model of the water-jacket blast furnace used in the Arizona mines in 1862, but not differing greatly from a small furnace of the present day; also a Douglas revolving calciminer in action. Fraser & Chalmers exhibited a full-sized copper furnace and converter, the furnace fitted

with four water jackets made of low carbon steel and with five *tuyère* holes ; also a lead and copper furnace apparatus. Copper-silver smelting and refining processes were exhibited by B. Sadtler, of Golden, Col. The Parrot Silver & Copper Company exhibited the concentration and smelting of ores as carried on at Butte, Mont. The Calumet & Hecla Company showed models of the Michigan mines and plant. The Chicago Copper Refining



NORTH END OF THE MINING BUILDING.

Company and Titus Ulke had exhibits of the electrolytic refining of copper.

The leaching works of the Commercial Mining Company, at Copper Basin, Arizona, were illustrated. The Copper Queen Company gave a demonstration of the wet method.

Group 52, embracing the metallurgy of tin, tin plate, etc., was divided into three classes: 344. Tin ores and their treatment. 345. Block tin and its extraction from tin ore. 346. Tin plate and methods of cleaning and coating iron and steel plates.

South Dakota had a very interesting exhibit of tin ore from Harney's Peak. From California was exhibited the ore of the Temescal mine.

Titus Ulke, of Washington, D. C., had a collection of tin ores and associated minerals. New South Wales had a pyramid of white tin ingots. Besides the stream tin, which is the fourth largest mineral product of the country, specimens were shown from the tin-bearing lodes of

the Barrier Range and of the ores and alluvial deposits of the New England district.

The metallurgy of tin was elucidated in the British collection. The American Tin Plate Association, with samples of tin plate, made a full exhibition of ingredients and different stages of manufacture of American tin plate and block sheet iron.

Group 53 covered the metallurgy of zinc, nickel, and cobalt. It was divided into the following classes: 347. Production of spelter. 348. Sheet and bar zinc. 349. Production of zinc oxide. 350. Nickel in ingots, bars, rods, sheets, and wire. 351. Nickel-covered steel and iron by rolling. 352. Nickel "plating." 353. Nickel salts. 354. Special nickel alloys, as German silver, etc. 355. Nickel steel.

Zinc was a prominent feature in the metallurgical exhibit of Missouri, which furnishes more than half the product of the country. All the operations by which the finished metal is obtained from the ore were exhibited by the St. Louis-Aurora Company. The New Jersey and Pennsylvania Companies, the Bertha Company, of Virginia, and J. P. Blake, of Wisconsin, exhibited ores, oxides, and silicates, concentration samples, and finished products. In the exhibit of the American Zinc-Lead Company, of Canyon City, Col., was seen the process of F. L. Bartlett for treating complex zinc ores. The zinc, lead, and sulphur are to a large extent driven off as fumes, which are recovered in woolen filter bags, leaving argentiferous copper matte. From the dark fumes a white paint is obtained, consisting of zinc oxide and lead sulphate.

Nickel was the central feature of the Ontario exhibit. Its adaptability to solid castings was shown by nickel anodes and other objects exhibited by the Canadian Copper Company. The nickel of this company, produced by melting the oxide in the refinery near Cleveland, Ohio, was remarkably free from carbon and other impurities. A solid casting, weighing forty-five hundred pounds, formed the capstone of the exhibit. The American Nickel Works, of Camden, N. J., and the Emmons Metal Company, of New York, exhibited extraction samples from nickel ores, and the former had a complete series of the salts and alloys of nickel.

The New South Wales mineral exhibit contained cobalt ores in the form of sesquioxide in manganese and arsenide with mispickel. The former has not yet been successfully worked.

Group 54 comprised the metallurgy of antimony and other metals not specifically classed, with the following subdivision: 356. Crude and star antimony. 357. Antimony compounds and principal alloys. 358. Arsenic, white arsenic, orpiment, and realgar. 359. Bismuth and alloys. Quick-silver and amalgams.

The Mathison Smelting Company made a remarkably fine display of antimony ores in the California Building, with regulus cast into bars and showing the fern-leaf crystallization characteristic of pure antimony. Idaho

showed specimens from its antimony mines. The process of reduction was shown by the United States Antimony Company, of Philadelphia. The Union Electric Company, of New York, exhibited lubricating metal. Antimony was shown from Arizona and Nevada. Utah showed antimony from more than forty mines.

New South Wales exhibited antimony ores, crude oxide, and sulphide, found associated with gold in the Hillgrove district. A massive pyramid was formed of square cakes of star antimony. The Ontario Silver and Antimony Company exhibited Canadian antimony, and in the collection from Port Arthur was antimony found in Woodside Island and McGregor.



SOME STATE PAVILIONS IN THE MINING BUILDING.

Arsenic, crude and refined, from Deloro Mine, Marmora, was in the Ontario Government collection. Ray & Little, of Oakland, Ore., exhibited arsenic, realgar, and orpiment.

Bismuth was exhibited from two mines in Utah, and from Wickes, Nev.

In the California Building were cinnabar and rich quicksilver ores from the New Almaden and other mines, one a new mine, discovered under the

streets of San Francisco. Arizona exhibited cinnabar. Utah exhibited quicksilver from the Mercury mine in the Lewiston districts, and from eight mines where it is found with antimony.

Sand was shown from the north coast of New South Wales containing platinum associated with gold.

Placet & Bonnet, of Washington, exhibited electrolytic chromium, with chrome alloys and articles. All the alloys of gold and silver were shown by Tiffany & Co., who exhibited the method of saving gold in the work of goldsmiths.

Group 55, confined to the extraction of silver and gold by milling, had four classes: 360. Gold mills and accessories. 361. Silver mills and accessories. 362. Apparatus and accessories of amalgamation; handling quicksilver. 363. Retorting, melting, stamping, shipping bullion.

In the Chilian mill for crushing gold and silver ores, exhibited by Fraser & Chalmers, the rollers, as they revolve on their axes, have also a horizontal rotary motion. There were other rollers for heavy and fine work, and large stamp mills. In some the dies and shoes were of ferro-alumina, a new material that was said to be the hardest alloy yet made.

Group 56, relating to the extraction of gold and silver by lixiviation, was divided into three classes: 364. Roasting and chloridizing furnaces. 365. Chlorination process and adjuncts. 366. Refining operations.

The Russell Company, of Park City, Utah, made the most complete demonstration of the modern method of extracting gold and silver by leaching, in which bluestone is used in the hyposulphite solution and soda ash for the precipitation of lead.

The McArthur-Forrest process of treating refractory gold and silver ores by cyanide solution was exhibited by the Gold and Silver Extraction Company, of Denver.

Group 57 contained exhibits having to do with the extraction of gold, silver, and lead by fire, of which there were three classes: 367. Furnace plant and appliances. 368. Lead bullion, molds, and bars. 369. Refining operations.

Fraser & Chalmers exhibited a full-sized smelting furnace, having six connected jackets of different patterns, a water-cooled slag spout, and the Davies escape attached to the *tuyères*. The same firm showed a Bridgman sampler, one of the kind that take up ore at short intervals from the whole width of the running stream. The Chicago Iron Works had an important exhibit of smelting and concentrating plants. Japan exhibited models of furnaces for smelting, liquating, and cupelling.

In the German exhibit the treatment of galena concentrates in the Upper Hartz was illustrated. They are smelted raw in blast furnaces that have no water jackets; the base bullion is desilverized by the Parkes process; the zinc crust is decomposed by superheated steam, and the resulting rich lead is cupelled; and after the silver (seven hundred to a thousand ounces to the ton)

is parted the zinc and lead oxides are converted into sulphate, which is turned over to color makers, who by combining it with barium sulphide produce lithopon, a white paint of good color and body. The Lower Hartz ores, copper and lead sulphides, are first roasted and leached. The Upper Silesian ores, sulphides and carbonates rich in lead and zinc, are worked in the Tarnowitz reverberatory furnace, the rich residue is smelted, and the resulting base bullion and matte are treated as in the Upper Hartz. The health of the operatives is thoroughly protected by arrangements for drawing off all the lead fumes.

England exhibited its methods of smelting ore in Flintshire and blast furnaces and desilverizing base bullion by the Parkinson and Parkes processes, with the intermediary and end products, including litharge, red lead, orange lead, and dry white lead.

The New South Wales exhibits of gold and silver ores were disposed as they occur *in situ*, and the chief object in the display was to attract the attention of metallurgists to the immense beds of black sulphide pyritous ores containing zinc that underlie the tractable carbonates, in the hope of discovering some economical method of reducing these refractory ores.

The electrolytic treatment of base bullion was perhaps the most important of the metallurgical exhibits. The Roessler-Edelmann method, as practiced in the Hoboken works in Belgium, of using an alloy of five per cent aluminium, instead of pure zinc, and electrolyzing the liquated crust, reduces the Parkes process to a single operation and recovers a higher percentage of zinc from the rich crust, and, moreover, eliminates the lead in a pure form.

The Picher Company, of Joplin, Mo., made a unique display of a new industry, the manufacture of strictly amorphous lead sulphate for paint. It is obtained directly from galenite as a by-product in the manufacture of pig lead by the Lewis & Bartlett bag process of volatilizing the galena and smelting the lead fumes.

In the Greek and French sections were exhibited the processes of working over, in modern blast furnaces and concentration works, the dumps of the ancient mines at Laurium, the litharge, zinc, and manganiferous iron ores neglected by the ancients, and the slimes rich in silver that the old Greeks washed unwittingly from the carbonate ores. The lead slags that are recovered from the sea contain laurionite, a new mineral.

Wisconsin exhibited bars of soft lead; Kansas, a column of bars from Galena; Missouri, the products of the St. Joseph and Picher companies; Utah, base bullion and refined lead from the Mingo and Germania works; Colorado, metallurgical specimens from the Globe, Omaha & Grant, Pueblo, Colorado, Harrison, and American smelting and refining works.

Spain sent only a few bars of lead and some bags of shot.

Group 58 contained things connected with quarrying and working stone, classified as follows: 370. Quarrying, channeling, and cutting engines. 371. Derricks and fittings. 372. Slate cutting, sawing, and planing machines.



373. Machines and apparatus for cutting, turning, and polishing marble, granite, and other stone.

A rapid single-gang channeling machine was shown by the Sullivan Company and a circular channeler by M. J. O'Connor. The Ingersoll-Sergeant Company, besides rock drills, had track and bar channelers. The Wardwell quarrying and channeling machine was exhibited by the Steam Stone Cutter Company, of Rutland. Slate machines and tools were shown with the black-board exhibit of Auld & Conger. The Pittsburg Crushed Steel Company exhibited a saw gang and a rubbing bed; A. F. Spaulding, a finishing machine for marble and granite; H. S. McKay, an electric carving machine.

Group 59 had to do with placer, hydraulic, and drift mining, and was classified as follows: 374. Apparatus and machines for washing gravel;

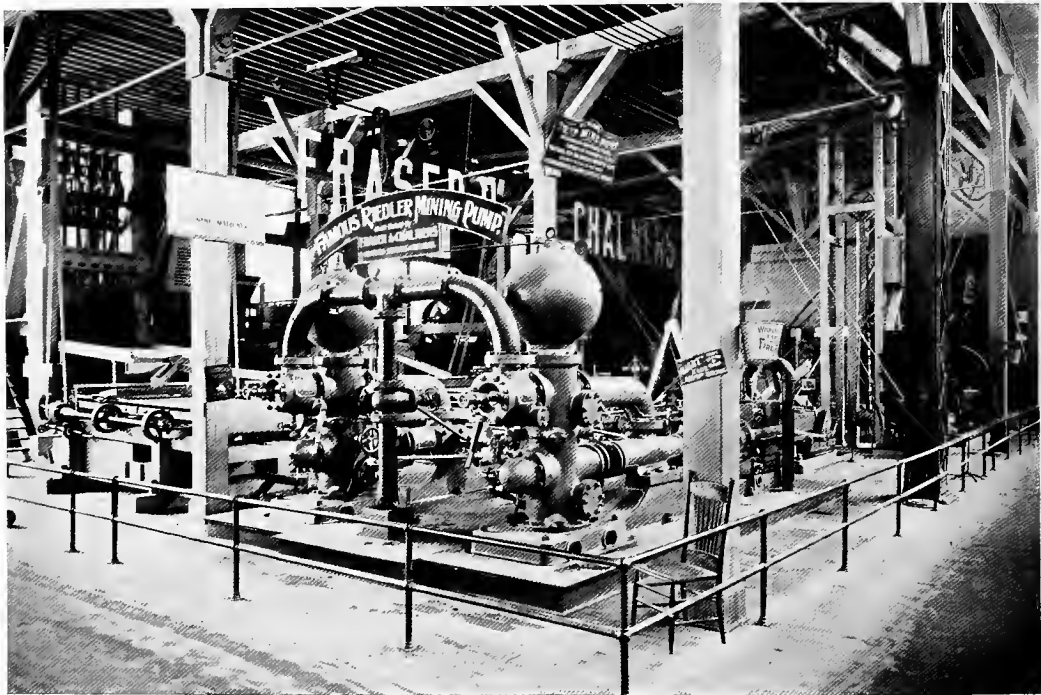


EXHIBIT OF FRASER & CHALMERS, CHICAGO.

sluices, cradles, toms, rockers, riffles, etc. 375. Construction of ditches, flumes, penstocks, etc. 376. Pipes for conveying water. 377. "Giants," nozzles, and appurtenances.

The Bucyrus Steam Shovel and Dredge Company showed placer excavators and an amalgamator for gold to be used with them. An entertaining part of Oregon's exhibit was a miniature placer mine, where gold and nuggets were washed out of gravels received from the placer mines of the State. In the California Building was a facsimile of a bar weighing six thousand one hundred and twenty-seven ounces, a single month's run of the North Bloomfield hydraulic mine in Nevada County.

Group 60 contained tools and appliances of underground mining, timbering, and supporting, divided as follows: 378. Timber cutting and framing machines. 379. Methods of timbering shown by examples. 380. Underground chutes, gates, and appliances for delivering ores. Methods and appliances for ventilating, lighting, and signaling.

Plans and models were shown of many timbered mines. The crib system of timbering, invented by Philip Deidesheimer and first employed on the Comstock lode, was shown by models. Safety lamps were exhibited by the Colliery Engineer Company, of Scranton, and by T. B. Bickerton & Co., who had also a water gauge and an anemometer for mines. The General Electric Company, of New York, exhibited apparatus for illuminating and for ventilating by electricity, with other electrical mining appliances.

Group 61 contained boring and drilling tools and machinery and apparatus for breaking out ore and coal. The classes were: 381. Picks, gads, and hammers. 382. Hand drills, hammers, and blasting implements. 383. Drilling by steam or compressed air—"power drills." 384. Diamond drills for prospecting or for sinking and driving. 385. Well and shaft boring (various systems). 386. Boring for water, oil, or gas—tools and methods. 387. Machines, apparatus, and implements for cutting coal.

James H. Lancaster showed grapples, or ore diggers. Drills and boring machinery were displayed in all their variety. The Sterling-Moreau percussion hand drill is a self-cleaning tool. The Rand drills of all sizes had improvements in the valve movements, cylinder heads, and packing rings. The duplex air compressor, which has a mechanical arrangement for working the inlet and outlet valves, was in operation in the exhibition buildings. The Bullock Company also had hand and power diamond drills of all kinds, with well-boring rigs and diamond-pointed core drills of eight sizes, the largest of which is warranted to bore a hole a mile deep. The Ingersoll-Sergeant Company, with drills and tripods, exhibited straight-line, duplex, and compound air compressors. The Sullivan Company had steam rock drills and diamond machines for testing mineral lands. Electric mining drills were shown by H. S. McKay and the General Electric Company. W. A. McCune & Co. showed hand and power drills; the Beal Company, core drills and tools; John Suydam, a flexible metal joint; and the American Well Works, drilling tools and the Chapman machine, with which a large well was rapidly sunk over three thousand feet on Galveston Island. The diamond boring and prospecting machinery of this last company, the well-boring machines of George Atkinson, F. C. Austin Company, and Morgan, Kelley & Taneyhill, the Star drilling machine, the Keystone driller for water, oil, gas, and minerals, the machine of the Oil Well Supply Company, and A. W. Morgan's well-making machinery were rigged up outside of the building. There also Dr. G. A. Miller displayed his gravity torpedo excavator. The Sullivan Company, among a dozen other machines in motion, exhibited a diamond boring machine with hydraulic feed independent of the driving engines. Coal-cutting

machines were exhibited by the General Electric Company, the Ingersoll-Sergeant Company, and the Peoria Coal Drill Works. The Jeffrey Company, of Columbus, which exhibited electric pumps, locomotives, ventilating and hoisting machinery, and all the equipments of a mine, showed coal cutters in operation upon an artificial bank of coal. The Stanley heading machine for driving entries into coal mines, and the Mitchell long-wall machine, with cutting bar at rightangles to the face of the coal, were exhibited by the Sullivan Company, of Chicago.



OIL-WELL APPLIANCES FROM PITTSBURG, PA.

The Rio Tinto rock drill, invented by James McCulloch and exhibited in the British section, has a simple and easy twist gear and is speedy and handy for tunneling and driving headings. In the German section was shown the Koebrich apparatus, with which a boring at Paruschowitz had already been carried down 6,573 feet, and was there momentarily arrested to ascertain the temperature of the earth before being continued experimentally as far as the appliances would permit.

Group 62 contained pumps, engines, and apparatus used in mining for pumping, draining, and hoisting.

One of the exhibits of Fraser & Chalmers was the Riedler pumping engine, now used in deep mines all the world over, a pump of the differential type, with valves having a liberal lift and worked by a positive gear that opens them wide at the beginning and controls them at the end of the piston stroke, enabling the pump to be run at high speed. The Dean Steam Pumping Company had sixteen machines in operation in the different departments; their internal construction was shown in the Patent Office exhibit. The John H. McGowan Company, of Cincinnati, exhibited improved single and duplex steam pumping engines operated by a new air compressor. The American Well Works had mining pumps at work outside. Other pumps were shown

by the Cookson Company, H. R. Worthington, the Eclipse Wind Engine Company, and the Goulds Company ; electric pumps by the General Electric Company and the Jeffrey Company. Webster, Camp & Lane exhibited a hoisting plant of the band friction pattern. Various hoisting machines were shown by the Chicago Iron Works, Crane Elevator Company, James H. Lancaster, M. C. Bullock Company, Fraser & Chalmers, and Samuel S. Brown.

Group 63 dealt with the moving, storing, and delivering of ores, coals, etc., and contained four classes : 388. Tramways, turntables, automatic hoisting and conveying on the surface, contrivances for loading and unloading ores and coals. 389. Cars of all kinds. 390. Automatic dumping. 391. Ore bins and appliances.

Webster, Camp & Lane and the Ottumwa Iron Works exhibited main and tail rope haulage apparatus. The Trenton Iron Company had a wire-rope tramway in service. The Jeffrey Company displayed chain belting and a variety of conveying and elevating machinery ; and Borden & Selleck, coal conveyers and elevators. W. C. Andrews exhibited the hydraulic transportation of coal. The Corey Car Company and the Truax Company, of Denver, had ore and dump cars ; the General Electric Company, electric locomotives ; the Barker Company, of Springfield, Ill., a model of a rotary tippie for dump cars ; J. Herbertson's Sons, a draw bar and coupling and a safety chain ; the Nelsonville Foundry, a haulage engine ; and the Watt Company and George Peacock, car wheels and axles. The Pittsburg Coal Exchange exhibited a miniature steamboat for coal barges.

Group 64 contained apparatus for crushing and pulverizing, as follows : 392. Rock breakers. 393. Rolls. 394. Large stamps. 395. Stamps and mortars. 396. Revolving grinding mills. 397. Coal breakers.

The Gates Iron Works, of Chicago, set up one of the rock crushers built for the hardest hematite ore or trap rock, with the Gates system of leverages and safety break pin. The McCully Company, of Philadelphia, exhibited a rock and ore crusher in which the shaft and crusher head are suspended from the top of the machine. An ore breaker with feeding apparatus was shown by George E. Woodbury, of San Francisco. James H. Lancaster, besides rock breakers, showed a combined crusher with rolls and screen and his patent ore granulators. The Austin Company, of Chicago, had a crusher ; the American Company, of Cleveland, pulverizers ; the American Road Machine Company, a stone crusher ; Raymond Brothers, of Chicago, ball pulverizers. The Bradley Fertilizer Company exhibited the Griffin roller mill for both the wet and the dry process, by which the material is granulated instead of being ground smooth ; the roll is not driven or carried around, but revolves on its own axis, which gives it freedom to move outward against the die by means of a universal joint. In the English section W. H. Coward showed his Niagara dry pulverizer, which can reduce any material to the fineness of flour.

Group 65 was made up of sizing appliances, as follows: 398. Grizzlies and bar screens and sieves. 399. Perforated plates. 400. Wire-mesh sieves and trammels. 401. Sizing by currents of water or air. Overflows. 402. Sizing by belts.

Grizzlies and perforated plates were exhibited by Robert Aitchison; coal screens by H. B. Sackett and Borden & Selleck. P. F. Poorbaugh, of Elkhart, Ind., exhibited his Common-Sense Separator, worked by hand or steam power and used to grade various materials, from crushed ore to concrete sand. The Walburn-Swenson Company, of Chicago, showed

a model for separating and concentrating gold-bearing pyrites. The Seymour concentrator employs centrifugal force and the force of gravitation together. Raymond Brothers showed pneumatic separators. The Card dry separator of the Gates Iron Works has adjustable bellows actuated by a sharp blow.

Group 66 was composed of assaying apparatus and fixtures of the following classes: 403. Plans of assay offices. 404. Furnaces, muffles, and appliances. 405. Scorification and cupelling. 406. Volumetric methods and apparatus. 407. Fluxes and their receptacles. 408. Assay balances, etc. 409. Assay tables, assay schemes and methods.

Richards & Co., of Chicago, exhibited all



IRONWARE EXHIBITED BY THE FARNLEY IRON CO.,  
LEEDS, ENGLAND.

the appointments of an assaying establishment; William Hoskins showed furnaces and blast lamps; and the Pittsburg Testing Laboratory had an exhibit of specimens that had been tested physically and chemically. Practical

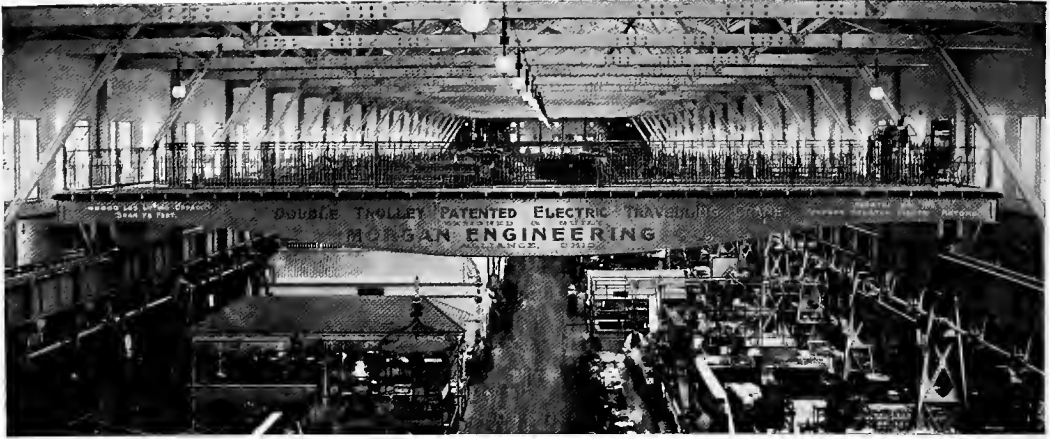
demonstrations of gravimetric and volumetric chemical analysis, fire assaying, and determinative blowpipe mineralogy were given in the departmental laboratory and model assay office.

Group 67 was devoted to the history and literature of mining and metallurgy, divided as follows: 410. Maps, relief models, and pictures to illustrate the geology and distribution of minerals and mines and the methods of working mines. 411. History and statistics of mines and mining districts. Charts, diagrams, and tabular representations. Statistics of mineral productions. 412. Mine engineering—surface and underground surveying and plotting, projection of underground work, location of shafts, tunnels, etc.; surveys for aqueducts and for drainage. Boring and drilling rocks, shafts and tunnels, etc.; surveys for aqueducts and for ascertaining the nature and extent of mineral deposits. Construction—sinking and lining shafts by various methods, driving and timbering tunnels, and the general operations of opening, stopping, and breaking down ore; timbering, lagging, and masonry. Hoisting and delivering at the surface rock, ore, or miners; draining by engines, buckets, or by adits. Ventilating and lighting.

In this group, amidst a profusion of reports, descriptions, maps, pictures, and literature, were exhibited numerous interesting models, as of George Atkinson's well-boring machinery, James Douglas's calcining furnace, Bisbee, Williams & Co.'s furnace, the Gates Company's rock breakers and Cornish rolls, James H. Lancaster's iron-ore deoxidizer, Charles T. Thompson's magnetic iron-ore separator, and the Walburn-Swenson Company's plant for concentrating low-grade ore. The workings of the Copper Queen mine in Arizona were shown in a wooden model. H. C. Frick showed a model of the Ramsey design adopted in the Standard shaft. There was a model of the New Almaden quicksilver mine, exhibited by J. B. Randall. In Ohio's exhibit were models of the machinery used in pumping oil at Lima, and of the plants of salt works in the State. The German exhibit was rich in illustrative models of mines and apparatus. There was the dressing plant of the Royal coal mines at Saarbruecken, with the drift in which explosives are tested in the presence of fire damp. The method of wetting the surfaces to prevent the spread of fire damp was illustrated.

Group 68 contained early and notable implements and apparatus.

In the Pennsylvania section were implements of the early iron age, and a reproduction of the furnace used a thousand years ago. In the Michigan exhibit were prehistoric tools, such as knives, adzes, and hammers, with spear and arrow heads fashioned of native copper and found in the copper mines. The metal is tempered and hardened by a process of which our metallurgists are ignorant. By a fortunate coincidence, a modern method of tempering copper had been invented and was brought to light by the Exposition. Japan made a delectable exhibit of models of its mines as they were worked before the introduction of modern appliances and as they are now.



Traveling crane in the Machinery Building, used as an observation car.

## CHAPTER VI.

### THE MACHINERY EXHIBIT.

The evolution of mechanics as shown by the exhibits—Group embracing motors and apparatus for generation and transmission of power, including pneumatic and hydraulic apparatus—Group containing fire engines and other appliances for extinguishing fire.—Group including machine tools and machines for working metal—Group embracing machinery for the manufacture of textile fabrics and clothing—Group comprising all machines for working wood—Group of machines and apparatus for typesetting, printing, stamping, and embossing, and for making books and paper working—Group embracing lithography, zincography, and color printing—Group taking in photo-mechanical and other processes of illustrating, etc.—Group containing miscellaneous hand tools, machines, and apparatus used in various arts—Group composed of machinery used in the preparation of foods, etc.



A. M. ROTHSCHILD,  
Member of the Directory.

THE exhibits in Machinery Hall, though an incomplete exposition of mechanical production and invention in the United States, were yet an impressive evidence of the evolution of mechanics here. Foreign countries made typical exhibits of branches of mechanical engineering in which their people are most proficient, and in these, too, especially in the German and British exhibits, the elaborate specialization of the newer machinery was apparent. In the Centennial Exposition in Philadelphia Europeans were astonished to see the extent of mechanical production in this country and the variety of tasks to which American genius had succeeded in yoking natural forces. The development brought to view by the Columbian Exposition was surprising even

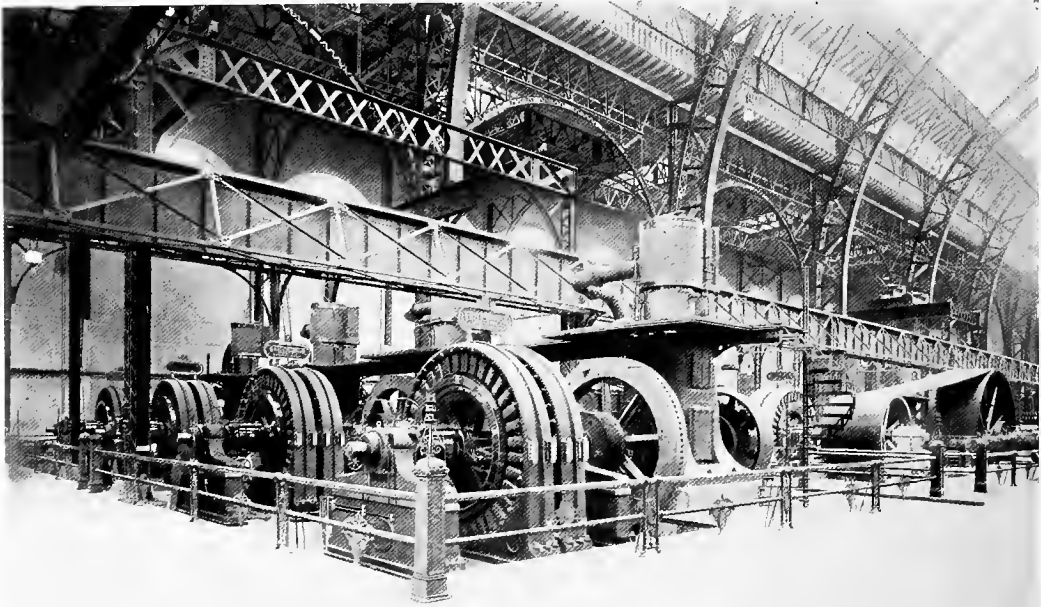


to resident Americans. Whereas in 1876 only two firms manufactured the great Corliss engines, in 1893 they were made by nearly sixty concerns. In 1876 pumping machinery was manufactured by only three or four Eastern firms, but in 1893 there were hundreds of manufacturers scattered through the States and Territories, and space could be given to only forty-three of the seventy-four applicants. The multiplication and differentiation of tools since 1876 made it impossible for a large manufacturer to display a full line. The single tool that twenty years ago was used for a dozen purposes had developed into a dozen distinct tools. Several manufacturers withdrew because the space allotted to them was too small.

The first group of exhibits in the machinery department, the sixty-ninth in the general list, took in motors and apparatus for generation and transmission of power, including pneumatic and hydraulic apparatus. It was divided into classes as follow : 413. Boilers and all steam or gas generating apparatus for motive purposes. Feed-water heaters, furnaces, and patent grate bars, patent stokers and steam-pipe covering. 414. Water wheels, water engines, hydraulic rams. 415. Steam, air, and gas engines. Piston packing and parts of engine. 416. Apparatus for the transmission of power—shafting, hangers, belting, pulleys, couplings, clutches, cables, gearing. Transmission of power by compressed air, etc. 417. Pumps and apparatus for lifting and moving liquids, water filters. 418. Pumps and apparatus for moving and compressing air or gas. 419. Pumps and blowing engines, blowers and ventilating apparatus. 420. Hydraulic presses, freight elevators, and lifts. Traveling cranes and derricks. 421. Beer engines, soda-water machines, bottling apparatus, corking machines. 422. Iron and other metallic pipes, tubes and fittings, stop valves, gauges, cocks, etc. 423. Diving apparatus and machinery. 424. Ice machines. Refrigerating apparatus.

The electric power plant of over 29,000 horse power for lighting and motive purposes throughout the Exposition afforded an excellent opportunity for the exhibition of powerful steam motors, of which there were forty-three in the power house, operating one hundred and twenty-seven dynamos. The fifty-two boilers, developing 26,000 horse power, were furnished by American makers. The feed pumps, about twenty, and the large circulating pumps were exhibits also. Oil used as fuel was brought in pipes of the Standard Company from Whiting, Ind., a distance of forty miles. The steam engines of the electric power plant were furnished free of cost by their manufacturers as working exhibits. It having been found impossible to obtain the boilers on the same terms, contracts were made with eight firms to furnish boilers guaranteed to evaporate at the cost of five dollars and thirty-three cents per horse power of thirty pounds of water per hour. The fifty-two boilers—four Abendroth & Root, four Gill, twelve Heine, four National, nine Campbell & Zell, ten Babcock & Wilcox, six Stirling, and three Climax—were guaranteed to evaporate 647,200 pounds of water per hour, equal to 20,000 commercial boiler horse power. As the great majority of the engines were com-

pound- and triple-expansion condensing, using only from eleven to eighteen pounds of steam per horse power per hour, the boilers were actually available for fifty per cent above their commercial rating. The actual total capacity of the engines in the electric power plant, as taken from the economical rating given by the makers, not the maximum rating, was something over 29,000 horse power. The steam power used by the pumping station and by exhibitors in the Machinery and Mines buildings brought the total energy of the plant up to at least 30,000 horse power. To drive the whole plant of the



WESTINGHOUSE DYNAMOS.

Centennial Exhibition a monster Corliss engine was built, from which power was transmitted by means of shafting under the floor. In the World's Columbian Exposition sixteen times the power of the Corliss engine was needed, and it was distributed by the instrumentality of electric motors, not only to the Palace of Mechanic Arts, but to the Electricity, Transportation, Mining, and other buildings, thus marking a great advance in the transmission of power. The Exposition power plant illustrated further the progress made since the Philadelphia Exhibition in the expansion of steam. The Allis quadruple-expansion engine had only a fraction of the weight of the Corliss triple-expansion engine, yet was nearly half as powerful again. The high-speed engine, a development that the generation of electricity called out, was exhibited very fully in all its types. A still later development suggested by the requirements of electric motors—that of direct-connected engines, doing away with belting—was exploited more fully than was expected, six of the

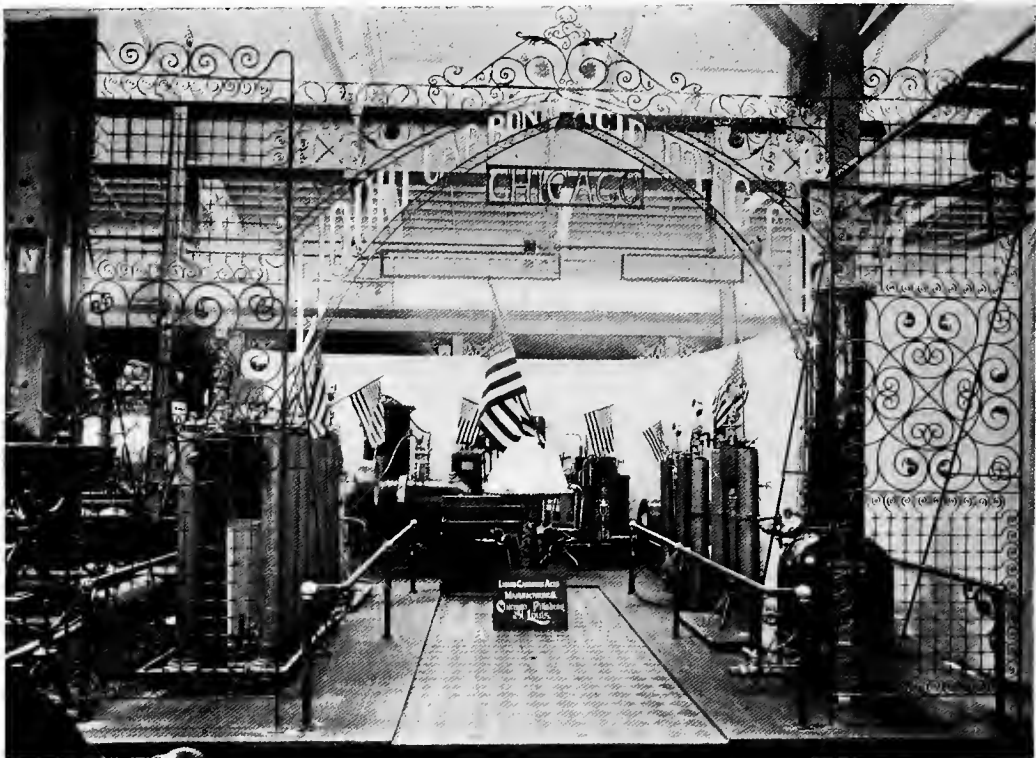
great Westinghouse alternating-current dynamos being direct-connected to Westinghouse thousand-horse-power compound engines and two Edison multipolar generators, of five hundred horse power each, thus connected to a vertical triple-expansion engine. There were about 6,500 feet of line shafting in Machinery Hall, divided into eighteen sections. Two of these sections were driven by electric motors, while the rest were driven by various engines, including two tandem-compound engines of about three hundred horse power each.

The big Allis engine of 2,000 horse power was a Reynolds horizontal quadruple-expansion double-crank engine. The cylinders were twenty-six, forty, sixty, and seventy inches in diameter, with seventy-two length of stroke. The fly wheel was thirty feet in diameter, with seventy-five inches face, built in twelve sections, and weighing eighty tons; the shaft was eighteen inches in the bearings and twenty in the wheel. The power house contained numerous engines that almost matched the Corliss of the Centennial. McIntosh, Seymour & Co. had a 1,200 horse power double compound that was equipped with a very sensitive governor; the main valves, of piston type, had cut-off valves actuated by the governor, all the valve gear being driven from detachable drag-link shafts. The Dake Company exhibited engines with a double reciprocating square piston taking steam at four points and rotating the shaft by means of a crank. The Ball & Wood Company, of New York, and the Ball Company, of Erie, had improved single-cylinder, tandem and cross-compound, and triple-expansion types for electric railways, lights, and welding. Fraser & Chalmers had a special improved Corliss for mining purposes; the Davis-Cresswell Company, of Denver, an upright engine; the Golden State and Miners' Iron Works, of San Francisco, a tandem-compound, slide-valve Corliss engine with I. F. Thompson's differential knuckle-joint ball governor; the Harrisburg Foundry and Machine Works, simple and compound engines with side and center crank. Andrews & Johnson's disk fans and blowers were run by the Johnson double-piston high-speed engine having pistons and valve gear inclosed so that the bearings run in oil and water. James Boyd, of St. Paul, had an automatic engine for elevators and a reversible hoisting engine for builders. Similar ones were shown by the American Hoist and Derrick Company, and the Crane Elevator Company had steam engines with elevators and hydraulic machines. The Oil Well Supply Company and the Erie City Iron Works exhibited engines with boilers. Other engines were exhibited by the Bass Works, of Fort Wayne; Bates Company, of Joliet; A. B. Farquhar, of York, Pa.; A. L. Ide & Son, of Springfield, Ill.; Thomas Cane & Co., of Chicago; Lake Erie Engineering Works, of Buffalo; Lane & Bodley, of Cincinnati; J. H. McEwen Company, of Ridgeway, Pa.; and W. B. Payne & Sons, of Elmira, N. Y. The New York Safety Steam Power Company and the Phoenix Iron Works exhibited automatic cut-off engines for electric light and power plants.

The four Westinghouse 1,000-horse-power engines, condensers, and

direct-coupled dynamos formed a remarkably compact block, occupying a space only ninety feet long and forty-seven broad. These engines were of the vertical, steeple compound type, the low-pressure cylinder being above the high-pressure. The cylinders were twenty-one and a half and twenty-seven inches, with twenty-two inches stroke, and the shaft made two hundred revolutions a minute. The Westinghouse Company had nine more engines, the whole having an aggregate capacity of 7,400 horse power.

The most comprehensive single exhibit was that of the Buckeye Company, consisting of a 1,000 horse-power four-cylinder, triple-expansion engine

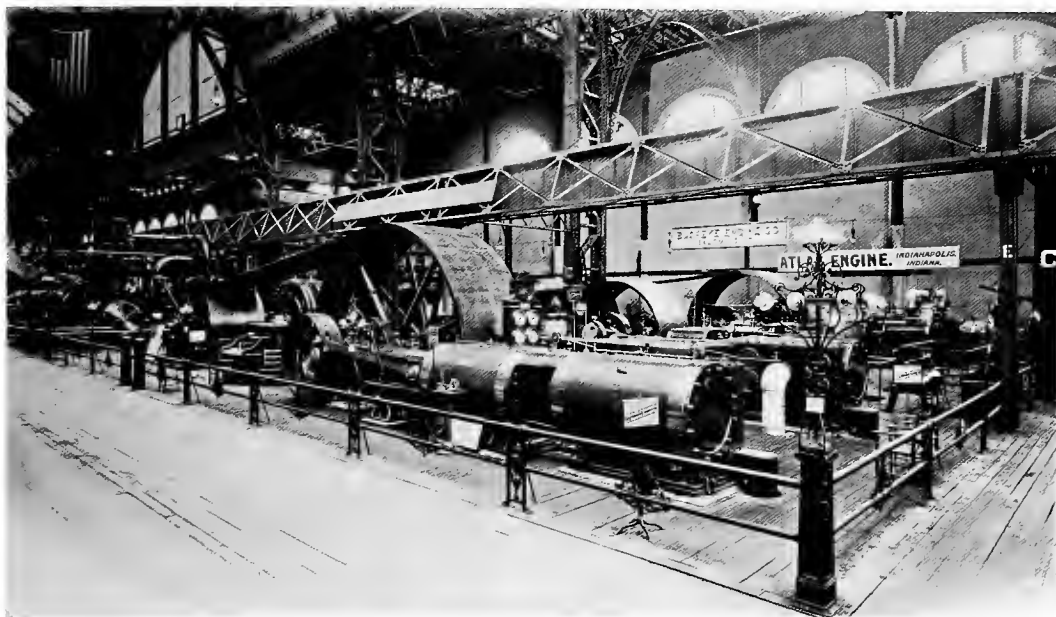


PAVILION OF THE LIQUID CARBONIC ACID MANUFACTURING CO., CHICAGO.

belted to one of the great Westinghouse dynamos and a block of five engines of as many different types and sizes driving the Fort Wayne arc dynamos. The Phoenix Company furnished a good exhibit, consisting of a simple, a tandem-compound, and a four-cylinder, triple-expansion engine employed in driving four Eddy generators of 250 horse power each. The duplex tandem-compound engines of the Watertown Company, designed for high speed and direct connection, have the two cylinders on each side closely connected to reduce the loss by condensation, while the use of a four-ported valve permits very rapid entrance and exit of steam. A cut-off valve is applied to both the high- and the low-pressure cylinders, the tandem arrangement of which allows of cushioning at the end of each stroke, enabling

the engine to attain a high speed under a heavy load without pounding. One of the curiosities of the exhibition was an engine weighing only half an ounce that Cyrus Chambers, of Overbeck, Pa., made when a boy.

In Machinery Hall were two tandem compound engines from the Harrisburg Foundry and Machine Shops and engines of B. W. Payne & Co., the Golden State Miners' and Iron Works, the Bates Machine Company, and the Erie City Iron Works. The Sioux City Company had an engine driving long shafts from a double-crowned fly-wheel, the belts extending in opposite directions. This was the largest single-cylinder engine in the building. The E. P. Allis Company had driving a shaft a small vertical box engine of an entirely new pattern. There were in all in the Machinery



THE BUCKEYE ENGINE AND WESTINGHOUSE DYNAMO.

Building fifteen engines, representing about 3,000 horse power, which drove the six lines of shafting for the use of exhibitors. For the German section Schichau & Co. constructed a 1,000-horse-power engine direct connected to an arc dynamo that furnished additional light. It was of the same design as their triple-expansion marine engine of 150 horse power, which drove three parallel shafts with a rope drive on the endless-rope system. For the British section the Galloways, of Manchester, constructed a horizontal compound engine in which the high-pressure cylinder was fitted with a novel gridiron expansion valve, through which steam was admitted by the action of the governor of parabolic shape with cylindrical fly balls. This engine ran a drive of eight parallel ropes. Two single-acting central-valve engines driving the shafts were remarkably smooth running for their speed, exceeding

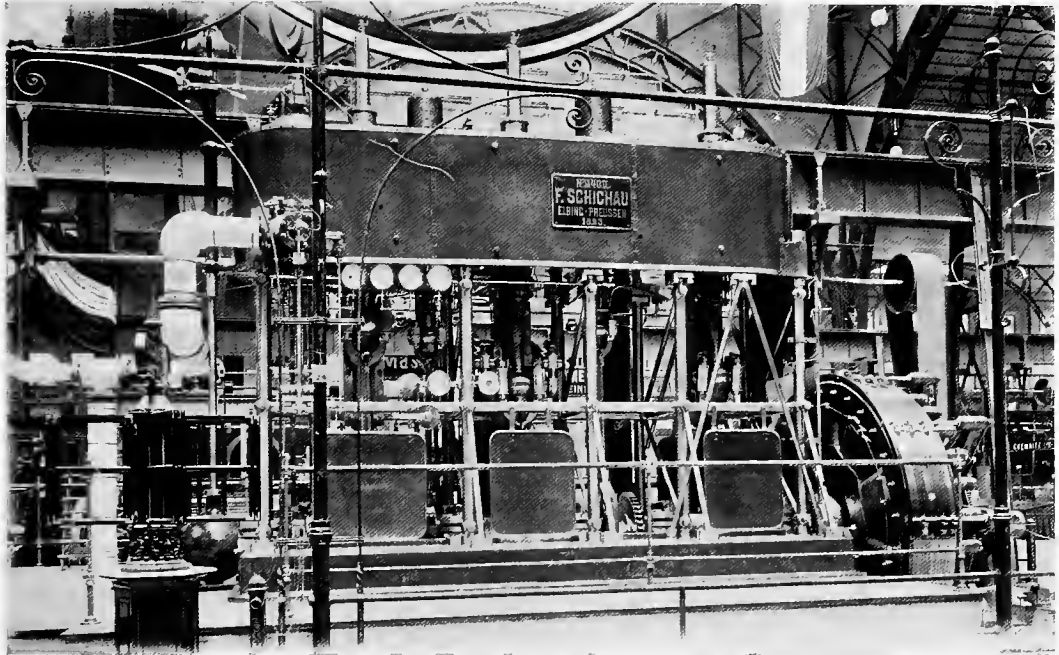
three hundred and fifty revolutions a minute. A dual screw marine engine from the Dumbarton works was designed for propelling vessels with concentric shafts without gear or belting. They ran at three hundred revolutions a minute and were made with very short stroke to reduce the piston speed. Mexico exhibited some powerful engines of good design. A Grantham firm showed a safety oil engine in which was no apparatus for firing the charge, the oil being converted in a red-hot vaporizer into a gas. In both the British and the German exhibits was shown the development of the gas engine. The English engines were highly specialized, being constructed to perform a single operation. German gas and petroleum engines ranged commonly from three to thirty horse power. The Otto gas engines, from one hundred down to one eighth horse power, are run either with an electric spark or with a tube igniter that has patent controlled valves to regulate the time of ignition; one engine was fitted with a self-starter that got up full speed in forty-five seconds. Some gasoline engines could run ten hours with a gallon of gasoline per horse power.

In the Grob oil engines the power is generated by ordinary kerosene, which is atomized, gasified, mixed with the proper proportion of air, compressed, and ignited behind a piston. The speed is regulated by varying the supply of oil, which for the ordinary rate of three hundred revolutions a minute is about a pint of oil per horse power per hour. These engines range in size from one half to thirty horse power. The Otto Company, of Philadelphia, had a similar exhibit to that of the German parent concern. Other engines were shown by the Gas Engine Company, of Philadelphia, and the National Meter Company had special patterns for deep well pumping and irrigation. The Sintz Company, of Grand Rapids, showed a special adaptation of their gas and gasoline engine for marine purposes. The engine makes its own gas from gasoline, and the explosive charge is ignited by an electric spark. The consumption is three quarters of a pint of common gasoline per horse power per hour. The governor regulates the charge of oil or gas, and thus controls the speed.

One of the novelties among the engines was the twenty-horse-power steam turbine of Dr. Gustaf de Laval, shown in the Swedish section, connected to a dynamo. The turbine, when run at full speed, makes 22,000 revolutions a minute, but this is reduced ten times before being transmitted to the armature of the dynamo. The shaft of the turbine is a light elastic rod of steel, less than half an inch in diameter. It is because it is thin and flexible that so high a speed is possible. The inventor claims that the speed can be reduced any desired degree with no appreciable loss in efficiency to secure a low-armature speed. The steam has acquired the same pressure as the surrounding atmosphere before reaching the dynamo, thus converting its entire capacity for work into momentum. It passes between the blades at a constant relative velocity in a clear jet, and the blades in the turbine can therefore be constructed in the same manner as if designed for water. The

wheel is cut out of solid steel. A flexible shaft is found necessary on account of the impossibility of perfectly balancing the wheel for a rigid shaft, whereas on a flexible one it revolves round its true center of gravity.

Steam separators were exhibited by the Exhaust Steam Purifying Company and the Pond Machinery Company. The Keystone Engine Works had one with centrifugal action. Doane's patent vacuum exhaust head was shown by the Exhaust Ventilator Company, of Chicago. W. C. Lyman



MARINE ENGINE SHOWN BY F. SCHICHAU, ELBING, PRUSSIA.

and W. L. Simpson had steam exhaust heads. Condensers were exhibited by the George F. Blake Company, and, with air pumps, by the Conover Company, of New York. George H. Hitchcock showed an adjustable stuffing box for sliding rods. Bearings of anti-friction metal were shown by the Magnolia Company, of Chicago.

Of the total power generated, half was utilized in incandescent electric lighting, and 5,000 horse power was required to operate the arc-lighting plant, while 4,000 was supplied to electric motors. The motive power was chiefly supplied by an assemblage of water-tube boilers, the greatest ever collected in one locality. These boilers required about 50,000 pounds of oil an hour. Most of the boilers were arranged in batteries of two. Each pair fed steam into a common pipe, which delivered it into the thirty-six-inch headers, of which there were seven, connected by ten-inch pipes arranged with elbows and nipples to allow for expansion. The water of condensation was carried back into the boilers by Westinghouse loops, consisting of pipes carried above the top of the boiler to the rear of the boiler house, then down



below the water line and into the boiler through a check valve, the weight of the column of water in the pipe being just sufficient, with the pressure in the header, to overcome the boiler pressure. Water glasses were placed on the headers to reveal any possible accumulation of water. The burner consisted simply of a tube which enters through the front of the boiler into the combustion chamber. The oil, under a pressure of six pounds to the square inch, rises through a pipe into the burner. A jet of steam entering through another pipe at the back of the burner atomizes the oil and blows it into the combustion chamber in the form of a fine mist, producing a great flame of gas, with intense heat. The burners were all of one type, but of different makes and patterns—Reid, Larkin, Arms, Graves, Burton, Wright, and locomotive. Pop safety valves were used on all the boilers, set at 125 pounds. The different boilers were fed by pumps and injectors of different makes—Deane pumps with Watson injectors, and Korting injectors with Barr pumps, regulated by the Thomas automatic feed regulator, which keeps the water at a constant level without the intervention of an attendant; Penberthy injectors used with Blake and Knowles pumps; Hayden & Derby injectors with Davidson compound pumps; Nathan injectors with Cameron's, Laidlaw & Dunn's, Wilson Snyder's, Canton, Worthington's, and Boyts Porter's pumps; Hancock inspirators with Snow pumps; and Schaefer & Budenberg injectors with Buffalo and Gould pumps. Blakeslee, Smedley, Marsh, Hall, and McGowan pumps were also seen in operation. Morrin's Climax boiler, the largest in the boiler house, generated 1,500 horse power of steam with a heating surface of 10,000 square feet, being composed of 864 three-inch tubes. The Babcock Wilcox Company, besides boilers in service in the power house, exhibited parts of boilers, tubes tied in knots or hammered flat, and a model of the most perfect boiler of the present day placed alongside of Stephen Wilcox's model of the first water-tube boiler, made in 1856. Sections of tubes and the headers joined together by nipples were shown by the National Boiler Company. The Walworth Company, of Boston, exhibited the Mills boiler; the Stearns Company had the Gill pattern among others. Charles Ward showed marine boilers free between decks, such as are used in United States coast-defense vessels, consisting of circles of tubes surrounding the fire chamber. The Erie City Iron Works showed return tubular portable and vertical boilers. Rice & Whitacre and others exhibited boilers with heaters. L. A. Olsen, of Oakland, Cal., had a novel heater, purifier, and steam generator. A submerged water heater was shown by Cardarelli & Dicks, of Sumter, S. C. Other exhibitors of boilers were the Atlas Engine Works, of Indianapolis; the Clonbrook Works, of Brooklyn; the Simplex Company, of Esopus, N. Y.; and Joshua Thomas, of Cleveland. The Hawley down-draft furnace and grate was a Chicago exhibit. The National Supply Company showed steam-actuated fuel-oil burners, and a device with service under the boiler was shown by the Chicago Gas and Crude Oil Burner Company, while Tuerk Brothers had another

device. The Globe Light and Heat Company, of Chicago, and R. D. Wood, of Philadelphia, had gas machines. William Baragwanath & Son received an award for a steam jacket feed and water heater, and E. G. F. Colles & Co. got one for an upright pressure heater. H. W. Johns Company exhibited boiler coverings of asbestos, and D. I. Stephens and F. Worcester exhibited sectional coverings of mineral wool. Other exhibitors were Keasbey & Mattison and A. C. Kemper. The Wainwright Company, Hopper Company, Funk Company, and Kroeschells & Bourgeois were



A CORNER IN THE DYNAMO SECTION.

some of the exhibitors of feed-water heaters. The Fuel Economizer Company had one that utilizes the surplus heat to raise the feed water much above the atmospheric boiling point. The Excelsior Heater Company, of Chicago, had a feed-water heater, purifier, filter, and oil separator combined. Webster, Warren & Co. showed a vacuum heater. A new packing material was Mabb's rawhide hydraulic packing, made in Chicago. Models of quadruple-expansion marine boilers were shown from Dumbarton in the British section, where were also displayed various new devices for superheating steam and for its thorough condensation and use in several cylinders. Smoke-consuming furnaces were exhibited by a Hamburg firm that has sup-

plied them for the Reichstag building. In the Russian section was a collection of petroleum grates and furnaces. Among the German exhibits were extension tubular boilers with portable steam engines.

The Pelton Company, of San Francisco, exhibited a water wheel connected to dynamos; the De Loach Company, of Atlanta, had a well-designed turbine; and other improved patterns were shown by the Stillwell-Bierce & Smith-Vaile Company and the Valley Iron Works. In the German section a Gotha establishment exhibited turbine wheels that make one hundred and seventy revolutions a minute and have a capacity of 50 horse power. Water motors were exhibited with an automatic hydraulic pump and an automatic cellar drainer by the Erwin-Welch Company. The Flint & Walling Company, besides lift, force, and spray pumps, had a water mill for use in residences. The Rife Company, of Roanoke, had a hydraulic ram at work forcing a large stream of water through a tall pipe, a ram having a rubber valve that is adjustable to any pressure, and an automatic arrangement for supplying air. Another ram was exhibited by the Simplex Company.

Shafting, hangers, belts, and gearing were, like the engines and dynamos, a part of the working machinery of the Exposition. The power transmitting machinery of H. W. Caldwell & Son, the Dodge Company, the Volney W. Mason Company, the Morgan Engineering Company, the General Electric Company, the L. P. & W. Transmitter Company, and the Falls Rivet and Machine Company could be seen and compared in actual service. The Dodge Company had, besides hangers, compression and plate couplings, and special pulleys, a friction clutch of two hundred horse power that ran in a quill, relieving the shaft of all but torsional and transmission strains.

The Falls Rivet and Machine Company had forged iron shafting with ring oiling bearings and clutch pulleys and couplings in use in various departments; one line shaft consisted of a solid shaft and a hollow shaft encircling it in the center, which, by means of a friction clutch pulley keyed partly to the quill and partly to the solid shaft, could be put in motion independently or together. Bliss & Laughlin showed machinery shafts, and the United States Car Company a system of interlocked shafting. The Bethlehem Iron Company had on exhibition a double-throw crank weighing twenty-six tons, made for a Pacific Mail steamship, a single-throw crank for the United States cruiser Minneapolis, a spare shaft for the Old Colony Steamboat Company that weighed 65,900 pounds, and a hollow forged shaft, black as it came from the forge. The Candy-Otto Company exhibited, in connection with large portable forges, a tight clutch consisting of three compound levers attached to a flat steel plate. Clutches with pulleys were shown by the Valley Iron Works. The Williams Company, of Beloit, had a friction clutch. William E. Leard showed connecting rods with strap joints. An extension movement in ball-and-socket joints was the exhibit of Otis C.

White. W. Osterlein exhibited clutch pulleys and couplings. Iron split pulleys and collars were exhibited by the McKinnon Company.

The balancing ways of N. P. Bowsher working on the Little separable pulleys appeared to give an example of perpetual motion. The large wood split pulleys of the Reeves Company, one of which was eighteen feet in diameter, had interchangeable bushings. The Menasha Company and Lansing B. Warner had exhibits of wood pulleys. Eaton & Prince showed worm-gear belt-winding machinery. The Chicago Belting Company, Andrew Cowan & Co., Jewell Company, Graton & Knight, George Oberne & Co., and Charles A. Schieren exhibited various kinds of belting. The Underwood Company had belts and pulleys. Rubber belting was shown by the Revere Rubber Company. The Boston Belting Company exhibited seamless, stitched, frictioned surface, and other belting, with packing, valves, and specimens of Pará rubber. The New York Belting and Packing Company had belts from sixty inches down and specimens of pure South American rubber. The Alexander Brothers showed leather belts with a belt truck. Charles A. Schieren, who had sixty-four driving belts at work in the buildings, displayed an electric three-ply belt, ninety-six inches wide and three hundred feet long, which weighed 5,350 pounds, being made of four hundred and fifty heavy steer hides. The Page Company made the six-foot wide waterproofed leather belts that coupled the monster Allis engine to two Westinghouse dynamos set tandem. These belts, one running over the other, the longer one about a hundred and sixty feet, traveled at a speed of over a mile a minute. The same firm exhibited a larger belt, the largest ever made, three quarters of an inch thick and eight feet and a half wide, into which five hundred and sixty-nine hides were worked. R. Hoffeld & Co. and E. B. Preston & Co. exhibited leather belts. The Chicago Rawhide Manufacturing Company exhibited twist belts from a thirty-secondth of an inch up and rawhide rope belting up to two inches in diameter. The American Leather Link Belt Company had an extensive exhibit. The Gandy Company exhibited stitched cotton-duck belting.

In the English section was a variety of belting, made from leather, textile fabrics, rubber, gutta-percha, and slotted steel. A Hamburg manufacturer supplied the belting for the German machinery. Endless driving ropes for transmitting power in several directions at the same time were shown in the German section.

The perfection of bevel gearing was exhibited by Hugo Bilgram, who, in addition to numerous bevel and miter wheels ranging in diameter from an inch to thirty inches, had two pairs of miter wheels driving at high speed with the least possible friction overhead shafting set at right angles. Sets embracing every variety of miter wheels that were mounted on stands proved by their smooth running and absence of backlash that they were cut theoretically correct.

A tank of water, one hundred and fifty by fifty feet, afforded an oppor-

tunity for scores of the newest pumps to reveal their capabilities by sucking up the water and returning it to the swirling pool in pulsing jets or gushing streams. Henry R. Worthington's pumping machinery was usefully employed in supplying water for general purposes. Manufacturers whose steam pumps were in use in the power house were the Barr, Battle Creek, George F. Blake, Blakeslee, Deane, Hall, Knowles, Lawrence, Smedley, Snow, Sulzer-Vogt, Wainwright and Wilson-Snyder corporations, Boyts, Porter & Co., M. T. Davidson, Joshua Thomas, and N. A. Watson. The John H. McGowan Company, whose direct-acting, duplex, and crank and fly-wheel



PART OF THE BRAZILIAN SECTION.

pumps discharge water into the great tank, erected a fountain with a glass dome, against which a constant stream of water was forced in a circular sheet by twin-lever valve pumps. The Laidlaw-Dunn-Gordon Company had direct-acting and standard duplex pumps, fire pumps, deep-well pumps, and a compound pump that was discharging 2,000,000 gallons a day. Joseph Menge's pump for irrigation and drainage consisted merely of a bucket wheel six inches wide, yet it discharged over 7,000,000 gallons a day. The internal workings of the Cameron pumps were laid bare to demonstrate their simplicity; the company had long-stroke pumps for rolling mills, double-plunger pumps for feeding engines under heavy pressure, vertical mining pumps for

sinking shafts, and direct-acting and fly-wheel vacuum pumps for sugar refineries. The Downie exhibited pumps for artesian wells, double and single acting, for steam, belt, or wind power. The Rider & Ericsson hot-air pumping engines for forcing water to a considerable elevation were shown by the Rider Engine Company. The Sandwich Company had a pitcher pump that can be reversed, so as to pump air down in order to aerate cistern water. The Bucket Pump Company had a pump which conducts air into the water by a series of buckets. H. Dickinson & Son had a water-purifying pump. The H. H. Perkins Company and the Hayes Company exhibited force pumps; Anthony H. Bryan, an automatic pump; Flint & Walling, iron pumps of every description; the Morris Machine Works, a stuff pump; the American Well Works, pumps with engines; Olmsted & Co., pump fixtures and drive-well points; Arthur Falkenau, the St. Joseph Pump Company, the Althouse Wheeler Company, the Simplex Company, the Challenge Company, the Buckeye Iron and Brass Works, the United States Wind Engine Company, the Turner Machine Company, and the Hersey Company, pumps of various kinds. Pumps actuated by wind engines were plentiful in the Agricultural Department. The General Electric Company exhibited electric pumps. The Goulds' Manufacturing Company had a triplex automatic electric pump at work in the Electricity Building, a triplex power pump in the boiler house, a hydraulic-pressure pump in the annex, a stuff pump in the paper mill, and a rotary force pump in the Mines Building. The Buffalo Steam Pump Company had direct-acting and duplex pumps, single-cylinder air pumps, and jet condensers. The Smith-Vaile pumps of large capacity were not seen in action. The Deming Company showed rotary pumps, non-freezing double-acting force pumps for elevating water by hydraulic pressure, and a hydraulic test pump to determine the strength of boilers, pipes, and pump cylinders. William Wenzel had a converse centrifugal pump. Novel contrivances were seen in boiler-feeding pumps. The Miller Company exhibited duplex pumps and others with a new plunger for either hot or cold water. The Union Manufacturing Company showed the Burnham direct-acting pump, which has an automatic device for creating a steam cushion to insure a uniform travel of the piston under varying loads; also the Frost contrivance for utilizing the waste heat of the exhaust steam to heat water on its way to the boiler. The peculiar pump of George E. Nye consisted of two rectangular chambers in which a vacuum was formed through the condensation of the exhaust steam. Filter presses were exhibited by G. H. Bushnell; oil filters and tanks by Wilson F. Cortez & Co.

The Fisher pump governors were shown with adaptations for hydraulic-pressure pumps; there were gravity governors that start and stop a pump as often as is desired to keep water at a certain level in a tank.

Besides the electric and steam machinery there were in the power plant several air compressors. Four compressors, single and double compound, of

varying sizes, the largest producing a pressure of 5,000 pounds to the square inch, from the Norwalk Iron Works, furnished compressed air for the sewerage system. There was a large double Corliss compressor from the Ingersoll-Sargeant Company, and another Corliss, compounded in both the air and the steam cylinder, from the Rand Company, both of which were used to furnish air for running elevators in the Transportation Building and various exhibits there and in the Mines Building. The Cleveland Faucet Company, E. C. Fasoldt, and the General Electric Company had compressors, straight-line, duplex, and compound. A medal went to Bishop & Babcock for air-compressing and pumping appliances, and one to the Aërometer Company for a pneumatic pump. The Turner Machine Company exhibited a peculiar machine, combining the qualities of a steam, air, or water motor, a fluid pump, a vacuum pump, and an air compressor, in which a solid piston was made to move in a rotary track without springs or valves. This compressor drove the apparatus used in mechanically painting the World's Fair buildings.

J. G. Hoffman exhibited the fan blower of his invention having a combined crank and lever motion that gives an after-blast like a bellows and is capable of being operated from any point. The Foos Company exhibited hand and power blowers with scientific and cyclone forges. Ventilating apparatus was exhibited by Andrews & Johnson and the General Electric Company; exhaust fans by the Exhaust Ventilator Company and W. C. Lyman. Allinton & Curtis showed an ingenious dust collector in connection with a Sturtevant fan.

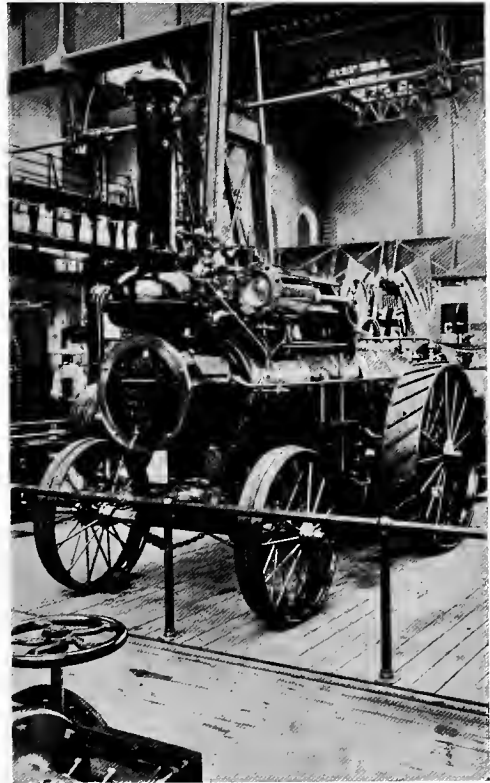
Hydraulic presses were exhibited in the Agricultural Department. The Jeffrey Company exhibited freight elevators, and the General Electric Company lifting magnets and electric hoists. Many of the hoisting engines designed for quarrying and bridge building were run by electricity. The Morgan Engineering Company, the General Electric Company, and the Shaw Company had traveling cranes. Cardarelli & Dick had a light electric crane; the Franklin Company and Maris & Beekly, cranes and hoists. The Yale and Towne Company showed an electric traveler and hoists and chain blocks. The three gigantic traveling cranes used to put exhibits in place and afterward to carry passengers in Machinery Hall excited wonder; covering a span of seventy-five feet, they were moved on tracks laid on plate girders by electric motors. The balcony that served as a landing was reached by means of elevators that formed part of the exhibit of the Crane Elevator Company. A fourth crane was in the machine shop, where it could pick up and remove a load of a dozen tons and deposit it without the slightest jar under the guidance of a single person. J. G. Spiedel exhibited derricks and chain hoists. The American Hoist and Derrick Company had an exhibit with power. E. B. Steele showed adjustable window derricks that could be fastened to any window frame and lift four tons. The Vulcan Iron Works had an exhibit of pile-driving machinery. Hod elevators were



exhibited by Conrad Carlson and James Boyd. Thomas F. Gray showed an elevator and grain scale, and other automatic weighing machines were exhibited by the Chicago Automatic Scale Company, and Pratt & Whitney. Henry Secco had an exhibit of lifting jacks. H. W. Caldwell, Son & Co. exhibited worm-screw conveying machinery in motion, with seamless steel elevator buckets, automatic grain shovels, link belting, sprocket wheels, and hangers. The Webster Manufacturing Company showed a conveying apparatus and elevator. The Jeffrey Company had conveyers of another pattern. The Link Belt Companies showed the performance of a horizontal box conveyer, a continuous bucket elevator, a light-package elevator, and freight and barrel and sack elevators with continuous discharge, all driven by a single manilla rope that was moved by a jack shaft connected with the engine. The Trenton Iron Company had a completely equipped wire tramway of the Bleichert type in operation, transferring the diamondiferous earth of the Kimberley mine from a store yard to the Mines Building in a continuous stream of buckets that weighed and unloaded themselves automatically.

Gustav Schock exhibited machinery for breweries and malt houses; the Vulcan Brass Company and H. R. Worthington showed beer pumps; Wittemann Brothers bottling machinery; and the Eick Company and Yawman & Erbe bottle-washing machines. The Cleveland Faucet Company showed a physicians' atomizing apparatus and beer-preserving device. The methods of charging soda and mineral water and champagne with carbonic-acid gas were demonstrated by the Liquid Carbonic Acid Company. Exhibitors of soda-water machinery were Charles Lippincott & Co., John Matthews Company, A. D. Puffer & Sons, James W. Tufts, and Otto Zwietusch.

Pipe and fittings were exhibited by the Eureka Company, National Tube Works, Morgan Engineering Company, R. D. Wood & Co., the Jarecki Company, and other makers. Ahrens & Ott, the Chapman Company, the Consolidated Safety Valve Company, I. F. Kearns & Co., the National Electric Valve Company, the Roe Stephens Company, and the Walworth Company



TRACTION ENGINE

shown by the John Abell Machine Works, Toronto.

were some of the exhibitors of valves of various sorts. J. G. Beckerleg had a pressure valve; the Eddy Company, valves for fire hydrants; James R. Floyd & Son, a slide valve, valve indicator, and retort mouthpiece; and John H. McGowan & Co., back-pressure and gate valves and a pump valve seat. The Brass & Iron Company, of Fostoria, exhibited Able's patent gate valves for waterworks. An ingenious exhibit of the same company was iron pipes fitted without threads and lead pipes without solder. L. Schutte & Company exhibited, with exhaust steam condensers and Korting's double-tube injectors, universal siphons and hydraulic valves. The Ashton Company showed pop safety valves for every kind of boilers, noiseless safety valves for locomotive and marine boilers, relief valves for pumps and standpipes, and vacuum and pressure gauges. The Chapman Company obtained diplomas for straightway valves, heavy union flanges, recesses for lead, an automatic indicator for sprinkler valves, and fire hydrants. The Consolidated Safety Valve Company exhibited pop safety valves of the Richardson-Ashcroft pattern, with adjustable screw ring; also the Blackall patent relief valve and Richardson's shifting and water relief valves.

No diving apparatus was exhibited except in the Midway Plaisance, where the operation of diving with modern machinery and the use of the submarine Bell telephone were witnessed in practice.

The De La Vergne Company with a huge refrigerating machine having a double-acting air compressor maintained an ice grotto above the water tank. The Hercules Iron Works had refrigerating machinery doing duty in the Cold Storage and Dairy Buildings. The Frick Company, of Waynesboro, Pa., showed an ice machine. Henry R. Worthington exhibited brine and ammonia pumps. Fred W. Wolf, of Chicago, exhibited refrigerating apparatus in separate structures in connection with the Waukesha Hygeia Company and a New Orleans ice factory. Henderson, Thoans & Gordes obtained a medal for an absorption ice and refrigeration machine.

Group 70 contained fire engines—apparatus and appliances for extinguishing fire, divided into five classes: 425. Engines. 426. Hose carts and hose. 427. Ladders and escapes. 428. Standpipes. 429. Chemical fire-extinguishing apparatus.

The fire-extinguishing apparatus was mostly installed in the fire stations on the grounds, and it was put to practical use when fire attacked the Cold Storage Building. The American Fire Engine Company displayed large fire engines, and one of the best type was seen in the Canadian section. The Manchester Locomotive Works had one, and Henry R. Worthington had fire-pumping engines. A fire-extinguishing apparatus was brought from Germany. H. L. Boyle & J. H. Calleton showed a traction truck. The Waterbury Rubber Company exhibited hose armored with spring steel. Various kinds of couplings and nozzles were shown by E. B. Preston & Co., who also had trucks and other fire apparatus, and by Irvin P. Doolittle and





THE TRAVELING SIDEWALK, ON THE LONG PIER.

others. Ernst Prowattain exhibited a swinging hose reel. The Chapman Valve Company, the Mellert Foundry, and R. D. Wood & Co. showed fire hydrants, and the last-named also standpipes. One of the new fire escapes was an inclined ladder and a sliding cage which the firemen moved by a crank. The General Fire Extinguisher Company, of Providence, showed an automatic sprinkler equipment. Different forms of the water tower were shown. J. A. Treat had a repeating chemical engine and the Fire Extinguisher Company and the Miller Chemical Engine Company, of Chicago, had other forms. The Worcester Fire Pail Company and the Harden Company exhibited hand chemical extinguishers.

No class of machinery was more amply and excellently exhibited than the metal-working tools, and in none was the progress of inventive skill and adaptation more marked. Group 71, embracing machine tools and machines for working metals, was subdivided as follows: 430. Small tools for machinists' use, drills; taps and dies, gauges, etc. 431. Squares, rules, and measuring tools. 432. Steam hammers, trip hammers, drop-forging and swaging machines, hydraulic forging, etc. 433. Planing, drilling, slotting, turning, shaping, milling, punching, and cutting machines. Wheel-cutting and dividing machines.

Large exhibits of machine tools were made by the Pond Tool Works, William Sellers & Co., the Niles Tool Works, and many others. The Miller's Falls Company, amid a great variety of small tools, showed a mechanics' vise with interchangeable jaws and a seat on which it could be swung around for filing; also bit braces with ball bearings in the head and antifric-tion collars on the handles. The Charles Parker Company showed machinists' vises of all sizes, some with anvils and some swinging on plates in any direction. Fisher & Norris exhibited, besides anvils for all purposes, a double-screw parallel leg vise. The Bonney Rapid Vise Company showed a very handy tool. Hill, Clarke & Co. showed a vise capable of being instantly adjusted to take up work of any size. The Armstrong Company sent a line of steam fitters' tools. The Trimont Company showed combination wrenches with double jaws for plain work and pipe; the Keystone Company, a new ratchet wrench; the Walworth Company, the Ashley & Stilson wrench. The J. M. Carpenter Company had an exhibit of taps and dies. Tools for brazing and soldering formed the exhibit of the J. C. Walsh Company. The Cleveland Twist Drill Company had a fine assortment of drills, taps, reamers, cutters, etc. The Cincinnati Tool Company exhibited many special implements, such as spoke shaves and pointers, brace wrenches, washer cutters, bench stops, belt punches, plug cutters, tail screws, and hollow augers. E. Horton & Son had car-wheel chucks and every other kind, including combination chucks with reversible jaws and chucks for holding taper-shank drills. The Candy-Otto Company exhibited portable forges, vises, drills, screw plates, anvils, and blacksmiths' tools. The Foos Company had another exhibit of portable forges and blacksmiths' tools.

The Bethlehem Iron Company prepared an extraordinary exhibit of steam hammer and hydraulic forging. There was a full-sized model of a steam hammer weighing one hundred and twenty-five tons which is served by two monster cranes and has a stroke of sixteen and a half feet. Examples of the work done in the establishment, in addition to steamer shafts, were a rifled navy gun weighing fifty tons, the smooth-forged trunnion hoop of an army gun of the same size, the tube of a thirteen-inch navy gun and a jacket, weighing 57,000 pounds, for one of these guns.

The American Screw Company exhibited machinery in motion, cold-forging screws and bolts, including a header and a threader. The Columbus Bolt Works exhibited drop forgings of all descriptions of carriage hardware, some of intricate shape and peculiar pattern. The Billings & Spencer Company displayed drop forgings. J. H. Williams & Company had drop forgings from iron, steel, copper, and bronze, including pipe and engineers' wrenches and parts of bicycles, engines, sewing machines, firearms, etc. The Christy Knife Company showed its knife-handle press and slotting machines. A drop hammer and trimming press and drop-forging machines were exhibited by Merrill Brothers. Wiswall & Davis showed a ready striker hammer; the Yeakley Company, pneumatic hammers; and Stiles & Parker, wheel presses and drop hammers. The National Machinery Company exhibited a forging and up-setting machine having a suspended rocking die attached to a hinge toggle motion and operated by an eccentric-face cam on a side shaft, capable of forging heavy pieces of difficult pattern. R. D. Wood & Co. exhibited hydraulic forging and Henry R. Worthington an hydraulic pump for forging. B. & S. Massey had in the English section steam hammers working between adjustable glides with a stop valve controlled by foot and hand power so perfectly that long or short, quick or slow, or hard or light blows can be delivered at the operator's will. Peter Wright & Sons, of England, exhibited their famous wrought-iron anvils. Clark Fisher showed American anvils. George B. Soley brought from the Mint in Philadelphia the first steam coining press that was used there, and with it coined souvenir half dollars.

The Detrick & Harvey Company exhibited open-side planers at work on heavy slabs of cast iron. The Niles Tool Works had a planing machine weighing one hundred and thirty-five tons which will plane twelve feet high, twelve feet wide, and thirty feet long, with automatic, positive, and independent feeds in all directions. The Pond Tool Company had newly designed planers, lathes, and drills at work in the machine shops. The planers had boxed uprights and a new feed box giving a positive feed; one was ten feet wide, weighing eighty tons.

The evolution manifested in the variety and capabilities of lathes and drilling and boring machines was remarkable. The Morse Twist Drill Company exhibited, alongside of its present assortment, the identical exhibit that was sent to the Centennial Exposition; in the larger sizes of the latest drills the

frictional grip of the taper shank is supplemented by a key set in the shank and fitting into the socket. The W. F. & John Barnes Company displayed hand and power drills, one a twenty-inch self-feeder, and velocipede lathes. A. D. Quint had a sensitive drilling machine with six spindles, in which the cutting was done by revolving, not the work, but the tools. The Sigourney Tool Company had an exhibit of sensitive drills. The Cleveland Twist Drill Company, together with reamers, taps, mandrels, hollow gauges, etc., exhibited many styles of twist drills made for the home and foreign trade, with straight, square, taper, and screw shanks; with drilling, countersinking, and wood-bit points; and for right- and left-hand cuts. Beaman & Smith, besides milling machines, showed drilling and boring machines for a great



TOOLS SHOWN BY THE MORSE TWIST DRILL AND MACHINE CO.,  
NEW BEDFORD, MASS.

variety of work, fitted with an ingenious safety drill and tap holder. A six-foot boring machine of the Niles Tool Company, having a table driven by an internal spur gear, and back-gearred to give a wide range of speeds, ran as smoothly as a heavy planer, with the accuracy of a perfect lathe; the patented balancing device is as simple as it is effective. This company had a horizontal boring, drilling, and milling machine that was capable of working a surface nine feet in length and six feet in width. Prentice Brothers exhibited engine lathes, special taper-turning lathes, speed lathes, vertical drill presses with twelve to fifty inches swing, radial drilling and countersinking machines, gang drills, and special drilling machines. The Standard Tool Company showed straight-flute increase twist drills, with reamers, milling cutters, and chucks. Drill chucks, scroll and geared combination chucks,



universal and independent lathe chucks, made up the exhibit of the Westcott Chuck Company.

The gun-making machinery of the Pratt & Whitney Company included drilling, reaming, and rifling machines for barrels. When the drill is set in motion it bores a straight hole through solid metal, making a rifle bore of thirty inches in little over an hour. This company had a large exhibit of cylindrical size gauges, thread gauges, and drop-forged caliper gauges; also mandrels and lathe and cutting tools, milling machinery, etc.

The Lodge & Davis Company exhibited engine lathes, turret-boring and chucking lathes, radial-drill presses having a new quick return for the spindle, and planers with shafts and pulleys bushed with phosphor bronze. The Narragansett Company had an engine lathe with a novel carriage. The Hendey Company showed the new Norton lathe, which gives twelve additional cuts or screws to the inch with every change of gear. A new lathe of the Pond Tool Works had a very heavy gearing, being back-geared from a cone spindle, with feeding gear on the head, giving angular, cross, and lateral feeds. F. E. Reed & Co. had engine lathes and hand and foot power screw-cutting lathes, the beds of which have large bearing surfaces. Sloan & Chase exhibited model lathes with attachments. The American Machine Company, besides a valve milling machine, exhibited cabinet drill lathes with taper attachment. The Gisholt Company showed the Conradson turret lathes. A forming lathe from the Buckeye Works had a novel automatic feed. A. Falkenau showed a lathe having a turret slide that could be exchanged for a plain tool rest. The Niles Tool Company had a forge lathe for rough-turning or finishing heavy shafts, rolls, or cranks, or boring large steel castings. The Diamond Machine Company showed speed lathes that have a patented combined lever and screw feed in the tail stock, working two spindles independently. The General Electric Company showed a turning device for trimming commutators without removing the armature from its frame. Bardons & Oliver showed a forming monitor lathe. Flather & Co. had a variety of lathes and planers. The Hurlburt-Rogers Company had cutting-off lathes that work two tools in the same cut, for cutting up iron and steel bars, shafts, and tubes, operated with an accelerated speed device producing a constant cutting speed. Jones & Lamson exhibited turret and flat turret lathes and a spindle hole screw machine. The Buckeye Iron and Brass Works exhibited machines for milling simultaneously all the sides of squares or hexagons on valves. The Kempsmith Company had milling machinery in the machine shop. The Brainard Company exhibited cam cutting, universal milling, and automatic gear-cutting machines, with cam-cutting machines. The American Screw Company had a full exhibit of screw-making machinery. Gould & Eberhardt exhibited shapers, drill presses, gear cutters, and machine tools.

The Brown & Sharp Company exhibited very exact automatic screw machines, screw slotting, grooving, angular and side milling, and spiral mill-

ing machines with improved feed and spiral head and convex and concave, miter and bevel, and other kinds of gear cutters, with calipers, gauges, and micrometers, one of which measures variations of a hundred thousandth of an inch. All the parts were turned out by these very machines. Hugo Bil-



A PORTION OF CANADA'S MACHINERY EXHIBIT.

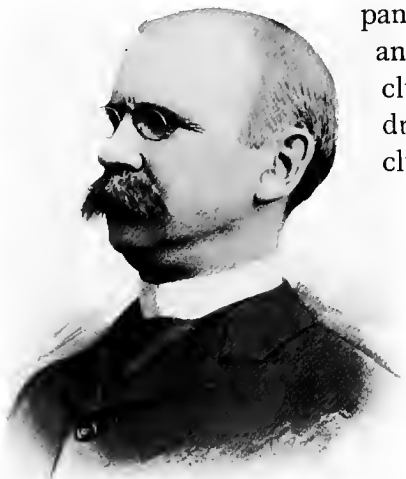
gram exhibited miter and bevel gears cut with his improved machine, which by means of a reciprocating gear gives the true involute curve at all points. Warner & Swasey exhibited the ingenious Warner gear generating and cutting machine.

The Hilles & Jones Company had plate-straightening rolls, planers, shears, milling machinery, and punches for boiler makers and shipbuilders. The International Steel Post Company made an interesting exhibit of the operation of the rolling machine that rolls tubular fence posts at the rate of two thousand a day.

The punching machine of the Long & Alstatter Company had a heavy multiple punching machine capable of making at one stroke any desired number of holes of any desired size and distance apart, up to two and a half inches in diameter, in plates an inch and a half thick. The Niagara Stamping and

Tool Company showed punching, drawing, and drop presses, and squaring, slitting, and circular shears, with all the tools used in working tin and sheet iron. Hilles & Jones had a combined punch and shears. Peck, Stowe & Wilcox showed folders, roll formers, a rim machine, a beader, a stake holder, and side-cutting pliers of improved designs. The Ferracute Company had twelve power presses, the largest 12,000 pounds in weight, with foot presses, and machines for beading, trimming, threading, etc., and about forty pairs of dies working on brass and on aluminium and turning out cups, pans, skillets, jewel boxes, cigar cases, etc. The E. W. Bliss Com-

pany had an interesting exhibit of presses and dies and special machinery working on sheet metal, including the Stiles drop hammers and large toggle drawing presses that have an automatic friction clutch. George W. Eaton & Co. exhibited power presses and shears for cutting, stamping, and embossing sheet iron, steel, brass, or copper.



G. H. WHEELER,  
Member of the Directory.

There was much diversity in the pipe threading and cutting machines. The Merrill Company had them of all sizes, for hand or power or both, with a centrally placed cone and a compound gear giving six changes of speed and a self-centered vise that feeds the pipe by a friction universal screw, enabling the machine to cut true threads on uneven pipe. The Jarecki Company had machines for cutting cast-iron pipe up to twelve inches in diameter. The machines of D. Saunders' Sons were equipped with

expanding dies and a new arrangement of die heads. Curtis & Curtis had pipe-working machines provided with the Forbes die stock, with which one man can thread and cut off eight-inch pipe. The power pipe-threading machines of the Armstrong Company had automatic cutters worked by a star feed and closed gears running in oil. The Hall tapping machine for tapping street mains under pressure was shown by the Walworth Company, of Boston. A combined twist drill and pipe thread tap shown by the Cleveland Twist Drill Company can tap either water or gas pipes under pressure.

The Acme Company, of Cleveland, exhibited ingenious automatic bolt cutters and headers and a taper threading machine with power feed. The Columbus Bolt Works had automatic headers, pointers, shavers, and threaders that turned out perfect bolts from a coil of wire, the blanks as they pass out of one machine being simply dumped into the hopper of the next. The Capitol Company, of Chicago, exhibited a Cook automatic nut-tapping machine, in which blanks thrown into the hopper came out finished nuts. In the same exhibit were single and double head bolt cutters and a new pipe

threader that has hollow spindles operated by independent clutches, enabling pipe to pass clear through the machine. Among the varied exhibits of the National Machinery Company were remarkable automatic bolt and nut machines, including double rapid-track bolt cutters that can thread bolts for two days without changing dies, at the rate of 7,000 a minute.

Group 72 embraced machinery for the manufacture of textile fabrics and clothing, classified as follows: 434. Machines for the manufacture of silk goods. 435. Machines for the manufacture of cotton goods. 436. Machines for the manufacture of woolen goods. 437. Worsted-working machinery and appliances. 438. Machines for the manufacture of linen goods. 439. Machines for the manufacture of rope and for twine making and for miscellaneous fibrous materials. 440. Machines for paper making and felting. 441. Machines for the manufacture of India-rubber goods. 442. Machines for the manufacture of mixed fabrics. Knitting machines and cloth-cutting machinery. 443. Machines used in the manufacture of tapestry, including carpets, lace, floor cloth, fancy embroidery, etc. 444. Sewing machines for heavy materials and for family work. 445. Machines for preparing and for working leather. 446. Machines for making boots and shoes.

There were more than seventy exhibits of textile machinery. Jacquard looms, which fascinated visitors to the Centennial Exhibition with the magic of the rolls of perforated paper guiding the threads of many colors into ever-changing groups to form a pictured pattern, were present in Chicago in larger number, greatly improved, and weaving larger and more intricate designs. John Best & Co., of Paterson, had an exhibition of the weaving of pictures, badges, and bookmarks that were taken away as souvenirs. W. H. Grant & Co. and Thomas Wilkinson, of Coventry, England, had also silk looms in motion and Thomas Stevens a figure loom. The Phoenix Company, of Paterson, exhibited the process of silk throwing and the manufacture of silk goods. Schaum & Uhlinger, of Philadelphia, and the Atwood Company, of Stonington, exhibited silk machines in operation. A loom was shown by J. J. Mannion, of Pittsburg, and the Knowles and Crompton concerns exhibited a variety of looms for silk and other textiles.

The Worcester manufacturers exhibited cotton looms in operation. The Potter & Atherton Machine Company, of Pawtucket, W. W. Altemus & Son, of Philadelphia, and the Kitson Company, of Lowell, furnished cotton machinery in variety. The Lowell Machine Shop exhibited the entire process of cotton manufacture in a miniature mill, where cotton was taken out of the bale, cleaned in the feeder, carded into lengths, spun, and woven into cloth. The Willimantic Linen Company exhibited the manufacture of spool cotton. There was a spool winder that wound eight spools at one time and, without a hand touching it, cut off the thread when the spools were full. J. R. Leeson & Co., of Boston, exhibited a thread-winding machine that inserted the ends in notches and labeled the spools. In the British section one firm displayed a full set of machinery for cleaning, comb-

ing, and carding cotton. Spinning frames and looms were exhibited by others.

The woolen looms on exhibition were products of the Worcester factories. The Miller Company, of Philadelphia, exhibited huddle weights; the American Card Clothing Company, card-setting machines and card clothing; and H. W. Butterworth & Sons, tentering and drying apparatus. A variety of carding, napping, pressing, and other appliances and machines, and machines for spinning yarn for warp and woof, came from Aue, Saxony, one of whose manufacturers exhibited the process of making bobbins of sheet metal for all kinds of looms. The Crompton Works exhibited a worsted-working machine and noble comb, coiler, and baller.

Under the superintendence of H. A. Frambach, a complete paper mill was built and equipped with machinery furnished by forty-five exhibitors. The raw material—spruce and some poplar that was subjected to the sulphite process—was brought to the mill by a conveyer built by the Jeffrey Company. The beaters, a new design of the Downington Company, have a roll acting simultaneously on two bedplates, of which the bottom one is fixed and the top one is attached to the pillars that support the roll, to which it is adjusted. The water, after being purified in a gravity filter of the O. H. Jewell Company, was pumped into the engines by a Gould triplex pump. The stuff chests with cypress tanks, built by the Williams Company, were fitted with Richard Smith's agitator, which is a reversed turbine wheel. A rotary stuff pump, made by the Morris Works, carried the stuff from one of the chests to a Marshall refining engine, and a Gould pump removed the stuff from the other chest into a mixing box, whence it went to a noiseless rocker screen of the Valley Iron Works, or to the new bellows screen of the Western Screen Plate Works. The novel Fourdrinier machine of the Beloit Iron Works one hundred and twelve inches wide, with capacity for ten tons of paper a day, has a deckle frame with slice and pulleys of aluminium so light that two men can lift it from the machine. The Revere Rubber Company furnished the rubber-covered couch and press rolls. The seventeen driers were arranged in a double stack, and the drying process began immediately. Black & Clawson contributed the seamless drier. The chilled calenders came from the Farrell Foundry. The slitter, with rubber feed roll, was made by the Bess Company, and a Manning winder was used. A dozen other firms contributed convenient accessories to a model paper mill.

A German paper-ruling machine, using brass disks fitted with metal rods, was capable of ruling 4,000 sheets an hour on both sides. Tag machines were shown by the Dennison Company and the North Press Company. The Appleton Woolen Mills exhibited the process of felting. The Barton Company showed rubber-stamp machinery and a matrix press.

The Knowles Works and Lewis Jones exhibited looms for mixed fabrics. The Star and Crescent Mills, of Philadelphia, showed how American skill can produce Turkish towels better and cheaper than the Oriental fabric.

The knitting machines of Scott & Williams and the Bransom Company, of Philadelphia, and the Weyburn Company, of Chicago, fascinated beholders with the rapidity with which they turned out underwear and hosiery. In the German exhibit were also knitting machines whose merit lay not in speed, but in the substantial texture of the product.

The Weyburn Company showed cutting machines and tables; Isaac Fenno & Co. and the Electric Machine Company had other cloth-cutting devices; Berry & Orton exhibited their machine for cutting out clothing;

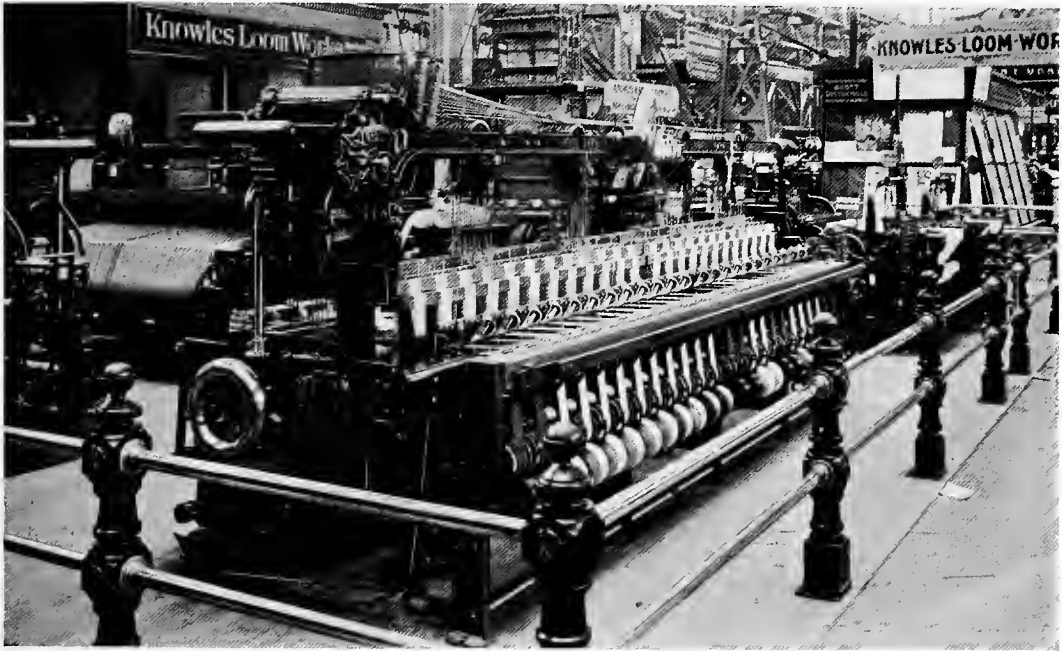


EXHIBIT OF THE KNOWLES LOOM WORKS, WORCESTER, MASS.

and in the German section were cutting machines for garments of various kinds.

The Foster Machine Company, with machines for doubling, twisting, and coning in one operation, and creels for warpers, exhibited a loom of the Jacquard type that was weaving a bordered carpet twelve feet square. William H. Mitchell and the Chicago Braiding and Embroidery Company showed ingenious mechanical devices for making embroideries, while French, German, Belgian, and Italian makers showed others of intricate design. C. D. Osborn & Co., of Chicago, had machines for embroidering either light or heavy material.

The Singer, Standard, National, New Home, American, Chicago, Williams, and Union Special companies exhibited all the recent improvements in sewing machines and all the special types for manufacturing. The Gardner Company had a folding apparatus as well as sewing machines, and the Brosius Company had a motor attached to its machines. J. H. Stern-

bergh showed machines for lacing belts and for sewing wood and leather with wire in fine stitches. There was a carpet-sewing machine, the operator of which rode a velocipede to guide the electric apparatus that stitched the carpet.

Special machines for sewing leather and all the appliances for making boots and shoes and harness were in the Leather and Shoe Trades Building.

Group 73 comprised all machines for working wood, which were classified as follows: 447. Direct-acting steam sawing machines, with gang saws, band saws, circular saws. 448. Sawmills and sawmill tools. Wood-working machinery for sawmills. Wood-working tools and minor appliances for sawmills. 449. Planing, sawing, veneering, grooving, mortising, tonguing, cutting, molding, stamping, carving, and cask-making machines, etc.; cork-cutting machines. Lathes for woodwork and machinery for the manufacture of matches, toothpicks, etc.

Sawing machinery and saw gangs were exhibited by Henry Lloyd Beach, N. Plumer, the Douglas-Cutter Company, the Stearns Company, the Valley Iron Works, and others. Henry Disston & Sons showed a full assortment of band, circular, and jig saws. Several exhibits were made of machines for sharpening and setting saws. The Simonds Company had machine knives as well as sawing machines. The Covell Company showed filing machinery. A Chicago company had a folding sawing machine.

The model sawmill built by the Edward P. Allis Company, with its band saw, made at Beaver Falls, forty-five feet long and twelve inches wide, had a capacity of 60,000 feet of lumber in ten hours. In the building the Novelty Iron Works had shingle and lath mills.

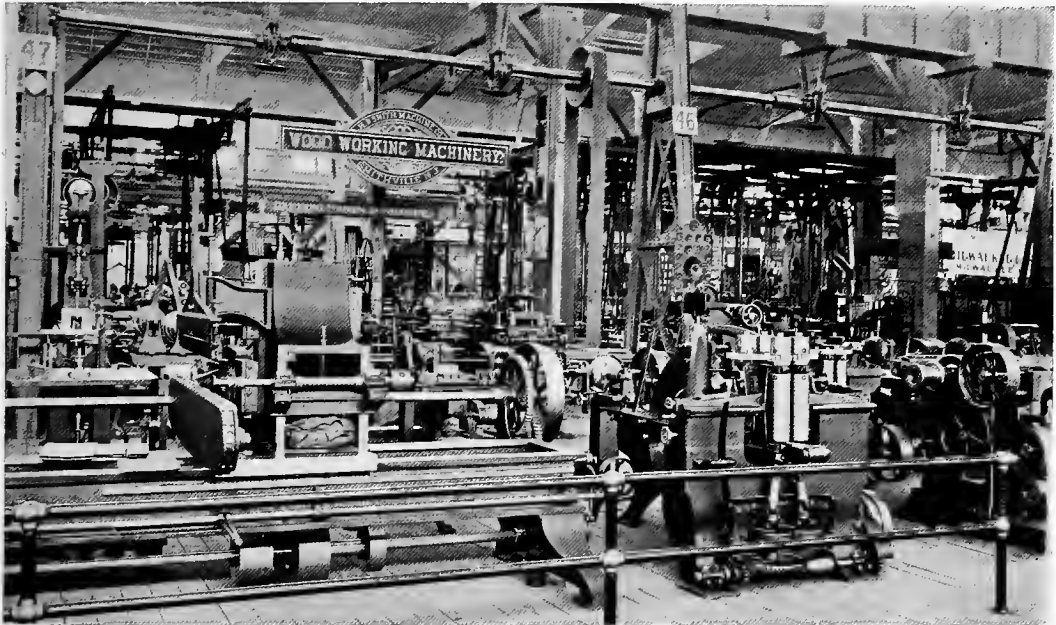
Ellis & Tunnell showed a crosscut saw to be handled by one man. E. C. Atkins & Co. exhibited saws in variety—solid or with inserted teeth, circular, shingle, heading, grooving, segment, band, gang, cross-cut, hand, back, and wood saws. Contrasting with an old muley saw made by this firm fifty years ago, was the sixteen-foot saw made expressly to cut down the big tree in the Washington Building. E. E. Cunningham exhibited saw blades and filing machinery. The De Loach Company and A. B. Farquhar showed sawmill equipments. M. Garland showed a log roller and deck stop; W. E. Hill & Co., a steam log turner.

Levi Houston exhibited sash, door, and blind machinery, with molders, mortisers, and tenoners. James Hallawell showed machinery for making hub blocks. Other special wood-working machines were shown by the Buss, Fox, H. B. Smith, Smith & Phillips, and Goodell & Waters companies. The S. A. Woods Company had an elaborate exhibit, in which an ingenious matcher and molder was noticeable. The Chicago Rapid Roofing Company showed a shingling machine, and William S. Doig, of Brooklyn, a box-nailing machine. Paul Probil exhibited machines used in piano-making. A picket mill was shown by the Goshen Machine Company and shingle ma-



chinery by the Dubuque Novelty Works. The display of planing and turning machinery, molding and carving and other wood-working machines, was the greatest ever brought together. In John A. White's circular, band-sawing, and resawing, planing, turning, mortising, boring, and sandpapering machinery all the parts are interchangeable. The Berlin Works, of Beloit, showed effective carpentering and cabinet machinery, including fast-feed flooring machines, inside molders, and glue jointers. Planing and matching machines were shown by Hall & Brown and some very heavy ones by E. & B. Holmes, who made a full exhibit of stave and barrel machinery.

One of the planers planes all four sides of a piece of timber at once. The Fay & Egan Company, of Cincinnati, had an improved matcher with auto-



DISPLAY OF THE H. B. SMITH MACHINE CO., SMITHVILLE, N. J.

matic attachment for increasing or decreasing pressure. This establishment displayed a remarkable collection of wood-working machinery for car-building, sash-and-blind factories, and furniture making. The Greenlee Brothers had a wonderful series of machines for car building. One machine works the heaviest timber as it is suspended from overhead rails. They had also a double mortising machine. A novel mortising machine was shown by M. Rothschild. The Dubuque Specialty Machine Company exhibited a swift chain mortising machine, in which the chain moves on pulleys graduated according to the width of the mortise, and no chisels are used. The W. F. & John Barnes Company had a small combination machine fitted with saws, boring attachment, and cutter heads for grooves, rabbet joints, etc.; also a lathe in which a friction disk, operated in contact with leather pulleys, takes the place of a cone. Bardons & Oliver exhibited their forming lathe. Some

of the wood-carving machines had movements almost as complex as those of the muscles. C. L. Goehring, of Allegheny City, carved out four or five groups of statuary in a few minutes. He had machines for moldings, such as are used in furniture, that produced perfect geometrical figures. The Milwaukee Carving Company and the Rohlmann Company showed other machines, and the Moore Company had one imitating the movements of the human arm with which four exact copies of a carving or plaster model can be made at one time by means of cutter heads having a hand movement and holding bits of different sizes. W. W. Grier exhibited an engraving machine capable of altering the surface of pine or spruce or poplar to represent quartered oak or other fine wood. The process of embossing wood by pressure to form ornaments, now much used in furniture and decoration, was illustrated by the machine exhibited by C. W. B. Sheridan that stamped souvenir medals of wood with impressions of the World's Fair buildings.

McGregor, Gourlay & Co., of Galt, Ontario, had some ingenious wood-working machinery. A Leipsic firm exhibited a model of the largest existing sawmill, with specimens of German sawing and wood-working machinery. An ingenious planer and joiner with hand feed was shown among other planing and molding machines. In one machine, which is capable of turning out 50,000 feet a day of timber for flooring and ceiling, the lumber is stripped of its covering by knives having a rotary motion, finished by being drawn over stationary knives, and then carried on rollers to the planing, tonguing, and grooving machines. Planing machines formed a part of the Spanish exhibit.

A manufacturer of Düsseldorf exhibited jig and circular saws and other machine tools and saws, some capable of cutting heavy iron plates. Machinery was in operation in the German section that could make 12,000,000 matches a day out of blocks of wood, dipping them in batches of 2,000 in the igniting preparation, shaving wood for boxes into thin slices, and cutting, folding, and labeling the boxes at the rate of 40,000 a day. Notable in the Swedish exhibit was a machine capable of making 200 barrels every hour.

Group 74 embraced machines and apparatus for typesetting, printing, stamping, and embossing, and for making books and paper working. It was classified as follows: 450. Steam-power presses. 451. Hand-printing presses. 452. Job presses. 453. Hydraulic presses. 454. Ticket printing and numbering machines. 455. Type casting and setting machines. 456. Hand-casting molds. 457. Machines and printing blocks. 458. Typographic electrotyping. 459. Stereotyping. 460. Bookbinding machinery. 461. Envelope machines. 462. Paper cutters, card cutters, and paper-box machinery. 463. Printers' cabinets and printers' machinery generally. 464. Composing sticks, cases. 465. Brass and type-metal labor-saving devices. 466. Specimens of plain and ornamental types, cuts, music, borders, and electrotypes plates. 468. Miscellaneous machinery used by printers and newspapers not otherwise specified. Folding machines, addressing, stamping, embossing, etc.

With exhibits of the Goss, Hoe, Scott, Potter, and other establishments, a large printing office was equipped, and visitors witnessed web perfecting presses printing off newspapers at the rate of seven or eight hundred a minute. The Daily Columbian was a special World's Fair journal. On August 26 a souvenir newspaper, composed on the linotype machine, was printed and distributed sixty-three minutes after the pulp for the paper was put into the machine. By an arrangement between exhibitors of book and

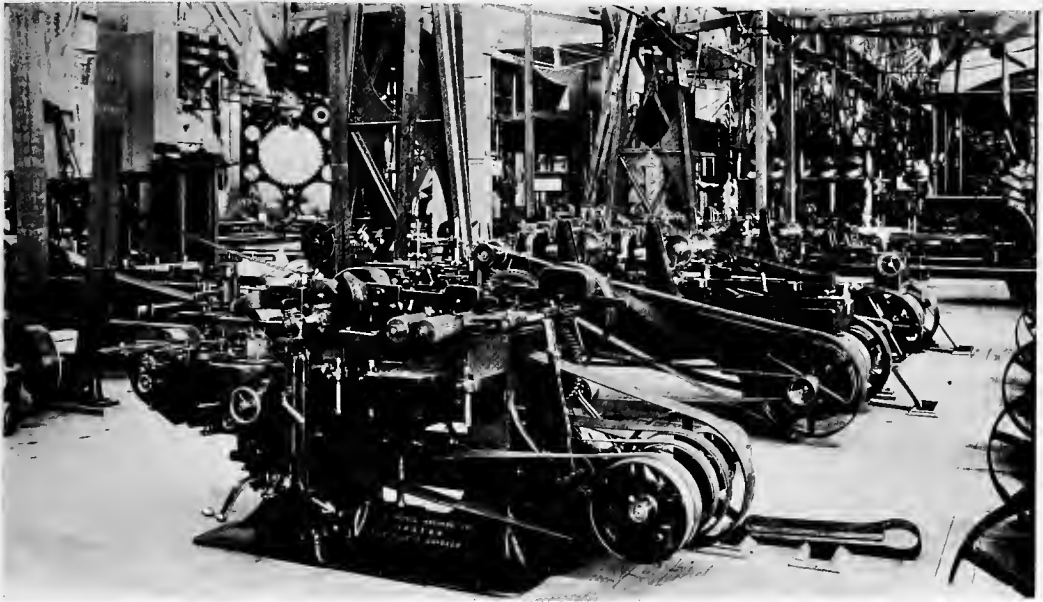


EXHIBIT OF THE S. A WOODS MACHINE CO., BOSTON.

job presses and bookbinding apparatus, the official catalogues and other World's Fair literature were manufactured in Machinery Hall. The Duplex Company had a press that can print on flat stationary beds and paste and fold 5,000 eight-page papers an hour. The Miehle flat-bed, two-revolution cylinder presses have a new bed motion, increasing the speed and insuring perfect register. C. B. Cottrell & Sons showed lithographic, stop-cylinder, and two-revolution presses designed for fine illustrated printing, and rotary web perfecting presses for printing illustrated newspapers and magazines. Other presses were exhibited by Schniedewend & Lee Company, who had also electrotypes' machines and paper cutters; the Babcock Company, W. G. Walker & Co., the Prouty Company, and the John Thomson Company. The Johnson Peerless Company exhibited paper cutters, and the Campbell Press Company and Golding & Co. paper folders with their job presses. McIndoe Brothers showed cylinder job presses. With the presses of Walter Scott & Co. were shown stereotype machines and paper cutters and folding machines. Merritt Gally, besides universal printing presses, exhibited a wood printer, a book-cover stamping press, a paper-box cutting and scoring

press, and an embossing machine. The Lanston monotype machine was exhibited by the Washington company that makes it.

One of the historical exhibits was a printing press such as Benjamin Franklin worked at in London. Of still earlier make was the press used by William Bradford in New York. One made in Boston by Thomas Draper in 1742 was long used by the public printer of New Hampshire. In the English section was a printing machine with attachments for cutting, collecting, pasting, folding, and counting. A rotating machine for printing illustrations was shown by an Augsburg firm.

The typesetting machine of J. R. Rogers was shown by the International Typograph Company, of Cleveland, and combined with it the type-line casting machine of F. E. Bright. The Monoline Composing Company, of Washington, made an exhibit ; also the Thorne Company, of Hartford. The Mergenthaler Linotype Company had a typesetting machine that avoids the use of ordinary type and produces new type ready for the press. A London maker had composing, justifying, and distributing machines.

Electrotyping processes were seen in operation in connection with the printing exhibit. In a separate building was installed the largest collection of electrotyping machinery ever brought together, including the latest appliances of all the chief American manufacturers

Montague & Fuller, the Seybold Machine Company, and T. W. & C. Sheridan displayed a great variety of labor-saving devices used in book-binding. The Smith Company, of Hartford, had a book-sewing machine ; the Elliott Company, of Newton, one for stitching with thread ; and R. H. Brown & Co., of New Haven, one for wire stitching. A Dresden firm, with other bookbinding apparatus, showed machines for edging and riveting.

An exhibitor of Heidelberg, Germany, showed a lightning printer, with automatic lifter and feeder, that can print 40,000 envelopes a day. A machine for manufacturing tags and labels, exhibited by the North Press Company, takes the paper from the roll, cuts out the tags, prints the labels, and inserts wire in the holes. A fine display of cutting and box-making machinery was made by the American Box Machine Company, the Child Company, and Salzkorn & Nikolai, of Dresden, Germany. The Western Paper Bag Company exhibited its automatic machinery. F. P. Rosback showed a toilet-paper machine.

The Hamilton Company, of Two Rivers, Wis., exhibited printers' furniture and materials. The art of making type was illustrated by a complete historical exhibit, beginning with the old hand molds of the last century, in which each letter was cast in a slow and uncertain manner. The next step was seen in the rotary type-casting machine operated by hand, which was invented in 1840. The application of steam came in 1870. The climax of the series was a type-perfecting machine of the pattern of 1893, which casts type at the rate of a hundred and eighty a minute, each type being perfect

and ready for use. Barnhard Brothers & Spindler exhibited type-casting machines and type in various stages.

Some of the machines for cutting and folding paper were of the heaviest kind. Folding machines for books and magazines exhibited in conjunction with printing presses and by special makers contained all the recent improvements. Chambers Brothers, successors of Cyrus Chambers, who introduced the folding machine in 1856, had single and double folders and machines with hand or automatic feed for folding, pasting, and covering pamphlets and periodicals. The machine of the Dexter Company had folders for books, periodicals, and newspapers, with covering, pasting, and trimming at-



PAPER CUTTERS DISPLAYED BY THE CHILD CUTTER AND PRESS CO., BOSTON.

tachments, to be fed by hand or with self-feeder and attachable to the printing press. Another form was that of the Brown Company, of Erie. An automatic feeding machine that can be attached to printing presses or ruling and folding machines was the exhibit of D. H. Burrell & Co. A ruling and paging machine for sheets or paper in rolls was shown by John McAdams & Co. A mailing machine was exhibited by Mahlon Gore. The National Cash Register Company displayed the printing and advertising cash registering machines. Among the miscellaneous exhibits were the perforating machine of Avery & Burton, the wood-embossing machine of the Art Embossing Company, of Indianapolis, and C. Keck's beveling machine.

Group 75, embracing lithography, zincography, and color printing, had two classes: 469. Lithography—tools, materials, and appliances. The various methods of lithography, crayon, pen and ink; engraving, brush work,

color printing, etc. Transferring, printing. Zincography. 470. Color printing—historical illustrations from the sixteenth century to the present time. Relief engraving. The old chiaro-oscuros. Modern wood-engravings. The Baxter process. Intaglio engraving, printed at one impression—i. e., from the plate rubbed in different colors, printed from several plates. Stenochromy, chromolithography. Wax process, etc. The modern photomechanical processes applied to color printing.

There was a good display of lithographic presses by the Orcutt Company, of Chicago. The Walter Scott Company exhibited lithographic distribution presses. The J. Ottman Company, of New York, fitted up a complete lithographic establishment. Some excellent devices for lithographing were shown in the Austrian section. A multicolor printing press was exhibited by a Kansas City company and a duplex color ink plate for ordinary presses by a company in Chicago.

Group 76 took in the photomechanical and other mechanical processes of illustrating, etc., and was subdivided as follows: Relief processes—photomechanical processes producing relief blocks for printing in the type press (etching, swell-gelatin, and washout processes) and line processes (phototypographic etchings, typogravures, etc.). 472. Half-toned processes—gelatin green processes (Paul Pretch's and later); screen processes (Meissenbach, etc.); the Ives process. 473. Photolithography, etc.—photomechanical processes, involving the production of printable designs on stone or zinc: i. e., photolithography and photozincography; half-toned processes (the bitumen process, Poitevin's process, Asser's process, etc.); recent grain processes; screen processes; line processes; Osborne's process. 474. Collographic processes—photomechanical processes, involving the production of gelatin or other glutinous films, to be used as printing surfaces in the lithographic press: i. e., collographic or photo-gelatin processes (albertype, heliotype, artotype, etc.). 475. Photomechanical processes—producing intaglio plates for printing in the copper-plate press: i. e., photogravure; etching processes, deposit processes, heliotypes, heliogravures, etc.; the Woodbury type—molds and impressions. 476. Mechanical processes—partly chemical, partly mechanical, devised as substitutes for the other hand processes, but not involving photography. Chalcotype, Comte process, Gillot process, etching in relief, typographic etching, improperly so called (chemitype, the graphotype, kaolitype), the wax process, and other allied processes (glyphography, kerography, stylography, typographic etching, engraving (medal ruling), galvanography, stenochromy, mineralography, nature printing, the anastatic process, etc. Appendix. Etching on glass (improperly so called, which involves photography, but not the use of the press). 477. Drawings for process work. 478. Aids to drawing for process work (used by lithographers and draughtsmen); grained and embossed papers; pasting tints; the air brush; Day's shading mediums, etc. Methods of reducing and enlarging; photomechanical processes.

479. Applications of the photomechanical processes in the industrial arts—prints on metal work, cloth, etc.

The actual processes enumerated in this elaborate scheme were not demonstrated ; but the results were abundantly exhibited in the department of liberal arts and in the German, French, and Russian sections of this department. Warren Ewen, Jr., & Co. showed a new multicolor process, and T. A. McFarland a device for sketching from Nature.

Group 77 contained miscellaneous hand tools, machines, and apparatus used in various arts, classified as follows : 480. Machines for making clocks, watches, and watch cases. 481. Machines for making jewelry. 482. Machines for making buttons, pins, needles, etc. 483. Wire-working machinery. 484. Machines for ironing, drying, scouring, and laundry work generally ; also dish-washing machinery. 485. Machines for making capsules and other pharmaceutical products. 486. Machines used in various manufacturing industries not specifically mentioned. Among them soap-making machinery and barrel-washing machinery. 487. Emery and corundum wheels. 488. Street rollers, sweepers, and sprinklers. 489. Steam gauges, oil cocks, and all kinds of appliances used in connection with machinery. 490. For testing the strength of machinery. Dynamometers.

The exhibit of watchmakers' and jewelers' apparatus was not large. Watchmakers' lathes and attachments, staking tools, and the rivet patent friction clutch of the Faneuil Watch Tool Company received a medal. Tuerk Brothers exhibited watch and clock tools. Laughlin & Smith's machinery for making scrip jewelry was working on souvenir buttons. Simons, Brother & Co. exhibited the process of making thimbles, selling the products as souvenirs. Samuel Moore showed a bead-chain machine. Machinery for piercing and polishing diamonds was a French exhibit.

Tuerk Brothers received an award for a medal-making machine. A French exhibitor had a machine for making helix buttons, a German one for making hooks and eyes.



THIMBLE DISPLAY OF SIMONS BRO. & CO.,  
PHILADELPHIA.



Various ingenious machines for making wire nails bore witness to the influence of international exhibitions in expanding industry. Before the Centennial Exhibition these nails were little used, and none were manufactured, in the United States. A manufacturer bought some crude machinery exhibited by a French maker and started the manufacture now carried on in several places with highly perfected apparatus. The McKay Association, of Boston, received a diploma for an improved machine. The Kennedy Company, of Chicago, showed another excellent design.

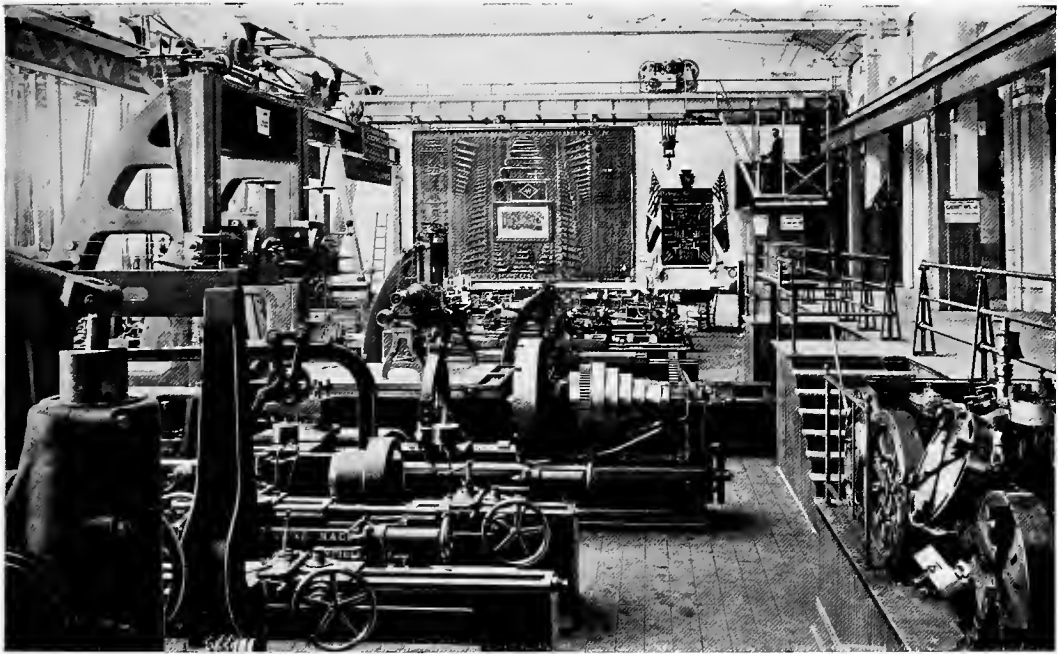
The Powell Company, of Cleveland, exhibited multiple machines making different sizes of nails, grouped around the heavy shaft from which they received their motion through wedges moved by the plunger, turning out 2,000 nails a minute. Spike, rivet, and wire-nail machines were shown by the National Machinery Company, of Tiffin. Malmedie & Co., a Düsseldorf firm, obtained a medal for wire-working machines and machines for making railroad spikes. George A. Le Baron, a Canadian inventor, exhibited wire-working machinery.

Clough & Macdonnell exhibited an interesting automatic machine for making wire corkscrews.

There was a complete and interesting display of laundry machinery. The Troy Laundry Company exhibited a duplex mangling machine, a double-gearied brass washing machine, and machines for dampening, folding, drying, tumbling, starching, and ironing clothes, with models of drying-closets. Spécial machinery was shown by the Hospital Supply Company, of Sandusky. G. A. Le Baron, of Canada, obtained a diploma for an outfit for drying clothes and machinery for its manufacture, and Lent & Coyne one for a washing machine; one went to the Waterforce Company, of England, for laundry machines, and John Austin, of New South Wales, obtained one for a patent washer. Other American machines were exhibited by the United States Mangle and Laundry Company, which had a mangle combined with ironers for shirts and collars, the Buckeye Churn Company, Jonas L. Knoll, and Louis Simon. Dish-washing machines of Illinois manufacturers, the Acme Company, the G. S. Blakeslee Company, the Covel Company, and the Garis-Cochrane Company were in use in the restaurants. A medal was bestowed for machines of Cress & Co., an English firm. The H. K. Mulford Company and Arthur Falkenau exhibited tablet-compressing machines. Brehier & Co. exhibited various French machines used for pharmaceutical preparations.

Philadelphia and Chicago matched each other well in the variety of special mechanical industries. From the former city came the dyeing machinery of the Delehanty Company, the brush-making machinery of the Consolidated Manufacturing Company, Siegmund Lubin's machines for making microscopes, Riehle Brothers' machines for twisting hay and straw rope, the oil extractor of Webster, Warren & Co., etc. Chicago was represented by the optical machinery of the Geneva Company and F. A. Hardy, the glove-mak-

ing machinery of the Western Steel Protected Glove Company and C. D. Osborne, Wolf, Sayer & Heller's apparatus for meat markets, etc. The fountain and gold pens of the Crown Pen Company were purchased by visitors who had watched the whole process of their manufacture. Charles Kaestner had a model paint mill in operation. The Hersey Company, of Boston, exhibited soap machinery. Elaborate machinery for grinding and polishing lenses was exhibited in the French section and by J. R. Caruss & Co., of New York. The Christy Knife Company manufactured knives on the spot. The Buckeye Company, of Dayton, exhibited an excellent tobacco cutter. The English firm of Davies Brothers & Co. received a medal for their method



EXHIBITS OF METAL-WORKING MACHINERY.

of manufacturing improved galvanized-iron plates. R. D. Wood, of Philadelphia, exhibited a standard apparatus for the manufacture and use of gas, and Gustave Cabrie-Gardien, of Paris, a carbureting apparatus for making gas. Jules Leblanc, of Paris, showed a machine for threading screw rings while hot, Fernand Martin machines for making mechanical playthings, and other French exhibitors machinery for making toilet soap and stearine, rubber balls, etc.

The Norton Company exhibited emery wheels of every shape and for every purpose, and grinding machinery in motion, including the Walker universal cutter and tool grinder, having wheels of eighteen shapes, each mounted on an iron collet drawn into a taper protecting spindle; also a friction countershaft giving five changes of speed up to 20,000 revolutions a minute, and a new elastic wheel for saws. The Springfield Company had

all classes of wheels and heavy grinding machines in motion, one of which could grind planing-mill knives twelve feet long, a large tool grinder with a water tank within the base, a surface grinder for boiler heads, and an automatic grinder useful for grinding the edges of rolled plates. The Northampton Company showed machines with single and double wheels for edge and surface grinding, shaping, and interior and exterior work. The Diamond Company showed automatic knife grinders and grinders for surface and face work, including the Kinsey grinder, with lateral and lengthwise feed. The Compress Wheel Company exhibited wheels for polishing and buffing, the faces of which were made of different materials. C. E. Le Massena exhibited solid leather wheels and cones turned to any shape, beveled, concave, or convex, and having emery or corundum applied to the face. The Gardner grinder, exhibited by Charles H. Besley & Co., was designed to grind perfectly square surfaces with emery cloth or paper pasted to the sides of steel disks. The Taylor automatic tool grinder for lathe and planer tools and the universal and cutter grinders had an adjustable apron and tool holder. Leland, Falconer & Morton showed a new double emery grinder.

The American Road Machine Company obtained a medal for graders, rollers, and rock crushers. An award was granted to the Harrisburg Foundry for steam road rollers. R. C. Pope exhibited a reversible roller and the O. S. Kelly Company and Russell & Co. steam street rollers. Machines for cleaning streets were shown by the American Company, of Sag Harbor, and Andrew H. Smith, who exhibited a machine for sawing pavement blocks. Street sweepers were exhibited by the F. C. Austin Company, the Climax Patent Manufacturing Company, and the United States Street Sweeping Company. The Davis-Creswell Company, of Denver, exhibited a street washer, and the Walworth Company an automatic sprinkler.

The exhibit of appliances for steam engines and machinery was rich in interest and instruction. The Ashcroft Company received an award for pressure and vacuum gauges, the Tabor indicator, and the continuous recorder; Schaffer & Budenberg for pressure gauges for gases and fluids, ammonia gauges for ice and refrigerating machinery, tachometers for high-speed engines, a steam-engine indicator, and exhaust injectors; the Electro-Automatic Appliance Company for an automatic engine stop; the Nathan Company for injectors, lubricators, and oil cups; the Sherwood Company for an automatic cylinder oil pump, gauge cocks, and flue scrapers and blowers; the Lunkenheimer Company for steam machinery, gate valves, and steam whistles; the Reliance Gauge Company for solderless copper floats and a safety-alarm water column; McCanna Brothers for an oil pump for steam cylinders; the Crosby Company for pop safety valves, a feed-water regulator and revolution counter, indicators, a double-spring gauge and water-line siphon valve, and a pressure gauge tester; the Detroit Lubricating Company for sight feed lubricators, a low-water alarm, glass oil cups, and hot-water valves; the Penberthy Company for injectors that can be taken apart to

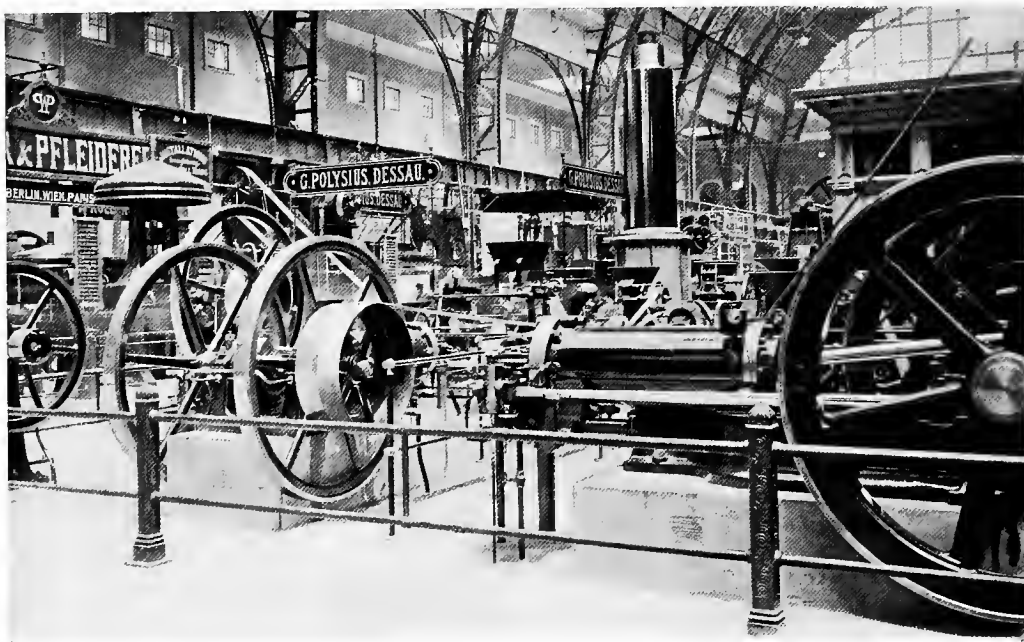
clean and readily put together again. The pressure gauges of the Crosby Company have the elliptical-section curved tube, but have different devices for actuating the index—the Bourdon, the improved Lane, or the Crosby improved. This company exhibited, besides steam gauges for stationary and locomotive boilers, a duplex air-brake gauge that gives two readings at once, a hydrostatic gauge indicating pressure up to 20,000 pounds to the square inch, compound pressure and vacuum gauges, a chemical gauge, a gas governor, and an ordnance gauge capable of recording the pressure not only of ordnance discharges, but of all kinds of explosive or vibratory shocks. The Roe Stephens Company exhibited Orme pop valves, Scott safety valves,



A PORTION OF THE RUSSIAN SECTION.

check and gate valves, angle globe valves, and Goldsmith throttle valves. J. E. Lonergan & Co. had pop safety valves that held the steam very close to working pressure, and also water relief valves. N. P. Bowsher showed speed and motion indicators. The Hancock Company had inspirators and ejectors for locomotive and stationary boilers. The Hayden & Derby Company exhibited automatic double-tube injectors for feeding water boilers and ejectors of every class in operation in the power house and on the steam launches. A positive-acting pump governor, made by Timothy Kiely, was designed for returning condensation to engines when a low pressure is carried

or when the exhaust is used for heating ; in the same exhibit were high-pressure reducing valves, pressure regulators, back-pressure valves, and multi-tubular oil and steam separators. The Webster & Perks Company got an award for an aluminium reducing valve. Joshua Thomas exhibited a water feed regulator and governor ; Peter Barclay & Co., cylinder lubricators ; the Crosby Company, testing apparatus ; the William P. Miller Company, a system of lubrication ; Hohmann & Maurer, thermometers ; James P. Marsh & Co., pressure and compound vacuum gauges ; William Sellers & Co., automatic injectors ; and Thompson & Bushnell, indicators with reducing wheels. E. Rutzler showed an exhaust head for main power plant placed



MACHINERY SHOWN BY G. POLYSIUS, DESSAU, GERMANY.

on the exhaust pipes above the roof. Electric tank and burner regulators were exhibited by the National Electric Valve Company, and an automatic heat regulating valve by Mrs. A. S. Kissell. Of Bristol's recording gauges, which register continuously pressures of air, gas, steam, water, or liquids ranging from vacuum to 1,500 pounds to the square inch, one was in operation recording the pressure of steam used in the buildings and seven others in different buildings. The same company showed a new recording thermometer and recording voltmeters.

Riehle Brothers received diplomas for collections of testing machines and measuring instruments. The machines were constantly at work testing various materials, from cloth to metal, that was subjected to comparison or tensile or transverse strains of a hundred and fifty tons. One machine had an autographic attachment for registering strains. Tinius Olsen's testing machines

and micrometers earned a medal, and William Sellers & Co. obtained an award with a hydraulic testing machine. George J. Alden exhibited dynamometers. Prince Gagasene received an award for a Russian machine for testing the strength of materials.

Group 78 was made up of machines for working stone, clay, and other minerals and comprised the following classes: 491. Stone-sawing and planing machines, dressing, shaping and polishing, sand blasts, Tilghman's machines, glass-grinding machines, etc. 492. Brick, pottery, and tile machines. Machines for making artificial stone. 493. Rolling mills and forges—roll trains, hammers, squeezers, engines, boilers, and other driving power; heating furnaces (coal and gas), special machines for shaping metal.

Riehle Brothers exhibited a machine for countersinking marble basin slabs and molding marble for interior finish. Edward Kennedy & Son exhibited mill picks. A saw gang for a stone mill was exhibited by the Gouverneur Machine Company. F. J. Dugan, of South Norwalk, showed a potter's wheel in operation. Apparatus for cutting and engraving glass and crystal was well displayed in the French section. Brick machines were exhibited by Canada, and machines for tiling and lime cement by Great Britain and Germany. Two English firms exhibited sand-blast apparatus and one had brickmaking apparatus in operation.

Interesting machines were shown for expanding metal for use in railings, into which a bar of steel passed at one end and came out at the other a broad network; this material is much used as lath in modern buildings. The Severance cut-nail machine is entirely automatic, and the nails it turns out have chisel points and heads that are not upset, but simply cut larger than the body on two sides. Molding machines in action were shown by the Tabor Company. Portable furnaces and crucible cupolas for gun metal and statuary were shown by A. Piat in the French section.

Group 79 was machinery used in preparation of foods, etc., in the following order: 494. Mills for the preparation of cereals. 495. Sugar-refining machines. Confectioners' machinery. 496. Oil-making machinery. 497. Machinery for spices, etc. 498. Machinery for condensing milk, etc.

There was a large display of flour-mill machinery from the works of E. P. Allis & Co., Barnhart & Leese, and Nordyke & Maimon. Flour milling was shown in full operation. Automatic flour mills were exhibited in the German section by a Dresden manufacturer. Grain, oil, and other mills were shown by a Brunswick firm, with turbine wheels, roll tables, appliances for husking grain, and an apparatus for coloring rice. A British exhibitor had machinery for making bread, biscuit, and pastry. An automatic refreshment stall was shown in the English section. French exhibitors had machinery for making bread and confectionery, and other machines for confectionery and for ice cream were among the Belgian exhibits. A machine that filled, weighed, and sealed one-pound bags of ground coffee at the rate of several tons a day was shown by Arbuckle, of New York.

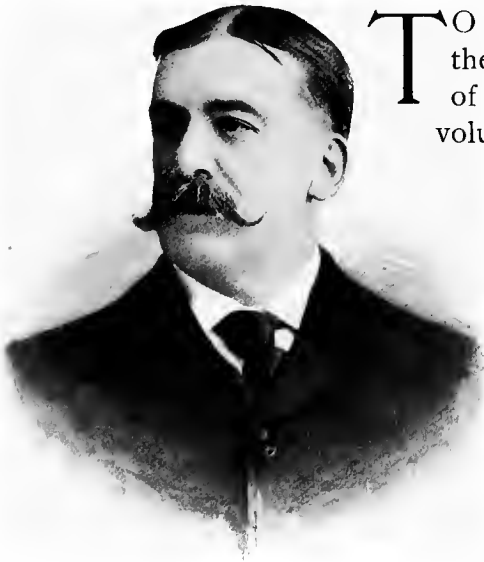


Life-boats displayed by Thomas Drein & Son, Wilmington, Del.

## CHAPTER VII.

### THE TRANSPORTATION EXHIBIT.

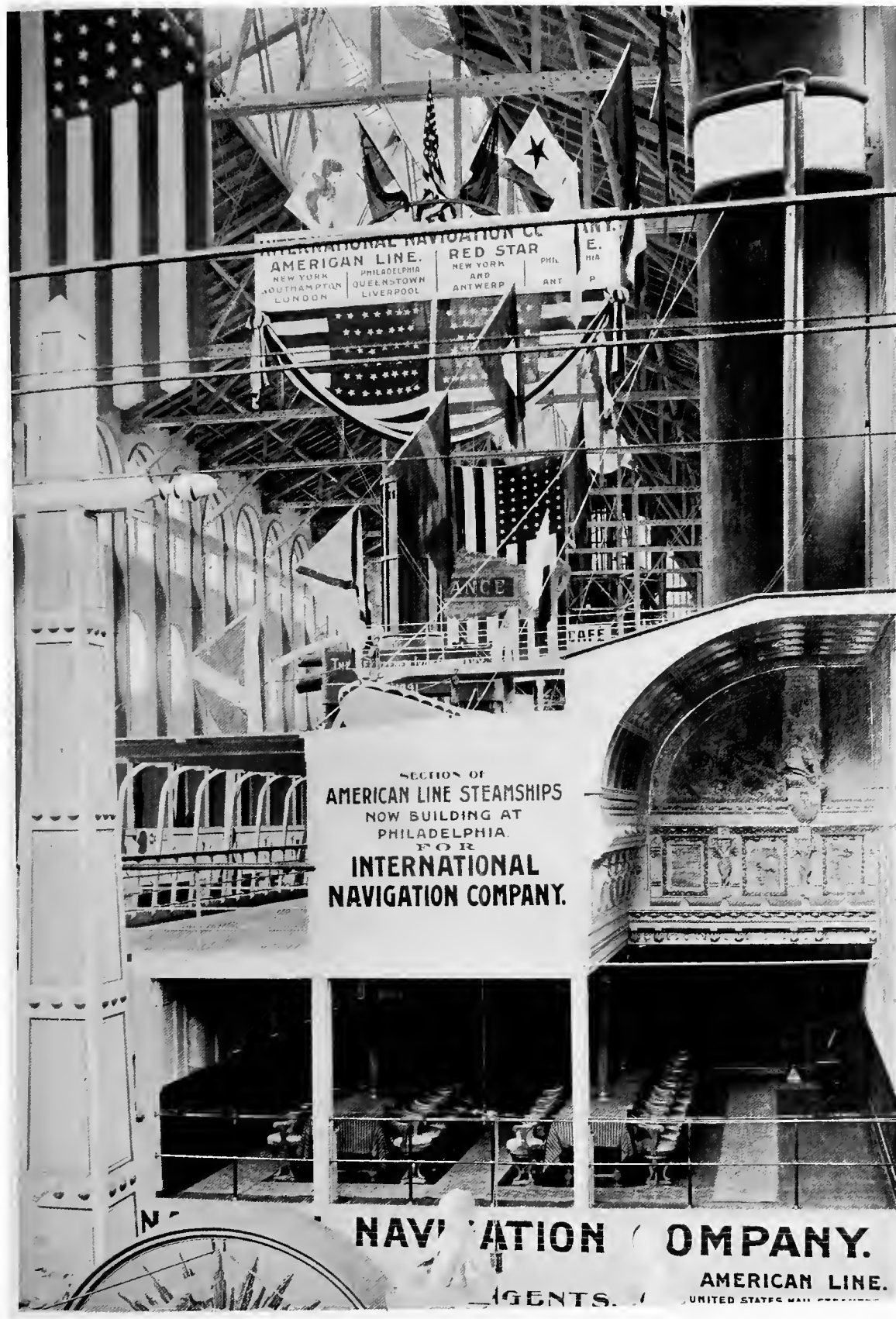
Description of the exhibits by technical periodicals—The American transportation exhibit—The vehicle exhibit—Exhibits in group including aerial, pneumatic, and other forms of transportation—The marine division—Naval warfare and coast defense—Railway exhibits—The German exhibit—The French exhibit—The exhibit of Great Britain—The exhibit of Austria—Belgium's exhibit—Brazil's exhibit—The exhibit of Canada—Italy's contribution—The exhibit from Japan—The exhibit of Mexico—Exhibits by Netherlands, New South Wales, Norway, Sweden, Russia, and Siam—The exhibit of Spain—Switzerland's exhibit.



EDWARD P. RIPLEY,  
Member of the Directory, Chairman  
of the Committee on Transportation.

TO give a careful and complete description of the exhibits in this department which would be of real technical value would require many volumes. The technical periodicals of 1893 devoted a great amount of space to illustration and description of the more important exhibits. Reference may be made to *Engineering*, of London, the *Railway Review*, of Chicago, and the *Railroad Gazette*, of New York, in connection with railway exhibits; the *Carriage Journal*, of Philadelphia, and *The Hub*, of New York, in connection with vehicle exhibits; and the various other weekly and monthly publications devoted to marine, engineering, and mechanical subjects, including also those devoted to bicycles, farm implements, street railways, and electricity. The most im-





SECTION OF OCEAN STEAMER.  
 Shown by the International Navigation Company.



portant book yet published in this connection is entitled *A Record of the Transportation Exhibits Building of the World's Columbian Exposition of 1893*, by James Dredge, editor of *Engineering*, of London, England. It is principally devoted to the railway cars and locomotives, track, machinery, etc., and to some of the principal marine exhibits. Valuable monographs were published in the *Proceedings of the Western Railway Club*, of Chicago, for September, October, November, and December, 1893, on the following topics: *The Locomotive at the Exposition*, by E. M. Herr, M. E.; *Passenger-Train Equipment at the Columbian Exposition*, by George Gibbs, M. E.; *Draft Appliances on Locomotives exhibited at the World's Columbian Exposition*, by Willis C. Squire; and *Steel in Car Construction*, by J. D. McIlwain. Admirable in the completeness and accuracy of its text, the liberality of illustration and its mechanical execution, is the volume entitled *The Pennsylvania Railroad Company at the World's Columbian Exposition*, Chicago, 1893. While devoted principally to the history of the origin and development of the Pennsylvania Railroad system, it contains also excellent illustrations and descriptions of the most improved modern machinery, track, and appliances that either in themselves or by photographic representation formed important parts of their brilliant exhibit. The work is published by the company for private circulation. In the German language important monographs have been published by Hermann von Littrow, of the *Oesterreichischen Staatsbahnen*, of Pillach, Austria, a member of the Jury of Awards, and by Mr. Petri, of the Hanover State Railways.

The American Transportation exhibit was very extensive and fairly representative except in one group. Several classes in different groups were not represented by any exhibits. For instance, aerial transportation by means of balloons, air ships, etc., was not represented by a single exhibit. But the reason for this is evident. Navigation of the air has not yet passed from the experimental stage or even reached the stage of successful experimentation. It exists only in theory, and while it was the subject of interesting discussion in a World's Fair Congress, there was really nothing that could be exhibited which would have any value. Other causes operated against representation in certain classes. Electric transportation machinery and appliances were necessarily exhibited in the Department of Electricity, and the Mining and Machinery Departments also overlapped the Transportation Department in certain instances.

It is evident also that there are many kinds of exhibits which are desirable in order to secure completeness and to present the subject in all its phases which can be made only through associations or societies. An effort was made to induce the American Society of Civil Engineers and other bodies to undertake some such exhibit as that made by the German engineering societies, but without success. Classes 501 and 502, covering methods of railway management and operation, were not represented except in so far as could be done by actual machines or appliances. The commercial idea was lack-

ing, and hence there was not sufficient inducement for individuals to bestow the necessary time and labor upon the preparation of such exhibits. This can be done, if at all, only by associations animated by public spirit and pride in their business.

The only missing feature in the vehicle exhibit was that of steam and electric carriages for use on common roads. Several applications for space for such exhibits were made but afterward withdrawn. In the German section there was a road carriage driven by the Daimler petroleum motor which made occasional trips about the grounds. An electrical carriage also made its appearance at the Electrical Building and made frequent trips through the grounds. Pleasure carriages of the heavier class, such as coaches, drags, victorias, and broughams, were exhibited in large numbers by the manufacturers. In style and beauty this exhibit was probably never surpassed, and the material and workmanship proved that the best American carriage builders are now the peers of any in the world. In lighter pleasure vehicles of the more expensive class the same was true ; but by far the largest exhibits, both in number and extent, were of light pleasure vehicles, such as buggies, carts, rockaways, phaëtons, surreys, and wagonettes. These were shown in endless profusion of styles and in different qualities, following a wide range of prices. Foreigners were especially impressed by the lightness, strength, and convenience of this class of vehicles, but above all by the moderate prices. Very comprehensive and wonderful in the variety of adaptation was the exhibit of light delivery wagons and of heavy wagons for every kind of business. These likewise were noticeable for cheapness and the perfection attained by the modern machinery and systematic methods of large manufacturing. From baby cabs to hearses, and from pneumatic-tired racing sulkies to ponderous log wagons, nothing seemed to have been overlooked. There were nearly three hundred exhibitors in the American vehicle section. These included those who showed harness, saddlery, etc., of which the display was not very extensive but of the best quality.

There were forty-three exhibitors of bicycles and their parts and appurtenances. These were grouped in the gallery, the spaces being for the most part small but very convenient for examining the exhibits from the aisles. There were artistic and expensive pavilions, the most prominent being those of the Pope Manufacturing Company and the Overman Wheel Company, the lavish expenditure on which made them centers of attraction. The development of the bicycle has been so rapid that it requires a specialist to keep up with it in all its ramifications. Every grade of wheel, from the cheapest child's toy to the most fancy patterns, was shown by the different makers. Many of the exhibits were enlivened by wheels and automaton riders in motion, electricity affording the motive power.

The exhibits in Group 84 (aërial, pneumatic, and other forms of transportation) consisted principally of passenger and freight elevators and a variety of pneumatic and gravity carriers for the conveyance of packages and cash in



EXHIBITS IN THE CARRIAGE SECTION.



stores. Otis Brothers & Co., of New York, made an extensive and elaborate display of hydraulic and electric elevators, which rendered excellent service in carrying passengers to and from the galleries. Morse, Williams & Co., of Philadelphia, operated a direct elevator, a very successful novelty. The Miles Pneumatic Tube Company, of Boston, operated a pneumatic elevator; and another novelty was a screw elevator, exhibited by the Standard Screw Elevator Company, of Baltimore. The Eaton & Prince Company, of Chicago, and the Smith-Hill Foundry Company, of Quincy, Ill., exhibited steam and hydraulic elevators, and operated them for the use of the public. Seven different concerns exhibited cash and general store-service carriers, including three pneumatic-tube systems, illustrating very fully the saving in time and labor effected in large establishments by the use of these ingenious contrivances.

For a complete study of the marine exhibits at the Exposition it would be necessary to include the great variety of craft shown in the Department of Fish and Fisheries. The United States Government exhibit necessarily monopolized most of the naval features that would have lent strength and completeness to the American section of this division. In everything except this, however, the exhibits were very complete and creditable.

There were three exhibits of folding boats designed for easy transportation over land; five exhibits of lifeboats and rafts; one of racing shells; and six of small rowboats and sailboats and canoes for hunting, fishing, and pleasure. These exhibits were remarkable for the lightness and strength of the boats, the beauty of their models, and the high finish bestowed on many of them.

There were five exhibitions of launches shown in operation on the lagoons, including those operated by electric storage batteries, by naphtha engines, and by steam. There were also five exhibitions of launches in the building. The largest single exhibit was of naphtha launches of different sizes and styles, by the Gas Engine and Power Company, of New York. The best products of American boat builders were well represented; and interest in them was supplemented by contrast with native canoes and rafts from all quarters of the globe.

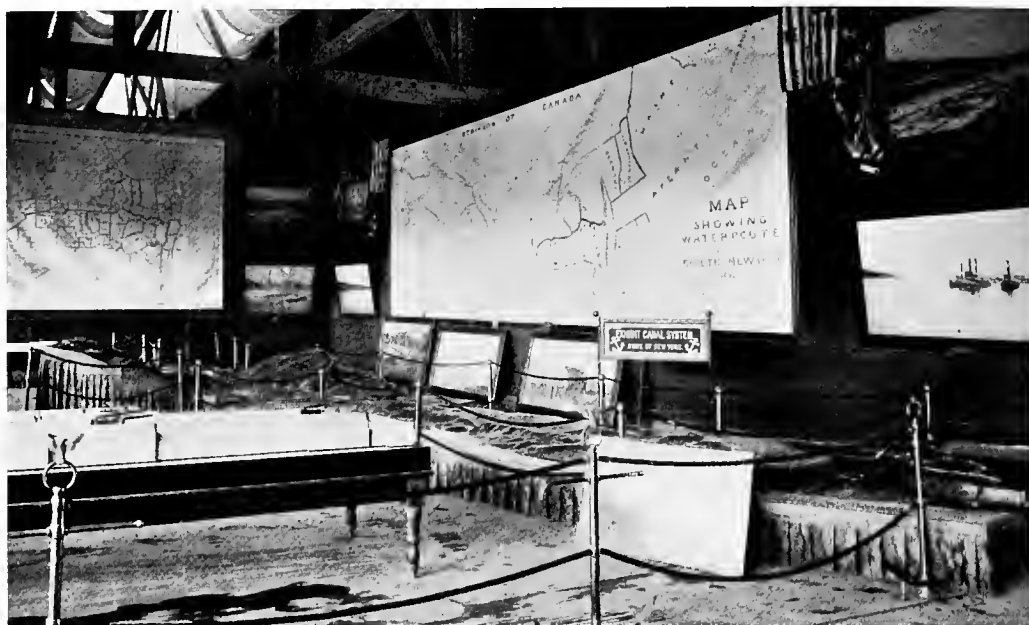
Shipbuilding on the seaboard was represented by models of steamers and vessels, arranged historically by the Harlan & Hollingsworth Company, of Wilmington, Del., and by elaborate models of ships and shipbuilding plants by the Newport News Shipbuilding and Dry Dock Company, of Virginia, and the Union Iron Works, of San Francisco. Shipbuilding on the Great Lakes was represented by the Globe Iron Works, of Cleveland, and the American Steel Barge Company, who illustrated by models the "whale-back" system of construction.

The State of Maine and the Essex Institute and Peabody Academy of Science, of Salem, Mass., made an historical exhibit illustrating the history of wooden shipbuilding, and the State of New York showed, by relief maps



and models, the canal and other internal water ways of the State. Much public interest was shown in a relief map or model of the Nicaragua Canal. River transportation was rather inadequately represented, the only instances being models and historical machinery by the Hoboken Ferry Company and the Mississippi River Logging Company.

Various steamship companies made exhibits of elaborate and expensive models. Among these were the Chesapeake and Ohio Steamship Com-



MODEL OF ERIE CANAL.

pany, the Old Colony Steamboat Company, and the Providence and Stonington Steamship Company, the latter showing an historic series of models. The International Navigation Company (American line) made the crowning marine exhibit, which presented a full-sized section of a steamer, extending from the main floor to the gallery, containing the various decks and all grades of staterooms, dining-rooms, etc. The plan of the new steamers St. Louis and St. Paul was followed exactly, the interior wood finish and furnishing being subsequently used in the construction of one of these vessels. The public was admitted either from the main floor or from the gallery, and more than 20,000 people passed through it in a single day. The technical value of the exhibit was not great; but it served remarkably well for giving the uninitiated an idea of the comfort and luxury of modern ocean travel.

In Naval Warfare and Coast Defense, the principal exhibit was that of the Bethlehem (Pa.) Iron Company. Attention was especially attracted to it by the full-sized model of its 125-ton steam hammer, which spanned the central avenue of the building and towered ninety feet, nearly to the roof. While naval guns, armor, forgings, etc., may not be very directly connected

with the subject of transportation, it was found unadvisable to dissociate them from other marine classes. Manufacturers object to separating their exhibits, and the presence of this vast model in the Transportation Building is thus accounted for. The weight represented in the hammer was 2,386 tons. The actual weight of steel in the ingots, armor plates, shafts of ocean steamers, guns, etc., was nearly 300 tons, a display of the highest character and worthy of one of the most advanced and complete gun and armor-plate works in the world. An important exhibit of ordnance, and especially machine guns for naval use, was made by the Hotchkiss Ordnance Company.

The American Railway Section was in all respects the greatest exhibit of railway material, appliances, and machinery ever brought together. Whether considered in its magnitude, diversity and completeness, historical interest, technical value, or practical educational importance, or as a matter of national pride, it is difficult to believe that it can be easily surpassed. The historical features were developed on a scale that never would have been attempted but for the generous public spirit of the Baltimore and Ohio and Pennsylvania Railroad Companies. The former undertook nothing less than a graphic history of the development of the railways of the world, from the earliest inception of steam locomotion. Full-sized models of the most typical locomotives were prepared with the greatest care and arranged in chronological order. Many original locomotives were also shown, and especially the various types used on the Baltimore and Ohio, from the time of Peter Cooper's experiment down to the present. Permanent way was not neglected, and the development of every kind of railway appliance was illustrated by an enormous collection of drawings and photographs. To describe adequately this great collection would require a large volume. After the close of the Exposition it was secured by the Field Columbian Museum of Chicago, where it was installed by Major J. G. Pangborn, who designed and prepared the exhibit for the railroad company. The historical portion of the Pennsylvania Railroad Company's exhibit was similarly preserved intact; and the two together afford to the student of transportation a valuable field of study.

The Pennsylvania Railroad exhibit illustrated the history of the road by models and relics, and its most modern practice in track, machinery, and methods. It was installed in a beautiful building of exquisite Grecian architecture and a surrounding outdoor space. Its extent and value can only be estimated by an examination of the illustrated descriptive catalogue published by the company and alluded to heretofore.

The New York Central and Hudson River Railroad Company also occupied an extensive outdoor space, fronted by a beautiful building in the shape of a triumphal arch. The first train on the Mohawk and Hudson Railroad, with cars like stagecoaches, headed by the locomotive De Witt Clinton, was reproduced with historical exactness. Alongside of it stood the Empire State Express, the fastest long-distance train in the world, headed by the

locomotive "999," which bears the palm for speed. These stood upon the standard track of the road. Historical cars and locomotives were also shown by the Chicago and Northwestern, Illinois Central, and Old Colony Railroad Companies, and by the Harlan & Hollingsworth Company.

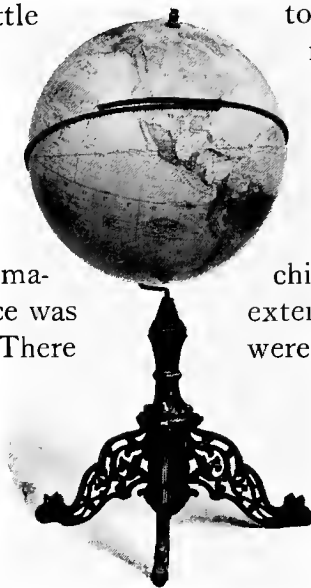
To describe the mechanical perfection and the luxurious furnishings of the passenger coaches, sleeping cars, dining cars, etc., exhibited by various builders would require abundant pictorial illustration and great space. Complete modern limited trains, with a lavishness of decoration hardly dreamed of before, were shown by the Pullman Palace Car Company and the Wagner Palace Car Company. Freight and working equipment in all its various forms, including recent develop-

ment in steel-car construction, snowplows, etc., left little completeness. The same remark applies to the collectives, of which there were every type from the di-

yard switcher to the giant and ninety-five thousand pounds. The exhibit of excavating, grading, and ballasting machinery used in rail-way construction and showed remarkable recent advancement. There were four working exhibits of ment of fifty-car trains be-

compact space and ingeniously inspection. Track, structures, water supply, etc., were extensively and adequately represented. Every form of locomotive and parts in endless variety, and car appliance, sentative manufacturers and were shown by representative manufacturers and Great care having been exercised in excluding the worthless and the erratic, a high level of merit was secured in every group and class. Mention of the advancement shown in street-railway equipment should not be omitted, although this applies only to track and cars, the motors being included in the Electrical Department.

The largest foreign exhibit was made by Germany. It developed so rapidly under the energetic promotion of the Imperial Commissioner and his able corps of assistants, and so far beyond their original expectation, that the problem of providing sufficient space for it became exceedingly difficult. The assurance was, however, continually held out by the Chief of the department that adequate space would be provided by the time it was actually needed. The withdrawal of American exhibitors and the resignation of space by other foreign countries made it possible to keep this promise and to provide exceptionally well for the magnificent exhibit that finally arrived. The German exhibit occupied the southern ends of the main building and

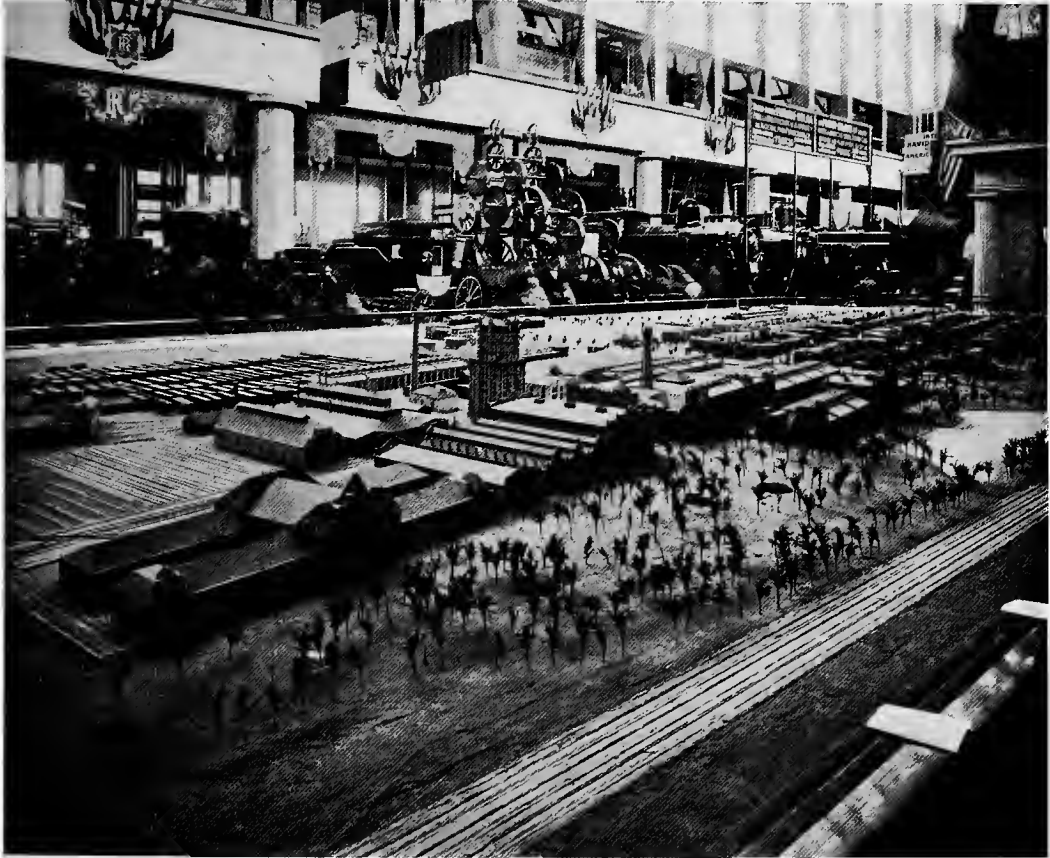


GLOBE

showing length of tracks of the Pennsylvania Railroad system if laid end to end in a single rail.

annex, the southern and a considerable portion of the eastern galleries, the Krupp Building, and certain space on the grounds and on the South Lagoon. The vehicle exhibit was not important, consisting of only three carriages, three or four exhibits of carriage parts and appliances, and six exhibits of bicycles and appurtenances.

The marine exhibits were not as effective as those of Great Britain, owing to the fact that they were scattered instead of being massed together.



MODEL OF THE TOWN OF PULLMAN, ILLINOIS,  
shown by the Pullman Palace Car Co.

Beautiful pavilions were built by the North German Lloyds and the Hamburg-American Packet Company on the ground floor, in which they showed very complete and accurate models of their best steamships. Various marine appliances and some small boats were also shown on the main floor.

In the collective exhibit of the civil engineers of Germany on the gallery floor were about thirty models of ships of remarkably fine workmanship. They represented for the most part naval vessels. Especially noticeable were the citadel ship *Woerth*, the torpedo boat *Kaiserin Augusta*, the dispatch boat *Hohenzollern*, and the ironclad *Brandenburg*. The Vulcan Company, of Stettin, exhibited four models, including one of the *Ting-Yen*, a

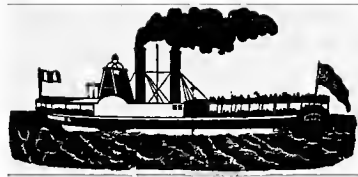
6,300 horse-power war ship built for the Chinese Government. A considerable portion of the engineering exhibit consisted of models of ships, yards, docks, etc., plans of river rectification, canal routes, models of river craft, methods of towing, lighthouses, lightships, etc. There were models illustrating the Abt system of mountain climbing for railways, drawings and models of important railway bridges, etc. This remarkable exhibit was made at great expense by the various engineering societies of Germany. It was admirably installed, the drawings, plans, photographs, and paintings of engineering works being mounted on large screens so that they could be readily examined. The collection related to engineering in general, and included many models, drawings, and books that had no direct connection with transportation, and hence would have been exhibited more properly in the Department of Liberal Arts. Such division was impracticable, and the collection as a whole was the most interesting and extensive exhibit of engineering, drawings, and models ever made in this country. It was returned intact to Germany, and was kept together for an engineering exposition in Berlin.

The German railway exhibit, while by no means comprehensive, was both varied and highly instructive. The Prussian state railways showed a collection of models of railway stations, bridges, etc., and drawings and photographs of railway terminals—an exhibit of great value, in view of the importance that now attaches to the subject of track elevation or depression in great cities. European methods in interlocking switch and signal systems were well illustrated by an extensive exhibit by the Siemens & Halske Company, of Berlin, who made a specialty of some recent apparatus. Track materials of all kinds, wheels, tires, etc., for both steam and street railways, nuts and bolts, seamless steel-drawn tubes, etc., of a high degree of excellence, were handsomely displayed by many German manufacturers. Great attention was drawn to the Daimler motors, actuated by the explosion of petroleum in a thoroughly safe and economical method. These motors are applicable to a great variety of uses, and were shown as adapted to a fire engine, a portable electric (arc) light wagon, an exceedingly swift launch operated on the Lagoon, and a light portable railway with passenger cars operated on a track near the terminal station. A prolonged effort was made to obtain a concession for laying and operating a surface road of this system for carrying passengers between important points on the grounds not otherwise provided for. The necessity for such additional transportation facilities was recognized, as well as the special merits of this system; but the exclusive nature of the contracts already entered into for transportation of passengers within the grounds prevented its use.

One of the most important exhibits in the entire Exposition, from an educational point of view, was made by the George-Mary Iron Works, of Osnabrück. It presented the history of railway track used in various countries from the earliest to the most modern. The series was introduced by a section of an old Roman corduroy road recently excavated from a peat

swamp in Germany. These timbers were laid just as found, over peat, so that the method of construction was visible at a glance. This was followed by a section of an ancient pole road, with a switch and a small wooden car, the wheels having a concave tread to fit over the pole track. Such roads are said to have existed in Germany several centuries ago. Then were shown, in as nearly chronological order as possible, the strap-iron rail laid on stone blocks and stringers, the fish-bellied rails, rails with flanges  $\Omega$ -shaped, and the many modifications of the T-rail. These were laid upon wooden stringers or ties, and fastened by various forms of chairs and fish plates. The most typical forms of iron and steel ties followed, and the series closed with the most modern German construction, in which the Haarman scarf joint and self-bearing rails are employed. Each sample of construction was laid with appropriate ballast and slightly raised from the floor. They were accompanied by plain, large, descriptive labels in German and English. This historical exhibit contained all the most important examples from the Haarman track museum of Osnabrück, the collection of which required six years of travel and work on the part of Dr. A. Haarman and Prof. A. Vietor, and forms the basis of their standard book on railway track. The commercial idea in this great exhibit was presumably to show the Haarman system of track as the culmination of experience and study. It afforded an opportunity never before presented in this country to study the development of railway track under varying conditions and the course of invention in connection therewith. In this, as in other mechanical fields, inventors often repeat one another. Methods of track construction have often been tried in this country which, as shown by this exhibit, had long before been tried and discarded elsewhere. This exhibit was also especially instructive in showing the thorough methods of German engineers and manufacturers in studying any subject they have determined to master. This was illustrated in other German ex-

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**REESIDE, SLAYMAKER & TOMLINSON.**

**October 1, 1832.**

Spicer & Hamblitt, Printers, Corner Wall and Water-streets.

POSTER

(Reduced) shown in the Pennsylvania Railroad Co.'s Historical Exhibit. Contributed by L. H. Anderson.

hibits, but in no case so impressively as in this. The system thus evolved has proved most economical in Germany, and is theoretically approved by many American engineers.

The exhibit of German railway motive power and equipment consisted of two locomotives, two passenger cars, and two freight cars; and these were exhibited under the auspices of the Prussian State railways, although built by private establishments. The locomotives were a six-wheel tank switcher, built by Henschel & Sohn, of Cassel, and a six-wheel two-cylinder compound of the von Borries system, built by F. Schichau, of Elbing. The design and details of construction of these engines attracted much studious attention. A first-class passenger coach, exhibited by Van der Zyphe &

Charlier, of Cologne, was especially noticeable from the fact that it was almost entirely of steel. Pressed-steel shapes of beautiful workmanship and fitting were used to a notable extent. The floor plan was on the American system, with a central aisle.

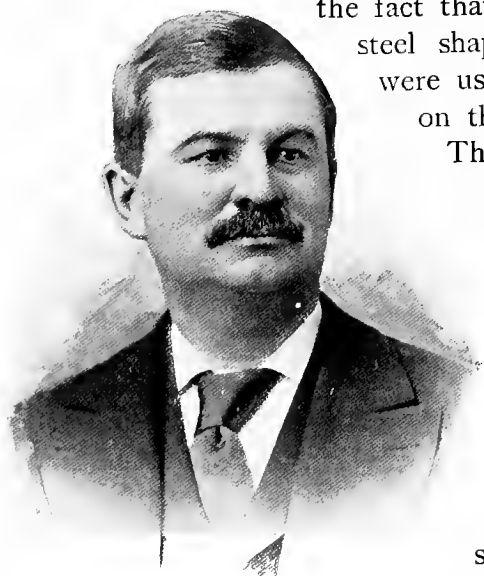
The decoration was exceedingly ornate. A coal car and a lumber car, built entirely of steel and iron, were shown by the same firm, who also exhibited many small parts in pressed steel. The excellence of the workmanship was highly praised.

A passenger car, built by the Aktien Gesellschaft für Eisenbahn Wagenbau, of Breslau, was on the compartment plan for first- and second-class passengers, such as is usual in Europe. It was provided with three axles and a flexible wheel base. The body of the car was sheathed with sheet steel. The compartments were provided with lavatories, in accordance with the

best late European practice. The workmanship throughout was of high grade and the finish remarkable.

The great exhibit of the establishment of Friedrich Krupp, of Essen, Germany, was installed in the Krupp pavilion on the Lake Shore, and is described in its own chapter in this volume.

The most important location in the French exhibit was given to a large and attractive collection of road vehicles, saddlery, and accessories of the stable. The artistically finished and superbly built carriages and carts exhibited by the celebrated firms of Guiet et Cie and L. G. Muhlbacher, of Paris, attracted admiring throngs. There were but three exhibits of bicycles, and these did not show any particular excellence. The saddlery was noticeable for stylish design and fine workmanship. A Parisian street omnibus, un-



GEORGE B. HARRIS,  
Member of the Directory.



painted, inspired confidence in its strength and durability. An exquisitely decorated sedan chair of the time of Louis XV showed that the taste of French vehicle builders is not a recent development.

The most important marine exhibit in the French section was that of the *Compagnie Générale Transatlantique*, which consisted of models of their principal steamers and a diorama of large paintings. These illustrated embarkation at Havre, the port of Algiers, the entrance to New York harbor, and various scenes on board the steamers. They were the work of genuine artists, and were displayed skillfully. Marine appliances of various kinds were exhibited by several manufacturers, and models of marine machinery, torpedo boats, and appliances for naval warfare, properly belonging in this department, were shown in Machinery Hall by *Schneider et Cie, Creusot*.

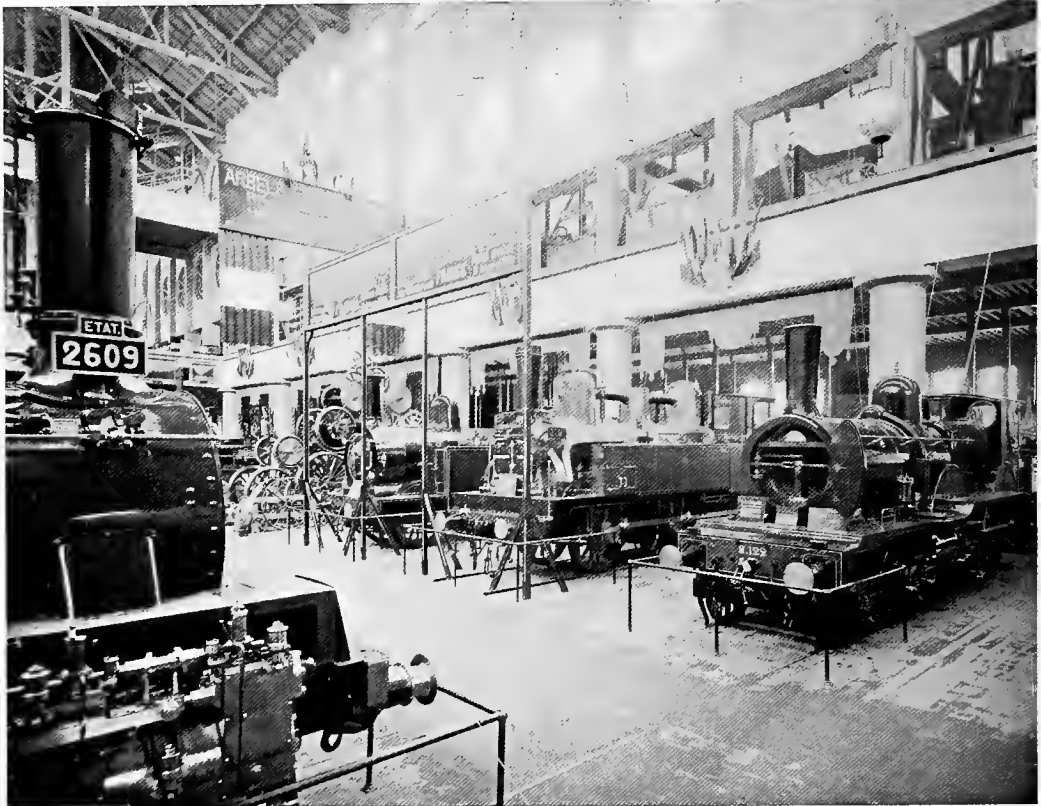
An important engineering exhibit, consisting mainly of models, maps, photographs, and drawings principally relating to transportation, was shown in the gallery. The *Fives-Lille Company* had some remarkable models—one of a 120-ton crane; one of a swing bridge at Marseilles, 311 feet long and weighing 1,210 tons; one of an arched bridge with a span of 68 metres over *L'Qued Saf-Saf* on the *Tabia Themeen Railway* in Algiers; and a model of a "Titan" employed in constructing sea walls at *Leizoes, Portugal*. This great crane is 229 feet 8 inches long, and handles a load of 50 tons at a range of about 100 feet, or a load of 15 tons at a range of 144 feet. The port of Dunkirk was illustrated by a map and models, which perhaps never have been surpassed in accuracy and general effectiveness. The *Ponts et Chaussées* exhibited finely executed drawings of engineering works, which attracted the especial admiration of engineers and draughtsmen, and private engineering firms contributed to an extensive and instructive collection of photographs, drawings, etc.

The most important portion of the French railway exhibit consisted of four locomotives. The Northern Railway of France sent a four-cylinder compound eight-wheeler. The drivers were coupled, and the driving-wheel base was nearly ten feet. It was fitted with a Joy valve gear, vacuum brakes, and electric signals. The State Railway of France exhibited an eight-wheel express engine with leading and trailing two-wheel trucks, outside cylinders, and coupled drivers. The apparent great complication of the *Bonnefond* valve gear attracted the constant attention of both technical and untechnical observers. It appears to have a remarkably good record for efficiency and durability. The Western Railway of France exhibited a six-wheel suburban engine, inside connected, with water tanks above the running board and a coal bunker at the rear of the footboard. As it has no tender and a short wheel base, it is easily operated around terminals. The Paris and Orleans Railway sent a six-wheel connected suburban engine, with a wide fire box and the frames and bearings outside of the driving wheels.

All these locomotives were accompanied by excellent drawings showing their interior construction, a feature of great value in such exhibits. A re-

lief model of the great St. Lazare Station and terminus hotel of the Eastern Railway of France was exceedingly instructive, and showed very clearly the method of handling passenger trains. The drawings of locomotives, cars, etc., exhibited by several railway companies were far more elaborate and artistic than any work of the kind ever executed in this country.

There was but one car in the French section. This was a passenger



RAILROAD EXHIBITS FROM FRANCE.

coach of the second class for suburban traffic, and was noticeable principally for the imperial or roof seats. It was kindly sent by a special request of the Chief of the department on account of this construction, which is not used in this country except for a few street cars. A prominent object in the central court was a pyramid of wheels and axles from the Society Anonym Industrielle des Établissements Arbel, Rive de Gier. The wheels had steel tires and forged wrought-iron centers, the peculiar method of their manufacture insuring a high-class product at a comparatively low price.

The French railway exhibit was under the charge of M. Desmoulin, of the Western Railway of France, who labored under great difficulties in bringing his locomotives with their long and rigid wheel base from the seaboard to Chicago. The installation of the exhibit was very creditable.

The British exhibit in transportation was one of the best made by Great

Britain in any department of the Exposition. In the division of road vehicles it was not extensive, but it was made exceedingly interesting and instructive by a considerable number of loan exhibits of historical and curious value. A dress coach formerly used by the Lord Mayor of London and several other vehicles used by royal or other notable personages were, in addition to these personal associations, interesting on account of their style, long since out of fashion. There was a collection of antique bits, spurs, etc., loaned by many different collectors of curios, and a large collection of mod-



EXHIBIT OF THE CUNARD STEAMSHIP CO., LIVERPOOL.

els, paintings, and drawings illustrating the progress of invention and improvement in carriage building loaned by the Institute of British Carriage Manufacturers. An antique English sedan chair and a "dandy horse" (the predecessor of the modern bicycle, propelled by the feet of the rider touching the ground), dating from the early days of the century, were among the interesting loan exhibits.

British carriage builders can hardly be said to have been represented. The London firm of Morgan & Co. sent five carriages of characteristic British excellence, and two other makers exhibited carts, one a pleasure vehicle and the other of the dumping variety. A system of patent haulage attachments for vehicles for saving horse power was vigorously brought to the public attention by the inventor. There were six exhibitors of saddlery, whips, stable fittings, etc.

The bicycle exhibit was not so successful as was anticipated, owing to the fact that some who had taken space failed to occupy it. Much of the space in the gallery reserved for bicycles was at a very late day assigned to other countries. Five or six firms who find sale for their products in this country were represented. The quality of their wheels was undoubtedly excellent, but the exhibits were not particularly attractive in their method of display.

The marine display of the British section constituted a leading feature of interest of the entire Exposition. There were thirty-six exhibitors, comprising a majority of the great shipbuilding firms. The eye of the visitor entering the golden door lighted almost at once upon the old lifeboat *Grace Darling*, the story of which was so familiar as hardly ever to raise an inquiry. There was something of the marine and naval history of Great Britain in such exhibits as that of the Cunard Steamship Company, whose models covered the gradual improvement from the *Britannia* of 1840 to the *Campania* of 1892. John Coryton, of London, loaned from his extensive antiquarian collection a set of English admiralty seals, medals struck in honor of naval victories, and many unique naval relics. With these exceptions, the exhibit was wholly modern and related almost entirely to steamships, sailing vessels being represented by a very few models. Boats were represented by Thames skiffs and canoes and by lifeboats and cutters.

The most striking of the naval models, because the largest and most complete, was that of the *Victoria*, by Sir W. G. Armstrong, Mitchell & Co. It was a half model, thirty feet long, erected against a plate-glass mirror so as to give the effect of a full model. The details were worked out with the greatest perfection, nothing being omitted. A raised platform was erected in front of the model with steps at both ends so that the public could look down upon it and observe every feature of its construction. It attracted a special and melancholy interest after the loss of the ill-fated battle ship. A full model of the cruiser *25 de Mayo* was shown by the same firm. Yarrow & Co., of London, exhibited models of torpedo boats, torpedo catchers, and "knock-down" boats (to be shipped to localities otherwise difficult to reach and erected where they are to be used). The remainder of the naval exhibit consisted of compound and steel armor plate by Brown & Co., of Sheffield, who also exhibited boiler plates and tubes and marine shafting; and the Maxim-Nordenfeldt quick-firing machine guns were shown in operation in a special building erected for the purpose just north of the annex of the transportation exhibits. The Adamson quick-firing gun was also shown.

Sixteen shipbuilding establishments and steamship lines exhibited models of freight and passenger steamers, yachts, dredges, marine engines, etc. The principal exhibits of steamship lines were those of the Cunard Company, mentioned as above, and of the White Star line, which was installed in a handsome pavilion of distinctly marine style of architectural ornamentation between the Horticultural and Woman's Buildings. The Peninsular and Oriental Steam Navigation Company displayed a great map with diminutive

ship models attached, showing the extent of their service and their method of keeping track of the daily whereabouts of their steamers. Among the exhibits of shipbuilders were those of the Fairfield Shipbuilding and Engineering Company, of London ; R. and W. Hawthorn Leslie & Co., of Newcastle-on-Tyne ; the Thames Iron Works and Shipbuilding Company, of London ; and J. and G. Thomson, of Clydebank, Scotland—all of which were noticeable for the size of the exhibits as well as the perfection of the models and the importance of the work they represented.

The tourist-travel firm of Cook & Sons had an attractive pavilion in Egyptian style presided over by natives of the banks of the Nile. While



MODELS SHOWN BY J. & G. THOMSON, SHIPBUILDERS, CLYDEBANK, SCOTLAND.

illustrating their system of conducting tourist travel in general they gave especial attention to Egyptian tours, an advertisement which must have been successful judging from the large annual increase of American tourists in the land of the lotus. The models of Nile steamers and *dahabeahs* contrasted strongly with those of the ancient Egyptian funeral boats, and the model of the temple of Edfou was calculated to increase the appetite for travel.

The history of the birth and development of the railway in Great Britain was very completely illustrated by drawings, full-sized models, and relics in the Baltimore and Ohio Railroad exhibit in the American section. The

British exhibit also contained many notable historical examples. In the gallery were shown many sketches, models, pictures, and relics, loaned by Atkinson & Philipson, of Newcastle-on-Tyne, and Isaac W. Boulton, of Ashton-under-Lyne. A remarkable high-pressure boiler, built by Richard Trevethick, whose locomotives first successfully drew cars on rails, was loaned by Harvey & Co., of Hayle, Cornwall. The Plymouth Works, of Merthyr Tydvil, Wales, loaned two trucks, which were the first ever drawn on rails



VIEW NEAR THE CENTER OF THE TRANSPORTATION BUILDING.

by steam, having been a portion of the train drawn by Trevethick's locomotive in 1804. These were mounted on a section of the original track, consisting of flanged rails resting on stone blocks. These interesting and valuable relics were subsequently purchased for the Field Columbian Museum. At the Exposition they were accompanied by original drawings of Trevethick's locomotive and maps of the old tramroad. In the great exhibit of the London and Northwestern Railway Company there was a full-sized model of this locomotive, as well as one of George Stephenson's Rocket, both of which were afterward presented to and installed in the Field Columbian Museum, Chicago.

The exhibit of the London and Northwestern Railway Company was a model in all respects and showed an extensive experience in exhibitions and a knowledge of their requirements. A mechanical representative of the company was sent to this country as soon as the building was far enough advanced to study the situation and make preliminary arrangements. The

exhibit was installed in good time and in a most workmanlike manner. It was maintained properly through the entire Exposition, and full information was furnished verbally and in printed form by uniformed attendants. The major portion of the space was occupied by a passenger train consisting of a locomotive and two cars standing on the standard track of the road, with double-headed rails and steel ties. The locomotive was placed over a pit, accessible by steps at the forward end, so that the machinery could be examined from underneath. The locomotive was a Webb three-cylinder compound, with four drivers and leading and trailing trucks of two wheels each. The symmetry of the engine and its high finish were remarked by all. The sleeping car was forty-two feet long, and had four compartments with four berths each and a separate lavatory. A corridor ran the whole length of the car on one side, and there was a smoking compartment. The other car was denominated a "composite carriage," having two first-, one second-, and two third-class compartments, and a baggage room. The cars were wired for electricity, and piped for gas light. They were fitted with both Westinghouse and vacuum brakes, as they run on a line composed of roads using different braking systems. The composite car was designed to be heated by foot-warmers, using acetate of soda. The sleeping car was heated through pipes from a gas stove in the attendants' compartment. At the close of the Exposition this train was run, under its own steam, from Chicago to New York, and attracted large numbers of visitors at the principal points along the route.

This company also exhibited in compact space a working locomotive model, a key interlocking apparatus, and electrical staff and ticket apparatus for controlling traffic on single-track roads, an electrical boiler-tube cutter, a model of the gridiron sorting sidings of the Footner system at Edgehill, near Liverpool, and numerous photographs of the machinery and scenery of the road.

The Great Western Railway of England made an especially noteworthy historical exhibit. The principal feature was the old locomotive Lord of the Isles, which made its public *début* at the first World's Fair, held in London in 1851. It had a single pair of drivers, eight feet in diameter, and was of the seven-foot gauge, which only recently has passed finally out of existence. Over this famous track of Brunel's this massive but simple machine ran for forty years and made a total of 789,300 miles, more than thirty-one and a half times around the globe. The accounts of its speed detract somewhat from the glory of more recent achievements. A chronological display of rail sections, the old broad-gauge track with longitudinal stringers, the present standard track with bullhead rails held by cast-iron chairs, and photographic views of scenery, made up the remaining portion of the exhibit.

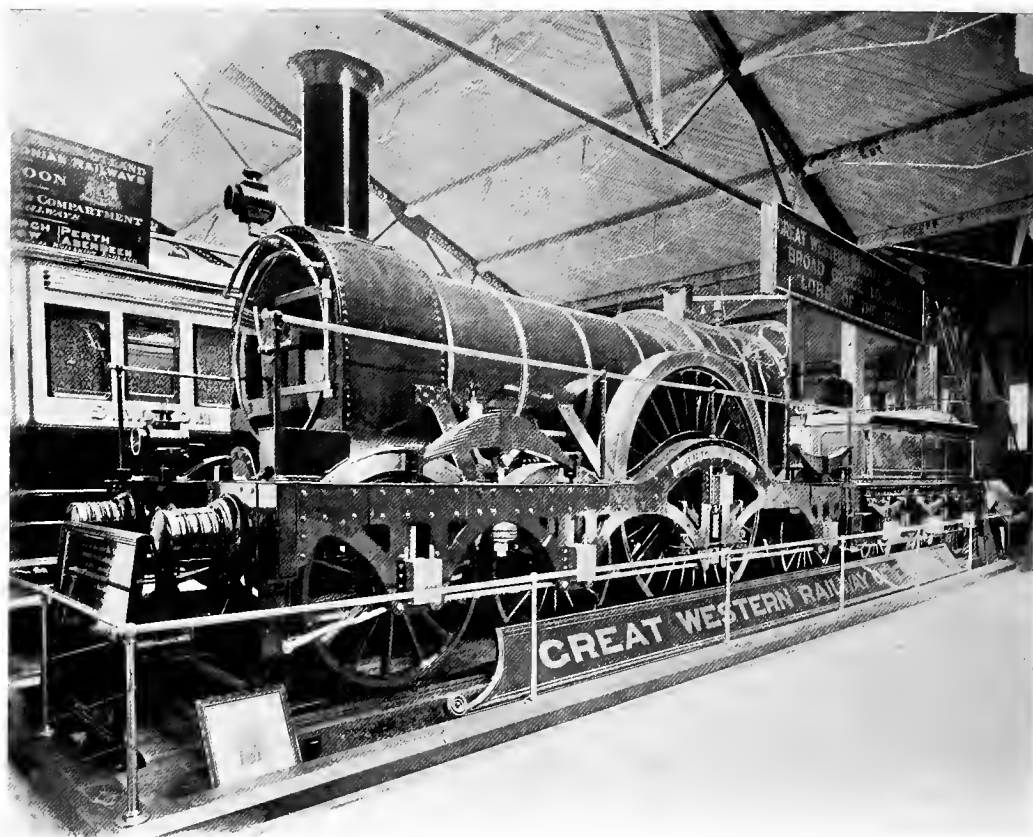
Westwood & Winby, of London, exhibited an experimental locomotive with four high-pressure cylinders arranged for driving two pairs of



seven-and-a-half-foot wheels without coupling rods, and having boiler and fire box with 2,000 square feet of heating surface and 28 feet of grate surface. This engine was tried faithfully on a Western road after the close of the Exposition, but proved a failure.

The Great Eastern Railway and the Midland Railway of England, the Belfast and Northern Counties, and four other Irish railways, advertised the attraction of their lines for tourist travel by means of maps and superb photographs of scenery. A beautiful model of that engineering wonder of modern times, the Forth Bridge, was sent by the engineers, Sir John Fowler and Sir Benjamin Baker.

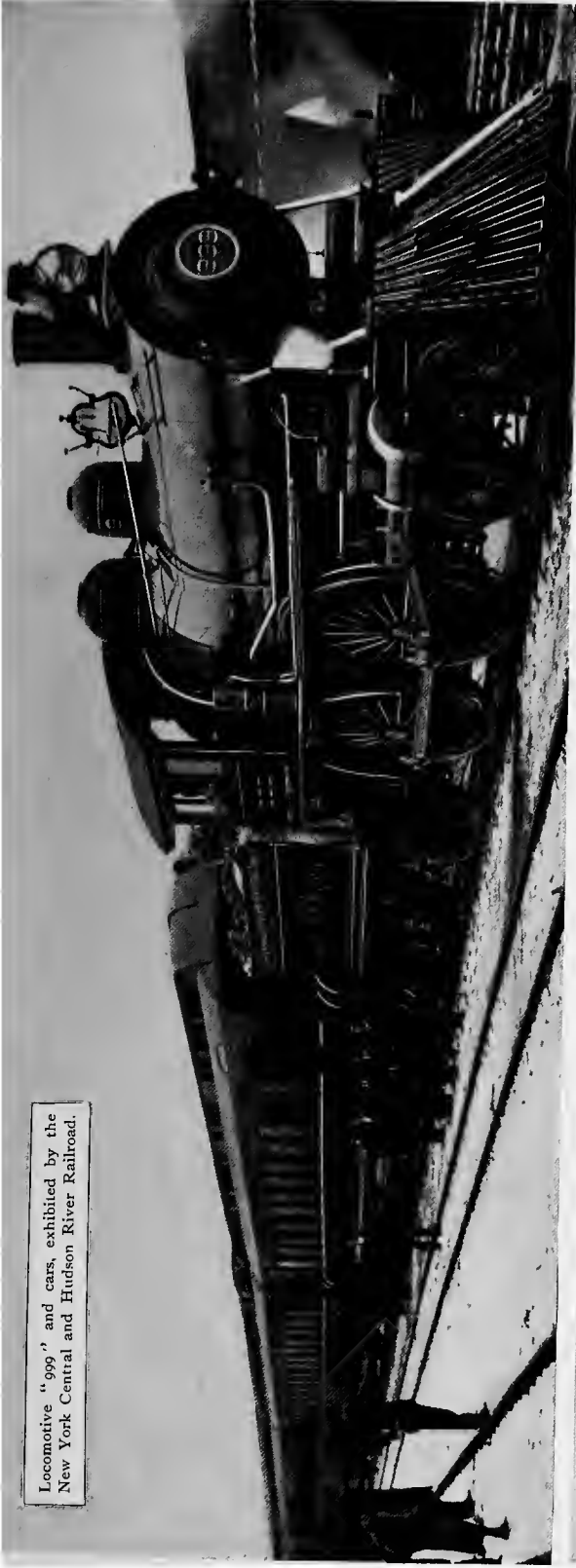
The Austrian exhibit consisted principally of pleasure carriages, which were shown by three firms of that country. There was an interesting



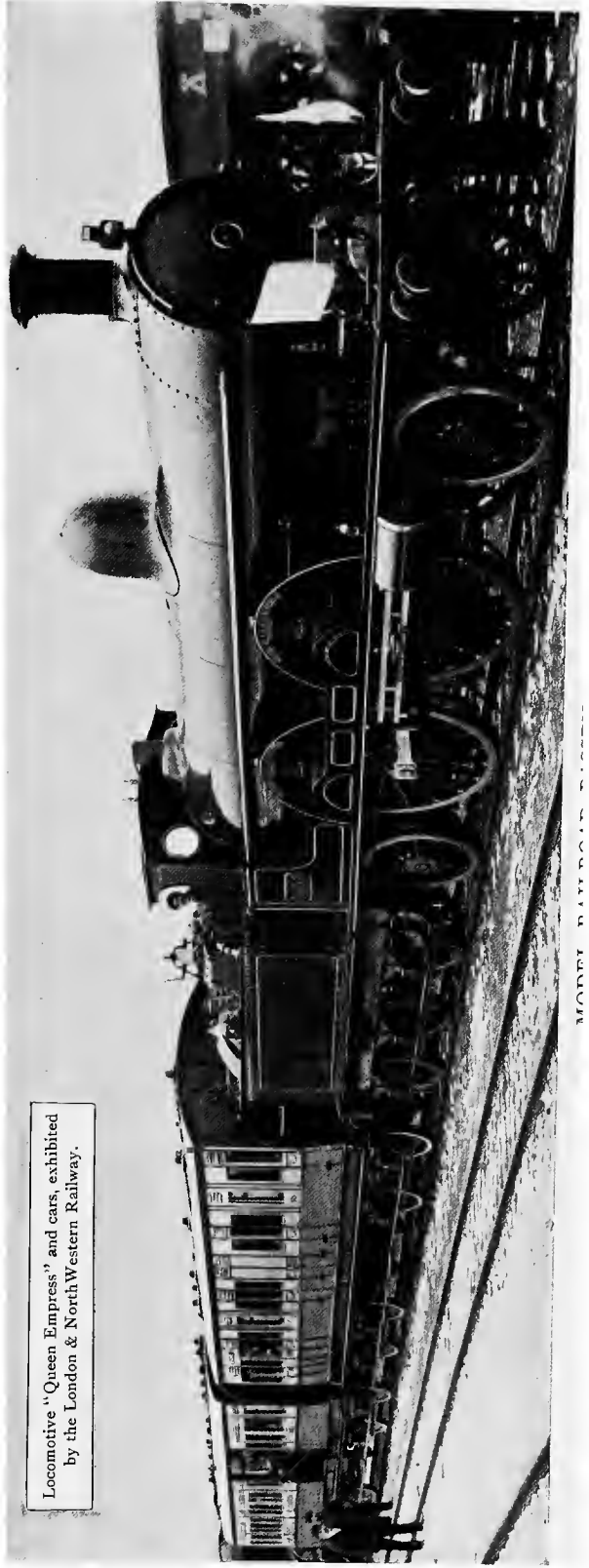
LOCOMOTIVE "LORD OF THE ISLES."

collection of drawings, photographs, and statistical tables by the Austrian State Railroads; and photographs of railway equipment were shown by car builders. The firm of E. Skoda, of Pilsen, Bohemia, exhibited car and locomotive wheels; but the exhibit was by permission removed to Machinery Hall to fill a gap in the Austrian space. A panorama of the Tyrol, attractively displayed, occupied the most prominent place in the Austrian section.

Locomotive "999" and cars, exhibited by the  
New York Central and Hudson River Railroad.



Locomotive "Queen Empress" and cars, exhibited  
by the London & North Western Railway.

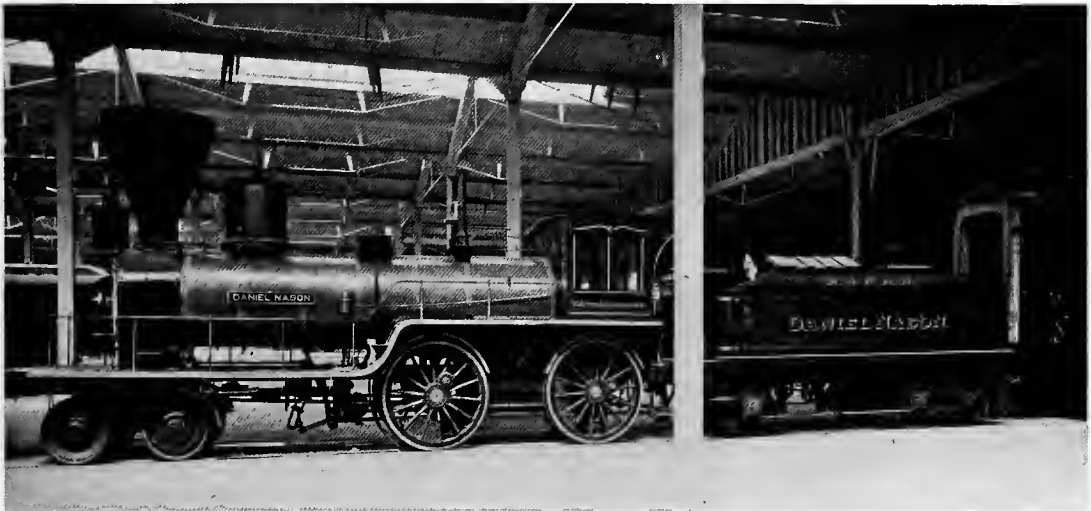




It was designed to attract tourist travel, but, while showing picturesque mountain roads, had very little connection with transportation.

The transportation exhibit of Belgium was installed in Machinery Hall, the space assigned in the Transportation Exhibits Building being given up at a very early date. The only feature worthy of special notice was an exhibit of portable railways and a great variety of equipment appertaining to them, for use about factories, on farms and plantations, and in a variety of situations. It was the only exhibit of the kind at the Exposition, and was made by the establishment of Achille Legrand, of Mons.

The Brazilian Commission is entitled to great credit for its effort to make an attractive and instructive exhibit. Perhaps the most interesting



OLD-STYLE LOCOMOTIVE AND TENDER.

vehicle in the building was the ponderous and ornate old state carriage of Dom Pedro I, Emperor of Brazil. The first tricycle made in that country and some barrows constituted the remainder of the vehicle exhibit. Nearly all the railways of Brazil were illustrated by photographs, maps, and models, and a few minor appliances were shown, and a horse tram car. The marine section was more extensive. A native canoe carved from a single log fifty-two feet long and models of *jangadas* (rafts) and canoes illustrated primitive methods. There was a model of pontoons for transferring railway cars, and photographs and drawings of dry docks, piers, bridges, etc. From the Pernambuco Navy Yard was a model of a sailing vessel built for a naval training school for boys; and from the Rio de Janeiro Navy Yard models of cruisers, men-of-war, machine guns, etc.

Cape Colony occupied a small space, with plans and photographs of harbors and harbor works.

The Canadian vehicle exhibit was composed principally of sleighs, farm wagons, buggies, and carts. The railway group comprised a number of such appliances as car couplers, wheels, headlights, and lanterns. The Department of Public Works displayed maps, tables, and photographs of railway lines and water ways. By far the most important Canadian exhibit was that of the Canadian Pacific Railway. The scenery on this line was illustrated by a series of oil paintings, well executed and handsomely displayed on the frieze of the central bridge connecting the east and west galleries of the building.

A transcontinental train occupied an entire track in the annex and extended into the main building. It consisted of a locomotive, a baggage car, a second-class sleeper, a first-class coach, a dining car, and a first-class sleeper—all built in the company's own shops. The locomotive was a ten-wheeler of the American type, characterized by good design. The exterior of the cars was of mahogany, handsomely finished and giving an appearance of peculiar elegance. They were equipped with the Barr vestibule and Trojan couplers. The second-class, or colonists' sleeping car, was upholstered with leather and designed for easy cleaning. No bedding was furnished in this car.

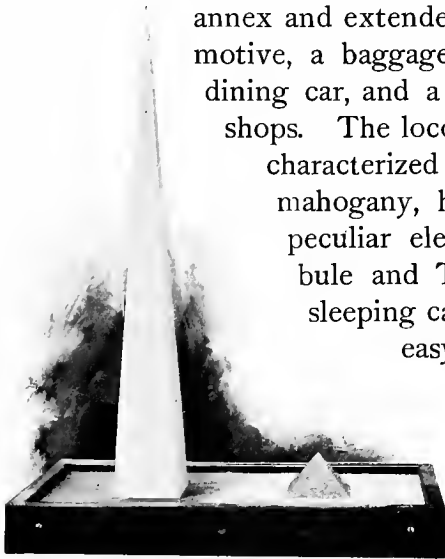
The interior of all the cars was elegant but simple in decoration, reliance being placed upon fine woodwork and substantial finish rather than on fanciful upholstery. Transcontinental journeys are long; and while these cars were provided with every convenience, the interior effect was designed to be restful rather than highly ornate. In the marine group the Canadian Pacific Railway also exhibited models of their Transpacific steamers. The exhibit of pleasure, hunting, and fishing boats, skiffs, canoes, etc., was large and characteristic. The Quebec and Lake

St. John Railway illustrated the attraction of its line for fowlers and anglers. In engineering there was an interesting model of the Chignecto Ship Railway.

The Ceylon Commissioner kindly loaned from his building models of bullock carts, catamarans, canoes with outriggers, etc., which were installed in the British section in the gallery.

Italy's contribution consisted of a beautiful set of models of the caravels of Columbus, sent by the municipality of Genoa; some models of naval vessels built by Orlando Brothers, of Leghorn, and an elegant modern Venetian gondola.

Japan secured originally only a small space on the ground floor for a



MODEL OF PYRAMIDS,

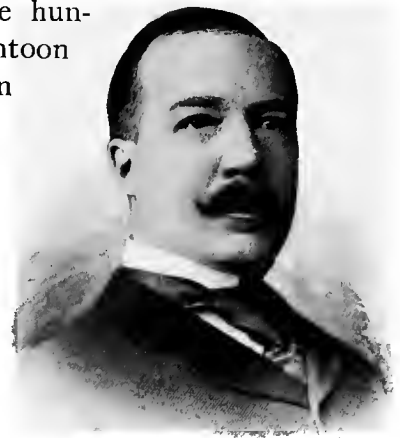
The short one representing the Pyramid of Cheops, base 750 feet square; the tall one, on a base of the same size, the amount of stone ballast in the tracks of the Pennsylvania Railroad.

marine exhibit. This was entirely modern, and consisted of lighthouse and naval charts, flags, a naval gun with shield, and models of men-of-war, cruisers, etc., shown by the Navy Department. An interesting pleasure boat was entered as an exhibit, but used on the lagoons by the Imperial Japanese Commission. It was a copy of boats used during the Fujiwara period (eleventh century) by feudal lords on the lakes in their gardens, and was called the "Hoomaru," or Phoenix boat, its figurehead and sides being in the form of the head, neck, breast, and wings of the phoenix. The originals were propelled like Venetian gondolas, but the copy, being propelled by an electric storage battery presented a strange compound of the old and the new.

The Japanese engineering exhibit, which was installed in the gallery, contained models of two seventeenth-century bridges remarkable for the engineering skill shown in their construction. These were the Aimoto cantilever bridge, with a span of one hundred and sixty feet, and the Kintai bridge. Pontoon bridges and the methods of conveying the parts on mule back were shown by excellent models; as were also the Ogaki sluice and the Usui Mountain pass with the Usui-Toge Railway climbing a steep incline by means of the Abt system. There were maps and charts descriptive of river improvement, and diagrams and maps showing the progress of railway construction in Japan. Mexico exhibited maps and profiles of railways, and the Mexican Central and Mexican National Railways appealed to prospective tourists with photographs of scenery and curiosities illustrating travel in Mexico. In the Mexican Central exhibit there was an excellent model of the harbor improvements at Tampico. The remainder of the Mexican exhibit was in the vehicle division. There were a few carts and heavy wagons and a mule litter from Oaxaca; but the principal attraction was the large and characteristic collection of saddlery and equestrian outfits. These were especially noticeable for beautiful leather work and elaborate silver trimmings and embroidery.

The Netherlands occupied a small space with engineering maps and drawings relating to water ways, and a picturesque model of an old-time Dutch sailing vessel.

New South Wales illustrated its railway system by large photographs and by models of remarkable engineering work. A large collection of iron-wood ties taken out of track, showing an unequalled record for durability, was more important than attractive. In vehicles there were two patent cabs, an immense "squatter's wool wagon," and some omnibus wheels.



GEORGE W. SAUL,  
Member of the Directory.

The marine exhibit included a few photographs and models, the most important of the latter being one of the Sutherland Docks, Cockatoo Island, Sydney.

The transportation exhibit formed a considerable portion of Norway's display in the Manufactures Building. It consisted principally of sleighs, carioles, and boats. A fishing boat from Hammerfest, one from the Lofoden Islands, and one pleasure boat from Arendal were, however, shown in different locations in the Transportation Building. A pair of skees, or snowshoes, were loaned by Charles H. Lawrence, of Chicago.

Sweden retained her transportation exhibit in her own building. It consisted of axles, wheels, tires, etc., for railway use, skates, sledges, and tobog-



MODELS AND DRAWINGS SHOWN BY THE RUSSIAN NAVY.

gans, skating sails, and models of ice yachts, lighthouses, and other marine appliances. Its location, apart from the general transportation exhibit, was unfortunate.

Russia showed only a few minor railway appliances, including a sleeping-car model. There was a large display of characteristic pleasure carriages, sleighs, robes, and harness, which won much admiration. The Ministry of the Navy showed models of The Grandfather of the Russian Fleet, a Rurik cruiser, and the Navarin ironclad. The Government also sent numer-



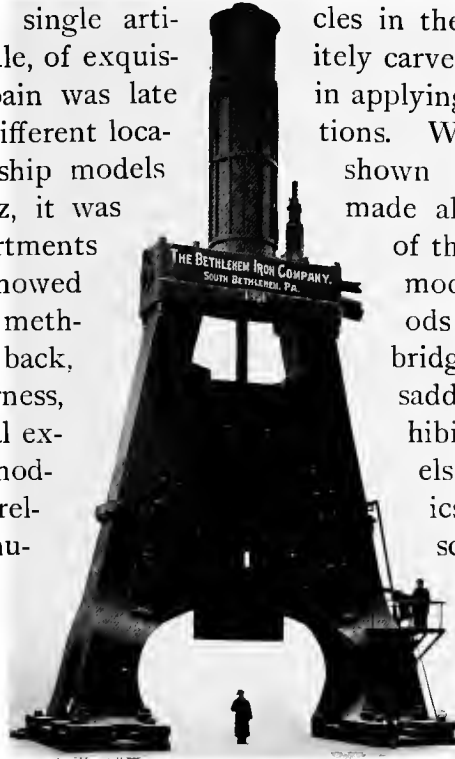
ous photographs of railway and engineering works, and distributed pamphlets descriptive of the railway and water systems of Russia, and especially the Trans-Siberian Railway, now under construction.

In a single show case Siam displayed a great collection of models of bullock carts and other native vehicles, the most interesting single artifact was an elephant howdah, or saddle, of exquisite workmanship.

Unfortunately, Spain was late in applying for space, and her exhibit was in three different locations. With the exception of a fine collection of ship models shown by the Compañia Transatlántica de Cádiz, it was made almost entirely by the War and Navy Departments.

The War Department showed fortifications, canals, metallurgical material on mule back, artillery and cavalry harness, armaments, etc. The naval exhibit consisted of a group of historical vessel models and numerous naval relics of special interest was a man-of-war boat and vessels of the navy illustrated in watercolor.

The sole exhibit of Switzerland was an enormous relief map of the St. Gothard Railway, and a series of paintings of the scenery along that most picturesque route.



MODEL OF THE GREAT STEAM HAMMER.

cles, and native boats. One of the most interesting single artifacts in the building was an elegantly carved ivory.

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of the Government. The models of harbors and methods of conveying bridge bridge construction, artillery saddles and accoutrements, etc. The naval exhibit consisted of a group of historical vessel models and numerous naval relics of special interest was a man-of-war boat and vessels of the navy illustrated in watercolor.

the world, superbly colored, and substantial two large volumes. The exhibit of Switzerland was an enormous relief map of the St. Gothard Railway, and a series of paintings of the scenery along that most picturesque route.

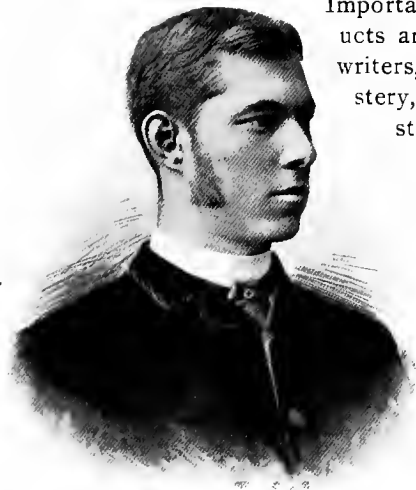
Nearly a score of other countries were represented by exhibits of historical and curious interest secured direct, by purchase, by the Chief of the department. Among these were a maxilla or palanquin used in African travel and a bimba or log canoe used by natives of Donga, with photographs showing method of handling—both sent from St. Paul de Loanda, Africa, by Edward Bannister, United States Consul. From the Argentine Republic came the sternpost of the Marañón, which, under the command of Alonso de Cabrera, went to the Plate River in 1538, and also a lombard or gun of the sixteenth century. From British Guiana came several canoes used on Demerara River. From Burmah there were models of bullock carts, state barges, and other water craft. China was represented by a passenger wheelbarrow and models of mandarin chairs and a great variety of water craft, with many photographs illustrating methods of transportation—collected by Edward Bedloe, United States Consul at Amoy. From Madeira were exhibited a mountain sled, a traveling hammock, and a sledge for freight—collected by John F. Healy, United States Consul at Funchal.



Entrance to the Norwegian section.

## CHAPTER VIII.

### THE EXHIBIT OF MANUFACTURES.



JOHN V. FARWELL, JR.,  
Member of the Directory.

Importance of the department—Chemical and pharmaceutical products and druggists' supplies—Paints, dyes, and varnishes—Type-writers, paper, blank books, and stationery—Furniture, upholstery, and artistic decoration—Ceramics and mosaics—Marble, stone, and metal monuments, mausoleums, mantels, etc., with caskets, coffins, and undertakers' furnishing goods—Art metal work, with enamels, etc.—Glass and glassware—Stained glass in decoration—Carvings in various materials—Gold and silver ware, plate, etc.—Jewelry and ornaments—Watches, clocks, etc.—Silk and silk fabrics—Fabrics of jute, ramie, and other vegetable and mineral fibers—Yarns and woven goods of cotton, linen, and other vegetable fibers—Woven and felted goods of wool and mixtures of wool—Clothing and costumes—Furs and fur clothing—Laces, embroideries, trimmings, artificial flowers, etc.—Hair work, coiffures, and accessories of the toilet—Traveling equipments—Rubber goods—Toys and fancy articles—Leather and manufactures of leather—Scales, weights, and measures—Material of war, ordnance and ammunition—Lighting apparatus and appliances—Heating and cooking apparatus

and appliances—Refrigerators, hollow metal ware, tinware, enameled ware—Wire goods and screens, perforated sheets, lattice work, fencing, etc.—Wrought iron and thin metal exhibits—Vaults, safes, hardware, edge tools, and cutlery—Plumbing and sanitary materials—Miscellaneous articles of manufacture not heretofore classed, including revolving stands, transfer letters and ornaments, skylights, burglar-alarms, and identification cards.

**T**HE department of a world's exposition in which the exhibitors of all nations are most certain to participate is the exhibition of finished products of manufacture and manual skill, the objects of utility, luxury, and taste in which each country excels and which constitute the most

valuable and profitable part of its foreign commerce. Artistic work is the kind that a nation shows with the greatest pride and satisfaction in these international exhibitions; and never before were the art industries of Europe and the Orient so abundantly and, taking all branches together, so splendidly displayed as in the crowded exhibits of the thirty-acre building. This rich profusion of beautiful art work, disclosing to the farmers and working people and the manufacturers and traders new ideas of form and finish, of style and ornament, had an important educational and stimulative effect on American taste and workmanship.

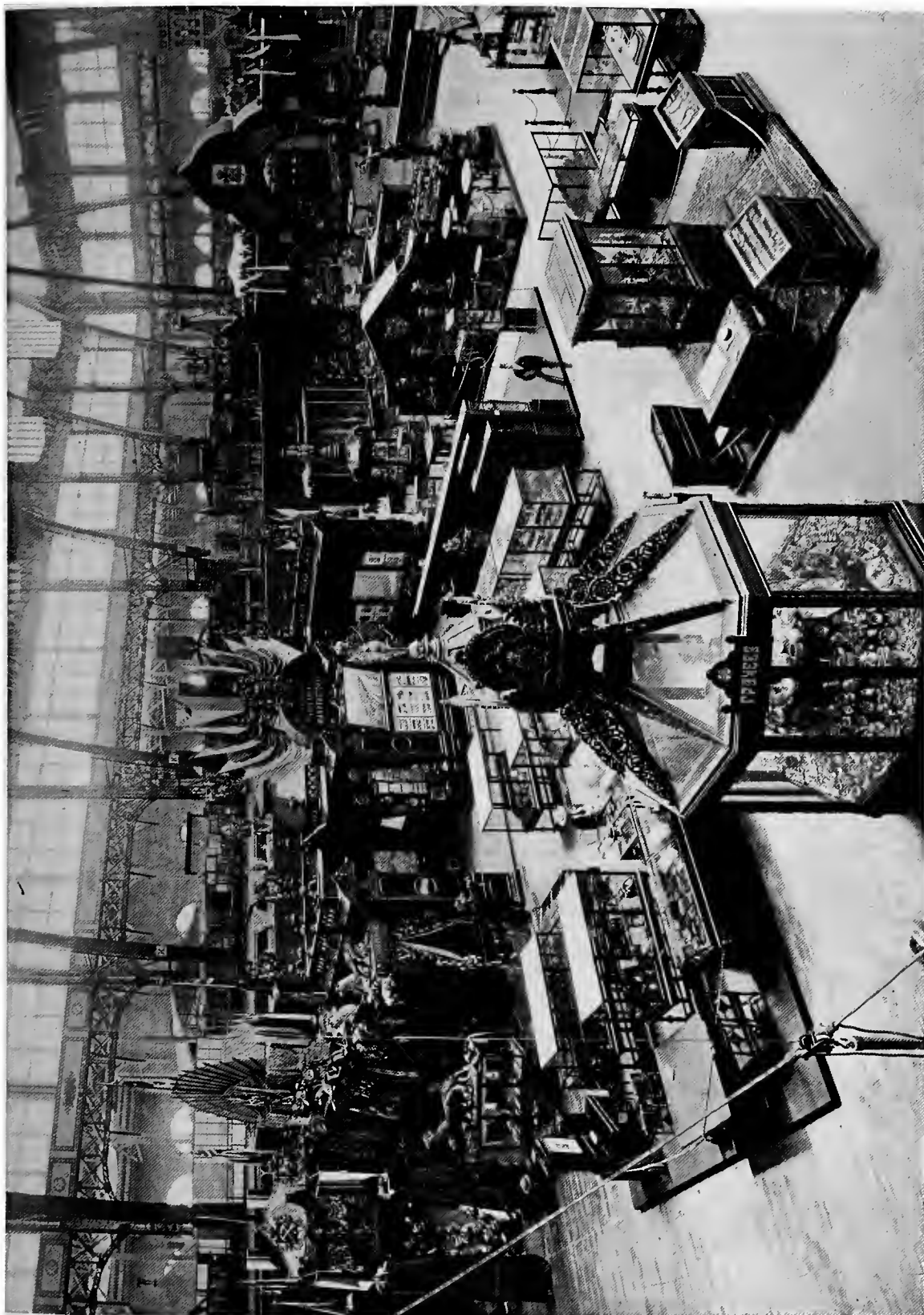
The Manufactures Department began with Group 87, chemical and pharmaceutical products and druggists' supplies, which was divided into the following classes: 543. Organic and mineral acids. 544. The alkalies and alkaline earths—potash, soda, ammonia, caustic soda, carbonate of soda, lime, magnesia, barytes, etc., with their salts and compounds. Bleaching powders, etc. 545. Metallic oxides and salts of the metals, and other commercial chemical compounds. 546. Pure chemicals for chemists' use. 547. Drugs and pharmaceutical preparations and compounds. 548. Chemists' and druggists' wares and supplies. 549. Flavoring extracts, essences, essential oils, toilet soap, perfumery, pomades, cosmetics, etc. 550. Explosive and fulminating compounds—powder, giant powder, etc., shown only in empty cases and packages, "dummy packages," and cartridges, to illustrate the commercial forms. 551. Pyrotechnics (in harmless forms, not charged). Pyrotechnic displays.

Alkalies and alkaline earths in cleansing powders for woolen and cotton mills and for buildings were the exhibit of the India Alkali Works. The Pennsylvania Salt Manufacturing Company also exhibited alkalies. The Roessler & Hasslacher Company exhibited cyanide of potassium, chloroform, acetone; peroxygene, a powder excelling peroxide of sodium in bleaching capacity and facility of application; and ceramic colors in powders, including rose, maroon, and blues, giving tints as delicate and rich as any English, French, or German products, as was evinced by Maywood tilework in which these colors were used. Henry Bower & Son exhibited aqua ammonia and muriate and sulphate, sulphuric acid, prussiate of potash, bichromates of potash and soda, bichloride of tin, and refined glycerin. Other exhibitors of glycerin were J. S. Kirk & Co. and Marx & Rawolle. J. J. Allen's Sons exhibited pure phosphorus and associated chemicals; the W. J. M. Gordon Company, sirup of hydriodic acid; Krembs & Co., various chemical preparations; Rosengarten & Sons, chemicals for use in medicine and the arts; Powers & Weightman, a considerable line of chemicals. Richard C. Remmey had an exhibit of acid bricks for chemical works and chemical stoneware. Joseph Burnett & Co., in addition to their well-known flavoring extracts, showed some new ones, such as pistachio and violet. E. R. Durkee & Co. exhibited extracts. Essential oils were exhibited by Dodge & Olcott, by H. G. Hotchkiss & Sons, and by Albert M. Todd, who, in addition to refined oils of

peppermint, wintergreen, etc., had an exhibit of refined drugs, camphor, thymol, menthol, etc. An exhibit of refined camphor was made by Gribble & Nash. Another exhibit of essential oils was made by Fritzsche Brothers, who showed also the chemical perfumes and synthetic aromatics that they make at their factory in Garfield, N. J., after the formulas of Schimmel & Co., of Leipsic.

The Cheeseborough Company exhibited vaseline and medicinal and toilet preparations and soaps of which it is the base. The Buttermilk Company had another cosmetic soap. Robert Low's Son exhibited soaps and perfumery; A. Melzer, toilet soaps; J. B. Williams & Co., shaving and toilet soaps; D. W. McNeal & Co., a hair tonic. Ladd & Coffin exhibited Lundborg's perfumery, cologne and toilet waters, and sachet powders. Exhibitors of perfumes were E. D. Baldwin & Co., J. S. Kirk & Co., Lazell, Dalley & Co., George Lorenz, Theodore Ricksecker, and the Zehring Company. Andrew P. Preston made an exhibit of the Portsmouth remedies and cosmetic preparations. The gritty scouring soap of Enoch Morgan Sons was well displayed, and C. Melzer had an exhibit of soaps and washing flakes.

Germany made a remarkable and effective exhibit of its wonderful chemical manufactures. The associated ultramarine manufacturers, symbolizing the secrecy of their process by a gray sphinx in a grotto of blue stalactites, showed their raw materials—alumina, silica, soda, sodium sulphate, sulphur, resin, and charcoal. Samples of the products were shown in the various shades of blue, green, red, and violet. The German acid and alkali industry was well shown by the Mannheim Company and others. To make sulphuric acid, pyrites are brought from the Rio Tinto mines of Spain, and the residual copper is enough to pay the freight. The company makes a specialty of liquefied gases—carbonic-acid, ammonia, and sulphurous-acid. The new liquid chlorine was preserved in steel cylinders. Chemical works at Griesheim exhibited the results of a new invention for separating chlorine and the alkaline metals with which it is associated by electrolysis; also chemically pure sulphuric acid produced by freezing the common English acid. This firm had quantitative exhibits of caustic soda, sal soda, soda ash, bichromate of sodium, and bichromate of potassium. The firm of Solvay exhibited the compounds of soda, and also chloroform, hydrate and sulphate of alumina, magnesia carbonate, sulphate of iron, and nitric and sulphuric acids. An establishment in Heilbronn showed soda produced by an ammonia process differing somewhat from Solvay's, and associated raw materials and products, as a kilo of pyrites with the necessary quantities of nitrate of soda, rock salt, limestone, coal, chrome ore, and potassium chloride; near by the resulting intermediate and waste products of niter cake, salt cake, purple ore, black ash, nitrate of soda, burned limestone, muriatic acid, fused chrome charge, sodium sulphate, sulphuric acid, and chloride of sodium; and at the end of the chain the final products—nitric acid, sulphuric acid, muriatic acid, and sulphur.



THE RUSSIAN SECTION IN THE MANUFACTURES BUILDING.



The important arsenic-mining establishment at Reichenstein, Silesia, made a fine exhibit of the crude ore, washed arsenical pyrites, white sublimated arsenic powder, yellow and red arsenic in lumps and powder, and gray and metallic arsenic crystals and powder, with a lump of gold as large as the quantity contained in a ton of the residue of the mine which has produced arsenic for two centuries, and in ages previous was a gold mine. Tin and zinc salts, stannate and phosphate of soda, and chlorides of manganese and phosphorus were exhibited by the Goldschmidt firm, of Essen, which furnishes dye houses with metallic mordants. The exhibit included cot-



DISPLAY OF CHEMICALS FROM MANNHEIM, GERMANY.

tons, velvet, and silk on which these had been used, and railroad sleepers preserved by zinc chloride for twenty-five years.

The establishment of Dr. von Heyden, near Dresden, which originally manufactured only salicylic acid and salts, exhibited the remarkable drugs discovered by Dr. Seifert—solutol, solveol (a powerful, non-poisonous disinfectant), creosote carbonate, and guaiacol carbonate (used as a remedy for tuberculosis); also the aromatic oxycarbonic acids, in which carbon dioxide, under pressure, reacts upon the alkaline salts of the phenols; and, in white



powder and translucent crystals, the salols, medicinal salicylic ethers of the phenols; lastly, the new sweetening substance called sucrol, obtained in needlelike crystals.

Rudolf Koepp & Co., the firm that first made oxalic acid and oxalates from sawdust and gave to the dyeing industry fluoride of chromium, double fluoride of antimony, and antimony salt, exhibited hydrofluoric acid and the oxalates and fluorides of antimony, sodium, and ammonium.



EXHIBIT OF THE CROSBY PAPER CO.,  
MARION, IND.

gentas, violet, and greens, the azo series, and numberless others. Dyed wool and silk fabrics showed the effects of the skillful application of their colors, and artificial alizarine was proved to be lasting by garments dyed with it exposed for weeks to the weather in Florida, contrasted with the sorry result when vegetable colors were subjected to the test. It was cheering to see the humane provisions that the German chemical manufacturers have made for the safety, comfort, sanitation, elevation, culture, and superannuation of their workmen.

In an English exhibit of druggists' supplies was the medicine chest that Henry M. Stanley carried through Africa. The British exhibit consisted

The firm of E. Merck, which handed down a modest apothecary business in Darmstadt from father to son for two hundred years, and then won renown and fortune by preparing cocaine, exhibited this and other famous specialties—aconitine, atropine, digitaline, and caffeine—which they were the first to obtain commercially in a pure state.

The great Aniline and Soda Works of Ludwigshafen showed their full line of aniline and alizarine colors and the other famous dyes and derivatives that they have evolved since they have begun the synthetic production of alizarine in 1868, which was followed by the manufacture of alizarine, anthrapurpurine, and flavopurpurine from the sulphonates of anthraquinone, and in later years by the resorcin dyes—methylene blue, the acid ma-

mainly of essences, soaps, cosmetics, medicines, and disinfectants. There were also exhibits of gunpowder and fireworks, of wax matches, and of bleaching powders.

Bulgaria had a great quantity of attar of roses and extracts of other flowers.

Group 88 embraced paints, colors, dyes, and varnishes, and was subdivided as follows: 552. Colors and pigments, natural and artificial, dry and ground in oil. Printing inks, writing inks, blacking, cochineal, etc. 553. White-lead and white-zinc industry. 554. Painters' and glaziers' supplies. 555. Artists' colors and artists' materials.

Heath & Milligan exhibited paints and painters' supplies; the H. W. Johns Company, paints, oils, and stains. Valentine & Co. and the Lawson Valentine Company both had exhibits of varnishes and colors. Rinald Brothers displayed on painted surfaces the porcelain enamel paint, the Bessemer paint, the German brewers' varnish, and the Colorven paint remover. The Senour Company exhibited floor paints. Henry Woods's Sons Company displayed paints and colors. Berry Brothers exhibited their hard-oil finish and varnishes; the Bridgeport Wood Finishing Company, paints, fillers, stains, and polishes; Dexter Brothers, shingle stain; the Rubber Paint Company, paints and materials. John W. Masury & Son had exhibits of varnishes, japans, and stains, of white leads, and of artists' colors. The Watts De Golyer Company exhibited varnishes; the Chicago Varnish Company, varnishes and fossil gums; the Egyptian Lacquer Company, lacquers and varnishes; the O'Brien Company, oils, varnishes, and lacquers. Ultramarine blue was shown by the International Ultramarine Company. The L. H. Thomas Company exhibited inks and bluing. Stove polish was shown by Hebblewhite Company. The patent liquid celluloid for varnishes, lacquers, and enamels was exhibited by the Celluloid Zapon Company. Gerts, Lumbard & Co. and John L. Whiting & Son made exhibits of paint brushes; G. D. Dunham, one of glaziers' diamonds. Baeder, Adamson & Co. and Wiggins & Stevens showed sandpapers. Bronze powder, with paints and brushes, formed the exhibit of Eugene Arnstein. The Scientific Art and Decorative Company displayed the Marseilles plush paint for decorating plush and satin or for painting photographs on china or glass. A full line of artists' oil and water colors was shown by F. Weber & Co.

In the German section were many exhibits of colors—aniline colors and dyes, bronze colors and powders, ebony enamel, water colors, etc. A. W. Faber exhibited ink oil colors; T. Moritz & Co., copying ink; the Ludwigs-hafen Works, writing inks; the Nuremberg Ultramarine Works, ultramarine. The German Gold and Silver Refinery, of Frankfort, whose mines are on the bay of Puerto de Mazzaron, in Spain, besides retorted silver and gold in bullion and beautiful artificial crystals, exhibited in the Mines Building the mineral colors produced at the works and specimens of ceramics on which they had been used.

Group 89 included typewriters, paper, blank books, and stationery, and was divided into the following classes: 556. Paper, pulp and paper stock. 557. Cardboard, cards, pasteboard, binders' board, building boards, and felts for walls and roofing; for floors, ceiling, and for decorations; embossed boards, etc. *Papier-maché*, useful articles made from paper. 558. Wrapping papers, manilla papers, paper bags, tissue papers. 559. Printing paper for books and for newspapers. 560. Writing papers, bond paper, drawing papers, tracing papers, and tracing linen; envelopes; blotting paper. 561. Blank books; sets of account books, specimens of ruling and binding,



PAVILION OF THE A. B. DICK CO., CHICAGO.

including blanks, bill-heads, etc.; bookbinding. 562. Ornamental and decorated paper; marbled papers, etc. 563. Wall papers, oil papers. 564. Typewriters, stationery and stationers' goods; inkstands, weights, rules, pens, pencils, filing cases, letter presses, etc.

An exhibit of paper and paper materials was made by the Denver Paper Mills. The American Paper Pail and Box Company made one of its useful products. The Cros-

by Paper Company exhibited strawboard; the Dennison Company, tissue-paper articles; the Standard Paint Company, insulating and waterproof paper; the Thompson & Norris Company, cork and corrugated paper for bottle packing; the United States Printing Company, of Cincinnati, playing cards and colored printing; the Scott Paper Company, toilet paper; the Western Paper Bag Company, paper bags and manilla paper; the Weston Company, roll paper and cutters and holders; the Western Coated Paper Company, its coated papers. Fine ledger and record papers were shown by the L. L. Brown Company and Byron Weston; bank-note, bond, and parchment paper by Crane & Co.; parchment paper, by the Patterson Company.

Exhibitors of fine writing papers were Z. & W. M. Crane, the Harding Company, the Whiting Paper Company, and Philip Hake Company, the Hurlburt Company, and Tiffany & Co., who showed also envelopes and visiting cards and society stationery, of which Mermod & Jaccard also made an exhibit. Typewriters in all forms and styles and with all improvements, conveniences, and accessories, some of them fitted out with keyboards for

various languages, were exhibited by the American Writing Machine, Blinkensderfer, Book Typewriter, Crandall, Columbia, Densmore, A. B. Dick, Essex, Franklin, Hammond, Karl Kiefer, Munson, Philadelphia, Remington, Smith, Williams, Wyckoff, Seamens & Benedict, and Yost Companies. The S. T. Smith Company showed typewriters' supplies; the Rogers Manifold Company, carbon paper; the Auto-typograph Company, a copying machine; the A. B. Dick Company, the mimeograph; the Cyclostyle Company and the Pomeroy Company, different duplicators. Copying presses were exhibited by the Illinois Iron and Bolt Company and Rockwell & Rupel.



DISPLAYS OF STATIONERY.

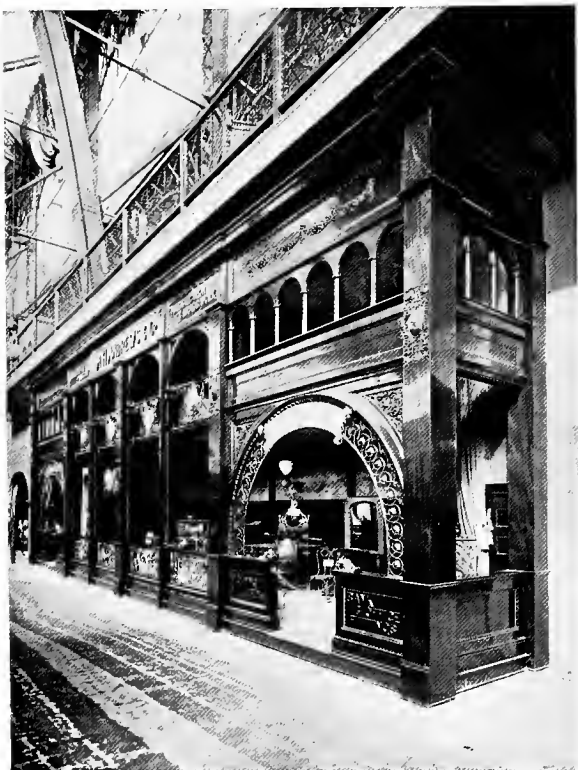
The different patterns of fountain pens were well displayed by the Caws Company, the Crown Company, B. Grieshaber, the Shattuck Company, the L. E. Waterman Company, and Paul E. Wirt. E. C. Hunt exhibited marking material. The Joseph Dixon Company had an exhibit of lead pencils. The Franklin Company showed marking crayons, oil and lithographic crayons, and colored chalks. Inkstands of a new material were shown by the Electroze Company, others of elegant form by Tiffany & Co., and one of a new patented design by the Perfection Ink-Well Company. The Esterbrook Company made an elaborate display of steel pens. Letter files and indexes were exhibited by the Amberg Company, Brown & Besley, the Office Specialty Company, M. Ohmer's Sons, and the Wells Company; copying books, by Alvah Bushnell; blank books, by the Henry O. Shepard Company. Rubel Brothers and the Safety Account Company exhibited

their account books and ingenious systems of accounts. The Arabol Company exhibited pastes and gums.

The court of the National Wall Paper Company—an amalgamation of twenty-three firms—was decorated and filled with all the new kinds of paper hangings, from the finest hand work at twenty-four dollars the roll to machine-made at fifty cents. One case was filled with paper made entirely of pulp, yet having a rich, satin sheen, due to pulverized mica mixed with the material. The central

room was papered with the new appliqué relief print, in which the design, standing out in bold relief, is composed of flexible and waterproof pigments.

Jeffrey & Co. exhibited the latest achievements of British paper stainers and designers. The wall papers included machine and block-printed papers, colored flock papers, raised flocks, printing in lacquer upon a metal ground, printing in transparent water color upon talc, and embossed-leather paper. They had also some panels in *repoussé* copper tinted with iridescent lacquer. Walter Crane furnished some of the designs, and others were by W. S. Block, W. H. Bately, W. G. Muckley, Heywood



PAVILION OF A. H. ANDREWS & CO., CHICAGO.

Sumner, and Lewis F. Day. William Woolams & Co. exhibited patent embossed flock papers and other kinds, including a novel paper having a deep blue bronze ground. The designs included a well-arranged Pompeiian pattern by Owen Davis, a broadly treated acanthus frieze by G. F. Catchpole, tapestry effects by T. W. Hay, blended flocks by C. F. A. Voysey, and others by Louisa Aumonier, A. Silver, H. Noble, and T. Godfrey. The same firm exhibited embossed-leather hangings.

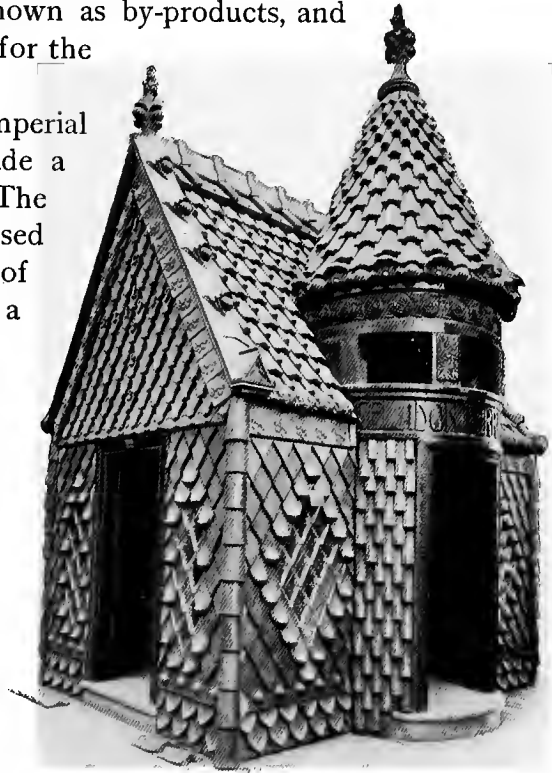
The Sulphite Company, of Waldhof, on the Rhine, had an interesting exhibit of the manufacture of cellulose by the Tuerck process in a special building near the German house. Heaped upon a pile of pine logs were specimens of the coal, limestone, and pyrites used in the manufacture, with zinc and iron obtained from the pyrites as by-products. In glass jars was

seen pulp in various stages of bleaching, in the form of sheets, and ready for nitration in the manufacture of smokeless powder. Below were paper made from the pulp, and other products were represented by a shirt, balls of colored twine, and a dyed fabric for furniture covering. The wrapping paper was strong enough to hold a weight of eight hundred kilos, and the writing paper of superlative texture. Oxide of iron and zinc, spent pyrites, ethyl alcohol, spent sulphite liquor, and artificial charcoal produced with it, and sulphite of lime were shown as by-products, and samples of the wood pulp prepared for the manufacture of collodion.

In the Russian section the Imperial Paper Mill, of St. Petersburg, made a complete and interesting exhibit. The families of the workingmen are housed and educated within the precincts of the manufactory, where a hospital, a library, and a chapel are provided, and at the end of the year the proceeds, after deducting expenses, are divided between the employees and the Government. The paper is made of hemp and rags. The bank-note paper, made chiefly of hemp, has a silk net put into the pulp, which is woven in the establishment. The bank notes, stamps, bonds, and drafts are printed there, and the type, of original design, is cast there. By means of a machine perfected in 1891 by M. Orloff, one of the engineers, colored figure printing is done by a process that allows designs in various colors,

passing from one tint to another, to be printed from one stereotype at a single impression. One of the fascinating artistic exhibits in the Russian pavilion was that of hand painting on *papier-maché* in trays, albums, pocket-books, bowls, etc. The Persian exhibit also contained dainty miniature paintings on writing cases and bookcases of *papier-maché*, as well as similar figures, landscapes, and battle scenes ornamenting small wooden boxes.

Group 90 consisted of furniture, upholstery, and artistic decoration, classified as follows: 565. Chairs of all grades, rockers, lounges, settees, etc. 566. Tables for various purposes—billiard, card, dining, etc. 567. Suites of furniture for the hall, parlor, drawing-room, library, dining-room, and for the



PAVILION OF THE CELADON TERRA  
COTTA CO., ALFRED, N. Y.

bedchamber. 568. Upholstery for windows, doors, curtains, *portières*, etc. 569. Mirrors and their mountings. 570. Treatment of porches, doorways, halls and staircases, mantels, etc. 571. Floors, ceilings, walls, doors, and windows. 572. Artistic furnishing, illustrated by completely furnished apartments, with selections of furniture and various objects of adornment from other groups. 573. Sewing and embroidering.

Seventeen of the furniture factories of Grand Rapids, Mich., combined to make a display of their furniture, which was already known all over the world for its strong and handsome material, convenient structural design, and degree of finish and ornamentation that seemed incompatible with the low prices until one had seen the wood-working machinery in the Palace of Mechanic Arts. There were elaborate sets and pieces in old Santo Domingo mahogany, bird's-eye maple, and other fine woods that attracted the admiration of French workmen by its excellent workmanship, but not by the designs, which were only careless adaptations from French originals. The devices and adaptations of form to secure comfort were the most successful and praiseworthy characteristic of the American furniture. The Royal Company made a special exhibit of cabinet ware. To a unified exhibit of the manufacturers of Rockford nineteen companies contributed. The furniture manufacturers of Indianapolis had also a unified exhibit, consisting of extension tables of the Cabinet Makers' Union, children's beds of the T. B. Laycock Company, L. W. Ott's Turkish couch, Otto Stechlan's bed lounges, the Krause-Kramer duplex mirror and couches, H. Lauter's center and library tables, M. S. Huey & Son's mantels, John W. Blacklege's display cases, and the rocking and dining-room chairs of the Central Chair Company. The Sheboygan Company made an exhibit of chairs, and Ford, Johnson & Co. showed chairs and other articles. George Hunzinger & Son exhibited novel chairs bound with steel rods concealed, and tables with chairs that formed part of the table when closed. Reclining and adjustable chairs were shown by the Marks Company, the P. C. Lewis Company, the George F. Child Company, and the Sargent Company, which exhibited also revolving bookcases. Schlesinger, Wiessner & Co. exhibited metallic beds and steel furniture; the Buffalo Company and the Whitcomb Company, brass and iron bedsteads; Adams & Westlake, brass bedsteads. The Gendron Iron Wheel Company had an exhibit of reed furniture and bamboo novelties. Bamboo furniture was exhibited by Dean & Co. The New Haven Chair Company had an exhibit of rolling chairs. H. R. Plimpton & Co. exhibited sofa beds, and the Windsor Company, Percy A. Sanguinetti, and others exhibited folding beds in variety. L. E. Steinman & Co. showed iron folding beds. William Schwarzwaelder & Co. exhibited roll-top desks. Other styles of desks were shown by Olsen & Co., who had also a combination bed, and by A. Peterson & Co., the Feige Desk Company, and the Midland Desk Company. Leopold Buxbaum showed an improved restaurant table. Air mattresses, cushions, and life-saving goods were exhibited



by the Metropolitan Air Goods Company. S. Karpen & Brothers had an exhibit of parlor furniture, and suites were shown by Demme & Dierkes, the Berkey & Gay Company, L. M. Hamline & Co., and Horn Brothers. Gensch & Hartmann had an exhibit of elaborately carved furniture. Wainscoting was shown by the Frost Veneer Seating Company, Kinnear & Gager, and others, and mantels by Ehman & Simon and by Sprague, Smith & Co., who had also an exhibit of hatracks. The Wenter Company exhibited hatracks and cabinets. Shade rollers were exhibited by the Hartshorn Company, Nevius & Haviland, and the Jay C. Wemple Company. Simon Wilnau and Tiffany & Co. displayed mirrors.

An enterprising Arizona firm, F. E. White Company, having factories at Tempe and Phoenix, exhibited for the first time the furniture, picture frames, easels, mantels, canes, inkstands, and other articles that it makes from the beautiful filigree-like, tough, woody skeleton frame of the cholla and other species of cactus, more intricately and perfectly ornamented than the finest of the European wood carvings.

Office furniture was shown by the Central Manufacturing Company, of Chicago, Derby & Kilmer Company, of Boston, and others; church and postoffice furniture by Thomas Kane & Co.; school and bank furniture by A. H. Andrews & Co.; furniture for billiard and club rooms by the Brunswick-Balke Company; saloon furniture by the American Saloon Fixture Company, R. Rothschild, Son & Co., and Charles

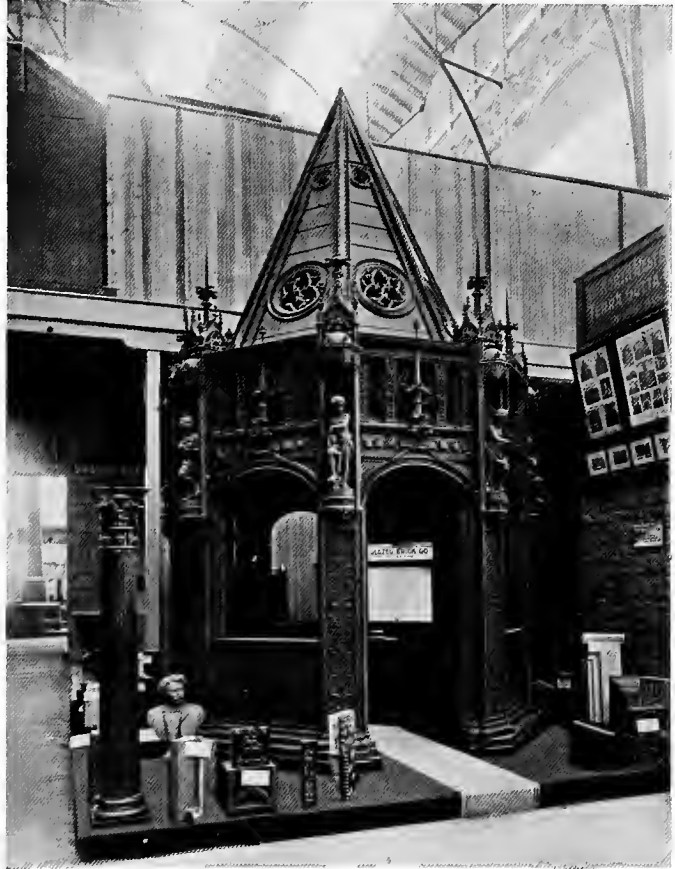


EXHIBIT OF THE NORTHWESTERN TERRA COTTA CO.,  
CHICAGO.

Passow & Sons; billiard tables by the Garden City Company; barber-shop fittings by the Hornung Company and Theodore A. Kochs; lodge furniture by the Henderson-Ames Company; office and store furniture by B. & W. B. Smith.

Picture frames and moldings were exhibited by the Reuhl Company, August F. Richter, and E. B. Clark & Co. Henry Dibblee & Co. had an exhibit of furniture, mantels, and decorations. Examples of parquet flooring and grill work were shown by John W. Boughton, and of wood carpeting by J. Dunfee. The Drake Company made an exhibit of petrified wood bric-a-brac; S. Klaber & Co. had one of Mexican onyx and marble and bronze decorations. Edward Janson, of New York, gave an example of artistic wall decorations, and exhibited reed furniture decorated with raffia cloth. Furniture decorations and draperies were shown by Herts Brothers; tapestries and Napoleonic relics by Sypher & Co. The Tiffany Glass and Decorating Company had an elaborate display of artistic furnishings and cabinet work, embroideries, suites of furniture, etc.

Great Britain made few exhibits, and, with one or two exceptions, no attractive exhibit of furniture. Gregory & Co. had a room furnished in the Italian style and another filled with Chippendale designs and marquetry. In the former the chief object was a Holbein sideboard of Italian walnut with richly carved panels and doors in high relief. The accompanying mantel and overpiece were also excellent in design and workmanship. Collinson & Lock exhibited many cabinets and tables of rosewood inlaid with ivory, with gracefully designed panels in the style of the Italian Renaissance. The reproduction of the banqueting hall of Hatfield House, in the British section, was rich in antique carved oak and tapestries and other fine old designs.

A liberal and brilliant display of interior furnishings was made by French manufacturers, especially gayly gilded and upholstered furniture of gracefully carved rococo designs. There were fine exhibits of tapestries and other hangings. Several rooms were fitted out with complete furnishings.

For dainty refinement of design and exquisite finish the French exhibit of furniture distanced all competitors. A cabinet in Renaissance style from the establishment of Alavaine & Co., made of French walnut carved on a ground of boxwood and supported on each side by onyx columns with chiseled bronze capitals, was as elegant and finished a specimen of carved work as was seen anywhere. The same firm showed a bedchamber furnished in the style of Louis XVI, with carved and gilded wood furniture, richly embroidered silk upholstery, and cabinets with Japanese lacquer paneling. A bookcase in the style of Louis XVI, made by Beurdeley & Co. for the Empress Eugénie, was a masterpiece, especially in the perfect chiseling of the bronze trimmings. A cabinet in ormolu and lacquer and other pieces exhibited by them showed the same finished workmanship. Beautiful exhibits were likewise made by Hamot, Poirier & Remon, P. Sormani, and Damon & Colin.

In the Belgian furniture exhibit fine workmanship and correct designs on established lines were noticed. Especially elegant were the designs of F. Rosel.

In several rooms were displayed the art and taste of German furniture makers and decorators. The Bavarian Art Industry Society, which had done much to develop the art of design, made a large exhibit of carved furniture. Nuremberg manufacturers exhibited complete rooms furnished in different styles. Simon Schneller, of Munich, furnished an interior in char-



DISPLAY OF CAULTON CHINAWARE.

acteristic German style. The most imposing feature in the German exhibit was the reproduction of a reception hall in the style of the sixteenth century, with elaborately carved and gilded ceiling and painted panels from designs by Profs. Seitz and von Miller. The most gorgeous interior was a reproduction of the drawing-room in the royal castle of Herrenchiemsee, decorated in blue and gold, with elaborately carved dark, rich Renaissance furniture upholstered with elaborate embroidery.

Among the few examples of Austrian furniture the most significant was the Princess Metternich salon, containing a complete suite of furniture heavily gilded and carved in the style of Louis XV by Sandor Jaray.

In the Italian section many of the furniture designs were copied direct from ancient models. Pogliani & Co. exhibited some elaborate and well-executed pieces, notably a great ebony cabinet in the purest Italian style of the sixteenth century, inlaid with beautifully engraved ivory panels and sur-

mounted by bronze figures ; also a fine carved walnut chair in the style of the seventeenth century.

In the Russian section was rich and peculiar furniture. The mosaic doors of three cabinets were made of bits of marble and bright stones almost microscopic in size, so perfectly matched and shaded that the eye could scarcely discern the lines of junction. Two of the cabinets had mosaics representing brilliantly plumaged birds on a background of lapis lazuli from the imperial quarries at Petershof. The doors of the other represented an entire scene in an Amazon forest, with masses of tropical foliage and birds, monkeys, and insects moving in the midst.

A curious and elegant piece of ornamental work in the Russian section was a cabinet covered with designs representing scenes in the daily life of



CERAMICS SHOWN BY DOULTON & CO., LONDON.

the philanthropist Tolstoi, done in burnt work by Mme. Semetchin, of St. Petersburg.

The Japanese, in their furniture, as in all their exhibits, showed marvelous skill and instinct in the use of every medium of artistic expression. One example was a suite of gold-lacquered furniture from Osaka, inlaid in a pat-

tern of cherry blossoms with many delicately tinted pieces of mother-of-pearl, with shapes and tracery adapted from the Japanese ecclesiastical style.

Group 91 included ceramics and mosaics, divided into the following classes: 574. Bricks and terra cotta for building, plain and enameled; terra-cotta ware for decoration; reproductions of ancient Roman and Grecian red ware. 575. Stoneware and pottery, lead-glazed and salt-glazed ware; Doulton ware. 576. Earthenware, stone, china, and semi-porcelain ware, faïence, etc., with soft glazes and with high-fire, feldspathic glazes and enamels. 577. Porcelain with white or colored body, painted, incised, or *pâte-sur-pâte* decoration. 578. Tiles—plain, encaustic, and decorated tiles, bosses, *tessare*, etc., for pavements, mural and mantel decoration, etc. 579. Mural decoration; reredos and panels; borders for fireplaces and mantels. 580. Designs for and examples of pavements in tiles and mosaics.

The United States Potters' Association made a collective exhibit, in which were found the decorated semi-porcelain ware of the Edwin Bennett, Burroughs & Mountford, Cartwright Brothers, the International Pottery Company, Homer E. Laughlin, Mayor Pottery Company, the Mercer Company, New England Pottery Company, Onondaga Company, Peoria Company, Sebring Company, and the Warwick China Company; the white granite ware of Cartwright Brothers, H. E. Laughlin, the Mercer Company, the Sebring Company, and others; the Belleek ware of the Willets Company, the Onondaga Company, and Ott and Brewer; the decorated Parisian granite ware of the Toronto Pottery Company; the Dresden china of the Potters' Co-operative Company, of Liverpool, Ohio, and art china of the Ohio Valley Company; the art pottery and faïence of the Rookwood Company, Haynes & Bennett, the Mayor Company, and the Lonhuda Company; the vitreous china of Knowles, Taylor & Knowles; the Rockingham yellow ware and stoneware of the Globe Pottery, J. E. Jeffords & Co., D. E. E. McNicol, and the C. C. Thompson Company; and potters' materials from the Brandywine Summit Kaolin and Feldspar Company, Golding & Son, Knowles, Taylor & Anderson, and Howard Spencer, of Kaolin, Pa. The Rookwood Company had an individual display of decorative faïence and mural decorations in underglaze, one of the best exhibits of pottery in the Exposition, quiet and unobtrusive in forms and coloring, yet containing all the best elements of artistic workmanship. William Galloway's exhibit of art pottery and terra cotta included reproductions of famous statues and of Greek and Etruscan vases. Brown & Eberhardt had an exhibit of china bric-a-brac and statuary. M. & E. Healsy's exhibit of chryso-ceramics consisted of chinaware decorated with pure gold in a very lasting form. The Tiffany Glass and Decorative Company had an artistic exhibit of tiles, decorations, and mosaics. Alabastine is a plastic material exhibited by a company in Grand Rapids. The Graham Company, of Chicago, exhibited manufactured stone. The Marezzo Company, of Chicago, showed imitation marble. Art tiles were displayed by the Low Company; terra-cotta tiles and

decoration by the Celadon Company, Fiske, Holmes & Co., the Northwestern Terra Cotta Company, and the Lawton Brick and Tile Company; hollow and porous tiles for fireproof construction by the Pioneer Company, of Chicago; roofing tiles by John C. Zallee and the Tiffany Pressed-Brick Company; pressed brick by the latter and by the Hydraulic Pressed-Brick Company, of St. Louis and many other places.

Nearly all the well-known English manufacturers of high-grade china made elaborate exhibits. The display of Royal Worcester was especially complete, including dining sets, lamps, and many beautiful vases, one ornate example being valued at six thousand dollars. In the display of Cauldon



DISPLAY OF THE COALPORT (ENGLAND) CHINA CO.

china was an attractive set of plates ornamented by Boullemier with scenes from the poem of *Evangeline*; also a Shakespeare vase and a Columbus vase painted by the same artist. Doulton, Coalport, Minton, and other famous wares were well represented. In the Wedgwood exhibit were fine specimens of *pâte-sur-pâte* ornamentation and replicas of Queen Victoria's Jubilee vase. A Lambeth vase covered with rich ornamentation was six feet high.

Brown-Westhead, Moore & Co., the Coalport Pottery Company, Doulton & Co., and the Worcester Royal Porcelain Company united to form a group of potters and makers of porcelain that challenged comparison with

makers of similar articles the world over, and did more than all other British exhibitors to uphold the position of their country in industrial art. The Worcester exhibit, which deservedly occupied the place of honor, was a vase pierced with a sharpened steel tool in the clay state in a pattern as delicate



EXHIBIT OF THE MANUFACTURE NATIONALE DE SEVRES, SEVRES, FRANCE.

as lace and finished with turquoise and chased gold. Another piece was a *jardinière* embossed with decorations in high relief, in the style of the Italian Renaissance, and finished in rich colors outlined with raised gold. H. B. Daniell & Son showed some splendid examples of the work of Mr. Solon in *pâte-sur-pâte* Minton ware vases.

The display of the Lambeth Art Pottery, for an art not twenty years established, revealed an astonishing wealth of design and advancement in artistic execution. In addition to the faïence, Carrara ware, silicon ware, or



unglazed vitreous stoneware, and marquetry earthenware, a new ware called "Crown Lambeth" had just been developed. The decorative patterns in which natural forms are conventionalized with great ingenuity and versatility and the highly original shapes of the Lambeth pottery and that produced at Doulton through the enterprise of Sir Henry Doulton belong to a new school of design that has no relation to the traditions of Staffordshire pottery. Noteworthy were an elaborate Chicago vase, modeled in Burslem china, a vase of Lambeth faience having a modeled foot and neck, a large faience vase decorated under the glaze in a bold design of orchids and cereus by Florence Lewis, tall ewers and vases of striking fresh designs by M. V. Marshall, and carved, perforated, and *repoussé* Doulton ware by F. A. Butler and Miss A. Simmance. Some of the colors were exceedingly deep and rich.

There were five exhibits of Limoges china, containing sample dishes and whole sets of table ware. Much ornamental work in porcelain was shown. A large room was entirely filled with richly decorated Sevres vases, large and small. Some of these examples, loaned by the French Government, surpassed any that were seen at the Paris Exposition. Large vases in single colors ornamented in floral designs and raised decoration were triumphs of skill and marvels of color, of a dainty prettiness not thoroughly consistent with the size of the pieces. Rich and varied in a degree unapproached by any other was the collection of florid and highly ornate pottery from the Royal Berlin Porcelain Manufactory. Two of the most striking among a great number of beautiful pieces were the "Aurora" vase and a wonderful porcelain bath with decorated tile background of figures designed in an appropriate cool tone. There were many examples of that deep rich blue, the secret of which is preserved in this factory. In the center of the exhibit was an altarlike structure, with twisted columns supporting the roof, which contained a large allegorical picture by Prof. Kips, representing the glorification of Germania. Behind this masterpiece of porcelain painting was arranged a bathroom, and winding staircases led to other rooms. Objects of porcelain adorned the spaces between the arcades and the central picture, among them a portrait of the Emperor and a great porcelain fireplace with ornamental figures, and beyond was a precious china toilet table with a beautiful mirror.

The exhibit of the Royal Porcelain Works of Saxony contained many objects that were nowhere surpassed for elegance of form, beauty of ornamentation, and skillfulness of execution. The masterpiece was a jewel case of ebony inlaid with plates of porcelain that were decorated with allegorical figures. This piece was valued at \$1,900. A pair of dark blue vases, three feet high, were decorated with platina paintings. A beautiful article was a toilet table with mirror framed in porcelain, the whole covered with floral decorations. The price was \$3,800. There were also great candelabra decorated with figures and flowers, small lamps, chandeliers, picture frames, and

a multitude of forms and articles that are made of Dresden china, all of rare delicacy and beauty of coloring. One of the most beautiful collections was that of the Royal Porcelain Company, of Copenhagen, severely simple in color effects of delicate blue and harmonious touches of green and red, with slender threads of gold in relief, with decorative designs very distinctive and original, often bold and forcible, yet always chaste and simple in their elements. Especially interesting were the spontaneous and truthful studies from Nature, the landscape decorations of Mortensen and Lüsberg, such as



EXHIBIT OF THE ROYAL PORCELAIN MANUFACTURING CO., COPENHAGEN.

one showing a boat sailing into the picture and Lüsberg's landscapes depicting swans in a coming storm and geese on a country road. These pieces had a wonderful glaze, attained at a very great heat, producing in some of the smaller ones curious and beautiful color results. There were many other exhibits of Danish pottery and terra cotta, all original and fine. There was blue ware surmounted by perforated rims, and in the candlesticks was a delicately wrought web between the branches. Some of the earthenware resembled Elton ware and Rookwood, having a metallic dripping under the glaze. The reproductions of Etruscan ware were remarkably faithful. Tanagra figures reproduced in Denmark were exhibited by an Austrian and

an English firm ; the modeling was fine and true, and the light tints were fired in.

The delf of Holland challenged admiration. The designs were charmingly simple and agreeable, especially the plaques framed in wood. Boch Brothers, of Belgium, exhibited charmingly natural and chaste delf ware, in

the ornamentation of which classical subjects were treated with delightful rural realism. The same exhibit contained fine pieces of pottery in Rouen style.

There was an abundant display of the gay majolica faience of Italy in all its styles and colors. A great pitcher in the exhibit of Molaroni & Co., of Pesaro, having for ornamentation the "Triumph of Bacchus," was a masterpiece of coloring. There were many characteristic *jardinières* with interwoven figures. There was Noveware of Naples, employing floral decoration. Two great vases and a mosaic plaque by Mollica were particularly fine and fresh in design. The pottery by Cantagalli contained a magnificent fireplace



VASES SHOWN BY LAZARUS & ROSENFELD,  
STEINSCHOENAU, BOHEMIA.

decorated after Gozzoli's frescoes, a vase with copies of Signorelli, plaques of Gubbio ware after Raphael, and reproductions of Luca della Robbia. The specimens of mosaics wrought by the skillful Florentine artists from hard pebbles picked up in the stream beds were more elaborate than any before shown in this country. There were several exhibits also of the mosaics of Venice.

Bohemian porcelain and majolica, terra-cotta goods from Styria and Vienna, perforated faience, flagons and pipes with miniature paintings, enameled ware, mosaics, and Carlsbad chinaware made a creditable showing for Austria. Fine-art pottery was exhibited by Ernst Wahliss, of Vienna, who showed Vienna vases of rich, brilliant colors, two of them very large and profusely decorated.

The Indian exhibit contained examples of Bombay, Jaypore, and Delhi pottery.

In the Chinese pavilion were exhibits of porcelain, chinaware, and stoneware from Kiukiang, and of Canton porcelain, white and colored, and stone china, and semiporcelain ware.

In the Japanese section the process of manufacturing porcelain was exhibited by specimens. There were fully two hundred and fifty exhibits of Japanese porcelain ware and pottery, including flower vases and incense burners of Ishikawa, Shimane, Kioto, Aichi, and other centers, samples from fifty makers of Kioto chinaware, porcelain, stoneware, and faience, the stoneware of Saga in great abundance, and numerous examples from Hiogo and some from Nagasaki, Kanagawa, Fukushima, and Tokoname, the chinaware of Gifu in abundance, china and faience of Osaka, semiporcelain of Nagoya and Seto, Tochigi earthenware, Kagoshima porcelain and pottery, many examples of porcelain and pottery of Ishikawa, Kanawazi, and Hiogo porcelain and that of Kanazawa and Tokio, and chinaware from Okayama, Aichi, and Kumamoto.

Group 92 embraced marble, stone, and metal monuments, mausoleums, mantels, etc., with caskets, coffins, and undertakers' furnishing goods. The classes were the following: 581. Marble, stone, and metal monuments, and mausoleums and fittings. 582. Marble and stone fountains, balustrades, and miscellaneous ornaments. 583. Marble, stone, and metal mantels and ornaments. 584. Coffins, caskets, and undertakers' furnishing goods.

Monuments, fountains, mantels, and ornamental work in granite were exhibited by the Granite Manufacturers' Association, of Quincy, Mass., and by the Barre Manufacturing Company and the R. C. Bowers Company, of Vermont, and in marble by the Vermont Marble Company, while the Tiffany Glass and Decorating Company made a fine display of the ornamental treatment of ornamental marbles.

One of the most fascinating exhibits in the beautiful Byzantine pavilion of Russia was that of the articles made from the rich-hued ornamental stones of the Urals and Siberia, especially the products of the imperial stone-polishing works at Peterhof, from which the Czar takes \$275,000 worth of articles annually. The articles made from these peculiar Russian stones—malachite, lapis lazuli, crystals, and rhodonite—were of all sizes and kinds, from shirt studs to mantels and immense table tops, writing tables, and vases. On either side of the broad entrance to the Russian pavilion stood a tall and massive rhodonite vase, not less beautiful in form than rich in color. The exhibit included bowls of wonderful size and finish cut from light-colored jade. One of the richest objects was a labradorite table and pedestals.

In Group 93 were placed art metal work, with enamels, etc., under the following subdivisions: 585. Art metal work; selected examples of iron forgings, bronzes, bas-reliefs, *repoussé* and chiseled work. 586. *Cloisonné* enamels. 587. *Champlevé* enamels. 588. Niello work.

The exhibit of art metal made by three American firms—the bronzes, *repoussé* and chiseled work, and *cloisonné* of the Gorham Manufacturing

Company, the bronzes and bas-reliefs, iron forgings, and *repoussé* and chiseled work of the Tiffany Glass and Decorating Company, and the engraved iron and other metals, bronzes, *cloisonné* and *champlevé* enamels, and niello work—were in the highest degree creditable to American art industry. Mau-



A DISPLAY OF CERAMICS IN THE CHINESE SECTION.

rice J. Power had an exhibit of bronze statuary and the Nicholas Mueller Company one of bronze and electro-bronze statuettes. The American Bronze Company, of Chicago, the Monumental Bronze Company, of Bridgeport, and the Western White Bronze Company, of Des Moines, displayed commercial statuary and castings.

In no group was the artistic superiority of the French more manifest than in that of art metal work. They had the largest and finest display of bronzes, many of which were groups and statuettes, while others were artistic electroliers for incandescent lights. A remarkably rich and minutely ornamented piece was the great vine vase of Doré, more than sixteen feet high, containing numerous figures that stood free or in high relief, modeled with artistic grace and freedom, representing a feast of Bacchus. The vase, which was valued at \$20,000, stood in the middle of the exhibit of Thiebaut Brothers, in whose collection were reproductions of such artists as Falguière, Barrias, and Aubé. At the entrance to the French exhibit was a huge bronze vase in Louis XV. style made by the *cire perdue* process, first employed by Rhæcus of Samos in the eighth century before Christ, and for ages forgotten until revived in the fifteenth century. The Spirit guarding the Tomb was exquisitely modeled. The display of Leblanc Barbedienne comprised some of the most perfect gems of art manufacture—bronze groups reproduced from the masterpieces of Barye in the Louvre, the Theseus, Strength, and Order, Boucher's Land, exquisite bronze and *cloisonné* work, and mirrors and cabinets by Constant Sevin, with other similar works, unrivaled in design and finish. Susse Brothers exhibited a masterly and vigorous group by A. Croisy, the Defense of the Flag.

Curious and beautiful was the collection of bronzes sent by the Société Anonyme, of Brussels, including a life-size statue of Leonidas at Thermopylæ, a vase eight feet high, and a fanciful group of Innocence tormented by Loves. These were cast by the *cire perdue* process, by which the object is modeled in wax, and from the wax figure a mold is made in cement, from which the wax is removed by melting, and into the aperture the bronze is poured. While less effective than the sand process for strong work, this process gives finer results for delicate outlines and minute design, preserving every slightest touch of the artist on the wax model. The most perfectly finished bronze in the Exposition was the twelve-fronted vase, ornamented with classical forms modified realistically.

The Russian bronzes were an unending source of wondering delight. They were rustic groups and animal pieces, telling stories of Russian outdoor life and rural toils, hardships, humor, and pleasures with perfect naturalness, accuracy, and interest. The St. Petersburg firm of Stange displayed the works of the brilliant artist Eugenius Lanceray, who studied national life in the Crimea, the Caucasus, and the Kirghiz steppes, and produced in enduring form all the types of bold riders and the attitudes of horses in motion. Other sculptors presented charming realistic scenes of peasant life in Russia.

The most conspicuous of the German bronzes was a copy of the statue of Frederick the Great on Unter den Linden. The Prussian royal family and dignitaries of the empire sent to the Exposition, as examples of German art industry of the highest class, many costly gifts received by them, such as caskets in which addresses were presented to Bismarck and Moltke by

municipalities and public bodies and wedding gifts of the Hohenzollerns. Some of the most exquisite designs of lamps and other works in wrought iron were by R. Kirsch, of Munich. Peter Seitz, of Munich, had an attractive exhibit of hammered copper—large vases, chandeliers, lanterns, crucifixes, etc.—elaborately chased and decorated. Prince Stolberg exhibited decorative iron work from his large works at Ilseburg, in the Hartz Mountains—antique shields, swords, spears, helmets, and battle axes, besides tables, screens, cigar presses, etc. A screen presented by the Grand Duke of Baden



EXHIBIT OF G. E. LEBLANC-BARBEDIENNE, PARIS.

to Wilhelm II was designed in the grand-ducal school for artisans, and the enameled panels were executed by the iron workers of Guggenau, and the wrought-iron frame was by F. H. Buehler's Son, of Offenburg.

There were few art-metal exhibits in the Austrian section, but they were very fine. Among many beautiful and admirably executed designs exhibited by Dziezinski & Hanausch, of Vienna, were the bronze candelabra designed for the *loggia* of the Imperial Court Theater by Freiherr von Hasenauer.

There was an interesting display of reproductions of Irish antique metal work, a thousand years old or more, yet artistic according to the best canons.



There was also bronze celts and the bell of St. Patrick, which is believed to be the earliest relic of Christian iron workers.

Two bronze candelabra in the exhibit of F. Doberck & Son, of Copenhagen, were unique and elegant.

In the Indian exhibit were noticeable admirable brass ware from Benares and brass and enameled work from Moradabad. Very fine was the Tanjore work in silver on copper.

The Ceylon exhibit contained many samples of Oriental cutlery and metal work.

The Tokio and Nagoya exhibits of art-metal work were full of beautiful objects. A *koro*, or incense burner, designed by S. Izumi, was one of the



EXHIBITS OF RUSSIAN BRONZES.

finest bronzes in the Exposition. It is of simple design, but exquisitely balanced in composition and handled with poetic grace. Turtles occupying the rocks at the base, sea dragons twining upward, water and the character of the fishes swimming therein, and the grotesque sea god surmounting the whole, produced an effect of moving waters and sea life such as only the Japanese artists have the power to suggest in metal. In the large exhibit of Japanese *cloisonné* gold wire soldered to silver bases formed the outlines of the designs.

Glass and glassware constituted Group 94, which was subdivided into the following classes: 589. Plate glass in the rough, as cast and rolled, and as ground and polished. 590. Blown glass, ordinary window glass, bottles,

tubes, pipes, etc. 591. Pressed glass and glassware generally for the table and various purposes; skylights, insulators, etc. 592. Cut-glass ware for the table and various purposes. Engraved and etched glass. 593. Fancy glassware—plain, iridescent, opalescent, colored, enameled, painted, beaded, gilded, etc. Millefiori and aventurine glass. 594. Crackled glass in layers, onyx glass, sculptured glass; reproductions of ancient glassware. 595. Glass mosaics, beads, spun glass, and glass fabrics.

Fine blown glassware was exhibited by the Zihlmann Company; optical and lamp glasses, by George A. Macbeth & Co.; mirrors, by Prugh, Conroy & Co.; wire glass, by the Wire Glass Company, of Philadelphia; plate glass, by the Diamond Company, of Kokomo; miscellaneous glassware, by the United States Glass Company, of Pittsburg. F. M. Hicks & Co. made an exhibit of ornamental flooring and skylights in iron and glass. The Suess Company, of Chicago, exhibited beveled glass and enameled glass. Cut glass for the table and ornamental purposes was exhibited by George E. Androvette and L. Strauss & Sons. The Libbey Glass Company, of Toledo, had an admirable display of fine-cut table glass, remarkable for the depth and accuracy of the cutting. Some of the pieces were very large, requiring extreme skill in handling while cutting, especially a vase that was five feet in height. Cut glass and other fine varieties mounted in silver were shown by the Gorham Company and Tiffany & Co. The Tiffany Glass and Decorating Company had a superb exhibit of onyx glass and of glass mosaics and incised and engraved glass. J. Hoare & Co. showed examples of glass engraving and rock-crystal cutting.

In the Belgian pavilion was a remarkable display of plate glass. A mirror an inch thick and eighteen by twelve feet was without a flaw, and so clear that the glass was almost invisible.

There were not many European exhibitors of really fine cut glass and sculptured and engraved glass. J. & L. Lobmeyr, of Vienna, had a conspicuous and meritorious exhibit, containing specimens of superior engraving and sculpturing. Of Bohemian colored glass and gilded glass vessels from Vienna, the best could be seen. The Venetian glass was well represented by a multitude of examples of all styles.

Stained glass in decoration formed Group 95, in which there were two classes: 596. Civic and domestic stained-glass work, panels, windows, etc. 597. Ecclesiastical stained-glass work.

Specimens of stained glass for domestic and ecclesiastical purposes, and of beveled and mitered glass for windows, and of ground and embossed glass and glass ornaments by the sand blast and in other ways were exhibited by Chicago firms and others. Exhibitors of decorative glass were George E. Androvette & Co., Flanagan & Biedenweg, Healey & Millet, McCully & Miles, Rawson & Evans, the Wells Glass Company, the Suess Ornamental Glass Company, the Continental Stained Glass Works, the Gorham Manufacturing Company, and William Reith. The exhibit of the Tiffany Glass

and Decorating Company was a splendid example of the progress made since 1876 in American decorative art, and the admiration that it generally excited proved that the soil is fertile for the growth of such forms of art. The exhibit revealed the value of glass as a decorative material in novel applications, especially in ecclesiastical art. It consisted of a complete chapel designed in the Romanesque style by Louis C. Tiffany. The altar, retables, and reredos



EXHIBIT OF ARDESHIR & BYRAMJI, BOMBAY.

were largely composed of glass mosaic in a setting of marble, enriched by inlays of mother-of-pearl and precious and semi-precious stones. The body of the altar was made of one hundred and fifty thousand pieces of flat, cream-white, opalescent glass in quarter-inch squares, relieved and ornamented with emblematic devices in various rich substances. The risers of the retable were filled with gold glass mosaic of the same size, carrying inscriptions in flat opalescent glass. In pleasing contrast with the altar in color and treatment was the reredos. In a wide setting of black marble was a symbolic picture, composed of iridescent glass mosaic, which gave forth blue, green, and golden scintillations of pearly light. The mosaic was in large pieces conforming in shape to the design, as in the Alexandrine mosaics of the Ro-

mans. Attached to and overshadowing the reredos was a semi-ciborium, constructed of a series of receding round arches, the soffit of each falling below the next one in a way to expose a number of faces and enhance the perspective, the whole being overlaid with gold, enriched with ornaments in relief, set with jewels, and made brilliant with inscriptions and inlaid designs in colored and gold glass mosaic. These arches rested upon twelve columns, whose metal caps were beautified with relief ornaments on a background of colored glass mosaic and with astragals of jewels set in gold; their shafts, resting upon bases of black marble, were composed of two hundred thousand quarter-inch pieces of red, green, and brown transparent glass arranged in six cruciform designs. Mosaic designs and inscriptions were set into the risers of the altar steps. Hanging from the roof of the chapel were large sanctuary lamps formed of thick, deep-green, glass globes faceted like emeralds. The chapel was illuminated by colored-glass windows containing figures of holy personages, in which were seen the latest improvements and inventions in glass, in leading, and in construction. They were all built on the mosaic system, the effect of light and shade being produced by the inequality of the surface of the glass, and there was no paint, stain, or enamel, except in the hands and faces of the figures. The furnishings of the chapel were appropriate and original designs in wood, metal, marble, upholstery, and embroidery. During the Exposition one million four hundred thousand persons visited this chapel, which won the encomiums of all American and foreign art critics and ecclesiastics.

The British stained-glass exhibit included some fine work, notably a window representing the Nativity, by Henry Holiday. The Austrian exhibit included good examples of Tyrolean stained glass.

There were five large windows of colored glass in the chapel of the German house, of which the central one, having for its subject Christ stilling the Tempest, was made by Mayer & Co., of Munich and New York, and was for the chapel of the Naval Academy in Annapolis as a memorial of the American sailors drowned by the Samoa hurricane in 1889.

Group 96 took in carvings in various materials: 598. Wood carving. 599. Ivory carving. 600. Bamboo incised work. 601. Metal carving and chiseling. 602. Sculptured and engraved glass. 603. Sculpturing, carving, and modeling in porcelain; *pâte-sur-pâte*.

In this group Tiffany & Co. exhibited specimens of ivory carvings, of metal carving and chiseling, and of sculptured glass. The Tiffany Glass and Decorating Company had wood carvings and carvings in ivory, as well as elaborately engraved glass. Rud Lund, of Knoxville, Tenn., had carved out of wood for the Exposition an emblematic design in the Greek style.

Some of the best examples of English wood carving were seen in the reproduction of the banqueting hall of Hatfield House.

Italy had the most abundant, the most elaborate, and the most artistic carved furniture and wood carvings of half-size figures in the style of the

eighteenth century. One of the finest examples of carved wood was seen in the Spanish furniture exhibit. Switzerland had nearly forty exhibits of wood carving, examples of artistic handiwork of which any nation might be proud. The wood carving of the Norwegians, broader in style, was beautiful and significant of a national art sense of a high order. A case in the Russian exhibit contained quaint figures in natural colors, all in the costumes, occupations, and postures of every-day life, molded in bread by a lady of St. Petersburg. In the Ceylon exhibit was a pagoda, after the fashion of Cingalese ecclesiastical architecture, octagonal, the posts of which were of



SPECIMENS OF BOHEMIAN GLASSWARE.

ebony, satinwood, and juk wood, elaborately carved. The gem of the India exhibit was a room of teak wood, carved outside and in, walls, cornices, and ceiling, in elaborate patterns, and furnished with Oriental furniture and draperies. Considerable teak carving was shown in other spaces occupied by India, besides fine carvings in ebony, sandalwood, and other woods. A complete boudoir in the Forestry Building showed the decorative capabilities of the woods of the Andaman Islands and the skill of the Indian carvers and wood workers, who wrought from these woods the ornamental ceiling, parquet, dado, panels, frieze, doors, and furniture.

Many fine specimens of ivory tusks were found in the Brunswick-Balke Company's exhibit, some of them quite straight, and others spiral and twisted. A pair from Zanzibar were nearly eight feet and a half long. At the entrance to the Siamese pavilion were two huge tusks. Excellent ivory carvings formed a part of the German exhibit. The wealth of inventive

fancy and the perfection of artistic skill shown in innumerable Japanese ivory carvings was bewildering, and quite as wonderful was the carving and chiseled work on copper and other metals.

Group 97 was that of gold and silver ware, plate, etc. Its classes were : 604. Gold and silver ware, gilt ware for the table and for decorations. 605. Silver table ware generally—plates, salvers, tureens, bowls, dishes, baskets, candelabra, *épergnes*, etc. 606. Knives, forks, spoons. 607. Fancy bonbon and other spoons ; miscellaneous fancy articles in silver, snuffboxes, matchboxes, cane heads, handles, chatelaines, etc. 608. Ware of mixed metals—Mokume ware, inlaid and incrustated ware, enameled and niello work. 609. Plated ware on hard or nickel-silver foundation. 610. Nickel ware, nickel-silver ware, aluminium ware, and aluminium-silver ware. 611. Plated ware on soft-metal alloys.

The goldsmiths' and silversmiths' work of the United States distanced easily the display of every other nation in the group of art metal work. The Gorham Manufacturing Company had a large exhibit of solid silver and other metals, designed especially for the Exposition, Sterling-silver articles were shown of every kind and for every purpose, ranging from pieces weighing less than an ounce up to Bartholdi's heroic statue of Columbus, which required in the casting thirty thousand ounces. One department was devoted to electroplated ware. Silver-mounted cutlery and leather articles, cut glass and decorated pottery with carved silver bands, silver chests of wood and leather, enamels on silver and bronze, and ecclesiastical wares in silver and other metals made up this varied exhibit, to which forty-seven certificates of excellence were given. The surface of the Columbian statue was oxidized, producing the strong and noble sculptural effect that appertains to bronze and is unattainable in blank silver. This exhibit contained remarkably fine *repoussé* work, notably a delicately executed tea service designed by George Wilkinson. One of the most splendid and highly finished pieces of American art work was the Century vase, four feet high, containing two thousand ounces of silver, on which were emblematic groups representing America summoning the nations to the Exposition, War yielding to Peace, and Genius recording the progress of the arts, with festoons of native flowers. The exhibit of Tiffany & Co. was at the entrance of the American court, in a pavilion that they, in association with the Gorham Company and the Tiffany Glass Company, had erected, on the plans of John Du Fais, to vie with the portals of the French, German, and British sections, the Chicago management having no funds to construct a suitable entrance. Tiffany & Co., who had borne off the prizes for art metal work in the Paris expositions of 1878 and 1889, had a display that in skill and design matched anything that the jewelers and goldsmiths of Europe could offer ; in magnificence it outdid them all, being valued at \$1,000,000. The Tiffany exhibit of silversmiths' work was very artistic, especially electroplated pieces and solid services and pieces of sterling silver. In fertility and originality of design, in ingenious

adaptations of materials, and in variety of form and expression, the Tiffany exhibit surpassed the work of any other firm in the group of art metal work. A notable work of art was the Magnolia vase with marvelous enameling, an original development of forms adopted from the pottery of the cliff dwellers of New Mexico, with decorations chased in high-relief work and some treated in enameling, representing magnolia blossoms, cactus leaves, and golden-rods, the flowers of the latter being produced in their natural color by the use of pure gold. Around the base were four large pieces of opal, symbolizing the earth in which the plants are springing.



GOLD AND SILVERWARE DISPLAY OF TIFFANY & CO., NEW YORK.

Jewelry and ornaments formed Group 98, classified as follows: 612. Gold ornaments for the person—plain, chased, or otherwise wrought or enameled—rings, bracelets, necklaces, chains, etc. 613. Diamonds and various colored gems, as rubies, sapphires, emeralds, chrysoberyls, tourmalines, topazes, etc., mounted in various ornaments. 614. Agates, onyx, jasper, ornaments for the person. 615. Pastes and imitations of precious stones, mounted or unmounted. 616. Gold-covered and gilt jewelry and ornaments.

The most artistic and elegant display of jewelry ever seen at a fair, and one of the costliest, was that of Tiffany and Co. In the center was a case of diamonds containing the largest yellow diamond in the United States,



valued at \$100,000, a girdle of canary diamonds, and hundreds of smaller pieces resplendent with gems. All kinds of precious stones were matched, harmonized, and arranged in the neat and tasteful settings for which this house is famous. Remarkable strings of pearls formed part of the exhibit. There was a display of unset gems and stones in the rough here as well as in the mining exhibit. Silver filigree work, an art preserved by the Scandinavian nations, was exhibited by G. Dirksen, who has naturalized it in the United States. Mermod & Jaccard, of St. Louis, with an elaborate display of silverware and diamond jewelry, had an exhibit commemorating the canonized King of France after whom their city was named. Fancy novelties and society goods were shown by Whitehead & Hoag, of Newark, and table silverware by the Wymble Company, Benziger Brothers, Diepenbrock & Uchtman, and Andrew Messmer Company made exhibits of church plate and ornaments, altar decorations, and embroidered vestments and banners. The Henderson-Ames Company showed lodge jewels, swords, and regalia. Exhibitors of silver-plated and gold-plated goods were the Holmes & Edwards Company, the Manhattan Company, the Meriden Britannia Company, the Pairpoint Company, Rogers & Brother, and James W. Tufts. The William Rogers Company exhibited, with finished and unfinished wares, the operations employed in making knives from bar steel, and plated forks and spoons. Among the other exhibitors of jewelry were Bell & Barber and D. R. Corbin, of New York, J. A. Canini, of Saratoga, and Ostby & Barton, of Providence. The large manufacturing firm of Kent & Stanley made a profuse display of gold watch chains, locketts, and pins, and sterling-silver trinkets. H. Muhr's Sons exhibited gold jewelry and thimbles. Gaynor & Washburne showed interchangeable jewelry. Articles wrought in amber were the exhibit of the Brown Amber Manufacturing Company. William K. Potter, of Providence, displayed tortoise-shell combs and jewelry. The Tiffany Glass and Decorating Company had an exhibit of onyx ornaments. Leon Favre, of New York, showed a process for transferring photographs to the gold surface of watch cases and locketts. R. F. Simmons & Co. had an exhibit of rolled gold, plated, and gold-filled watch chains and other jewelry. Plated jewelry was also exhibited by the Reynolds Company, of Providence. The manufacturing jewelers of New England made a collective display, to which George H. Cahoon & Co., of Providence, contributed miscellaneous jewelry; A. Lorsch & Co., diamonds and other gems, agate ornaments, and imitation precious stones; Arnold & Steere, gold rings and ornaments; W. E. Webster & Co., rings; Charles F. Irons, gold emblems and plated charms; S. & B. Lederer, plated emblems and jewelry; R. L. Moorhead & Co., plated lace and scarf pins and chains and silver novelties; Marden & Kettleby, gold lace and stick pins; B. A. Ballou & Co., safety pins; Clark & Coombs, plated rings; J. W. Grant & Co., plated chains and bracelets and silver jewelry; Foster & Bailey, gold locketts and lace pins and plated bracelets and chains; R. L. Griffith & Son, gold scarf





VIEWS IN THE FRENCH SECTION, MANUFACTURES BUILDING.

and lace pins and shell novelties; the Seery Company, chains and rings; Payton & Kelly, plated bracelets and neck and eyeglass chains; O. C. Devreux & Co., plated link and collar buttons and silver ornaments; J. H. Fanning & Co., plated locket and watch chains; M. L. Read & Co., gold scarf pins and studs and plated watch chains and necklaces; F. F. Pearce & Co., gold and silver pens and pencils; Hancock, Becker & Co., gold rings, studs, and mountings and plated brooches; D. R. Child & Co., gold cuff and collar buttons; Flint, Blood & Co., plated rings; the Providence Co., gold, silver, and plated chains, necklaces, and charms; E. L. Spencer & Co., of Attleboro, gold pins and drops; W. & S. Blankinton, of the same town, plated goods and silver and fancy chains; George H. Fuller & Co., of Pawtucket, jewelers' findings, ornaments, and supplies; and W. H. Leland & Co. and Thomas W. Lind, of Providence, engravings and designs of jewelry.

The only examples of high-class gold and silver work in the British section were exhibits of the Goldsmiths' and Silversmiths' Company, of London. Enameled gold caskets were the ones in which the freedom of the city of London was presented to the Emperor of Germany and to Mr. Gladstone. The Columbian shield, of solid silver, had panels representing scenes of the landing of Columbus, modeled and chased in high relief. The Shakespearean casket, of gold on an iron frame, was ornamented with gold medallions and moldings, enameled paintings, and *repoussé* work. A musical clock in a finely wrought case rested on a pedestal ornamented with portraits of great Americans and pictures of American games. In the French section the silversmiths' work of Christofle was as chaste and elegant as the purest taste could demand—more refined and chaste in design, perhaps, but much less inventive and original than Tiffany's equally fine display. Spanish goldsmiths exhibited many examples of an elegant art peculiarly their own—that of damascening, or inlaying steel with gold. Two massive vases covered with arabesque designs in gold were valued, one at \$20,000, and one at double that figure. Denmark exhibited some striking designs in silver work, with flat, brilliant surfaces. Norway had some silverware of very strong and characteristic design, especially the handsome and curious lamps. An interesting feature of the Norwegian exhibit was a large display of enameled gold and silver spoons, ornaments, and trinkets. The enamel, often transparent, was rich in variety and effects of color, and many objects were ornamented with beautiful fine filigree. Gold and silver work, copied from Byzantine models, and enamel work sent by several Moscow firms, were much admired, and found many purchasers among people to whom the Russian ornamental forms and the translucent enamel and niello work were unfamiliar. The enamel work of Ovchinnikoff was gemlike, consisting of tinted glass insertions in a wealth of interlaced and reticulated designs of gold and silver, made into small vases, plates, pocket books, chatelaines, receivers, watch covers, jewel cases, etc. A rich gift from the Cossacks of the Urals to the Czarevich was a magnificent vessel in silver and gold. No

workmanship in these metals could be more perfect than a napkin in silver imitating the texture of fine linen lying on a gold salver. The Indian exhibit contained an abundant display of cutchwork in solid silver.

In the jewelry display of the Goldsmiths' and Silversmiths' Company, of Regent Street, were some good designs in which black pearls were the principal gems, turquoise necklaces and other pieces set with diamonds, and pieces in which curious effects produced with the opal matrix constituted or enriched the design. In the French display were exhibits of gilt and paste jewelry so artistic and deceptive as to attract the admiration of crowds of people. The neighboring exhibit of genuine jewels were valued at \$2,000,000. One necklace, worth nearly \$100,000, was composed of eleven diamonds of as many different colors, each joined to the band by a diamond clasp. A brooch of blue diamonds on a background of yellow diamonds had for its central gem a stone weighing forty-one carats and valued at \$100,000. Another pin, composed of five large white brilliants, was worth \$140,000, the largest stone, of forty-three carats, being valued at \$53,000. In the same case was an ancient prayer book with a binding in gold and silver enamel set with rubies. A tiara of diamonds was composed of some of the crown jewels formerly worn by the Empress Eugénie.

Group 99 was that of horology—watches, clocks, etc. The exhibits were classed as follows: 617. Watches of all kinds. 618. Watch movements and parts of watches. 619. Watch cases. 620. Watchmakers' tools and machinery in part. 621. Clocks of all kinds. 622. Clock movements. 623. Clock-making machinery. 624. Watchmen's time registers.

The Waltham Watch Company, besides watches and watch movements, exhibited its automatic watch-making machinery in motion. The machines, in many instances the invention of employees, drew crowds about them to see the marvel of steel arms silently picking up minute screws and jewels and fitting them into their places. The company made an historic exhibit of antique watches, many of which once belonged to famous persons. Tiffany & Co. made an elaborate display of fine watches and chronographs. Their watch cases were admirable examples of correct and tasteful design. The display of clocks was remarkable, and included several astronomical clocks, besides the elaborate "Globe" clock. The Waterbury Watch Company showed hundreds of watches and movements. The drawing feature of the exhibit was a clock that records the hour, minute, and second, the day of the week and of the month, the phase of the moon and the state of the tide, and has automatic figures reproducing in miniature the movements of operatives and machinery in a watch factory, of miners in a mine, of Elias Howe working at the model of the sewing machine, of telegraph and telephone operating, etc. Watch cases were shown by H. Muhr's Sons and the Keystone Company. The Bundy Company, of Binghamton, N. Y., exhibited automatic time recorders. The Ansonia Company exhibited hundreds of clocks, of all sizes and kinds. The exhibit of the Self-Winding Clock Company,

which, with the co-operation of the Western Union Telegraph Company, furnishes standard time from the Naval Observatory at Washington to subscribers in all parts of the United States, besides filling a large pavilion, included two hundred clocks in different parts of the grounds and a large belfry clock, and twenty-four clocks in the railroad station showing the time in the principal cities, all controlled by the master clock in the pavilion, which was provided with a gravity escapement, the invention of James H. Gerry, and by an electric connection corrected every clock to the second at the end of each hour. The company exhibited signaling apparatus that will



PAVILION OF THE AMERICAN WATCH CO., WALTHAM, MASS.

ring bells or give other signals throughout the day, according to any possible time schedule. A chime clock was fitted with an electrical mechanism that would play automatically any number of tunes according to any predetermined programme at any desired intervals of time. The chime of bells in the clock tower, cast by the Clinton H. Meneely Company, although they weighed over seven tons, were similarly fitted with special hammers and magnets, so that they were rung automatically or operated by a lady sitting at a keyboard.

The genius of the French for original work and delicate execution was finely shown. Several watches were exhibited that had faces not more

than half an inch in diameter. The smallest was set in a rosebud studded with stones, and was opened by pressing a spring at the point, at which the petals parted ; another was set in a ring, encircled with brilliants, like a gem. A repeater of ordinary size was so constructed that when the case was opened, to see the time the act of closing it wound up the spring. Another watch had on one side the hour, minute, and second hands, smaller faces showing the time in other cities, and an index showing how near the watch was run down, and on the other side a perpetual calendar, giving the month, the day of the month and of the week, and the phase of the moon, and also a thermometer. There were \$400,000 worth of watches in a single show case.

The Swiss watchmakers proved themselves, as ever, masters in intricate designing and perfection of workmanship. Watches set in the table of a signet ring were wound, like similar ones in the French exhibit, by turning them in their setting. Other miniature watches were mounted as butterflies, beetles, and ducks, in bracelets and brooches, and one of them in the center of an enameled gold daisy. There was a remarkable collection of curious and antique watches in the Swiss section, including a watch of Arabian workmanship made in 1074, a Nuremberg egg of 1550, and a wooden watch made by a Siberian convict.

Group 100 comprised silk and silk fabrics, classified as follows : 625. Raw silk as reeled from the cocoon, thrown or twisted silks in the gum ; organzine, tram, spun-silk yarn. 626. Thrown or twisted silks, boiled off or dyed, in hanks, skeins, or on spools ; machine twist and sewing silk. 627. Spun-silk yarns and fabrics and the materials from which they are made. 628. Plain-woven silks, lutestrings, sarcenets, satins, serges, foulards, tissues for hat and millinery purposes, etc. 629. Figured-silk piece goods, woven or printed ; upholstery silks, etc. 630. Crapes, velvets, gauzes, cravats, handkerchiefs, hosiery, knit goods, laces, scarfs, ties, veils ; all descriptions of cut and made-up silks. 631. Ribbons—plain, fancy, and velvet. 632. Bindings, braids, cords, galloons, ladies' dress trimmings, upholsterers', tailors', military, and miscellaneous trimmings.

American silk manufactures were fully and extensively displayed. There were the dress silks, printed silks, plushes, velvets, and figured upholstery goods of Cheney Brothers ; the serges, surahs, satins, dress goods, braids, and twists of Belding Brothers & Co. ; John D. Cutter & Co's. plain and fancy piece goods and spool silk and twist ; Dexter, Lambert & Co's. dress silks and ribbons ; B. H. & E. E. Elwood's broad silks ; Doherty & Wadsworth's dress silks and surahs ; the silk dress goods of the Empire Silk Company ; Hamil & Booth's dress goods, brocades, and ribbons ; the Hitchcock-Meding Company's satins, damasks, brocatels, dress silks, ribbons, and tie silks ; dress silks of the Liberty Silk Company ; Pelgram & Meyer's dress silks and ribbons ; the dress silks, handkerchiefs, ribbons and bookmarks, and braids of the Phoenix Company, of Paterson ; dress silks and ribbons from R. & H. Simon, of Union, N. J. ; serges, linings, and braids made by the William



Skinner Company; John N. Stearns's dress silks; serges, dress goods, linings, and ribbons shown by William Strange; William Trevor's cravats, handkerchiefs, and ties; the dress silks, hosiery and mittens, and braids of the Richardson Company, of Chicago; ribbons and silks from the Rhenania Mills; the dress goods and ribbons of Werner, Itschner & Co.; silk plushes from the Wahneta Mills; William Robertson's silk curtains and upholstery goods; the ribbons made by the Meisch Company, Levy Brothers, Johnson, Cowdin & Co., John Erskine & Co., and A. & S. Blumenthal; C. F. Baum's dress trimmings; the woven-silk pictures, bookmarks, and badges made for the Exposition by John Best & Co.; the labels of the American Silk Label Company; the silk and mohair braids of the Castle Braid Company; the silk braids of Sutro Brothers and the McLaughlin Company; laces, gloves, veils, and scarfs from the Jennings Lace Works; the silk hosiery of the McCallum Constable Company; the silk underwear, mitts, and hosiery of Julius Kayser & Co.; the spun silk of the Griswold Worsted Company; the silk fur and tie silk of the Meyenburg Corporation; and wash silks, underwear, hosiery, mittens, sewing, knitting, and crochet silks, buttonhole twist, and braids and bindings from the mills of the Nonotuck Company.

The French manufacturers were well represented in the departments of the textile industry in which they especially excel. The exhibits of silk and other fabrics were mainly of kinds used in dress and adornment, and the rooms in which costumes and accessories of dress were shown were always crowded with women. Many large cases were filled with gowns of the newest fashions devised by French designs. There were also exhibits of bonnets and gloves.

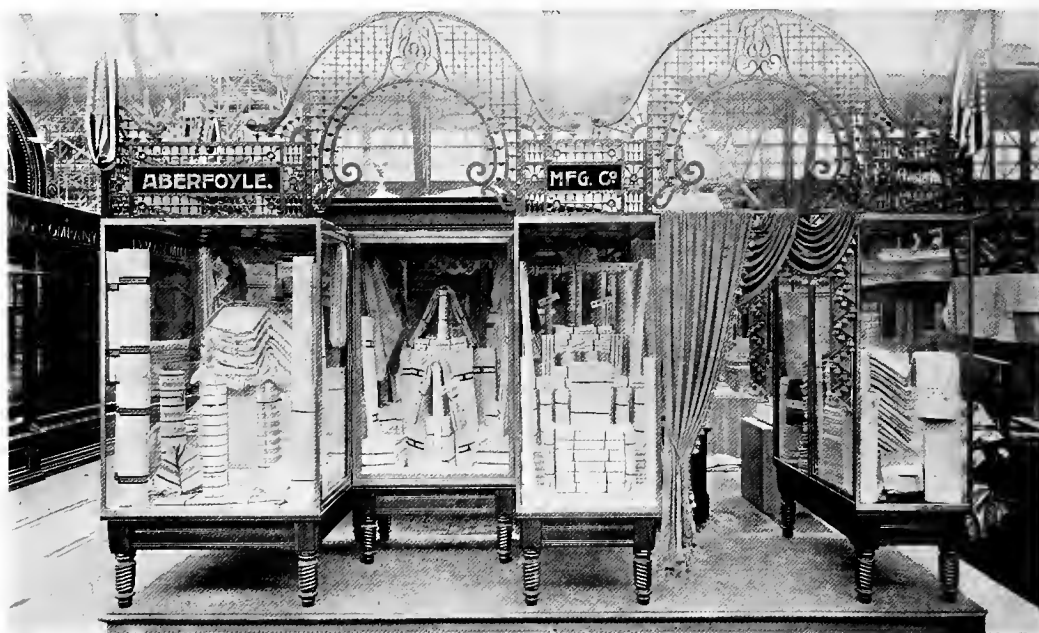
Group 101 comprised fabrics of jute, ramie, and other vegetable and mineral fibers, and was classified as follows: 633. Jute cloth and fabrics, plain and decorated. 634. Ramie and other fabrics. 635. Mats and coarse fabrics of grass, rattan, cocoanut, and bark; mattings, Chinese, Japanese, palm-leaf, grass, and rushes; floor cloths of rattan and cocoanut fiber, aloe fiber, etc. 636. Floor oilcloths and other painted and enameled tissues, and imitations of leather with a woven base. 637. Woven fabrics of mineral origin—fine wire cloths, sieve cloth, wire screen, bolting cloth. Asbestos fiber, spun and woven, with the clothing that is manufactured from it. Glass thread, floss, and fabrics.

In this group the H. W. Johns Company made a good display of asbestos cloths, twine, and felted fabrics. The Asbestos Specialty Company had another exhibit of asbestos articles. A substitute for leather was shown by the Pantasote Leather Company, and the Tannette Company exhibited imitation leather for furniture coverings. George W. Blabon & Co. and Thomas Potter, Sons & Co. exhibited oilcloth and linoleum.

Group 102 comprised yarns and woven goods of cotton, linen, and other vegetable fibers, divided into two classes: 638. Cotton fabrics—yarns, twines, sewing cotton, tapes, webbings, battings, waddings, plain cloths for printing and

converting, print cloths, brown and bleached sheetings or shirtings, drills, twills, sateens, gingham, cotton flannels, fine and fancy woven fabrics, ducks, ticks, denims, stripes, bags and bagging. Upholstery goods—tapestries, curtains, and chenilles. 639. Linen fabrics—linen thread, cloths and drills, plain and mixed; napkins, tablecloths, sheetings, shirtings, etc.; cambrics, handkerchiefs, and other manufactures of linen.

A finer line of cotton manufactures was observed in Chicago than at the Philadelphia fair. The most noticeable addition was the product of the com-



COTTON FABRICS SHOWN BY THE ABERFOYLE MANUFACTURING CO., CHESTER, PA.

bing machine, both yarn and fabrics. One Massachusetts mill showed the product of fifty-six combing machines. The variety of yarns gave evidence of great advancement. One establishment manufactures three hundred different kinds and qualities, including harness and seine twines, yarn for covering electric wires, fine yarns for plushes, and three-, four-, and six-ply yarn, several of which are new to American industry. The largest exhibits from Massachusetts were brown and bleached sheetings and shirtings. Some of the mills that exhibited only these staples at Philadelphia were seen to have turned their attention to goods requiring greater skill in their production, such as muslins, sateens, lawns, and nainsooks. Former exhibitors of dyed and printed calicoes now showed chambrays, challies, llama cloth, velveteens, and corduroys. None of the Fall River mills sent their printing cloths, but they exhibited instead gingham and cambric muslins. The exhibit of the Aberfoyle Company, of Chester, Pa., contained zephyrs and fine cotton goods and cotton and silk mixtures for dress goods and shirtings. The

Amoskeag Company exhibited gingham, tickings, checks, and Canton flannels. The Appleton Company, besides ticks and shirtings, showed flannels and eider downs. Zephyr gingham was the exhibit of the Barnaby Company and of the Lancaster Mills. Gingham, with other goods, were shown by the Valley Falls Company and the Glasgow Company. The Jackson Company, of Boston, and the Overland Mills, of Denver, Col. John W. Slater showed gingham and napped goods, chevots, and shirtings. Brown, bleached, colored, and printed goods were exhibited by Joseph W. Woods, the Great Falls Company, the Pacific Mills, the Ponemah Mills, the Dwight Mills, the Lyman Mills, and the Whittenton Company. The New York Mills had an exhibit of muslins, jeans, cottonades, and camlets. Garner & Co. showed calicoes, percales, sateens, and prints. An exhibit of lawns, sateens, calicoes, and flags was made by S. H. Greene & Sons. The Grosvenor Dale Company, with gray and bleached cottons, had an exhibit of cotton handkerchiefs. The Wilkesbarre Lace Company exhibited cotton-lace curtains. The Monadnock Mills showed Marseilles quilts. The Lonsdale Company had a varied exhibit, including sheetings, shirtings, cambrics, twills, sateens, and holland. The Manville Company exhibited plain and fancy dress goods, chambrays, fancy curtains, plain and brocade sateens, and novelties. The Naumkeag Company exhibited sateens, with bleached and unbleached cottons. The exhibit of the Nashua Company included brown and bleached sheetings, flannels, table felting, dometts, and drills. The Binns Company, of Philadelphia, exhibited trimmings and upholstery goods. Miscellaneous exhibits were made by the Fisher Company, the Forestdale Company, Kneeder & Co., and B. B. & R. Knight.

The Merrimack Company made a large exhibit of fancy prints, indigo and tartan red goods, challies, chambrays, llama cloth, velveteen, etc. The exhibit of the Eddystone Company included silver-gray and fancy prints, solid blacks with alpaca and delaine finish, fine sateens, etc., done in aniline colors. Another Philadelphia printing establishment, the Berlin Works, exhibited Turkey and Berlin reds and oil colors, black satins and brocades, and solid colors with merino, foulard, and cashmere finish. The Wamsutta Mills exhibited sheetings and fine lawns and nainsooks. Cambrics and lawns were exhibited by the Berkeley Company, the Conanicut Mills, and others. The Clarendon Mills had an exhibit of crocheted quilts. Cotton fabrics quilted by a knitted process were shown by the Knitted Mattress Company, of Canton Junction, Mass. The Pemberton Company, besides shirtings and ticking, had an exhibit of toweling. The pile fabrics and cotton and linen toweling of the Star and Crescent Mills were of many kinds. The Claremont Mills exhibited wide sheetings. Bleached and brown cottons were exhibited from the Allendale, the Amory, and the Williamsville Mills. The Clifton Company showed brown cotton. Exhibitors of bleached and gray shirtings were the Hope Company, the Farwell Mills, the Cabot Company, the Blackstone Company, and the Powhatan Mills. Bleached muslin was

exhibited from the Attawaugan, Davol, Hamlet, Greenville, Monohansett, Morse, Nightingale, Slater, and Enos Lapham Mills. An exhibit of Southern domestics and sheetings was made by the Trion Company, of Georgia. The Stark Mills exhibited drillings, ducks, and bagging. Awning stripes, tickings, and ducks were shown by the Methuen Company.

James Thompson & Co. showed twines, mosquito nets, buckram, and screen cloth. John T. Bailey & Co. exhibited bags, burlaps, and cordage and twine. Thread for fancy work was shown by the Glasgo Lace Thread Company; spool cotton by the Willimantic Linen Company; yarns by the Arlington Mills, Globe Yarn Mills, Sanford Spinning Company, and Hadley



EXHIBITS OF GLASSWARE FROM VIENNA.

Company. The Stevens Linen Works, of Boston, had an exhibit of linen crash.

A British manufacturer exhibited the finest piece of linen ever made, containing six thousand threads in the width of thirty-six inches.

Group 103 comprised woven and felted goods of wool and mixtures of wool, divided into the following classes: 640. Woolen and worsted fabrics—woolen yarns, union and merino worsted tops, noils, and yarns, shoddy and mungo. 641. Woolen goods—all-wool woolen cloths, doeskins, cassimeres, indigo flannels, and broadcloth, overcoatings, cloakings, and kerseys, flannels, dress goods, etc., for both men and women. 642. Blankets, robes, traveling rugs, horse blankets, shawls, bunting, etc. 643. Worsted goods—coatings, serges, suitings, cashmeres, etc. 644. Cotton and woolen-mixed woven goods—unions, tweeds, cheviots, flannels, linseys, blankets, etc. 645.

Woven on cotton warps. 646. Upholstery goods. 647. Sundries and small wares, webbing and gorings, bindings, beltings, braids, galloons, fringes and gimps, cords and tassels, and all elastic fabrics, dress trimmings, embroideries, etc. 648. Felt goods, felt cloths, trimming and lining felt, felt skirts and skirt-ing, table and piano covers, felts for ladies' hats, saddle felts, druggets, endless belts for printing machines, rubber shoe linings and other footwear, hair feltings. 649. Carpets and rugs, ingrains (two-ply and three-ply) and art carpets, tapestry and body Brussels, tapestry velvet, Wilton or Wilton velvet, Axminster, tapestry Wilton, Moquette, ingrain and Smyrna rugs, other woolen rugs, rag carpets. 650. Wool hats of every description. 651. Fabrics of hair, alpaca, goat's hair, camel's hair, etc., not otherwise enumerated.

The woolen manufacturers of the United States made an extensive and thorough display of their products, and proved that they have kept pace with their foreign competitors in the great advances and changes that have been made in their industry through the supplanting of carded wool and shoddy by combed wool and worsted yarns. The exhibits, compared with those of 1876, showed throughout a marked improvement in style, quality, and finish, and the variety of goods was incomparably greater. While there were some superior cassimeres made from carded wool in various colorings and tasteful designs, most of the exhibits of this class were of medium grade, intended for the masses, but displaying a degree of skill in manufacture quite equal to that bestowed on the finer fabrics.

The Washington, Talbot, and Ballardvale Mills of Massachusetts, and the Appleton, Merritt, and Seymour factories of the West, exhibited their woolen yarns, and the Arlington, Cranston, and Farr Mills their worsted yarns. Erbsen, Search & Co. showed processed Australian lamb's wool, with woolen, worsted, and merino yarns, and F. Hartley showed carbonized Australian lamb's wool and domestic wool and noils. The Griswold Company exhibited worsted and spun silk for all purposes, and the Providence Worsted Mills worsted, genapped, and mohair goods. Exhibits of hosiery or knit underwear were made by French & Ward, the Midland Mills, and the Mississippi Mills. The woolen goods were shown in the greatest variety: fancy cassimeres from the Broad Brook, Calumet, Glendale, Hockanum, Kimball, Milner, New England, North Adams, Rock, Sawyer, Springville, and Seabastcook Mills of New England, and the Raritan and Somerset Mills of New Jersey; kerseys by the Blackstone, Berkeley, Kiamensi, American, and Sanford Mills; overcoatings by the Auburn, Bound Brook, Empire, and Peacedale Mills; beavers, with kerseys, cloakings, etc., by Connor Brothers, the Germania, Globe, and Burlington Mills; fine broadcloths by the Waumbeck Company, J. Capps & Son, and others; broadcloth dress goods by the Gonic Company; meltons, tricots, doeskins, or the like, by the S. Blackington Company, the Worumbo Company, George W. Hetzel, and others; uniform cloths by Thomas Oakes & Co. and the Charlottesville Mills; wool cheviots by William Wood & Co.; elysians, ratteens, and carriage

cloth by the Harris Company. Most of these exhibitors made a varied display of woolen goods, which were exhibited also by the Canoga Company, Thomas Dolan & Co., the Hecla Mills, T. E. Hopkins, B. Lucas & Co., the Mississippi Mills, the Norwich Company, C. H. and F. H. Stott, the Talbot Mills, and Elias Titus & Son. Exhibitors of dress goods were the Belvidere Company, Clinton Mills, Devonshire Mills, Georgis River Mills, Merrimack Mills, Niantic Mills, and Pacific Mills, all New England concerns, and by George Folwell, of Philadelphia. Henrietta cloth, plaids, whipcords, albatross, iridescent fancies, and many other varieties were shown by Massachusetts manufacturers. The Arlington Mills showed plaids, and William F. Read a silk-warp lansdowne.



EDOUARD GUERETTE,  
Delegate of the  
Commissioner from Belgium.

Flannels, which are not made so much now since knitted fabrics are produced by machinery, were shown by the Appleton Mills, E. G. Carleton & Sons, the Cocheco Company, the North Star Mills, and the Yantic Company. The Waterloo Company showed flannels and carriage cloth. Fine white flannels were exhibited by the Ballardvale Mills, and Charles A. Stevens had an exhibit. The Assabet Company showed fancy flannels and cassimeres. Dress flannels were exhibited by the Seymour Factory and the Stirling Mills. Blankets were exhibited by French & Ward, the North Star Mills, the Midland Woolen Mills, the Seymour Factory, Shuler & Benninghofen—all Western concerns—and by the Winthrop Mills, of Maine. J. Capps & Son exhibited Indian and carriage robes; the Sanford Mills, robes, rugs, and horse blankets; and the Merrimack Mills, George Merritt & Co., the Muncy Mills, the Racine Mills, and the Waterloo Company, goods of this class. An exhibit of shawls was made by the Sebasticook Mills, and the Merrimack Mills had an exhibit of velvet shawls, beaver shawls, and woolen long shawls that was unsurpassed. The exhibitors of worsted overcoatings and cloakings were the Providence Worsteds Mills and Wanskuck Mills; of trouserings, the S. Blackington Company, the Clinton Worsteds Company, and the National Mills. Connecticut and Rhode Island were strongly represented in this class. The Blackstone Company, the Broad Brook Company, Connor Brothers, the Auburn Woolen Company, the American Mill Company, the Empire Mills, the Globe Woolen Company, George C. Hetzel, the Hockanum Company, the Rock Company, Sawyer Mills, the Springville Company, Washington Mills, Weybosset Mills, Winck & Weed, and William Wood & Co. had exhibits of plain or fancy worsted suit-

ings and coatings. William Tinkham & Co. also exhibited fancy worsteds, and Thomas had a varied exhibit, while the Milwaukee Company showed fine worsted cloths. All-wool serges were shown by the Peacedale Company and the Waumbeck Company; mohair serges by the Farr Alpaca Company; and worsted dress goods by the Arlington Mills, Folwell Brothers, and the Pacific Mills. Mixed fabrics formed part of the exhibits made by the Merrimack Mills, the Mississippi Mills, the Norwich Woolen Company, the Winthrop Mills, and Elias Titus & Son. The Niantic Mills showed cotton-mixed dress goods, and the S. Blackington Company chevots. An exhibit of unions came from the Bound Brook Mills. Flannels and dress goods on a cotton warp were shown by L. L. Allen & Brothers, cloakings by Thomas Dolan & Co., Italian cloth by the Farr Company, and other goods by the Bound Brook, Clinton, Folwell, Lucas, Norwich, and Stott Mills. Both of the Raritan factories made exhibits of chinchilla overcoatings. The chief exhibits of upholstery goods were mohair and grained plushes and Spanish velvet by the Massachusetts Mohair Plush Company; furniture coverings and drapery materials by the Orinoko Mills, including a special Columbian cover; and furniture and car plushes by the Sanford Mills. S. B. & B. W. Fleisher had an exhibit of skirt braid. An admirable display of felt goods was made by the City Mills Company, of Massachusetts, and one by the Appleton Woolen Mills, while J. Capps & Son and Shuler & Benninghofen exhibited felt skirting. The only exhibit of carpets and rugs in the American section was made by the Read Carpet Company. Alpacas were shown by the Farr Company, and material for hair fabrics by P. Woll & Sons.

In the British section T. H. & J. Muddiman exhibited dress trimmings of Roman pearls in handsome colors. Carpets were seen in the British exhibit that for elaborate and painstaking hand work matched the fine Oriental carpets. The choicest was a small silk rug containing over two hundred stitches to the square inch, each stitch tied separately by hand, or, altogether, four hundred thousand stitches.

Persia furnished the most extensive and complete exhibit of rugs, ancient and modern, of silk, wool, and hair, from the priceless prayer rug from the holy mosque which no Christian has ever entered to the ordinary but artistic *kali*, or pile carpet, and the *doru*, on which travelers enjoy their tea and pipe by the roadside.

Group 104 was composed of clothing and costumes, divided into the following groups: 652. Ready-made clothing—men's and boys'. 653. Dresses, gowns, habits, costumes. 654. Hats and caps. 655. Bonnets and millinery. 656. Boots and shoes. 657. Knit goods and hosiery, woven gloves, gloves of leather and skins. 658. Shirts, collars, cuffs, cravats, suspenders, braces, and appliances. 659. Sewing machines for domestic purposes.

There was a display of ready-made clothing by Chicago manufacturers—Ederheimer, Stein & Co., Kuh, & Nathan Fischer, E. Rothschild & Brothers,



Wachsmuth & Co., and James Wilde, Jr., & Co. Hull & Co., of Poughkeepsie, exhibited trousers. The Henderson-Ames Company made a display of regalia. L. P. Hollander & Co. had exhibits of boys' clothing and of ladies' costumes and millinery. Costumes and wraps were exhibited by Strawbridge & Clothier, and cloaks by F. Siegel & Brothers. Jean Ulrich showed tailor-made clothing for ladies, and L. Dryfoos & Co. showed skirts. Corsets and waists of many shapes were exhibited by the Coronet, Delsarte, Downs, Gage, Van Orden, and Worcester Companies, and by Mayer, Strouse & Co., and Weingarten Brothers. The Brooklyn Shield Company and the Canfield Rubber Company showed their dress shields. James Bowers & Co. had lock clasps for corsets. Exhibits of millinery were made by the N. B. Haynes Company and F. W. Seybel. E. M. Knox, of New York, and John B. Stetson, of Philadelphia, exhibited men's hats; G. H. Stiehl & Co., boys' headwear; and Charles F. Lehman, cork helmets.



EXHIBIT OF THE DOMINION COTTON MILLS CO.,  
MONTREAL.

Knit goods and hosiery were abundantly exhibited in this group by the Alden Knitting Mills, the American Hosiery Company, Henry H. Bell's Sons, Hay & Todd, the Lewis Knitting Company, A. McFarlan & Co., the Midland Woolen Mills, the National Knitting Company, the Norfolk & New Brunswick Company, the Star Knitting Company, Conde Swits, and the Wauk-

enhose Company. Striking displays were made of the sanitary woolen underwear of Dr. Jaeger and the Jaros Company. The Gloversville firms of John C. Allen and Dempster & Place, the Northrup Company, of Johnstown, and Jacob Adler & Co., of New York, exhibited gloves, and Paul Foster & Co. had an exhibit of kid gloves and glove making. Shirts were exhibited by Brill Brothers and E. Millen & Co., and by H. C. Curtis & Co. and the United Shirt & Collar Company, with collars and cuffs also, of which alone Earl & Wilson made a good exhibit. The Ivorine Company displayed its collars and cuffs. The Altman Company made a display of neckwear. Baum & Ulman and the Wire Buckle Suspender Company, both of Williamsport, Pa., exhibited suspenders, and the George N. Buck Company, the Earl Company, and C. J. Haley & Co. showed hose support-

ers. Very complete and instructive exhibits of sewing machines were made by the Domestic, Household, New Home, Singer, Standard, and White Companies. The Excelsior fur and glove sewing machine was seen at work. The Self-Threading Sewing-Machine Company brought out a patent open-eyed needle which takes up the thread itself, or silk floss if desired, and carries it only while going through the cloth.

In a separate structure, known as the Merchant Tailors' Building, the cut and fashion, make and finish, of American tailoring could be contemplated in an aggregate display of garments furnished by fifty-four tailors, of whom nineteen belong in Chicago, eleven in New York, five in Boston, three in Philadelphia, two each in St. Louis, Denver, Milwaukee, and Kansas City, and single representatives in Cincinnati, Pittsburg, Louisville, San Francisco, Providence, Rockford, Des Moines, St. Paul, and Detroit.

Group 105 was made up of furs and fur clothing, as follows : 660. Furs and skins, dressed and tanned. Of the cat tribe, of the wolf tribe, of the weasel tribe, of the bear tribe, of the seal tribe. Fur seals—Alaska, Oregon, South Georgia, Shetland, and Siberia, undressed, plucked, and dyed. Hair seals, Greenland and Labrador seals, spotted seals, silver seals, harp seal, saddle-back. Furs of rodent animals—squirrels, chinchilla, beaver, hares, rabbits, and other fur-bearing animals. Birds' skins treated as furs. Swans and swan's down. Skins. Goose and goose down used as swan's down. Grebe, eider down, and penguin. 661. Fur mats and carriage or sleigh robes. 662. Fur clothing. 663. Fur trimmings.

C. G. Gunther's Sons made a striking and artistic exhibit of furs, set off by fine mounted specimens of bears, wolves, the American eagle, and heads of deer, bison, moose, and caribou. The cases contained the richest specimens of sables, sea otter, and other costly furs made into garments and rugs of every form, including many captivating novelties. The firm received seventeen awards. Shayne & Co. also had a very attractive display, especially of seal and mink garments. H. Liebes & Co., of San Francisco, made a large display of valuable sealskins. Fur cloaks and other garments were shown by the importing and exporting house of A. E. Burkhardt, of Cincinnati. George C. Treadwell & Co., of Albany, showed seal garments dyed by them with the peculiar dye that they have used for sixty years. Wolf & Periolat, of Chicago, had a neat arrangement of furs and various mounted animals.

There were purchasers for nearly all the wares displayed in the Russian section, but none were more eagerly bespoke than the fine sealskin, sable, mink, and less costly furs, of which a very extensive assortment was displayed.

Group 106 comprised laces, embroideries, trimmings, artificial flowers, etc. It contained the following classes : 664. Laces of linen and cotton, of silk, wool, or mohair, made with the needle or the loom ; silver and gold lace. 665. Embroideries, crochet work, etc. ; needlework. 666. Artificial flowers

for trimming and for decoration of apartments. 667. Fans. 668. Trimmings in variety, not otherwise classed. Buttons, hooks and eyes, pins and needles. 669. Art embroidery and needlework. 670. Tapestries, hand-made. 671. Tapestries, machine-made.

A beautiful exhibit of embroideries and art needlework was made by the Tiffany Glass and Decorating Company. A. Samaha, of Philadelphia, displayed gold and silver embroideries, and Johannes Bodenmann, of Chicago, some neat and delicate specimens of embroidering. A superb collection of ostrich feather and other fans came from Tiffany & Co., of New York, the gem of which was a fan of carved jade.

The Excelsior Quilting Company had an exhibit of fancy stitching and



FUR EXHIBIT OF C. G. GUNTHER'S SONS, NEW YORK.

quilting. Classed with miscellaneous trimmings were the dress stays of Crotty & Mitchell, the fastenings for gloves, coats, and bags of the Ball and Socket Fastener Company, the pearl buttons of Victor Gerschell & Co., the manufactures of the New England Whalebone Company, and the patent hooks and eyes of Richardson and De Long Brothers. The New England Pin Company made a display of their various kinds of pins.

In the British section the process of fashioning needles from the coil of wire was shown.

In the display of Irish lace was a piece two yards and a half square that weighed only two and a quarter ounces, being made of eleven thousand yards of the finest thread of two-ply Shetland wool.

A Scotch-French manufacturer who employs four thousand lacemakers showed a pair of curtains on which half of that force had worked during the six months that they were making, and other fine laces, valued altogether at \$50,000.

Among the rare and curious laces was a handkerchief made for Queen Margarita, valued at \$30,000, that was of such filmy fineness that the finger could not feel the texture, and it was capable of being inclosed in a casket no larger than a bean.

The great and elegant pieces of Gobelin's tapestry have heretofore been made in the works at Paris, while the branch at Beauvais made the smaller pieces for walls of rooms, and more particularly for furniture coverings, for which Watteau's delightful paintings supplied the preferred designs. In the exhibit at Chicago the tapestries of Beauvais bore away the palm from the Paris works. The masterpiece was the "Godchild of the Fairies," which it took fifteen years to make, and which was valued at \$119,000. Opposite hung an allegorical representation of art by Ehrmann, superb in coloring and gracefully designed. Smaller pieces, less finished and of cruder color, were spread on the other walls. In the furniture exhibits tapestries, carpets, bronzes, and bric-a-brac were arranged in harmonious combination with the furniture, and this was in many cases upholstered with elegant tapestry.

The most valuable of the French tapestries were loaned by the Government and were not for sale. One piece that represented the continuous labor of a man for thirty-six years was valued at \$200,000.

Group 107 embraced hair work, coiffures, and accessories of the toilet, and contained the following classes: 672. Hair work, as souvenirs and ornaments. 673. Coiffures, wigs, switches, etc. 674. Barbers' and hairdressers' tools and appliances. 675. Combs, brushes.

Hair goods were shown by E. Burnham and M. & B. Blumenthal, tools and heaters by Nicol & Co., combs by the India Rubber Comb Company, and brushes by the Palmetto Fiber Company.

Group 108 embraced traveling equipments—valises, trunks, toilet cases, fancy leather work, canes, umbrellas, parasols, etc. The classes of this group were: 676. Tents, shelters and apparatus for camping, camp stools, etc., hampers, baskets, etc. 677. Shawl and rug straps and pouches, gun cases. 678. Valises of various materials; dress-suit cases, satchels, hand bags, etc.; toilet articles. 679. Trunks of leather, paper, canvas, and of wood and metal. 680. Fancy bags, pouches, purses, cardcases, portfolios, pocketbooks, cigar cases, smoking pipes, cigar holders, etc. 681. Canes. 682. Umbrellas and parasols.

The exhibits in this group were not numerous. F. J. Palica showed an assortment of trunks; David J. Raab, bureau trunks; Charles T. Wilts, traveling equipments; H. M. Rosenblatt, shawl straps; and J. C. Hacker, various leather goods. Smokers' articles and walking canes were displayed by William De Muth & Co. The Cheval Standard Company showed the canes

used for measuring horses. An elaborate exhibit of luxurious equipments for journeying, purses and fancy bags, canes, smokers' articles, etc., was made by Tiffany & Co. The Gorham Company had a similar exhibit, and both included umbrellas and parasols, which were shown also by Hirsh & Brother, of Philadelphia.

Group 109 comprised rubber goods, caoutchouc, gutta-percha, celluloid, and xylonite. It was divided into the following classes: 683. Clothing: Mackintoshes, caps, coats, boots, shoes, hats, etc. 684. Piano and table covers, horse covers, carriage cloth. 685. Stationers' articles. 686. Druggists' articles, toilet articles. 687. Medical and surgical instruments. 688. House-furnishing articles, mats, cushions. 689. Hose, tubes, belting, packing. 690. Insulating compounds. 691. Toys of rubber. 692. Gutta-percha fabrics.

Boston made the only exhibits of rubber clothing—the slickers, oilskins, and rubber hats and horse covers of A. J. Towers, rubber garments of the Stoughton Company, and mackintoshes and rubber and oiled clothing of the American Rubber Company. The Rubber Comb Company, besides combs, brushes, hairpins, and mechanical goods of hard rubber, exhibited soft-rubber articles, such as syringes and water bottles. Rubber brushes and novelties were shown by C. J. Bailey & Co., and specialties by the Elastic Tip Company.

Group 110 was made up of toys and fancy articles of the following classes: 693. Automatic and other toys and games for the amusement and instruction of children. 694. Bonbons, fancy boxes and packages for confectionery. 695. Miscellaneous fancy articles not especially classed.

The display of Morton E. Converse & Co. contained an immense variety of games, dolls' furniture, and other wooden toys. The Ives, Blakeslee & Williams Company had a display of mechanical toys. Peter F. Pia showed an assortment of pewter toys. M. B. Ross had a new game to show. Parker Brothers exhibited parlor games and toys. Ihling Brothers & Everard exhibited the Kalamazoo duplicate-whist trays. Edward Jansen had an exhibit of fancy baskets; Rosenblatt & Co. one of plush and leather boxes. Turned wooden novelties were shown by E. B. Estes & Sons. Tiffany & Co. made an exhibit of fancy boxes and *bonbonnières*, and one of leather pocketbooks, blotters, etc., trimmed with gold. Fancy bone goods were shown by Emil Wahl, tortoise-shell articles by Rice & Hochster, various fancy goods by Pattberg, Lewis & Brother, California wood novelties by George F. Atkinson, and inlaid pearl mosaics and other ornamental articles by E. Hansen. Joy & Seliger, who devised various novelties as mementos of the Fair, exhibited fancy articles made from aluminium, white metal, celluloid, and brass, including their patented electric metal belts.

Group 111 was that of leather and manufacture of leather, the exhibits of which were in the Leather and Shoe Trades Building.

Group 112 comprised scales, weights, and measures, and was divided as

follows: 706. Scales for commercial use in weighing groceries, produce, and merchandise. Counter scales, etc. Portable platform scales. 707. Scales for weighing heavy and bulky objects, as hay, ice, ores, coal, railway cars, etc. 708. Druggists' and prescription scales. 709. Bullion scales. Assayers' and chemists' scales, 710. Postal balances. 711. Gas and water meters. 712. Commercial weights and sets of scales—avoirdupois, troy, and apothecaries', with the weights of the metric system. 713. Commercial examples of the measures of capacity, for solids and fluids—measuring glasses, for the kitchen and for the laboratory.

The E. & T. Fairbanks Company made a full exhibit of their scales, weights, and measures. The Springer Company showed the torsion balance. Kirk & Baily had an exhibit of family scales.

The Buffalo Scale Company made a display. Heavy spring scales were exhibited by the Chicago Spring Balance Company and the Mogul Company.

Those of the Chicago Scale Company were used in the Stock Pavilion. An exhibit of delicate balance scales was made by H. Troemner, of Philadelphia. The Metric Metal Company, of Erie, exhibited gas meters. Water meters could be well studied in the exhibits of the Thomson Company, who had one with interchangeable parts, the Neptune Company, the National Meter Company, and Henry R. Worthington.



ÉMIL MEYER,  
Commissioner from Denmark.

Group 113 embraced material of war, ordnance and ammunition, weapons and apparatus of hunting, trapping, etc., military and sporting small arms. It was divided into the following classes: 714. Military small arms, rifles, pistols, and magazine guns, with their ammunition. 715. Light artillery, compound guns, machine guns, mitrailleuses, etc. 716. Heavy ordnance and its accessories. 717. Knives, swords, spears, and dirks. 718. Firearms used for sporting and hunting; also other implements for the same purpose.

No single group contained a more complete illustrative display than this. Even the great unfamiliar engines of war could be examined in the Krupp Building, in the model United States battle ship, and in the Bethlehem Iron Company's display of gun forgings and Harveyized armor. The Marlin Firearms Company, the Burgess Gun Company, and Colt's Patent Firearms Company made displays of military small arms, such as are largely manufactured in the United States for export to foreign countries troubled with wars. The Remington Company, manufacturers of the Lee magazine rifle, whose weapons are in use in all parts of the world to the number of

two millions, had an interesting exhibit of their repeaters and of the fifty-millimeter rifle that has been adopted as the New York State model, and the rifle of forty-three caliber, the Spanish standard, that is manufactured for the countries of South America. The Winchester Repeating Arms Company, whose rifles have more diversified uses and are even more widely distributed, exhibited several different systems of military small arms, both repeaters and single loaders, and all the varieties and forms of ammunition. Both these establishments, as well as Colt's, exhibited revolvers, of which Smith & Wesson had a large display, of the automatic, self-extracting kind, well known for accuracy, force, convenience in loading, and safety, and unexcelled in excellence of material and beauty of finish. Francis Bannerman made an exhibit of guns designed for use in fighting rioters and the regulation prison guard gun of the United States army. The Union Metallic Cartridge Company, of Bridgeport, Conn., which furnishes ammunition to the United States Government and oftentimes to the public authorities of other nations, made an extensive display of cartridges, of paper and brass shells for shotguns, of wads, primers, percussion caps, etc. Ammunition for sporting, hunting, and target rifles, for pistols, and for shotguns formed a part of the exhibit of the Winchester Company, which had a great variety of sporting weapons to show, including hunting and pastime rifles, both repeating and single-loading of several systems, and two systems of repeating shotguns. The Remingtons also exhibited sporting rifles and shotguns. The C. C. Brooks Arms and Tool Company had an exhibit of these, and Louis Jordan one of his shotguns. Francis Bannerman showed a magazine shotgun already in the hands of thousands of sportsmen, which can fire six shots in three seconds. Hammerless guns were displayed by the Lefevre Arms Company. An elaborate display of shotguns, with hammers and hammerless, was made by Parker Brothers, the pioneers in the manufacture of breechloading fowling pieces in the United States, whose products can be compared with those of any European gunsmith for accuracy, ease of handling, serviceableness, quality of material, workmanlike execution, and beautiful finish. The Ideal Manufacturing Company, of New Haven, had an exhibit of gun implements and ammunition. The Bridgeport Gun Implement Company sent one of its products. Reloading tools formed a part of the Winchester Company's exhibit. The Brooks Arms and Tool Company showed the assortment of knives turned out in its factory for warlike and other uses. The Ames-Henderson Company had a display of elegant swords.

The display of arms in the foreign sections, from the latest weapons devised in Europe to deal swift death by wholesale, to the antiquated weapons of remote countries where individual prowess is still a factor in warfare, was as comprehensive as could possibly be expected in view of the fact that the forms and designs of effective weapons are not merely trade secrets, but secrets of state as well. The display of European sporting weapons was



even more varied than that of the American makers. The British display of firearms was very attractive to the Westerners and to sportsmen in general. The best known makers exhibited their finished guns, some of very elaborate workmanship, and the new improvements, such as hammerless rifles, shell extractors, etc., with models large and small showing the breech action and other mechanism. In the Greener exhibit were the latest Martini-Henry rifles, the large-bored, double-barreled, elephant cartridge rifles, the still larger whaling gun, which has a range of six hundred yards, and other special rifles; also the new regulation small-bored army repeating rifle. The firms of Lancaster and Scott made fine displays of shotguns, and Lancaster one of pistols, while Eley Brothers and Joyce showed cartridges, and the Shultze Company the new nitro-powder.

The exhibit of H. Pieper, of Liège, contained every conceivable size and style of small arms and shotguns, including the peculiar styles demanded by the natives of Africa, smooth-bore guns, not over three feet long, with yellow or green stocks, and the guns made for the Arabs, seven feet long, with a black or red stock running the whole length of the barrel. There were sporting guns with two and three barrels, some of them having one barrel rifled for bullets. This firm exhibited the method of making the barrels by winding a ribbon of metal round an iron rod and afterward welding the edges together. The ribbon is formed of three or four small square rods, some of iron and some of steel, welded beforehand into one, in some cases after first being twisted in different ways. There were six other Belgian exhibitors of firearms.

In the Spanish exhibit of war material were included some elegant works of art, specimens of weapons made by the famous swordsmiths of Toledo, among them duplicates of the swords of Queen Isabella and Hernan Cortez. The Spanish Government sent an interesting historical exhibit of ordnance, showing the forms of field guns in use in Spain from the earliest times down to the present.



VIEW IN THE GERMAN SECTION.

From Brazilian arsenals came a light field gun, specimens of ammunition, and a dynamometer for gunpowder. A Bohemian manufacturer exhibited a mitrailleuse. In the French section four gunmakers showed elegant sporting weapons, and one exhibited snares for animals. There was an exhibit of powder also and one of light and heavy cannon from the Schneider forges at Creusot.

Termansen, of Copenhagen, exhibited his magazine rifle. The National Arms Factory, of Mexico, exhibited models of the Mauser, Remington, Gross, and Martini-Henry systems and various cannon models. There were several exhibits of Mexican cutlasses, *machetes*, and poniards. The arms of a gunsmith of St. Petersburg and side arms of the cutlers of Zlatoust were shown in the Russian section. Hunting guns and carbines, heavy ordnance and shot, a mounted cannon, military small arms, and cut-and-thrust weapons were seen in the Swedish exhibit.

In the Ceylon exhibit were old Kandyan pistols, knives, and spearheads, a beautiful sword of state, and an antique gun and swords. From Mysore were sent swords and daggers, guns, bows, and spears. A swordsmith of Osaka had an exhibit that indicated that keen blades have not lost their important place in the armament of the Japanese soldier, as that soldier has proved in the battlefield. The art bestowed on the ornamentation of these weapons put to shame the efforts of the Western cutlers. Most of the Oriental exhibits of war material were interesting from the æsthetic rather than from the military point of view. Turkey had exhibits of a military rifle and of decorated arms and armor, and Persia showed some of these, much richer, but in smaller variety. In the Siamese pavilion was an ornamented bow.

Group 114 embraced lighting apparatus and appliances, divided as follows: 719. Lamps for burning petroleum, burners, chimneys, shades, table lamps, hanging lamps. 720. Lanterns, coach lamps, street and special lights and lanterns. 721. Illuminating gas; fixtures, burners, and chandeliers. 722. Electroliers and electric lamps. 723. The "Lucigen" and similar lighting apparatus.

Lamps for kerosene oil were exhibited by the Rochester Lamp Company and, with fancy brass and glass articles, by the American Brass and Lamp Company. The American Automatic Lighting Company exhibited a new lighting system. H. Hohenstein made a fine display of lamp and candle shades. Exhibitors of special lamps and lanterns were R. E. Dietz and the Steam Gauge and Lantern Company. The Globe Light and Heat Company had an exhibit of street lamps, reflectors, and gas and electric fixtures. Highly ornamental fixtures were shown by the Schultz Company, of Baltimore, and some of chaste and beautiful design, both for gas and electric lights, by the Tiffany Glass and Decorating Company.

Group 115 embraced heating and cooking apparatus and appliances, divided as follows: 724. Fireplaces, grates, and appurtenances for burning wood, coal, or gas. 725. Hot-air heating furnaces. 726. Steam heaters,

hot-water heaters, radiators, etc. 727. Stoves for heating, cooking stoves, kitchen ranges, grills, roasting jacks, ovens, etc. Stove polish. 728. Gas burners for heating, gas logs, gas stoves, etc. 729. Petroleum stoves. 730. Kitchen utensils and other miscellaneous articles for household use.

A continental climate, excellent fuel, a high standard of living, and the American inventive faculty are causes that have worked together to place the United States ahead of all other nations in the enjoyment of luxurious and sanitary heating arrangements. The principal makers of the country furnished a very complete exhibit of heating and cooking apparatus, in which many new ideas were exemplified. Edwin A. Jackson & Brothers made an exhibit of grates for fireplaces. The newest kinds of hot-air furnaces were shown



EXHIBITS OF STOVES AND HEATERS.

by the Abendroth, Farquhar, Warren, Fuller, Kelsey, Magee, Peninsular, Reading, Richardson & Boynton, Smith & Anthony, Spicer, Superior, and Wrought-Iron Range companies. The Ridgeway Company exhibited a heater with a revolving open fire pot. The Howard Thermostat Company

exhibited a heat regulator. The duplex temperature regulator was shown by the Powers Company. Hot-water heaters were exhibited by Abendroth Brothers, the American Heating Company, and Smith & Anthony. J. W. Warner had one with a very rapid circulating boiler. H. M. Chapman showed boilers and heaters, and Gorton & Lidgerwood a house-heating boiler. The Dangler Company exhibited vapor stoves and ranges. The Wilcox Company exhibited a heater and radiator. Radiators for both steam and hot water were shown by the American Radiator Company and A. A. Griffing. Tuttle & Bailey had an exhibit of registers and ventilators. Parlor heaters and cook stoves were exhibited by the Co-operative Foundry, of Rochester. The Cortland Howe ventilating stove was a special design. An interesting retrospective exhibit was the earliest base-burner made on the model invented by Dr. Eliphalet Nott in 1817. The P. D. Beckwith Estate exhibited the round oak stoves and furnaces. Pugh & Grovenor showed drums and complete stoves. In the Garland exhibit was a square box stove that was brought from France in 1693 and placed in the first convent established in Quebec. Stoves and ranges of many patterns, adapted to all kinds of fuel, were exhibited by the Abendroth, Born Steel Range, Bucks, Chicago Stove Works, Collins & Burgie, Cribben, Sexton & Co., F. & L. Kahn, Michigan Stove Company's, William Miller, Laura Nevins, Peninsular, William Resor & Co.'s, Spicer, and Traub establishments. Those of the Magee Company were finely finished. The Mason & Davis Company showed ranges of wrought steel for families, hotels, and restaurants, suitable for coal, wood, or gas, and even combination ranges that burn coal in one section and gas in another, also canopies and broilers and laundry stoves. An exhibit of laundry stoves with clothes-drying attachment was made by the Chicago Clothes Dryer Works. The Northwestern Stove Repair Company exhibited stove repairs and water backs. Francis Henry Buzzacott showed field ovens, such as are used by the United States army, and portable camp cookers. B. B. Johns showed some stove polish that is applied without brush or water, and will neither burn nor wash off. George M. Clark & Co. exhibited gas stoves of fifty patterns, nearly as many gasoline stoves, and an oil heating stove. Gas heaters and oil heaters were exhibited by the Huette-Barler Company. The New Era Fuel Appliance Company showed gas ranges and heaters and laundry stoves, with clothes dryers for hotels or dwellings and flats. The Edwards parlor-lamp stove was a new kind of oil-burning stove. Novel and useful household utensils were the roaster and baking pan of W. A. Daggett & Co., James Stroud's roasting pan and roller, the steamless and odorless broilers and frying pans of aluminium and iron made by Hill, Whitney & Co., various specialties of the Enterprise Manufacturing Company, Goodell's apple and potato parers and cherry stoner, the nutmeg mill of Kingsley & Davis, S. B. Traub's carving table, the Stone clothes wringer, the Ohmer flour bin and sifter, A. & F. Schlueter's oil cans, the Universal charcoal sadirons, the white-wire household goods of Woods,

Sherwood & Co., the woven-down dusters, and the Milford carpet sweeper. An assortment of kitchen utensils was shown by the Wrought Iron Range Company and by the William Miller Company. R. A. Boyd showed a new smoothing iron and friller in the Canadian pavilion. Brown & Brothers' patent-drawn copper range boilers had no seam, and were stiffened inside by a spiral rib. The principle of Leggott & Marsh's patent device for consuming the smoke of ranges and heaters, shown in the English section, consists in having the draught pass downward through the hottest part of the fire and with the heat into a hot-air chamber, consuming the smoke until only seven per cent of carbon remains in the soot, compared with seventy-seven per cent in ordinary ranges.

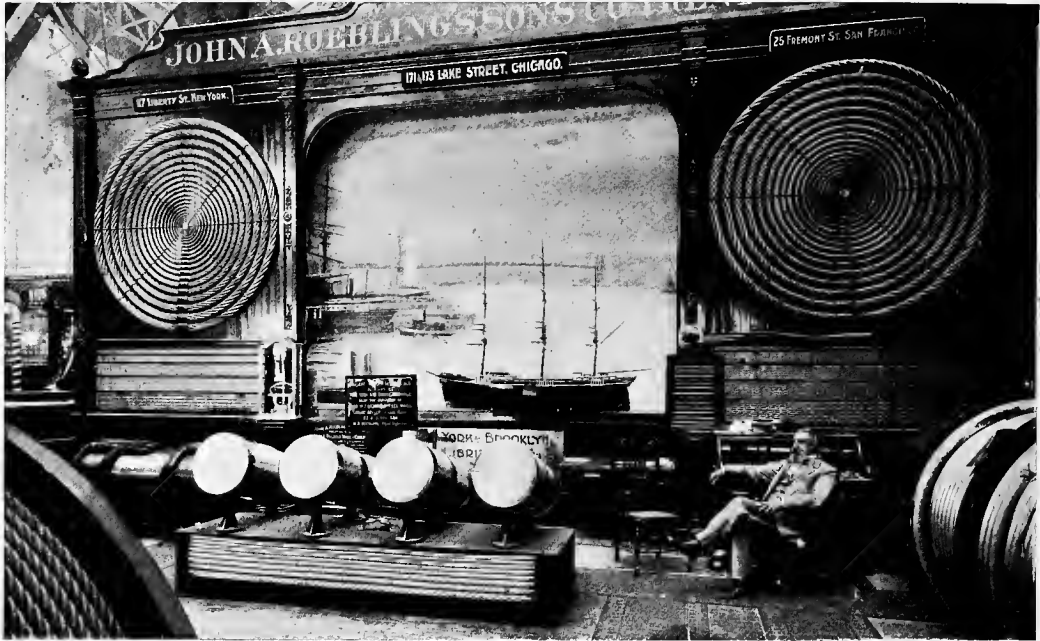
The cooking and heating stoves in the German exhibit contrasted in form and material with the American stoves ornamented in the iron casting or with nickel-plated trimmings, and the style of ornamentation was so much finer in material and the forms and color so attractive as to draw the attention of all visitors. The heating stoves were entirely incased in tiling or porcelain, ornamented with rococo or Renaissance designs in raised or colored decorations. H. Koloseus exhibited cooking ranges, thirteen feet by six, faced with beautiful tiling and mounted with polished steel and brass.

Group 116 comprised refrigerators, hollow-metal ware, tinware, enameled ware, and contained the following classes: 731. Refrigerators. Soda and aerated-water fountains and appliances. 732. Cast hollow ware—kettles, pots, etc. 733. Hollow ware of copper, nickel, tin plate, and iron. Bells. 734. Enamel ware, granite ware, and porcelain-lined ware. Enameled letters and signs.

Refrigerators and cooling rooms were exhibited by Paul J. Daemicke, J. S. Thomson, and the Alaska, Belding, Grand Rapids, Hurd, Northern, G. M. Shirk, Summit, Wickes, and Wisconsin Refrigerator corporations. Charles Lippincott & Co., John Matthews, A. D. Puffer & Sons, and James W. Tufts exhibited soda-water apparatus; Otto Zwietusch showed his draught apparatus and steel fountains for dispensing soda water; and the Low Art Tile Company had a very handsome and elaborate soda fountain on exhibition. The Griswold Company and the Wagner Company made exhibits of hollow ware, and Smith & Anthony and D. R. Sperry of kettles. Fred A. Wilke showed portable kilns for firing decorated china. Copper and tin hollow wares were exhibited by Adams & Westlake, the Chapman Company, and Keen & Haggerty, and enameled ware by the Iron-Clad Company, the Vienna Company, and Jacob J. Vollrath Company.

Group 117 embraced wire goods and screens, perforated sheets, lattice work, fencing, etc. It contained the following classes: 735. Wire cloth of brass or of annealed iron and steel. 736. Wire cloth of special alloys, as aluminium bronze wire, etc. 737. Sieves of various grades and materials. 738. Screens for special purposes. 739. Perforated metal plates. 740. Artistic latticework. 741. Wire netting. 742. Wire fencing.

The Baackes Wire Nail Company exhibited steel billets, wire, and nails; Gilbert & Bennett, wire cloth, fencing, and fireproofing; the New Jersey Wire Cloth Company, wire lath for floors and ceilings; the Translucent Fabric Company, translucent fabrics and transoms; John A. Roebling's Sons, wire rope and cloth; the Clinton Company, fancy and galvanized wire cloth, netting, fencing, and wire lath; the Jones Company, wire fencing; E. T. Barnum, wire and iron fences; E. T. Burrowes & Co., wire window screens; Washburn & Moen, wire and flat steel springs, round,



STEEL CABLES, ETC., SHOWN BY J. A. ROEBLING'S SONS CO., CHICAGO.

angular, and convex card wires, and many other articles; the United States Wire Mat Company, galvanized and brass matting; the Tiffany Glass Company, metal lath and artistic latticework; the Trenton Iron Company, iron and steel wire, spring weaving, transparent steel and music wire, and telegraph wire.

Group 118 was made up of wrought iron and thin metal exhibits of the following classes: 743. Wrought-iron gates, railings, crestings, and artistic forgings, not otherwise specifically classed. 744. *Repoussé*, hammered, and stamped metal ornaments, used for buildings, bridges, and other structures. 745. Beams, girders, columns, angle irons, etc. 746. Horseshoes and crude forgings.

The American exhibit contained numerous specimens of highly artistic wrought-iron work and forgings. Some of the finest were in the exhibit of the Tiffany Glass and Decorating Company. Some handsome forgings came from the architectural iron works of Paul Seidels, in Chicago. Bayer &

Sherbner, of New York, manufacturers of folding gates for elevators and stores, and Hainsworth & Son, of Chicago, furnished good examples of ornamental *grille* work in wrought iron. The Champion Iron Company, of Kenton, Ohio, had an exhibit of ornamental stairs, balustrades, and other finished interior iron work, with fences, store fronts, etc., and jail cells and corridor in which all the steel bars and doors locked with a patent lever locking bar. High commendation was given to a wrought-iron gate, thirty-three feet high and twenty-three broad, in the exhibit of Winslow Bros., ornamented with buds and flowers, masks, and faces of delicate workmanship, all hammered out of solid American low-grade steel without the use of mold or form, the heavier parts being constructed of Swedish and Norwegian iron. Bryant & Watson exhibited ornamental crest tiles. Metal roofing tiles and shingles were shown by the Cortright Company, of Philadelphia. The Canton Steel Roofing Company exhibited sheet metal roofing. Wrought-iron turn-buckles came from the Central Iron and Steel Company, of Brazil, Ind. Iron and steel forgings were exhibited by C. M. Van Every, Jr. Horseshoes were exhibited by Cornelius Desmond, John Hogan, N. P. Nielsen, and, with toe calks, by the Rhode Island Perkins Horseshoe Company. William Russell accompanied his display of hand-made horseshoes and horseshoers' tools with illustrations of scientific shoeing and of the ill results of improper methods. William Wedekind had another exhibit of shoes and tools. Horseshoe nails, hot-forged from the rod and pointed by the hammer without shearing, formed the exhibit of the Putnam Nail Company. The North Western Horse Nail Company showed nails with large and small heads for general use, and special fine plate nails for racers and trotters. The Capewell Company exhibited the corrugated nail which does not need clinching, a kind used in the army.

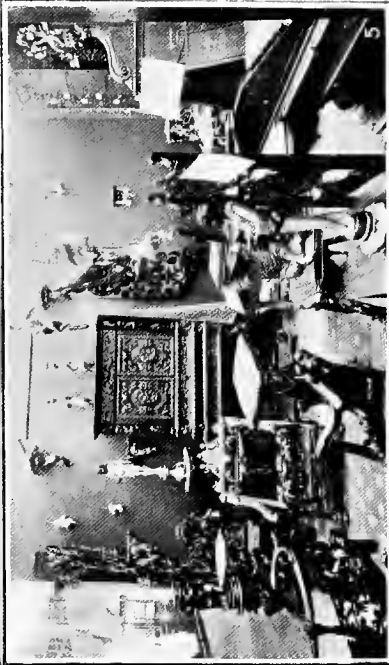
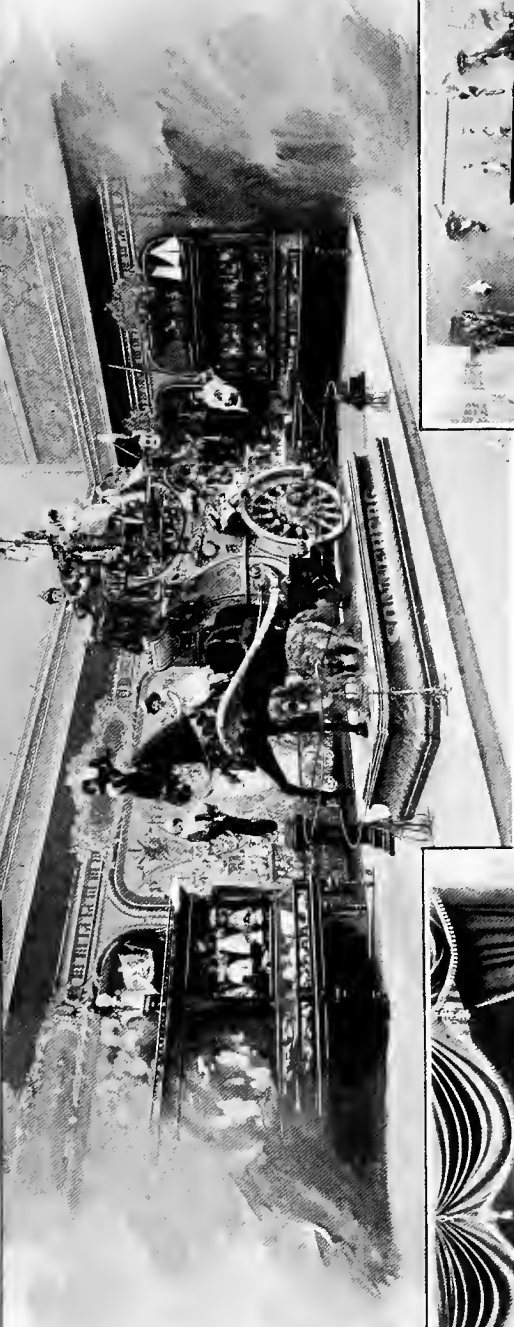
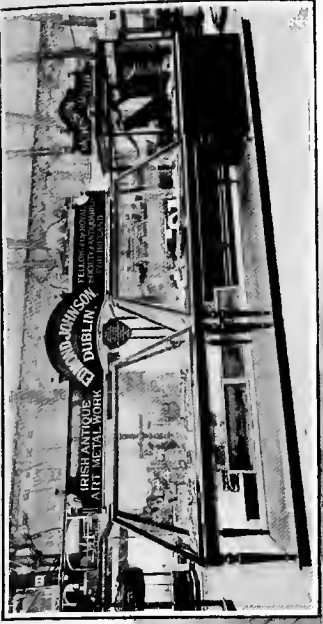
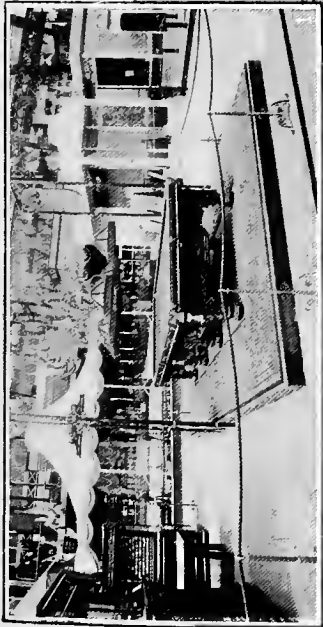
The most admired part of the German exhibit was the beautiful wrought-iron gates that fenced in the court, made by Armbruester Brothers, of Frankfurt. The central gate, forty feet long and twenty-two feet high, is probably the largest work in wrought iron ever executed, weighing eighteen tons, and the side gates, thirty feet by fifteen feet, weighed thirteen tons each pair. The iron was hammered and wrought from crude bars entirely by the hand work of fifty of the firm's most skillful artificers, who spent nearly six months on the work. Baden made an exhibit of artistic iron gates, and Bavaria had three more. Armbruester Brothers exhibited also many smaller articles, including candelabra, candlesticks, andirons, railings, door trimmings, picture frames, and jewel boxes, hammered out of iron with delicate skill and artistic feeling. There were vines and flowers more delicate than the basket of flowers that capped the arch of the great iron gate. Even the German work, however, was outdone in intricacy of design and refinement of detail by the Belgian wrought-iron work, consisting of small pieces, one of which represented a leafy branch of flowers with birds perched upon it.

Group 119 was composed of vaults, safes, hardware, edge tools, and



cutlery in the following order: 747. Builders' hardware—locks, latches, spikes, nails, screws, tacks, bolts, hinges, pulleys, furniture fittings, ships' hardware and fittings. 748. Axes, hatchets, adzes, etc. 749. Edge tools of various descriptions. 750. Saws, files. 751. Cutlery—knives, scissors, shears, razors, etc.; table cutlery. 752. Vaults, safes, and appliances; machinists' and metal workers' tools.

The American Screw Company had an exhibit of the best wood and machine screws, bolts, and rivets; Russell & Erwin, exhibits of screws and bolts with helicoid shanks, of wrought-steel door locks, of artistic steel and bronze work, of nails, of builders' hardware, of carpenters' tools, and of house-furnishing goods; the Atlas Corporation, a complete assortment of tacks, brads, and glaziers' points; the Severance Company, nails and spikes; J. H. Sternberg & Son, bolts, rivets, nuts, washers, and screws; M. B. Schenck & Co., furniture and other casters; Washburn & Moen, builders' hardware; Stanley Works, builders' and cabinetmakers' hardware; the Grand Rapids Brass Company, furniture trimmings; J. S. Thompson & Co., harness and trunk rivets. Hobart B. Ives & Co. showed sash locks with double eccentric mechanism locking securely when either opened or closed. Lock buckles for bicycles, trunks, and straps were exhibited by the Lynch Company, of Madison. The De Mars Company received an award for sash locks. Locks, keys, and hardware specialties were shown by the Eagle Lock Company, especially keyless cabinet and post-office-box locks and padlocks for railroad switches. Umbrella locks constituted the exhibit of Smith & Buckingham. Wilson Bohannon exhibited locks and night latches. A check-controlled lock was shown by a Cleveland firm. Josiah J. Deal received a premium for combination locks. The Miller Company, of Philadelphia, had a good exhibit of locks, padlocks, and post-office-box locks. The improvements in spiral-spring door hinges shown by Bommer Brothers obtained an award, while others were given for the spring hinges and butts and sliding-door hinges of the Chicago Spring Butt Company, the door checks and springs of the Blount Company, the check and spring of the Norton Company, the springs, checks, and checking spring hinges of Joseph Bardsley, the double-acting spring hinges, sash pulleys, and locks, and book holders of the Stover Company, and William D. Gibson's springs. The Van Wagoner & Williams Company exhibited double and single spring hinges. The Coburn Trolley Track Company exhibited its parlor, barn, and fire door hangings. J. C. White, of Waseca, Minn., showed a nail counter. The shingle-nailing machine of L. A. Baker & Co. was an interesting contrivance. G. J. Capewell had an improved hammer and nail puller. Mechanics' tools were exhibited in great variety by the Cincinnati Tool Company and by William Rose & Brothers. The Rhode Island Tool Company exhibited wrenches, bolts, turn-buckles, and machinists' supplies in general. There was a full line of the saddlers' and harness makers' tools with which C. S. Osborne & Co. supply the world. The company founded



1. George Wright & Company, London. 2. Edmond Johnson, Dublin. 3. Combined exhibit of dolls, Sonneberg. 4. A. Forster, Vienna. 5. Rossi & Sons, Venice.  
A GROUP OF FOREIGN EXHIBITS.



by David Maydole, the earliest maker of adze-eye hammers, exhibited the hammers that are used and valued in every country. Fayette R. Plumb made an ornate, as well as extensive, display of edge tools, hammers and sledges, and railroad, blacksmiths', and miners' tools. Charles Buck obtained a premium for edge tools, and one went to Buck Brothers for chisels and light tools. Henry Disston & Sons exhibited saws of every kind. The



A VIEW IN THE BELGIAN SECTION.

Simonds Company exhibited crescent-ground and crosscut saws, and E. C. Atkins & Co. all sorts of crosscut and hand saws and saw tools. Disston & Sons exhibited, moreover, gammers, cane knives, post-hole diggers, screw drivers, and a complete line of plumbs, levels, squares, straight edges, bevels, machinists' rules, wire gauges, saw sets, trammels, and swage bars; one also of files and rasps, which were exhibited likewise by the McCaffrey Company, the Kearney & Foot Company, and the Nicholson Company. The ice-cutting and distributing tools of the Knickerbocker Ice Company obtained a medal. The Snell Company made an exhibit of boring tools, and C. E. Jennings & Co. displayed augers, bits, drawing knives, and planers. Wolf, Sayer & Heller, of Chicago, won a certificate with their dried-beef cutter. The carpenters' tools of the Stanley Rule and Level Company included

various improved labor-saving devices, such as Bailey's patent adjustable bench planes. Among the hand farm and garden tools of Wittington & Cooley Company were hoes, rakes, potato hooks, and scythe snaths and handles. The Iowa Farming Tool Company had a large display of hand tools, and the Geneva Tool Company had another. The Oliver Ames Company made a display of shovels, spades, scoops, and drainage tools.

Premiums were awarded to N. Stafford for a coin-registering bank, to E. T. Barnum for cheese safes and jail cells, and to Barney & Berry for ice and roller skates. The Detroit Corkscrew Company, whose specialty is cut worm screws, exhibited corkscrews. The Hatch Cutlery Company made a fine display of knives, shears, and scissors; the Northfield Knife Company,



ANGORA GOAT SKINS FROM SOUTH AFRICA.

one of pocket cutlery; the Clauss Shear Company, one of scissors and shears; and J. R. Torrey, one of razors. The Campbell Cutlery Company also made a display, and the Christy Knife Company exhibited carving, cake, and paring knives of novel design. Safes, vaults, and safe locks were shown by the American Vault Company, of Chicago, the Detroit Safe Company, the Herring-Hall-Marvin Company, Mosler, Bahmann & Co., and the National Safe and Lock Company.

J. A. Henckel, of Solingen, filled forty feet of upright cases with pocket and surgical cutlery. The Borloz files for all purposes were exhibited in the Swiss section by P. A. Frasse & Co.

Group 120 comprised plumbing and sanitary materials and was subdivided as follows: 753. Bath tubs, bathing appliances, and attachments. 754. Wa-

ter closets, siphons, flushing tanks ; apparatus and receptacles for ventilation and sewerage. 755. Porcelain laundry tubs, basins, cocks, drains, and other appliances. 756. Plumbers' and gas fitters' hardware and appliances.

Bath tubs of different materials were shown by the Steel Clad Bath Tub Company, the Oswego Indurated Fiber Company, the Standard Manufacturing Company, the Smith & Anthony Company, McCambridge & Co., Dawes & Myler, and the Stewart Ceramic Company. The Mosely Company showed folding bath tubs and water heaters. The Day Company showed self-heating bath tubs, and the Instantaneous Water Heating Company had heaters to be used with gas. Water closets and lavatories were exhibited by Smith & Anthony and Strong, Boyce & Co. Norton Brothers exhibited sanitary closets.

The Kilbourne & Jacobs Company exhibited an enameled sink pressed out of a single plate of steel. Sanitary and plumbing specialties were shown by the Albarene Stone Company. The Johnson Lehnér-Hoyer Company and Peck Brothers exhibited plumbers' brass goods ; Randolph & Clowes, copper range boilers and brass kettles ; and E. M. Lang & Co., solder.

Group 121 contained miscellaneous articles of manufacture not heretofore classed. Stands and fixtures were shown by Edward Leger & Son, a display rack by N. B. Haynes Company, revolving stands by Robert Faries, revolving cloak stands by the Improved Cloak Rack Company, display trays by the Campbell Cutlery Company, and window fixtures and forms by J. R. Palmenberg's Sons. The Palm Letter Company showed transfer letters and ornaments ; the Rodwell Company, sign letters ; N. Stafford, metallic badges, checks, numbers, and signs. Brown Brothers had an exhibit of vault lights and F. M. Hicks & Co., one of footlights and skylights.

In this miscellaneous group were found some striking examples of American invention, such as the perforating ticket dater of the B. F. Cummins Company, used in the exit gates, the Home embroidery machine, McDowell's garment-drafting machines, the Excelsior burglar alarms, Alanson Taft's burglar guard, the Wayne self-measuring oil tank, and the fare registers of the New Haven Car Register Company. Otis C. White's ball-and-socket and cone joints, with their firm grip and ready power of quick change, were shown to be useful, not only in electric-light supporters, but for any tool or appliance, without regard to weight or size, as machinists, dentists, photographers, and others have discovered. Ridgeley & Smith exhibited a paper trimmer and paper hangers' roller ; the Alpena Spool Company, spool and curtain poles. Cushman & Denison had an exhibit of pocket oil cans for bicycles, typewriters, etc. An improved counter block for butchers was shown by Paul J. Daemicke. An elaborate exhibit of matches was made by the Diamond Match Company. The International Company, of Chicago, had an exhibit of the international identification cards. The Matchless Metal Polish Company and George William Hoffmann exhibited metal polishes, the Meyers Putz Pomade Company a liquid polish, and the Queen Silver Polish Company a polish for silver. A. Major exhibited cement for rubber and glass.

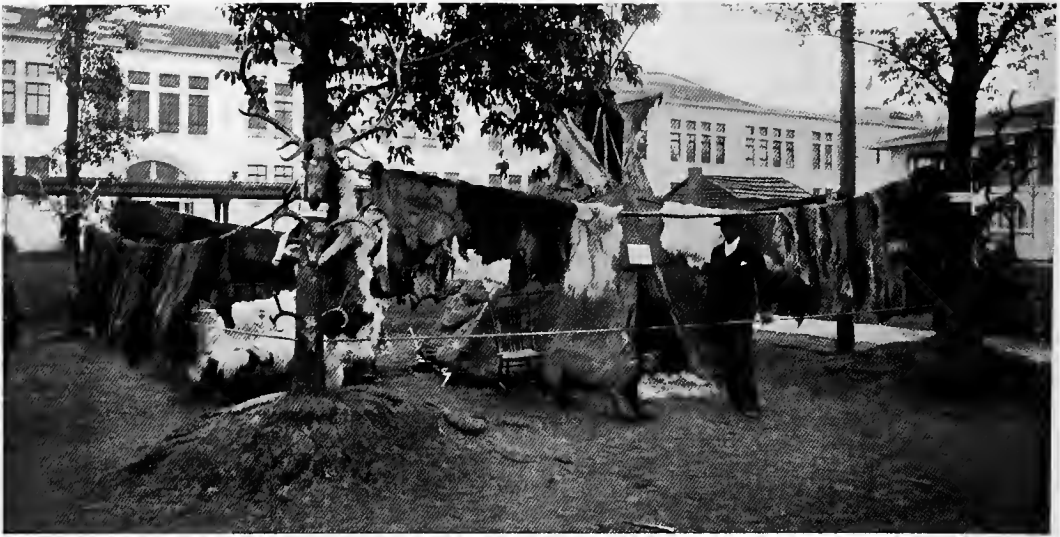


Exhibit of Hides outside the Shoe and Leather Building.

## CHAPTER IX.

### LEATHER AND SHOE TRADES EXHIBIT.

The collective exhibit—Glue, leather dressings, etc.—Boots and shoes—Collective exhibit of footwear—Group made up of leather and manufacture of leather—Exhibit of shoe machinery—Displays by foreign countries.



ROBERT NELSON,  
Member of the Directory.

LEATHER and all the important and useful articles into which leather is made formed a group in the department of manufactures. Leather foot-wear formed a class in another group—that of clothing—and articles used in the manufacture of leather goods came within the categories of drugs, colors, and yarns, while the elaborate and intricate power machinery which Yankee genius has devised for the manufacture of these goods without hands belonged in the department of machinery ; yet these objects and all that pertains to the production and working of leather were conveniently housed in a separate building, where the operations of this distinct industry were practically demonstrated, and the apparatus and accessories and the products were thoroughly exhibited.

Cold-water glue for leather was shown by Arthur S. Hoyt. Shoe and leather dressings, blackings, and stains were exhibited by the Frank Miller Company, Donald Cameron, Whittemore Brothers, the Boston Blacking



Company, John Sankey, and S. A. White ; bottom finishing stain, by the Mitchell Stain Company ; leather dye, by the National Shoe Color Company ; waterproofing, by the American Company ; cements, by the Eclipse Company and the George H. Wood Company ; oak and chestnut tanning extracts, by the Gandolo Company ; spool silk and machine twist for shoes and harness, by Hammond, Knowlton & Co. ; thread, by Barbour Brothers, Finlayson, Bonsfield & Co., and J. R. Leeson & Co.

Exhibits of boots and shoes were made by the James A. Bannister Company, John Bartlett & Co., the E. & A. H. Batcheller Company, Edwin C. Burt & Co., Charlie & Curtiss, George C. Davis, C. H. Fargo & Co., Florsheim & Co., Hazen B. Goodrich, Grover's Sons, Hanan & Son, the Hamilton-Brown Shoe Company, Harney Brothers, C. M. Henderson & Co., G. W. Herrick & Co., Hoag & Heath, J. J. Lattemann, Leonard-Atkinson Company, P. F. McNulty, Murphy Brothers, the New York Shoe Company, Benjamin F. Oblinger, the Phelps, Dodge & Palmer Company, Rice & Hutchins, Rumsey Brothers, Selz, Schwab & Co., A. F. Smith, R. P. Smith & Sons, D. A. Sutherland, the J. E. Tilt Company, Charles L. Webert, Welch & Landregen, M. D. Wells & Co., Williams, Clark & Co., and Wright & Richards. The Amesbury Company, William T. Ash, George M. Coburn & Co., Charles K. Fox, John C. Gardner, George W. Ludlow & Co., Morse Brothers, Beniamino Scarinci, and Woodman & Howes exhibited shoes and slippers. Exhibitors of ladies' shoes were C. H. Aborn, the Consolidated Adjustable Shoe Company, Copeland & Ryder, G. B. D'Ippolito, Faunce & Spinney, C. P. Ford & Co., F. E. Hutchinson, Pingree & Smith, Thomas G. Plant, and Schillaber & Co. Men's shoes were exhibited by J. S. Turner ; waterproof shoes, by the J. Freeman Company ; hand-made theatrical shoes, by V. J. Mousek ; misses' and children's boots and shoes, by Brown & Balcolm and J. F. Swain & Co ; infants' shoes and slippers, by the St. John Company ; welts and turns, with finished shoes, by George Fuller & Co. ; shoe goring, by Dean, Chase & Co. ; elastic goring and webbing, by the Bridgeport Elastic Web Company and the Hub Gore Makers ; shoe tips, by Harold F. Blake ; trimmings, by M. L. Heller & Son ; heels and lifts, by John B. Renton ; overgaiters and leggings, by S. W. Hall, J. E. Scroggy, and William H. Wiley & Son ; overgaiter fasteners, by the Harvey Company. Displays of rubber boots and shoes were made by the American Rubber Company, the Boston Rubber Shoe Company, the Goodyear Metallic Rubber Company, and the Woonsocket, R. I., Rubber Company.

An interesting exhibit was a collection of footwear from all parts of the world and for different periods, as far back as the Middle Ages. There were many specimens from China, Japan, Australasia, the Philippine Islands, Palestine and various countries of Asia, the Caucasus, Siberia, Finland, Russia, Sweden, Norway, Mexico, various parts of South America, and Africa.

Group III—leather and manufactures of leather—was divided into the

following classes: 696. Hides and skins. 697. Tanned leathers—belting, grain, and harness leather. Sole leather—calf, kip, and goat skins; sheepskins. 698. Curried leathers. 699. Patent and enameled leathers; morocco. 700. Alligator, porpoise, walrus, and kangaroo leather. 701. Russia leathers. 702. Oil leathers, wash leather, and all other varieties of leather not before mentioned. 703. Parchment for commissions, patents, deeds, diplomas, etc. Vellum for similar purposes, and for books and bookbinding; for drums and tambourines; for gold beaters' use, etc. 704. Leather belting. 705. Embossed leather for furniture, wall decoration, etc.

Leather of every conceivable kind and of all colors was shown in abundance. Among the hides one of a horse was noticeable, with mane and tail



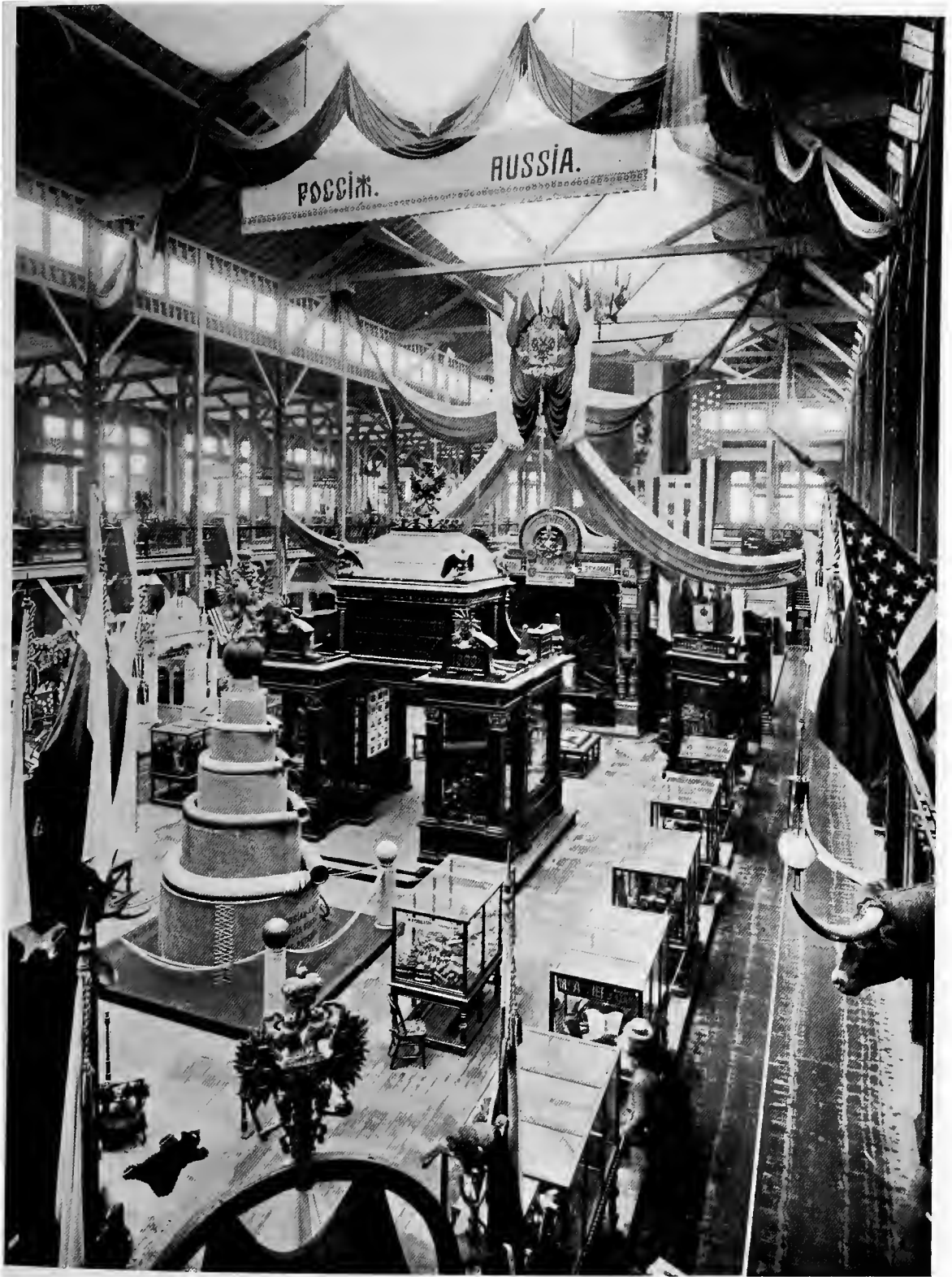
EXHIBIT OF SWIFT & CO., CHICAGO.

intact. Walrus hides were an inch and a half or two inches thick, and there was an African elephant's hide weighing eight hundred pounds. American leather of all the most useful varieties now ranks with the very best in the world, and our tanners furnished a display that fully sustained their reputation. Hides and skins were exhibited by Swift & Co. and J. H. Halsey & Smith. Belting and sole leather was displayed by the American Oak Leather Company, Deford & Co., England & Bryan, Fayerweather & La-

dew, S. H. Frank & Co., Leas & McVitty, and C. C. Smoot & Sons. Sole-leather exhibits were made by Bechtel & Son, the Charles E. Harwood Company, R. E. Hillard, C. A. Rippman, and Wilder & Co. Fine displays of harness leather of every description were provided by James Callery & Co., Thomas Delvin, William Flaccus & Son, the Freiberg-Wolfstein Company, A. Groetzinger & Son, Amos Hollinger, J. W. & A. P. Howard & Co., Kistler, Lesh & Co., David Moffatt & Co., and W. W. Mooney & Sons. The exhibit of finished shoe leather was quite as complete, contributed by J. S. Barnett & Brother, B. D. Eisendrath & Co., W. N. Eisendrath & Co., the Pfister & Vogel Co., Sharpe, Clarke & Co., the Shaw Leather Company, Albert Trostel & Sons, the Walker-Oakley Company, and James B. Weed & Co. Herman Zohrlant exhibited grained leather for boots and plow shoes and William Howard Hoople Goodyear welting. S. H. Frank & Co., of San Francisco, had an exhibit of walrus leather. Leather clothing was shown by the Avery Company, of Denver. The Western Tannery and Glove Company showed calf, kid, horsehide, and buckskin for gloves and shoes, and Lyman Smith's Sons had exhibits of sheep and lamb skins and sheepskin bindings and linings. Exhibits of glazed kid were made by Robert Foerderer and Burk Brothers, by Charles Hauselt (who showed also glazed calf and pebbled goat), and by William Zahn, with dongola kid. Gustav Levor also had an exhibit of American mat kid and patent shoe kid. Samuel Halsey & Son exhibited patent, enameled, and fancy leather; J. H. Halsey & Smith, patent and harness leathers; and Patrick Reilly & Son, Hugh Smith, and T. B. Howell & Co. made other exhibits of patent and enameled leathers. Colored morocco was shown by Stiles & Winslow, together with the sheep and goat skins from which it is made. Kaufherr & Co. made a good display of alligator leather and of lizard and snake skins and fancy leather. Exhibits of kangaroo leather came from the Lambeau Leather Company, Gustav Levor, Herman Zohrlant, and Albert Trostel & Sons, and the last-named also showed Russia leathers that compared favorably with the European, while Herman Zohrlant had a good exhibit of oil leather. S. J. Gordon and Hugh Smith displayed artistic embossed and upholstery leathers.

Over thirty manufacturers contributed to the Massachusetts exhibit of shoe machinery, representing a score of different processes. A duplex hide worker was shown by the Vaughn Machine Company that will flesh and unhair simultaneously or do either separately, and will work hard skins, or skins in the batch, without their being taken out or rehandled. Leather-working machinery was shown by Hemingway Brothers. An improved slating machine has a capacity for two thousand skins a day. There were machines for graining, glazing, and pebbling. The Union Company and the Sawyer Company exhibited different forms of leather-measuring machines. The skiving of the edges of leather was done by a machine shown. Another machine was R. H. Lufkin's vamp folder, which turns the edges

of leather or cloth for vamps and linings. The Goodyear, Fifield, Bertrand, Campbell, Globe, Harlow, Merrick, Rockingham, Ross-Moyer, Stanley, Swain-Fuller, and other concerns showed sewing machines. A closing and seaming machine was fitted with a safe elastic stitch made with two threads, for the purpose of producing strength and elasticity, in the direction of the length of the seam, each stitch being fastened and as safe when formed of cotton thread as of silk. On a three-thread vamping machine an operator can do two hundred and fifty pairs a day, with twenty stitches to the inch, using either silk or cotton thread. A three-throw machine uses three needles and two under threads and makes the safe elastic stitch, free from friction at the crossing of the threads and in no danger of loosening during the wearing of the shoe. The seam is pliable, and, owing to the manner in which the upper thread is drawn below the surface of the leather, all danger of the ripping of the vamps by chafing or by wearing off the tops of the stitches is avoided. Work requiring a zigzag stitch or overedge seam is done by an overseaming machine, which can be run at a high rate of speed, and is used for ornamental shoe linings and many sorts of cloth and leather sewing, the thread being taken directly from spools without being wound on bobbins. Leeson & Co. had a thread-winding machine. Machines which cut, work, and finish buttonholes were exhibited, with remarkable improvements in construction and in the work done, by the Globe Company and the Reece Company, on one of which an operator completed over ten thousand buttonholes in less than ten hours. The Morley Company showed a machine for sewing on buttons. Other machines punch the holes and put in eyelets. The Standard Company showed a rivet-and-stud machine, and the Tubular Rivet Company had one that puts hooks and studs in shoes at the rate of ninety a minute. Judson L. Thompson showed riveting machinery and the Lacing Stud Company stud-setting machines. The Bertrand Company had a lock-stitch sewing machine for sewing the outsoles, also used for welt sewing or inseaming, for which purpose the Eppler Company had a special machine. A sole molder that shapes the bottom was exhibited by a Boston company. The Busell Company had an edge trimmer. The Tripp Company showed a leveling machine and Bresnahan & Co. an automatic sole leveler that makes the ball of the shoes absolutely uniform. The Consolidated Company had a lasting machine in which the shoe is lasted on a jack, the upper being drawn over with pinchers, as in hand lasting. On bringing the shoe upon the jack in contact with the machine the mechanism that drives the tacks is started automatically, and the jack is so arranged with compound motions that every part of the shoe is turned to the proper position for driving the tack. The Chase Company and others exhibited other patterns. One machine takes the stretch out of leather and lasts of all kinds—sewed, nailed, or pegged. The Holt, Fifield, Stanley, and Swain-Fuller firms exhibited various kinds of boot and shoe machinery. There was shown an entire system of manufacturing shoes by machinery, in which



GENERAL VIEW IN THE SHOE AND LEATHER BUILDING.

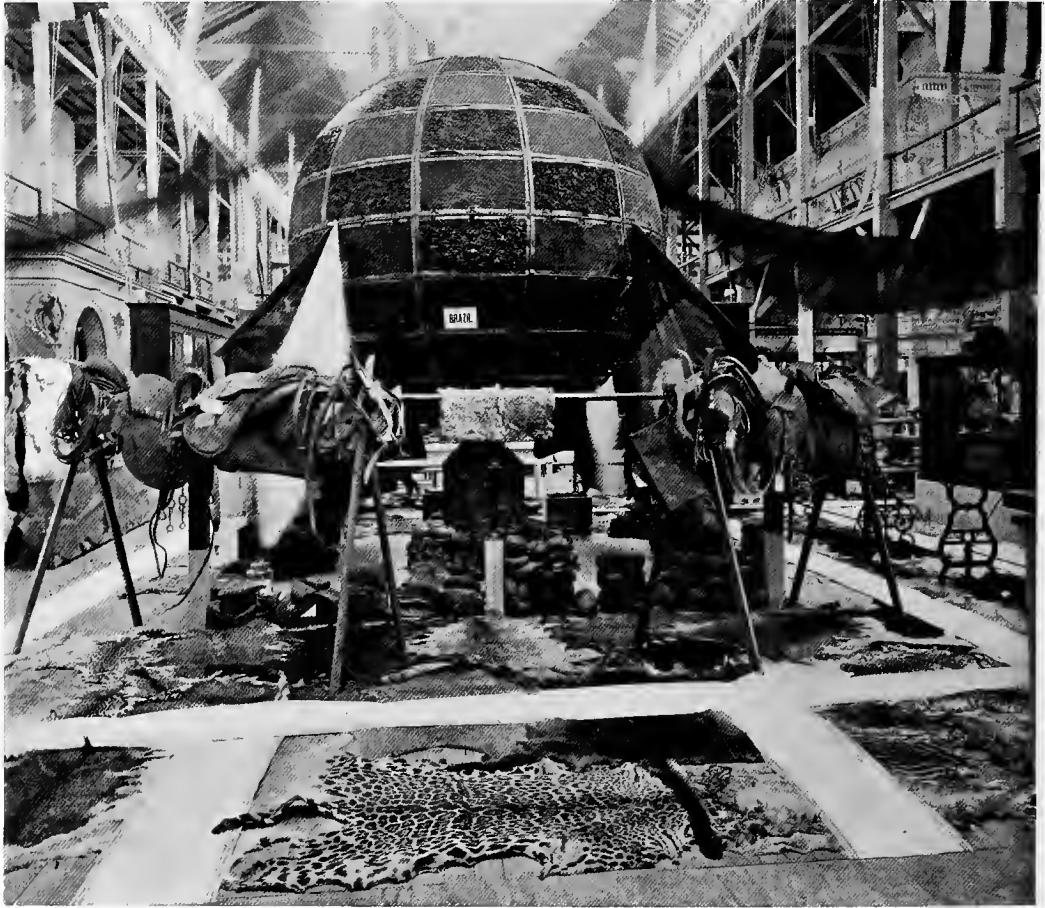


machines sew the welt, using both the curved awl and the needle, the thread having passed through hot wax in a cylinder at the rear; the outsole is laid with cement, trimmed to the shoe, a channel being cut at the same time, and then fastened to the welt by a rapid stitcher, the same as in hand-sewed shoes. Upon one machine a horn is used, having a shape that permits it to enter any shoe, and the sewing is done without changing the shape of the shoe or causing it to wrinkle. A Boston concern showed steam-heated horns for sole-sewing machines. There were various devices shown for waxing the thread. The surplus hot wax through which the thread runs is returned to the reservoir. A rotary whirl attachment guards against breakage of parts. On one of the improved machines expert operators can sew nine hundred pairs a day. The McKay Metallic Fastening Company and the Wire Grip Company exhibited slugging and nailing machines. One slugger drives sixty-five kinds of slugs of solid brass or steel wire. There was an automatic clinch-nailing machine that does many kinds of work, and drives and clinches nails at the rate of three hundred a minute. The American Company, of Brockton, had one of the fastest heeling machines. The Union Trimmer Company was one of the exhibitors of trimming machines. McKay & Bigelow had a machine that compresses, attaches, and trims the heel. T. A. Norris Company showed a heel-breast finishing machine. Upper beading machines were shown by the Lightning Beading Company, and a heel-seat beading machine by S. M. Littleton. Hartford Brothers showed sole-rounding and pattern-drafting machines. Henry W. Brett had an upper-cementing machine. Edge-trimming, edge-setting, and sand-papering machines were shown. The Globe Buffer Company and the Naumkeag Association exhibited buffing machines. Burnishing and bottom-polishing and upper-cleaning machines finished the manufacture, all done with very little handling. Crimping machines were exhibited by S. W. Jamieson and the Stoddard Company, and others by the Auburn Company, of Maine. Twin treeing machines for holding boots without wrinkling were the exhibit of O. A. Miller. A heel-nailing machine was shown by the Ætna Company, of Unionville, Conn. The Rockingham Company, of Exeter, N. H., exhibited some well-designed boot and shoe machinery. From other parts of the country came the barring and tacking machine of the Philadelphia Barring Machine Company; the shoe-lining marker of the Humphrey Company, of Towanda, Pa.; the turning and cording machines of Booth Brothers, of Rochester, N. Y.; the button-attaching machine of the Elliott Company, of Grand Rapids, and the riveting machinery of the Corrugated Rivet Company, of San Francisco. Shoe-sewing machines were shown by the Campbell Company, of Pawtucket, R. I., and machines for sewing a great variety of leather work by the Singer Company, of New York, and the Union Special Sewing Machine Company, of Chicago. An interesting series of machines for saddlery and harness making was exhibited by H. F. Osborne, of Newark, N. J. Shoe manufacturers' brushes were shown by



S. A. Felton & Son and A. Worcester & Sons ; shoe racks by A. Barrows, J. A. Higgins & Co., E. A. Hupper, and S. L. Saunders. John A. Enos exhibited lasts made of compressed paper.

France had an extensive and varied exhibit of lining skins, tanned and curried calf skins, kid and other skins for gloves, patent and enameled calf,



BRAZIL'S DISPLAY OF LEATHER PRODUCTS.

smoothed leathers, dyed leathers, gilded enameled kid skins, white calf, morocco leather for tapestry, etc.

Germany exhibited chemicals used in finishing leather. Among the boots and shoes were shown reformed shoes, horsehide leggings, and shoes with wooden soles. The leathers included horse leather in abundance, lacquered cow, horse, sheep, and calf leather, glazed kid, hair calf, special leathers for purses and for saddles, colored and black morocco, and parchment.

Russia made a good display of boots and shoes. One firm showed leather bag beds, another a mosaic leather table, and others upholstery leather, ammunition leather, manufactured fishskins, white calf, chamois leather, cap-peak leather, shagreen, Hamburg leather, and all varieties of Russia leather.

Curious and interesting garments and articles were shown from Mexico as specimens of the general wear and native handicraft, such as buckskin suits and gloves, ornamented riding boots, and shoes of many styles, embroidered white-satin shoes, and babies' shoes. There was a large display of skins and leathers, including sole leathers, shoe leathers, black-goat skins, deer, wolf, tiger, wild-cat, and sheep skins, oxhides, alligator skins, fish-skins, printed buckskins, patent-leather skins, and embroidered leather.

Brazil made a considerable display of ladies' and men's shoes, ladies' slippers, seamless shoes, leather hats, and suits of leather clothing. Brazilian tanners exhibited harness and sole leather. Fine saddles were shown, and bridles and harness made of rawhide and of leather, stamped-leather horse mantles, and whips. Excellent whips and headstalls were made of tapir hide. There was a large exhibit of hides and skins, and skins of wild animals were shown, and of the deer snake and other snakes. Tanned seal skins and wild-animal skins, hides, and sheep and goat skins, and chamois leather were shown by Uruguay. Japan displayed curried leathers and artistic embossed leather and leather work.



Tanned Leathers exhibited by G. Groezinger's Sons, Lancaster, Pa.

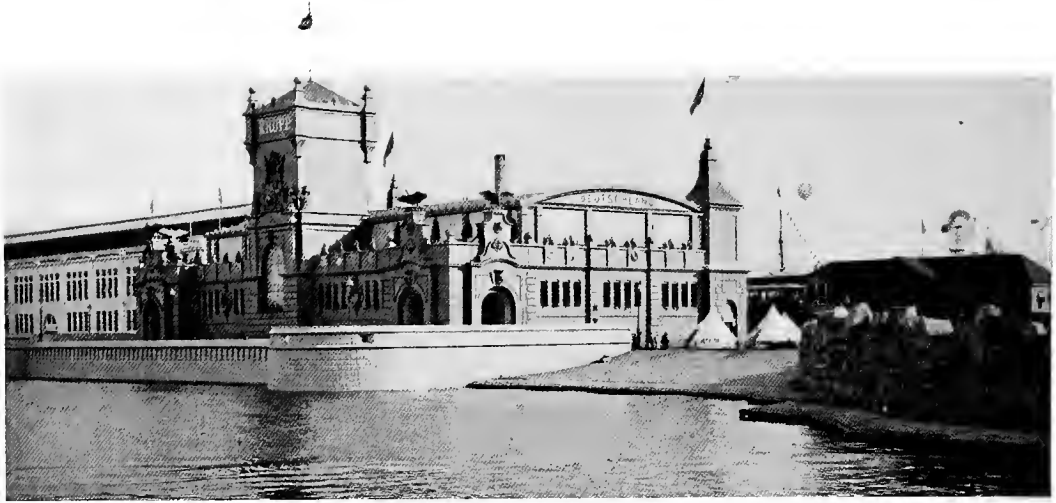


Exhibit Building of the Krupp Cast Steel Works, Essen, Germany.

## CHAPTER X.

### THE KRUPP GUN EXHIBIT.

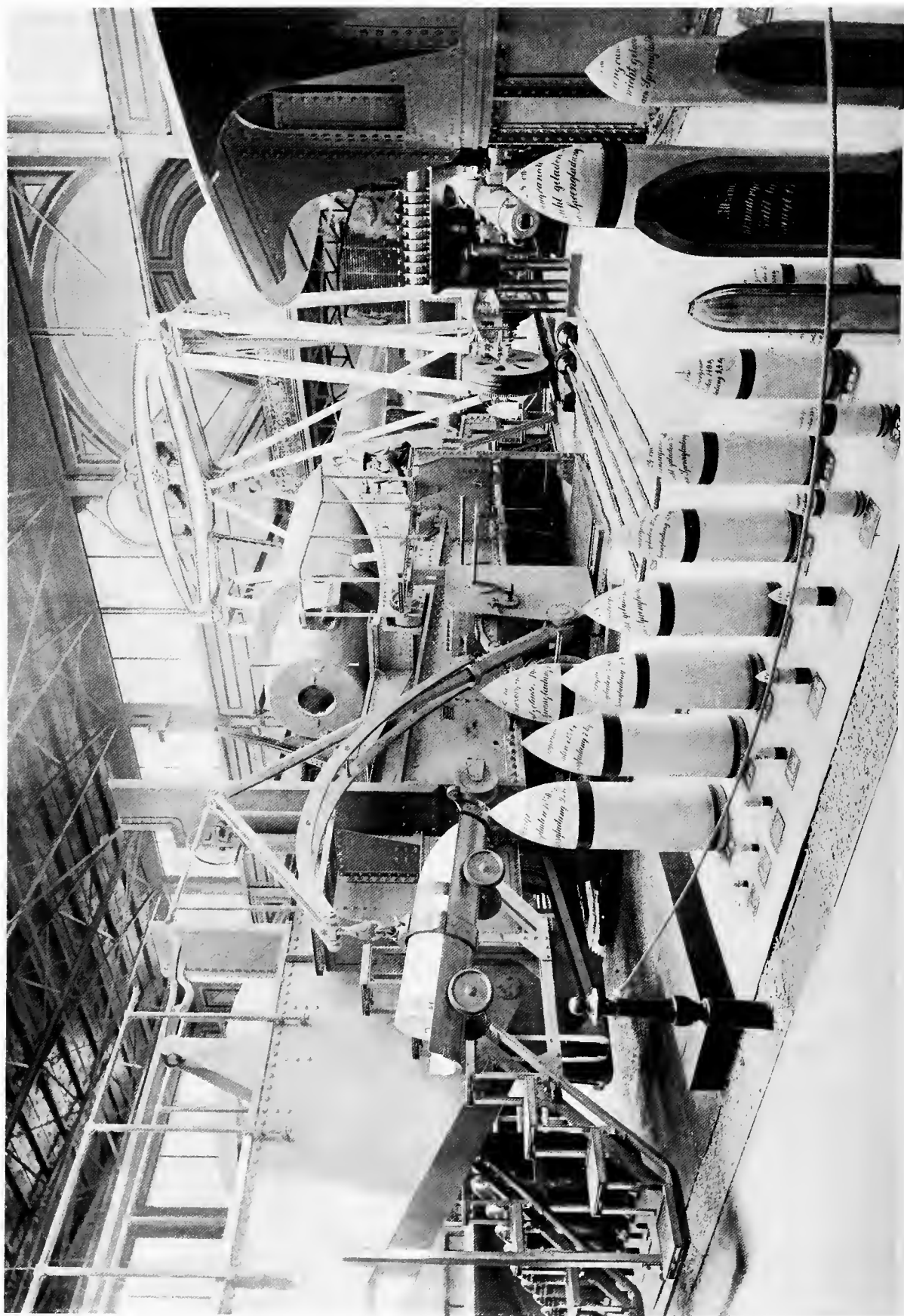
Importance of the exhibit—The collection of guns—Projectiles—The exhibit of armor plates—Lighter products of the Krupp rolling mills.



PAUL O. STENSLAND,  
Member of the Directory.

SO large was the Krupp ordnance display, the expenses and value of which reached a million and a half dollars, that a special building was necessary to contain it. The largest weapon shown was a coast-defense gun weighing nearly one hundred and twenty-two tons. Sixteen rounds had been fired at the testing grounds at Meppen, the projectile weighing twenty-two hundred pounds, and the charge of nine hundred pounds of brown prismatic powder developed an initial velocity of nineteen hundred and eighty-one feet a second and a striking energy of eighteen thousand six hundred metric tons. This gun was transported over the Pennsylvania Railroad on a special truck of identical design with the one on which it was conveyed over the German railroads. In Chicago it was slung on one of Krupp's enormous electric traveling cranes, which are as graceful in proportions as they are massive. This great gun is capable of piercing the heaviest armor carried by existing ships at any range where ships are able to engage coast batteries. The barrel is a jacketed built-up tube of special gun steel. It has Krupp's rounded





THE BIG COAST GUN (LARGEST GUN IN THE WORLD).  
Shown in the Krupp Building.

wedge breech closure, with traversing screw and breech nut. It is closed by a steel ring and steel-plate obturator, or gas check, against the breech block, and is fired by means of friction-fuse screws of Krupp's system. The caliber is four hundred and twenty millimetres, or sixteen and a half inches. The length of the barrel is forty-six feet and of the bore nearly forty-two feet. There are one hundred and twenty grooves in the rifling. The steel armor shells, with a bursting charge of two hundred and twenty pounds, are able to perforate a wrought-iron plate three and a half feet thick close to the muzzle, one over three and a quarter feet thick at a distance of a thousand metres, and one three feet thick at two thousand metres.

A naval gun of twelve-inch caliber, twenty-eight centimetres, that had fired ninety-eight rounds and was still in active service as a naval gun, was exhibited mounted in its turret, with all the hydraulic arrangements for working and loading. The gun, weighing nearly sixty-one and a half tons, is carried by means of its trunnions in the upper carriage, and has a breech closure which is moved vertically by hydraulic power. The braking of the recoil and the advance and return movement of the upper carriage with the barrel are effected by means of two brake cylinders, whose pistons are fixed to the upper carriage and enter the cylinders when the gun is fired. One man is able to move the upper carriage forward and back, to open and shut the breech, to raise and lower the ammunition, lift and operate the loading ram, and to sight, elevate and train, and fire the gun. This gun is loaded while in its rearward and elevated position, the bag cartridge and projectile being raised by a hydraulic lift and the projectile driven firmly into the grooves of the rifling by a hydraulic ramrod. This gun is adapted for the main battery of a man-of-war or other powerful armored vessel.

A gun of twenty-eight centimetres bore, or eleven inches, forty calibers in length of bore, was mounted on a hydraulic carriage used in coast fortresses and in the navy, allowing a maximum elevation of forty-five degrees, which gives a range of twelve and a half miles. The gun weighs forty-three tons and fires a projectile weighing seven hundred and sixty pounds with a charge of three hundred and fifty-two pounds of prismatic powder. An armor shield covers the carriage and loading apparatus. The carriage weighs fifty-nine tons and the shield twenty-three tons. The strain upon the carriage is relieved by braking in the direction of the fire. The breech mechanism is operated from the turntable, on which is arranged the stand for the gun captain, with the slides or valves for the hydraulic actuating mechanism of the gun and the turning engine.

A gun of twenty-four centimetres, with a bore of forty calibers, weighing thirty-one tons, mounted on a coast-defense carriage, carried a shot nearly thirteen miles when tested in the preceding year. This cannon has a hooped barrel like the great gun and the same breech mechanism. The projectile weighs four hundred and seventy-four pounds. The carriage is of peculiar construction. The cylinders of the hydraulic recoil brake are located on the

outside of the carriage. The gun is trained laterally by a pinion working in a toothed ring on the base and vertically by a worm-gear toothed elevation arc. A worm gear that can be thrown in and out at will enables the gun captain to train the gun both vertically and horizontally. The projectile is

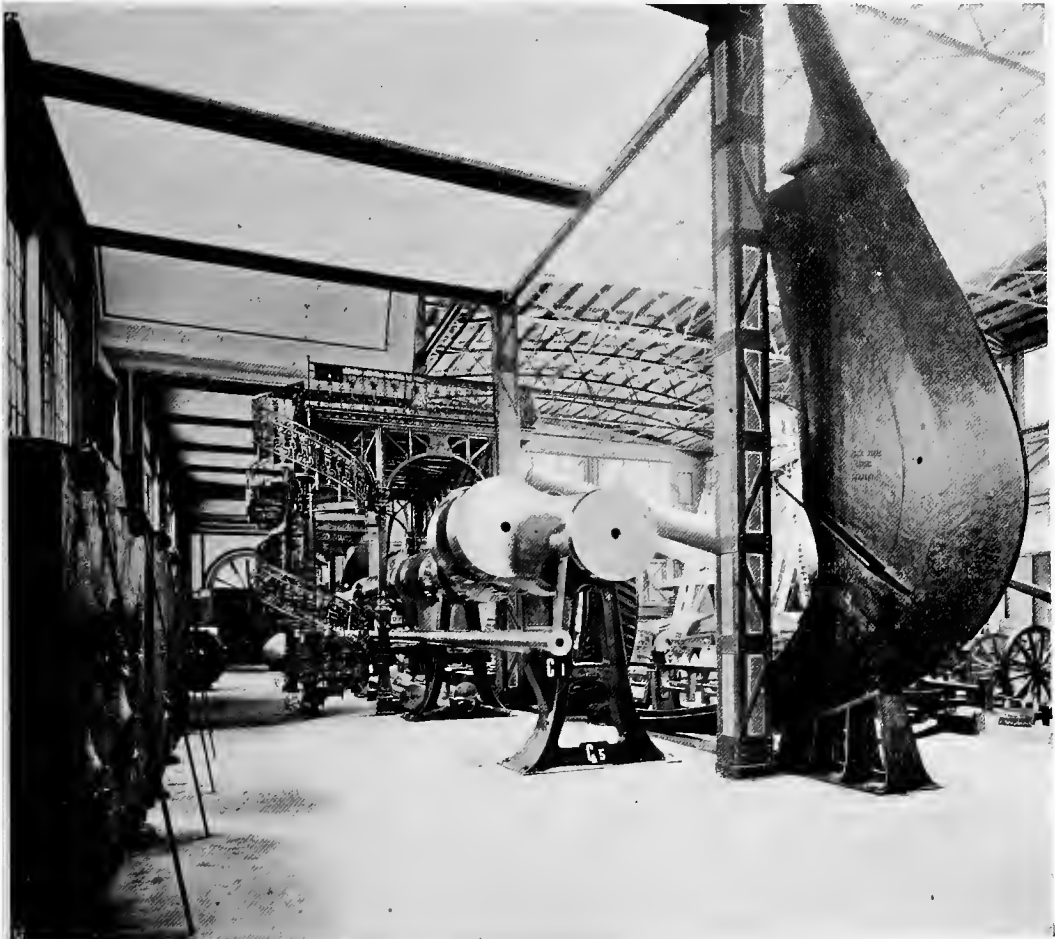


HEAVY ORDNANCE SHOWN IN THE KRUPP BUILDING.

lifted into its cradle by means of the wire rope of the shot crane. A naval gun of twenty-one centimetres caliber in a center-pivot ship carriage, manned by hand or electricity, throws a projectile weighing three hundred and eight pounds with an initial velocity of twenty-one hundred and nineteen feet a second. There was a fifteen-centimetre quick-firing gun in a center-pivot ship carriage that fires one-hundred-pound shot at the rate of eight a minute; one of twelve centimetres caliber makes thirteen shots a minute, the projectile weighing forty pounds; another, intended for warding off



torpedo attacks, fires nineteen shots, weighing twenty pounds, each minute ; and one mounted on a Caponnier carriage and intended, in the defense of a fortress, to rake the ditches of the besiegers is very easy of manipulation, and is capable of firing thirteen-pound projectiles at the rate of forty shots a minute. There were, moreover, a siege gun of ten and a half centimetres on a very light carriage, two portable siege mortars, two light field guns, a boat and landing gun mounted on a center pivot, two mountain guns, one of them



Pierced iron plates.

Steel shafting.

Propeller blade.

## SUNDRY EXHIBITS IN THE KRUPP BUILDING.

capable of being transported, with carriage, by three mules, and a bush gun of an inch and a half bore.

The collection of projectiles comprised steel armor shells, without fuse, having greater penetrating power than chilled armor shells, which they have supplanted ; steel fuse shells that explode on striking the mark and have thin walls and a large bursting charge so as to have the greatest possible explosive effect, intended for firing at earthworks ; mine shells having still thinner

walls, and intended to be fired only in a curved trajectory at low velocities; and cast-iron fuse shells, shrapnel, and case shot.

After the heavy guns, the most important part of the Krupp exhibit consisted of armor plates. The most interesting of these were compound plates fifteen and three quarters inches thick, a nickel-steel plate eleven and four fifths inches thick, and one of ten and a quarter inches differing in quality.

The lighter products of the Krupp rolling mills illustrated the resources of the works at Essen more strikingly than the heavy armor plates. There was a section of a boiler weighing nearly three and a half tons that was twelve feet eleven inches in diameter, with an inch and a half thickness of plate. A plate of Siemens-Martin steel rolled out to an inch and a quarter thickness was sixty-five and three quarters feet long and weighed sixteen tons. There were some interesting specimens of stamped and flanged steel plates for boiler work.

The Krupp establishment showed of railroad material a group of fifty-odd steel tires, a number of complete wheels, and a collection of axles. Of cast steel there were notable examples, including a part of the bow frame of a new German armor clad weighing twenty-four tons, and a part of the stern frame in two castings, weighing some twelve tons apiece. An engine bed-plate weighed six and a third tons. There were also steel side frames for locomotives and a steamship screw like that made for the Lloyd steamer Spree. There was a collection of the mining machinery manufactured at Essen; also a rolling mill, mint rolls, a reed-rolling machine, a gold-rolling machine, and a tinsel-rolling machine. A centrifugal cream separator, pressed by hydraulic power from sheets of Martin ingot steel, can be driven at a speed of ten thousand revolutions a minute.



The Krupp Building, from the northwest.



View in the Educational Section, gallery of Manufacturers Building.

## CHAPTER XI.

### THE EXHIBIT OF LIBERAL ARTS.

Scope of the department—Group comprising all that pertains to physical development, training, and condition—Group embracing instruments and apparatus of medicine, surgery, and prosthesis—Group comprising primary, secondary, and superior education—Group embracing literature, books, libraries, and journalism—Group of instruments of precision, experiment, research, and photography—Group embracing civil engineering, public works, and constructive architecture—Group confined to exhibits illustrating government and law—Group containing exhibits relating to commerce, trade, and banking—Group containing exhibits of institutions and organizations for the increase and diffusion of knowledge—Group embracing social, industrial, and co-operative associations—Group containing exhibits of religious organizations and systems, statistics, and publications—Group comprising music and musical instruments and the theater.



FRANKLIN H. HEAD,  
Member of the Directory.

THE Department of Liberal Arts embraced education, literature, engineering, public works, music, and the drama. Governments and municipalities, religious and charitable institutions, and associations of exhibitors furnished many well-selected and systematically arranged exhibits in this department.

Group 147 comprised all that pertains to physical development, training, and condition—hygiene. It was divided into the following classes : 824. The nursery and its accessories. 825. Athletic training and exercise gymnasiums, apparatus for physical development and of gymnastic exercises and amusement ; skating, walking, climbing, ball playing, wrestling, acrobatic exercises ; rowing, hunting, etc. Special apparatus for training in schools,

gymnasia ; apparatus for exercise, drill, etc. 826. Alimentation—food supply and its distribution ; adulteration of food, markets, preparation of food, cooking and serving, school kitchens and arrangements for school canteens, methods of warming children's meals, etc. Dinner pails, or receptacles for carrying meals for school children, workingmen, and others. Restaurants, dining halls, refectories, etc. 827. Dwellings and buildings characterized by the conditions best adapted to health and comfort, including dwellings for workingmen and factory operatives, houses and villages for operatives in connection with large manufacturing establishments, tenement houses, "flats," and suites of apartments, city and country residences, clubhouses, schoolhouses ; designs and models of improved buildings for elementary schools, infant schools and *crèches*, court rooms, theaters, churches, etc. 828. Hotels, lodging houses. 829. Public baths, lavatories ; public and domestic hygiene. Sanitation—sanitary appliances and methods for dwelling houses, buildings, and cities. Direct renewal of air. Heating, ventilating, lighting, in their relation to health. Conduits of water and sewage. Drains and sewers. Sinks, night-soil apparatus, sanitary plumbing, walls, bricks, roofs, flooring, etc. Sanitary house decoration—non-poisonous paints and wall papers, floor coverings, washables, decorations, etc. Apparatus for carrying off, receiving, and treating sewage. Slaughter-house refuse, city garbage. Apparatus and methods for filtering water and cleansing water courses. Apparatus intended for the prevention of infectious diseases. Methods, materials, and instruments for purifying and destroying germs ; disinfectors. Apparatus and fittings for warming, ventilating, and lighting schools ; school latrines, closets, etc. Special school fittings for storing and drying clothing. Precaution in schools for preventing the spread of infectious diseases ; school sanitarium, infirmaries, etc. 830. Hygiene of the workshop and factory. (Classification modified from that of the London health exhibition.) Designs and models for improvement in the arrangement and construction of workshops, especially those in which dangerous or unwholesome processes are conducted. Apparatus and fittings for preventing or minimizing the danger to health or life from carrying on certain trades. Guards, screens, air jets, preservative solutions, washes, etc. Objects of personal use—mouth pieces, spectacles, dresses, hoods, etc., for use in certain unhealthy and poisonous trades. Illustrations of diseases and deformities caused by unwholesome trades and professions ; methods of combating these diseases ; preservative measures, etc. Sanitary construction and inspection of workshops, factories, and mines ; new inventions or improvements for ameliorating the condition of life of those engaged in unhealthy occupations ; means for economizing human labor in various industrial operations. 831. Asylums and homes—asylums for infants and children ; foundling and orphan asylums ; children's aid societies. Homes for aged men and women ; for the maimed and deformed ; for soldiers and for sailors. Treatment of paupers ; almshouses. Treatment of aborigines ; Indian reservations and

homes. 832. Hospitals, dispensaries, etc. ; plans, models, statistics. Shed hospitals for infectious fevers and epidemic diseases ; tent hospitals ; hospital ships ; furniture and fittings for sick-rooms. 833. Protective supervision—sanitary supervision ; vaccination and its enforcement ; isolation of contagious diseases ; quarantine ; prevention and elimination of animal epidemics. Food inspection—treatment of adulterated foods ; inspection and analysis ; treatment of stale food substances ; regulation of abattoirs, mills, etc. ; regulation of sale of horses ; protective devices. Building inspection, etc.—building regulations and inspection ; building drainage and plumbing ; fire regulations, fire escapes, etc. Personal inspection—color tests, etc. ; professional examination for licenses. Immigration—reception, care, and protection of immigrants.

The North American Turnerbund made an interesting display of gymnastic apparatus and athletic costumes. Gymnastic apparatus and appliances were exhibited by the Narragansett Machine Company. The American Sporting Goods Company showed the Whitley exerciser. The Battle Creek Sanitarium School of Cookery exhibited the Swedish-movement apparatus and system of physical culture, as well as food preparations and healthful dress. Albert Wahl exhibited his health apparatus. The Whitney Home Gymnasium Company showed its cabinet of appliances.

An exhibit of sanitary cookery instituted by the New York Women's Board of Managers was conducted by Miss Juliet Corson. Practical illustrations of matters appertaining to housekeeping were given daily, and special attention was given to the preparation of foods for invalids and children. There was also an exhibit of household articles invented by women.

In the corn kitchen, which was in the Woman's Building, Mrs. Sarah T. Rorer, Principal of the Philadelphia Cooking School, editor of *Household News*, and author of a popular cook-book, demonstrated and explained the culinary uses of Indian corn, and lectured also on soups, meats, and pastry as well, under the auspices of the Women's Exposition Board of the State of Illinois.

The exhibit known as the Rumford Kitchen was the outgrowth of work in the application of the principles of chemistry to the science of cooking that for three years had been carried on in Boston by Mrs. Robert H. Richards, of the Massachusetts Institute of Technology, and Mrs. John A. Abel. In order to reduce the expenses of the exhibit, the food cooked in the Rumford Kitchen was sold under a concession. A series of pamphlets in the

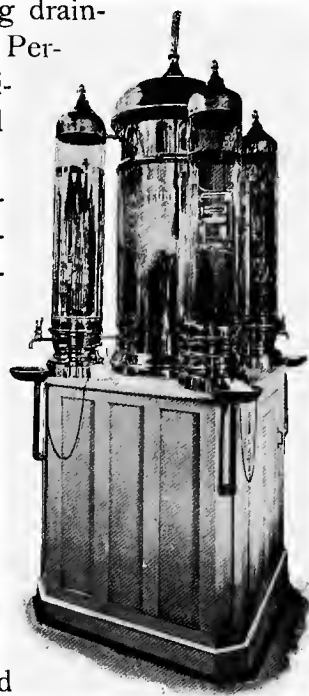


EXHIBIT OF THE  
PASTEUR-CHAM-  
BERLAND FILTER  
CO., DAYTON, O.

departments of science that relate to human food were prepared by Profs. Remsen and Abel, of Johns Hopkins University, Chittenden, of Yale, Sedgwick, of the Boston Institute of Technology, and others; and charts and diagrams were made to indicate the nutritious contents of different aliments and the requirements of the body. Food was served in portions containing a definite amount of nutrition. A *menu* card gave the requirement for one quarter of one day's ration, with the weight and composition of each dish composing the meal. For example, a standard lunch consisting of ten ounces of scalloped meat, four of bread, seven tenths of an ounce of butter, and five and three tenths ounces of apple sauce, served for thirty cents, contained thirty-two and a fraction grammes of proteids, nearly twenty-seven of fat, and one hundred and thirty-eight of carbohydrates, with nine hundred and forty-two of calories, and the cost of the materials was six cents. About ten thousand people were served with meals during the two months that the Kitchen was open.

Evidence was abundant that cookery is being made a subject of instruction in the schools in this country and in Europe. It was included in the school programmes of many of the cities and towns. In the German section of the Woman's Building was a collection of utensils used in the people's kitchen schools, household schools, and homes and schools for servants in Germany, with statistics of these institutions and plans and models of the buildings. In the model kitchen of the Woman's Building Mrs. Emma P. Ewing gave lectures in June on bread making and in October on other cookery, under the auspices of the Committee on Household Economics, of the Board of Lady Managers. W. E. Beveridge, of Baltimore, exhibited automatic steam cookers, another form of which was shown by the Peerless Steam Cooker Company. Mrs. Caroline Romney, of Chicago, exhibited a warming closet, a heat conserver, a dinner pail, etc. The Sanitarium Company, of Battle Creek, had an exhibit of granola, gluten, and other health foods. Sterilizers, steam cookers, and bacteriological apparatus were exhibited by Wilmot, Castle & Co.

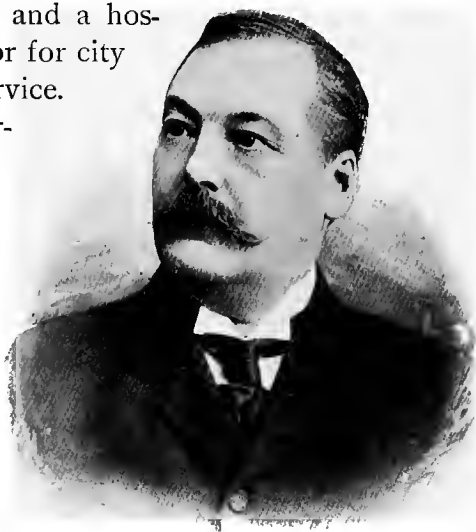
In a workingman's model home Miss Katherine B. Davis demonstrated how a family of five can be comfortably and wholesomely fed, housed, and clothed out of earnings of \$500 a year. A Philadelphia workingman's home, erected by the Woman's Auxiliary of that city, inside the Midway Plaisance, was a two-story brick dwelling having six rooms and bath, planned to cost about \$2,300. Plans of a model tenement house were presented by the Beneficent Association of Philadelphia. The model of an improved dwelling for workingmen was shown by the Improved Dwelling Company, of New York. Edward T. Potter, of Newport, offered a model of a town dwelling house, showing a method of concentration in a small space. The Tenement House Building Company, of New York, sent drawings and plans of buildings.

Turkish, hot-air, and sun baths for the household were shown by Mrs. L.

Mendenhall. I. M. Coolbaugh showed a bath with a movable seat. The Albarene Stone Company exhibited sanitary washing troughs. The Pacific Company, of Los Angeles, exhibited flush tanks with an automatic system for flushing sewers, closets, etc. A. W. Cram showed a method of cleaning out drains, and Charles H. Miller appliances for cleansing water mains and sewers. Henry R. Worthington exhibited sewerage pumps. Public urinals and closets and a drinking fountain formed the exhibit of J. L. Mott & Co. Brown & Sharp and Norton Brothers had sanitary closets; the Heap Manufacturing Company, earth closets; Hans H. Jensen, an odorless water closet. The Sanitas Company exhibited antiseptics and disinfectants, and William Bannerman his phenyle disinfectant. The Hydromaze Company had a health guard to show. The Engel system of cremation for vegetable refuse, dead animals, and miscellaneous waste in cities and towns, infectious matter, excreta in schools and dwellings, etc., was well exhibited by iron and brick closets for domestic use and a hospital furnace, and outside a garbage cremator for city use and a school closet were in actual service.

F. A. C. Davis & Co. showed models of garbage and crematory furnaces. Photographs of the Buffalo crematory were shown by Cyrus K. Remington. The State Commissioners of New York showed models of a crematory for the dead. The New York Ladies' Health Protective Association exhibited models of abattoirs and of a dust cart. A garbage storage vault was shown by William Ostermeyer; a sanitary garbage pail, by a Detroit firm.

In the McConnell germ-proof filters, which were adapted for attachment to the water pipe and made so that they can be cleaned without trouble, the filtering medium is a porous wall of a fine mineral flour, through which only pure water and air can pass. The Columbia Automatic Filter Company exhibited a self-cleansing and germ-proof filter invented by Colonel Marshall McDonald. The automatic water-purifying apparatus of Nelson Hunting produces aerated water from aqueous vapor in the same way in which rain is formed. The Pasteur-Chamberland Filter Company, in addition to germ-proof filters and filtering apparatus, exhibited a special apparatus for detecting impurities in water. Other filters were exhibited by the Akron-Canton Company, J. A. Bowden & Co., the Cummings Company, the Eclipse Filter Company, Henry Verhage Company, Mrs. Caroline Romney, Peter Stone, and the World's Crystal Water Filter Company. B. S. Benson had an air purifier and filter. The Automatic



EGBERT JAMIESON,  
Member of the Directory.



Fountain Company, of Canton, Ohio, exhibited a fountain air-purifier. A portable disinfecter was made by Zambelli & Co., of Turin, Italy.

The Boston Water Board showed a model and plans and photographs of the new waterworks. A plan for a system of sewerage for Chicago was shown by Jean Marie Guenantin. The Massachusetts Board of Health, in an exhibit that obtained the highest award, showed models of the Lawrence experimental station, samples of filtered water with analyses, views of sewage purification works in operation in Massachusetts, a large map indicating the normal chlorine of the waters of various parts of the State, and all the results of its long-continued investigations upon water supply and sewerage, its system of sanitary advice to cities and towns, and its regular inspection of food and drugs.

Sections of sand filters were constructed and specimens of crude and of purified sewage were exhibited, and apparatus, both chemical and biological, together with river waters and typical surface waters, ground waters, and waters from reservoirs, taps, and wells, with the analysis of each. Models of the trichina were shown, with charts bearing upon trichinosis; and investigations of epidemics and the geographical and seasonal distribution of various diseases were illustrated by maps and diagrams. Models and maps of the Croton water system were presented by the New York State Commissioners.

Fuller & Warren showed a siphon system of ventilation and an air-warming furnace for schools. The George H. Hess Company exhibited by models an apparatus for ventilating and warming schools and houses. Health arrangements for schoolhouses were shown in charts by the Maine Board of Health. James F. Almy had a window ventilator that can be adjusted to any window or removed at will, and be regulated to admit a greater or less volume of air, which it diffuses through the room. The United States Commission of Education presented reports on the heating and ventilation of schools. Rufus R. Wade gave plans and reports of heating and ventilation in schools and public buildings.

Fifty-five orphan asylums, reform schools, children's protectories, day nurseries, and similar institutions exhibited their methods, equipments, and work. Sixty-one associated charity and charity-organization societies, almshouses, homes for the aged, charity farms, and relief societies for the adult poor sent exhibits. The States of California, Colorado, Delaware, Illinois, Indiana, Iowa, Kansas, Maine, Maryland, Massachusetts, Michigan, Minnesota, Missouri, Nebraska, New York, Pennsylvania, and Wisconsin and the Territory of New Mexico exhibited the workings of their charitable and penal institutions. Exhibits were made by the Penny Provident Fund of the New York Charity Organization Society, the Pioneer Co-operative Bank of Boston, the Home Savings Institution of the same city, the Provident Savings Bank of Baltimore, the Workingmen's Loan Association of Boston, the Independent Order of Benai Berith and the Order of Grace Schwestern of

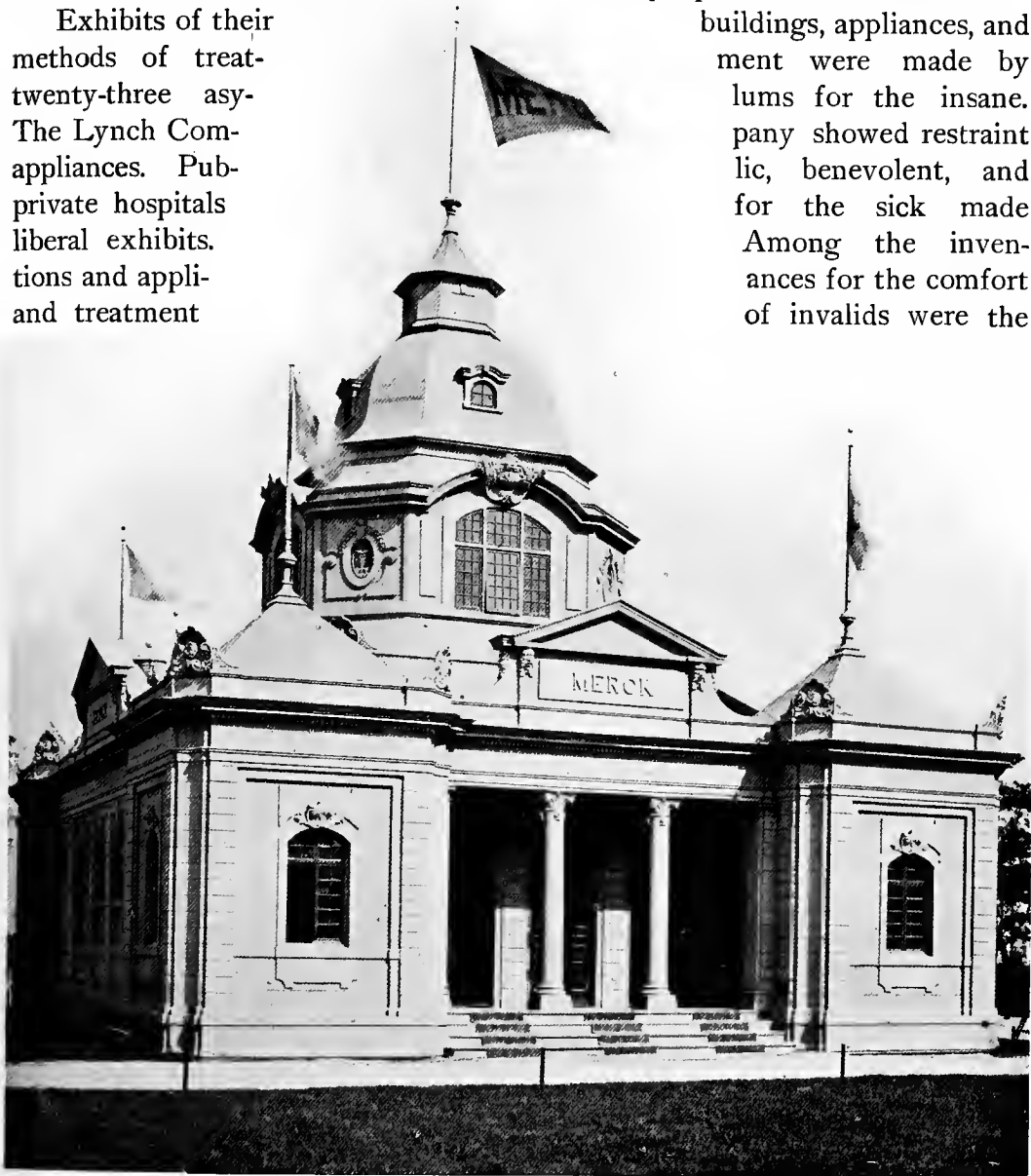
New York, the Massachusetts co-operative banks, the Boston Monday Evening Club, the Philadelphia Board of Police, the New York State Charities Aid Association, the Women's Christian Temperance Union, and the Antivivisection Society.

charts of crime and

Exhibits of their methods of treatment—twenty-three asylums. The Lynch Companies. Public and private hospitals liberal exhibits. Medications and appliances and treatment

F. H. Wines exhibited graphic pauperism in the States.

buildings, appliances, and ment were made by lums for the insane. Many showed restraint lic, benevolent, and for the sick made Among the inventions for the comfort of invalids were the



BUILDING OF MERCK & CO., NEW YORK.

Exhibits of Pharmaceutical Preparations, etc.

hospital furniture of the Sargent Company and the Crosby Invalid Bed Company, Carrie V. Reeves's head rest, Mary E. Allen's invalid chair, Seth P. H. Hale's apparatus for moving invalids, Mary A. Hawley's invalid table, Jesse Hodgman Meggy's bed lift, Mrs. B. A. Dugot's combined douche and

bedpan, Miss C. C. Barnwell's dispensary for plaster jackets, and the emergency bag for ambulance work shown by the Fitch Accident Hospital, of Buffalo.

Surgeon-General Sternberg sent a collection of micro-photographs of bacteria. H. M. Alexander & Co. had an exhibit of vaccine virus. The Illinois Board of Health presented the maps that had been compiled to show the sanitary condition of Chicago. Reports and statistics of the Boards of Health of New York, Connecticut, Rhode Island, California, Oklahoma, Washington, and Wisconsin, and of the province of New Brunswick showed the state of public sanitation in America. The Michigan Board of Health had a set of diagrams to illustrate its work in the prevention of disease, and Minnesota illustrated by charts and statistics methods of protection and sanitary work. The Pennsylvania Board of Health exhibited a bacteriological outfit and apparatus for collecting specimens of drinking water from hydrants. The New Jersey Board of Health showed specimens of adulteration in food and drugs. The Massachusetts Institute of Technology presented interesting sanitary statistics, and Amherst College some valuable hygienic statistics. The University of Pennsylvania sent the hygienic publications that have issued from its press. Sanitary publications were exhibited by the Academy of Political Science, the American Book Company, F. A. Davis & Co., D. C. Heath & Co., and Lea & Brothers. William David offered publications on ventilation and heating. There was a large collection of books and pamphlets on sanitary and hygienic subjects, issued by English publishers and benevolent associations, like the Ladies' Sanitary Association of London, the National Health Association, the Society for the Propagation of Christian Knowledge, and the Religious Tract Society. M. L. Davis presented a plan for a quarantine hospital.

The quarantine system of New York State was exhibited, also the city supply of water from the Croton aqueducts. The State Board of Health and the Board of Health of New York city made exhibits. There were models of the quarantine station and disinfectors at New Orleans, exhibited by the Louisiana Board of Health. The sanitary station at Curaçoa was shown in photographic pictures. Plans of the quarantine system of New York were shown by the State commissioners.

Group 148 had for its contents the instruments and apparatus of medicine, surgery, and prosthesis, classified as follows: 834. Pharmacology, drugs, pharmacy, etc.—medicines, officinal (in any authoritative pharmacopœia) articles of the materia medica, preparations unofficinal. 835. Dietetic preparations intended especially for the sick. 836. Instruments for physical diagnosis, clinical thermometers, stethoscopes, ophthalmoscopes, etc. 837. Surgical instruments, appliances, and apparatus, with dressings, anæsthetics, antiseptics; obstetrical instruments, etc. 838. Prosthesis—apparatus for correcting deformities; artificial limbs. 839. Instruments and apparatus of dental surgery and prosthesis. 840. Vehicles and appliances for the trans-

portation and relief of the sick and wounded, during peace or war, on shore or at sea.

Pharmaceutical preparations, compounds, specifics, and mixtures were exhibited by the Albany Chemical Company, the Ale and Beef Company, Armour & Co., the J. C. Ayer Company, the Frederick Brown Company, Burrough Brothers, the Drevet Company, the G. F. Harvey Company, the H. K. Mulford Company, Sharp and Dohme, Frederick Stearns & Co., the Tilden Company, William R. Warner & Co., John Wyeth & Bro., and J. H. Zeilin & Co. The Upjohn Company exhibited pills and granules. Merck & Co. displayed the remarkable medicinal products

of coal tar in a separate building. The Mellor &

Rittenhouse Company showed licorice

and its products. Boericke & Ta-

fel exhibited homœopathic prep-

arations and the Standard Homœ-

opathic Globule Company glob-

ules and disks. Reed & Carnrick

made an exhibit of food prepara-

tions, as well as one of pharma-

ceutical preparations. Digestive

ferments and peptonized foods

were exhibited by Fairchild Bro-

thers & Foster, and by Swift & Co.

Horlick's Food Company showed

medicinal food preparations, and

there was an exhibit of Thom-

sen's extract of malt. The Doli-

ber-Goodale Company exhibited

food for infants.

The Sargent Company made a display of surgical chairs, tables, and apparatus, and one of appliances for

transporting sick or wounded. The Harvard Company had an exhibit of surgical furniture, and others were made by the W. D. Allison Company and Miner & Elbreg. Seabury & Johnson showed medical, surgical, and antiseptic specialties, and J. Ellwood Lea surgical specialties. The Canton Company also exhibited surgical chairs, and the Daggett Company posturing tables. John C. Milnes showed the model of a veterinary operating table. Exhibitors of surgical instruments and appliances were William H. Armstrong & Co., the Carroll Aluminium Company, Haussmann & Dunn, T. W. Heinemann & Co., Johnson & Johnson, A. A. Marks, the E. C. Penfield Company, Sharp & Smith, and Charles Truax, Greene & Co. Edward A. Tracy had exhibits of splints and jackets. The Carroll Company showed an orthopædic apparatus and a dental apparatus; E. P.



BOOTH OF FAIRCHILD BROS. & FOSTER,  
NEW YORK.

Banning, spinal appliances and other kinds ; the E. C. Penfield Company and the Common Sense Truss Company, trusses and supporters ; the Harvey Human Hand Appliance Company, trusses ; the Storrs Company, air pads and supporters ; Sherman R. Nye, a finger truss ; the E. L. O'Connor Company, an extension shoe ; the Marvin Truss Company, trusses and abdominal supports ; William J. Donald, crutches and safety attachments. Artificial limbs were exhibited by the Chicago Artificial Limb Company, C. A. Frees, the Gault Company, James I. Lyons, Sharp & Smith, and the Winkley Company. A. A. Marks showed his artificial limbs with rubber hands and feet, and A. Niehaus legs with a rubber foot and ankle joint. J. T. & A. H. Davis had a display of artificial eyes. The Ritter Company exhibited dental chairs and cases ; the Chicago Company, folding dental chairs ; the Canton Company, the Gould chairs and engines ; Constant Doriot, a chair and tools ; the Harvard Company, dental furniture ; Anna Thomas, various appliances ; F. G. White, dentistry ; L. J. Mason & Co., an electric dental engine and appliances ; the Ohmer Company, a dental plaster bin and sieve ; the S. S. White Company, dental supplies ; and Charles H. Land, a cabinet and furnaces for his system of practice that aims to restore the natural appearance of the teeth. C. D. Allen and Henry F. Deane made displays of artificial teeth, and George Evans one of crowns for teeth. A. A. Marks had an exhibit of invalid vehicles, and the Sargent Company another.

Group 149 comprised primary, secondary, and superior education. It was divided into the following classes : 841. Elementary instruction—infant schools and kindergartens. Descriptions of the methods of instruction, with statistics. 842. Primary schools, city and country—schoolhouses and furniture. Apparatus and fittings. Models and appliances for teaching, text-books, diagrams, examples. Specimens of work in elementary schools. 843. Domestic and industrial training for girls—models and apparatus for the teaching of cookery, housework, washing and ironing, needlework and embroidery, dressmaking, artificial-flower making, painting on silk, crockery, etc. Specimens of school work. 844. Handicraft teaching in school for boys—apparatus and fittings for elementary trade teaching in schools. Specimens of school work. 845. Science teaching—apparatus and models for elementary science instruction in schools. Apparatus for chemistry, physics, mechanics, etc. ; diagrams, copies, text-books, etc. ; specimens of the school work in the subjects. 846. Art teaching—apparatus, models, and fittings for elementary art instruction in schools ; diagrams, copies, text-books, etc. ; specimens of art work, modeling, etc., in schools. 847. Technical and apprenticeship schools. Apparatus and examples used in primary and secondary schools for teaching handicraft ; models, plans, and designs for the fitting up of workshop and industrial schools ; results of industrial work done in such schools. 848. Special schools for the elementary instruction of Indians. 849. Education of defective classes—schools for the deaf,

dumb, blind, and feeble-minded ; adult schools for the illiterate. 850. Public schools—descriptions, illustrations, statistics, methods of instruction, etc. 851. Higher education—academies and high schools. Descriptions and statistics. Colleges and universities. Descriptions, illustrations of the buildings, libraries, museums, collections, courses of study, catalogues, statistics, etc. 852. Professional schools—theology, law, medicine and surgery, dentistry, pharmacy ; mining, engineering, agriculture, mechanic arts ; art and design ; military, naval, normal, commercial ; music. 853. Government aid to education—national Bureau of Education ; reports and statistics.

Many different kinds of exhibits were displayed on the walls : Pictures and photographs of exteriors and interiors of buildings, and of equipment,



EXHIBITS BY SCHOOLS OF COLORADO.

faculty, and students ; specimens of students' work, literary, scientific, artistic, or mechanical ; statistical graphic charts and tables ; programmes of study ; and statements of special features or superior achievements in the school work. Bound volumes of pupils' work were placed on the tables of the alcoves, while drawings and specimens of school exercises hung on the walls, and there were portfolios full in cupboards.

Massachusetts made collective exhibits of the work of kindergarten, primary, manual-training, high, and normal schools, and also showed the general features of the public-school system of the State by series of maps, charts, and photographs, and by a large collection of educational reports.

The educational exhibit from New York occupied one seventh of the whole space devoted to education in the Department of Liberal Arts. The

material collected was preserved afterward in the Capitol at Albany to form the nucleus of a permanent pedagogic department of the State Museum. The State University exhibited its system of academic and college and law and medical examinations, and other workings. The State Library exhibited the decimal classification, the clearing-house method of distributing duplicate publications among the libraries, its bulletins for the guidance of smaller libraries, its annual summaries of comparative legislation, and its system of traveling libraries on different subjects that are loaned to communities on application for the period of six months. The State Library School exhibited its methods and the work of its students. Among several systems of manual training exhibited by New York schools, the one practiced by Prof. Charles A. Bennett in the Columbia Teachers' College was scientific and practicable, consisting of a series of groups of models designed to illustrate certain principles and their application, which the pupils between eight and fifteen years of age were taught to make. The course in wood working ended with turning. Prof. Herrick showed a course of clay modeling, supplemented with drawing and coloring, and embracing studies of Nature and of the styles of architecture and decoration. The universities and colleges, the endowed academies, and the public schools of New York exhibited their schemes of instruction. The Workingman's School of the Society of Ethical Culture aims in its system of manual training to train eye and hand, develop imagination, and inculcate the dignity of labor and foster the moral habits that manual labor is calculated to produce. The School of Pedagogy connected with the University of the City of New York had charts illustrating the evolution of the public-school system. In the Vassar College exhibit was a model of Prof. Dwight's petrotome and rock specimens cut by this machine; also work from the biological and zoölogical laboratories. The kindergarten exhibits were very full and varied; the most striking one was a series of instantaneous photographs of the children in Colonel S. P. Moulthrop's school in Rochester while they were engaged in the talks, occupations, and games of the different grades.

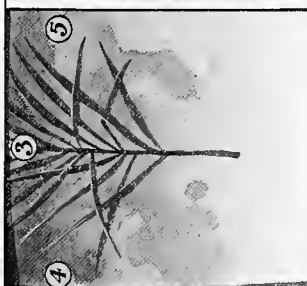
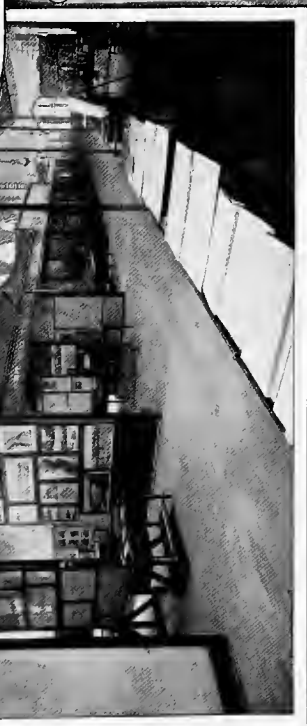
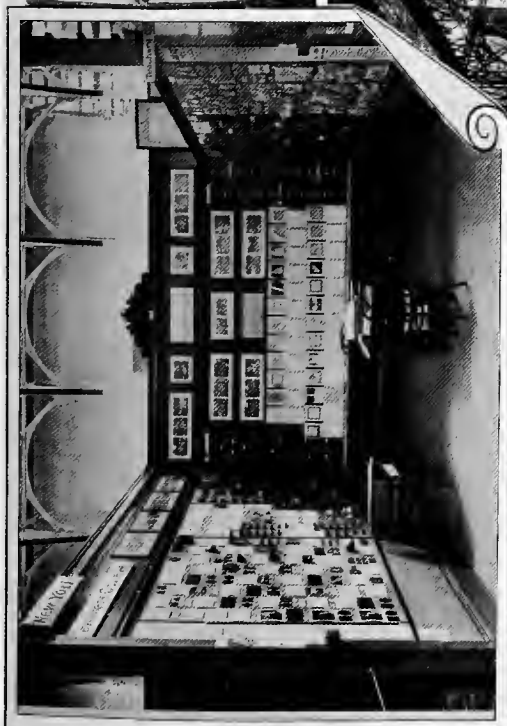
Besides the collective exhibit of the Ohio public schools, Cleveland, Cincinnati, and Toledo made separate exhibits.

In the Illinois building there was a systematic exhibit of the educational work of all kinds maintained by public taxation in the State, especially the public schools.

One of the most unique features was the phonograph exhibits made by five of the States, which sent wax cylinders stored with records of recitations, oral examinations, and exercises in singing. Teachers were most interested in the new and progressive methods of teaching that were brought out.

In the method of teaching mathematics pursued by Nelson Haas in the Washington public school at Hackensack, N. J., the abstract is illustrated by concrete examples. Apples or other objects to be added or subtracted are drawn and frequently colored, so that the child of six or eight has a prac-





1. Teachers' College, New York City. 2. Vassar College, Poughkeepsie. 3. General view, intersection of aisles. 4. Rensselaer Polytechnic Institute, Troy, and Pratt Institute, Brooklyn. 5. Columbia College, New York City.

SCHOOL EXHIBITS IN THE NEW YORK STATE SECTION OF THE LIBERAL ARTS GALLERY.



tical demonstration of the problem ; and if it is asked to find out how many yards of carpet of a certain width will cover a room, or how much plastering it requires for the walls, the room and its dimensions are presented in a drawing. The same principles are carried out in higher mathematics, so that pupils from fourteen to eighteen years of age acquire a clear comprehension of processes in algebra, trigonometry, and even the differential calculus. A system of teaching music by picture scales attracted a great deal of attention from educators.

The exhibits of universities, colleges, normal schools, and higher technical institutions were placed as far as possible near the exhibits of their respective States. There were exhibits from Harvard, Yale, Johns Hopkins, the Massachusetts Institute of Technology, the University of Pennsylvania, the New York Teachers' College, Cornell University, the University of Michigan, Columbia College, Princeton College, Lehigh University, Williams College, Clark University, Tufts College, Bryn Mawr, Amherst College, Wellesley, Smith College, and other well-known institutions for the higher education of men and women. An alcove was filled with a great variety of students' work from some of the art schools.

A collective exhibit of university extension afforded a comparative view of the courses, methods, and examinations of the Universities of the State of New York, Chicago, Edinburgh, the London People's Palace, Chautauqua, and the Catholic Summer School.

The schools of the Catholic Church were represented by a collective exhibit, in three divisions, that were in charge respectively of the Christian Brothers, the Archdiocese of Chicago, and a committee for the collective Catholic educational exhibit. This exhibit was very extensive and full, and brought out in a strong light the important part that this Church performs in the education of American youth. The list of institutions includes all grades of schools, from the kindergarten to the university, besides many kinds of schools for manual and industrial training and special schools. There was a considerable group of exhibits by the medical colleges of the country, and the commercial colleges made a good showing of their plans and courses of instruction. A very good showing was made of the results of industrial training in the Chicago Jewish Training School, the Baron de Hirsch Fund Trade School of New York, and the elementary, technical, trade, and agricultural schools of the Alliance Israelite Universelle.

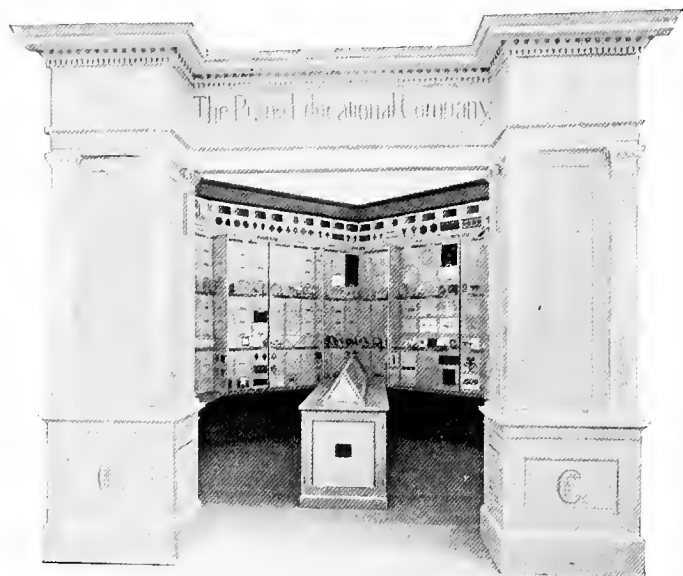
The exhibit of the Pratt Institute of Brooklyn was extensive and well arranged, being divided into five sections—manual work, science teaching, industrial and fine art, technical and trade work, and literary work. The schools of manual training and the industrial and trade schools made many praiseworthy exhibits. The institutions intended primarily for Indians or for negroes, such as Hampton, Carlisle, and Atlanta University, made excellent exhibits of their work.

Interesting exhibits of the Indian schools were made by the United States

Government, each school remaining nearly a month, and then departing to make room for another. The Haskell Institute, for instance, displayed the work of the forty-six pupils, taken from twenty-three tribes, in all the grades from the kindergarten to painting and drawing, making shoes, harnesses, clothing, and other adult occupations. The Indian schools of Manitoba and the Northwest demonstrated their efficiency in an unmistakable manner. Indian boys were seen setting type and operating a printing press, and examples of their handiwork in wood, metal, and other materials were shown in variety. The skillfully wrought robes of deer and muskrat skins, loon

skins, lynx paws, etc., were very interesting, and especially the light, warm robes woven out of strips of the skin of arctic rabbits.

There was a large collective exhibit of American schools for the defective classes which contained remarkable samples of work done by deaf and dumb, blind, and feeble-minded pupils. Among the exhibits of the Bureau of Charities and Correction, in the Anthropology Building, were represented schools for the training of nurses, and industrial and reform schools for the dependent and delinquent classes.



DISPLAY OF THE PRANG EDUCATIONAL CO.,  
BOSTON.

The Canadian exhibit consisted of pupils' work, especially in drawing and modeling, from the schools of all kinds that are supported by the Government of Ontario or are under its supervision. New South Wales sent some superior work in manual training done in public schools. England sent two exhibits of special importance, one from the school board of London representing the work in manual training, form study, and drawing in the schools under its supervision, and one made by the British Government, showing the work done in the National Art Training Schools at South Kensington and in schools of art maintained for the people in other parts of the United Kingdom. Near these examples of students' work could be seen a great variety of manufactured articles in which the taste shown in design and color is the direct result of work done in those schools. The same degree of influence could be traced in the French exhibits of industrial art back to the work shown from the industrial art schools of Paris.

Germany made a collective exhibit of the lower schools, the intermediate schools, and the universities, that form the main part of the governmental system of education. The universities had library and laboratory exhibits, showing the resources placed at the disposal of students, and also theses showing the work of the students in original research. The lower schools were represented by maps, charts, photographs, and statistics, and by typical collections of materials and apparatus used in teaching. There was a library exhibit showing the different systems that have been introduced in the chief libraries of the empire. Austria exhibited the public-school system of Vienna.

The Russian Government Pedagogic Museum displayed scientific and other educational apparatus, together with cases of stuffed birds and animals and pictures of Russian rural life. The St. Petersburg School of Design exhibited fine specimens of lace and needlework made by girls, and examples of the manual-training work of boys. There was a collective exhibit of pupils' work from the common schools and the handicraft and technical schools of Egypt.

The Japanese exhibit was exceedingly systematic and comprehensive, representing the whole range of public education from kindergarten to university, including agricultural schools, schools of engineering, art, science, manual training, and industry, commercial schools, normal colleges, and schools for defectives.

One of the best of the commercial exhibits was that of Prang & Co., containing a series of cards representing a model four-years' course in drawing, color, and form study. The Air Brush Company exhibited its brush and paintings produced with it. The Milton Bradley Company made a large exhibit of kindergarten, manual-training, scientific, and drawing materials. Lucy Burd, of Bridgewater, Pa., exhibited a dissected map of the United States. Thomas Kane & Co. showed school desks and slates, and W. A. Olmsted blackboards and scientific apparatus. School furniture was exhibited by the United States School Furniture Company. C. Gilbert Wheeler had an exhibit of scientific charts.

Group 150 embraced literature, books, libraries, and journalism. It was subdivided as follows: 854. Books and literature, with special examples of typography, paper, and binding. General works—philosophy, religion, sociology, philology, natural sciences, useful arts, fine arts, literature, history, and geography; cyclopædias, magazines, and newspapers; bindings, specimens of typography. 855. Schoolbooks. 856. Technical industrial journals. 857. Illustrated papers. 858. Newspapers and statistics of their multiplication, growth, and circulation. 859. Journalism, statistics of, with illustrations of methods, organization, and results. 860. Trade catalogues and price lists. 861. Library apparatus; systems of cataloguing and appliances of placing and delivering books. 862. Directories of cities and towns. 863. Publications by governments. 864. Topographical maps. Marine and coast

charts; geological maps and sections; botanical, agronomical, and other maps, showing the extent and distribution of men, animals, and terrestrial products; physical maps; meteorological maps and bulletins; telegraphic routes and stations; railway and route maps; terrestrial and celestial globes; relief maps and models of portions of the earth's surface; profiles of ocean beds and routes of submarine cables.

The D. Lothrop Company, besides a full line of publications of the house, including magazines, showed the stages of making pictures and the plates used in ornamenting book-covers. Estes & Lauriat made a fine display of *éditions de luxe* and original etchings and illustrations. B. F. Bonaventure showed some rare books in fine and historic bindings.



EXHIBIT OF THE D. LOTHROP CO., BOSTON.

In the exhibit of Rand, McNally & Co., besides their standard publications, were wall maps, indexed maps, and globes, including a new relief globe.

Charles Scribner's Sons filled a large pavilion with a selection of their publications, including their art books. In their magazine exhibit they showed the process of making a magazine from the original manuscript through the proofs and the dummy to the finished work, and of picture making from the artist's original wash to the printed illustration. As a reminder of the distance that the magazine publishers have traversed to outstrip all other nations in their branch, a copy was shown of the American Magazine, printed in New York by Samuel Loudon in December, 1787, which might be contrasted with the exhibition number of Scribner's, produced at an outlay of \$60,000. Harper & Bros. showed a full line of their

publications without bindings, and a collection of drawings by Abbey, Frost, Smedley, and other illustrators, and original manuscripts of Lew Wallace and other authors; also the souvenir Distaff Series of volumes written, edited, printed, and bound by women.

In the booth of the Century Company was shown the evolution of a dictionary, from the crude beginnings of English lexicography, and through all the stages that the copy for the Century Dictionary had to pass. In an exhibit of the evolution of an engraving, such as appears in the Century Magazine, the processes were made apparent from the original India-ink



EXHIBIT OF CHARLES SCRIBNER'S SONS, NEW YORK.

drawing, through the photographic negative, the print on copper, the copper plate, the biting in with acid, the trial proofs, and the overlays. A drawing on wood, by Mary Hallock Foote, showed the old manner of producing woodcuts. The originals of Cole's Old Italian Masters were shown, and there was a collection of book covers.

Dictionary making constituted the exhibit of Funk & Wagnalls.

The production of engravings by different processes, and the art of illustrating magazines and books, formed an important and highly interesting part of the exhibits of literature. Montague Marks exhibited the methods



of illustrating an art magazine. A. Zeese & Co. showed half-tone engravings direct from photographs and wash drawings, zinc etchings from pen-and-ink drawings and prints, and wax engravings of maps and plates, together with lithogravures of ornamentation and photo-electrotype reproductions of book pages. Steel plate and lithographic engravings were displayed by the Western Bank Note Company. The American Bank Note Company showed fine specimens of bank-note engraving and lithographing. The American Lithographic Company exhibited art and commercial lithographs. Shober & Carqueville had an exhibit of lithographs. J. Manz & Co., the Gugler Company, and W. J. Morgan & Co. exhibited lithography; the Moss Company, engraving; the Globe Company, photogravures; Radke, Lauckner & Co., etchings and engravings; the Winters Company and Hermann Schedler, lithographs; Bruno Scholl, show posters; F. Tuchfarber, show cards; Charles Wuster, engravings. William Freund & Son had an exhibit of copper-plate and steel-die work. L. Prang & Co. made a fine display of lithographic art prints. Joseph Hoover exhibited facsimiles of pastels and water colors. J. B. Campbell, of Chicago, exhibited lithographs in connection with his magazine. The Columbian Engraving and Publishing Company made a display of engravings and half-tone reproductions. The Levytype Company exhibited engravings and prints. Fishel, Adler & Schwarz had an exhibit of engravings and etchings. The J. Ottmann lithographing establishment made the most magnificent exhibit in the Puck Building, where were shown the finest productions that had appeared in that journal, and the entire process of making and printing lithographs. C. Lindsay Ricketts showed specimens of engrossing and illuminating. Prang & Co. exhibited their color work on cards and satin, the best examples of which were fine reproductions of water colors. Beside some of the prints were placed the original paintings for comparison. Charles Kurtz, of New York, in addition to specimens of photographic art, displayed fine examples of his photo-mechanical process work, which has been used successfully in illustrating books and magazines. George Barrie exhibited books and engravings. G. H. Wilson had an exhibit of musical publications. George Soule exhibited books on business methods. The Good Health Company made an exhibit of popular health and medical books. The Brodix Company exhibited its monthly magazine. The National Christian Science Company made an exhibit of its books and magazines. Juliet L. Axtell, Amos A. Baldwin, Barbee & Smith, and William Corner and Emmeline B. Wells made small exhibits of books. Thomas Manning exhibited the American yacht list, G. M. Donham the yearbook of Maine, D. A. Paradis an illustrated volume in one hundred and fifty languages, and Emmeline B. Wells an illustrated book of Salt Lake City. The Manufacturers' Publishing Company exhibited a directory of manufacturers. H. P. Hubbard made a fine display, including magazines and newspapers, technical and industrial journals, illustrated journals, newspapers, and statistics of journalism. The

Salem Press Company displayed the historical and scientific publications of the Essex Institute. The Columbian History Company made a display of the Art History of the Exposition. B. Franklin Lieber made an exhibit of his telegraphic cipher and manual. The Volapük societies and Alfred A. Post made an exhibit of their publications. Eben Putnam, of Salem, Fogg & Dunham, of Portland, and Seeger & Guernsey exhibited rows of the books that they have issued. Houghton, Mifflin & Co. displayed, in a pavilion built like a Greek temple, sets of the works of the great authors of the New England school, each set under the writer's bust, after the old



EXHIBIT OF HARPER & BROTHERS, NEW YORK.

Roman custom. The rare set of Charles Dickens was shown which H. O. Houghton printed at the Riverside Press for a firm that failed to keep the contract, causing him to become Dickens's publisher. In another elegant pavilion D. Appleton & Co. displayed their cyclopædias, histories, and other publications, and good examples of artistic work in illustration. In showcases were grouped the displays of G. C. Merriam & Co., Duprat & Co., J. B. Lippincott Company, F. H. Revell & Co., A. C. McClurg & Co., Orange Judd & Co., and others. The publishers of the Art Amateur, the Open Court, and other periodicals made exhibits. In the kiosk of the North American Review were letters and manuscripts of many illustrious persons. Colbz & Co. exhibited their historical charts. The Phonographic Institute displayed the text-books of some of the short-hand masters. Other phonographic text-books were shown by N. P. Heffley. The Concordia Publish-

ing House showed the standard Lutheran books. William Wood & Co., F. A. Davis & Co., and W. T. Keener displayed full lines of their medical publications. Exhibits of educational books were made by A. Flanagan, Leach, Shewell & Sanborn, and Ginn & Co., who had also a fine collection of rare antiquarian books of instruction. George A. Plimpton furnished another historical collection of schoolbooks. D. C. Heath & Co., the University Publishing Company, A. Lovell & Co., and Silver, Burdett & Co. also made good exhibits of schoolbooks, and C. W. Bardeen exhibited his educational publications and supplies. Other exhibitors were Albert Scott & Co., Fairbank & Rolison, O. M. Powers, the Practical Text-Book Company, and Thompson, Brown & Co. The Western School Journal Company exhibited periodicals. Sunday-school requisites formed the exhibit of D. A. Perrin & Co. S. S. Packard showed his text-books. Charles R. Wells exhibited his system of penmanship. The New England Publishing Company exhibited teachers' books and periodicals. Carl Betz exhibited gymnastic manuals. School supplies were shown by the Central School Supply House, of Chicago. George P. Brown, of Bloomington, exhibited his school journal. In the attractive booth of E. L. Kellogg & Co. teachers were accustomed to meet. John M. Mott exhibited a phonetic chart of the English alphabet. James T. B. Ives had an exhibit of strata, altitude, and historical maps of the United States, compiled with great care and study. M. M. Gillam exhibited an historical chart. A relief map of Palestine was the work of Clara Dickert, of Chicago. A. L. Bancroft and the Park Commissioners, of Boston, showed topographical maps, and Pennsylvania a meteorological map. There was also exhibited a fine and exact relief map of the State of New York.

The French exhibit of literature consisted of a collective display of the Paris circle of publishers and the individual exhibits of about sixty firms. The leading publishers of Paris—Firmin-Didot, Hachette, Plon, Hetzel, and the rest—and several in the provinces, like Mame, of Tours, and Storck, of Lyons, had liberal exhibits of typography, bookbinding, cartography, etc. There were at least 2,000 volumes, including many of the choicest examples that have come from the French presses in recent years. The exhibits of bookbinding included some of the finest specimens of that art produced by Gruel, one of its chief representatives in Paris, whose collection, valued at \$15,000, contained rich specimens of tooled leather, carved ivory covers, silver-work clasps, and miniature painting. There were also exhibits of the bindings of Zaehnsdorf, both the inexpensive kind and the finer styles.

The most extensive exhibit of literature was that of the German publishers in the German Building, in which three hundred and thirty-three firms took part. The exhibit of Bernhard Tauchnitz alone contained upward of 2,000 volumes. An interesting part of the exhibit of the Imperial printing establishment was the galvanic work done by the pupils of the institute in their experiments on the substitution of iron for copper plates, which have

resulted in the production of plates that will give 5,000,000 impressions—five times as many as a copper plate. Helio-engravings from Chemesoff and other Russian artists, remarkable for clearness and beauty, were executed by this special process.

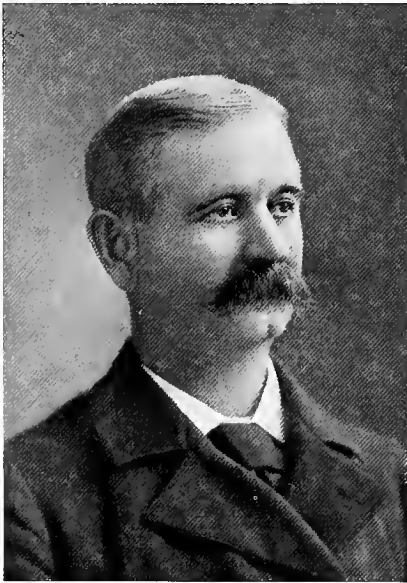
Group 151, embracing instruments of precision, experiment, research, photography, and photographs, contained the following classes: 865. Weights,



EXHIBIT OF D. APPLETON & CO., NEW YORK.

measures; weighing and metrological apparatus—balances of precision, instruments for mechanical calculations, adding machines, pedometers, cash registers, water and gas meters, etc.; measures of length, graduated scales, etc. 866. Astronomical instruments and accessories—transits, transit circles, mural circles, zenith sectors, altazimeters, equatorials, collimators, comet seekers. 897. Geodetic and surveying instruments—transits, theodolites, artificial horizons, surveyor's compasses, goniometers; instruments for surveying underground in mines, tunnels, and excavations; pocket sextants, plane tables and instruments used with them; ship's compasses, sextants, quadrants, repeating circles, dip sectors, etc. 868. Leveling instruments and

apparatus—hand levels, water levels, engineers' levels, of all patterns and varieties; cathetometers, leveling staves, targets, and accessory apparatus. 869. Hydrographic surveying; deep-sea sounding. 870. Photometric apparatus and methods. 871. Photographic apparatus and accessories; photographs. 872. Meteorological instruments and apparatus, with methods of recording, reducing, and reporting observations. Thermometers—mercurial, spirit, air; ordinary or self-registering, maximum and minimum. Barometers—mercurial, aneroid; anemometers, rain gauges, etc. 873. Chronometric apparatus—chronometers, watches of precision, astronomical clocks, church and metropolitan clocks, clepsydras, hourglasses, sun dials, chronographs, electrical clocks, metronomes. 874. Optical and thermometric instruments and apparatus. 875. Electric and magnetic apparatus. 876. Acoustic apparatus.



C. D. ARNOLD,  
Official Photographer.

There was a full representation of cash registers—the American, Boston, National, Standard, Chicago Autographic, John F. Greene's, and the instrument of the Dayton Company that registers in triplicate. George M. Eddy & Co. had a display of measuring tapes, and William A. Rogers one of standards of length and comparing and graduating machines. Felt & Tarrant exhibited the comptometer, a universal adding and calculating machine operated by a key, and the comptograph, which adds and at the same time prints a list of the items added.

Scientific apparatus for technical and educational work was shown by Queen & Co. and the McIntosh Battery and Optical Company. Exhibitors of surveyors'

and engineers' instruments were Buff & Berger, W. & L. E. Gurley, Young & Stevens, and Keuffel & Esser. Theodore Alteneder & Sons and the Ball-Ball Company exhibited drawing instruments. S. W. Robinson had a velocity meter and a templet odontograph. Davis & Cook showed spirit levels. Cameras and photographic apparatus were well displayed by the Eastman Kodak Company, the Blair Camera Company, and E. R. Andrews. E. & H. T. Anthony & Co., the Photo-Materials Company, and James H. Smith & Co. displayed photographic supplies, and Sweet, Wallach & Co. some specialties. Gundlach & Co. and some of the manufacturing opticians exhibited photographic lenses. G. Cramer had an exhibit of dry plates, and the Keystone Dry Plate Works showed gelatino-bromide and orthochromatic plates and celluloid films. The Keystone Blue Paper Com-

pany made an exhibit of photographic paper. The American Aristotype Company showed photographs on aristo paper. There were exhibits of platinotypes, aristotypes, albertypes, bromo enlargements, carbon prints, photogravures, etc., to illustrate all kinds of sensitized papers and all known processes of development or reproduction. Max Levy exhibited engraved photographic screens. The artistic side of photography was well represented by a great number of finished photographs shown by professional and some by amateur photographers, illustrating a great variety of treatment and effects. There were interesting collections of micro-photographs contributed by Carl T. Gramm, William H. Knapp, and the Illinois Microscopical Society. W. G. Bentley brought microscopic

preparations of chemical substances and V. A. La-

tham of histology and pathology. L. Manasse exhibited meteorological instruments, and the Northwestern University showed barometer and a printing chronograph. Telescopes were exhibited by Gundlach & Co., and, with astronomical apparatus and well, by Fauth & Co. John as geodetic instruments as spectroscopes, spectro- A. Brashear exhibited telescopes, and telescopes. The great telescope that Charles T. Yerkes presented to the Chicago University was set up, without the lenses, which were not yet completed. The tube, made with its machinery by Warner & Swasey, was mounted on an iron column weighing fifty tons. The tube is sixty-four feet long and fifty-two inches in diameter in the center, tapering toward the ends. It is controlled by three electric one-horse-power motors, one of which automatically winds the driving clock, keeping the tube in exact side-

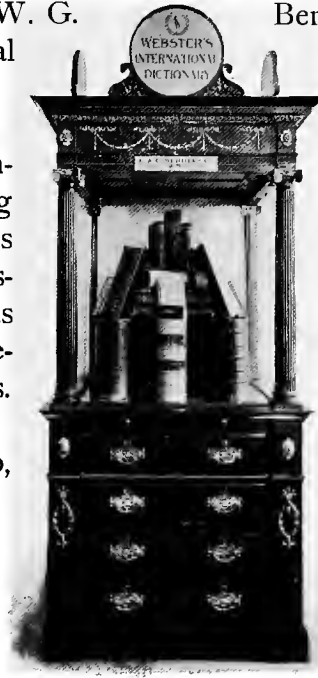


EXHIBIT OF THE G. & C. MERRIAM CO.,  
SPRINGFIELD, MASS.

real time.

Chronometer clocks were exhibited by Hezekiah Conant, of Pawtucket, and the Self-Winding Clock Company had a self-winding astronomical regulator. Optical goods of every variety were exhibited by Bausch & Lomb, the Geneva Optical Company, and L. Manasse in the greatest variety and of an excellence calculated to maintain the fame of the United States in this branch. The Gundlach Company obtained three awards for the excellence of their goods. The photographic lenses are peculiarly constructed to eliminate to a great extent the defects inherent in such lenses, and so that either the front or the back combination can be used as a separate objective, doubling the length of focus. The microscopes and portable telescopes were of high optical excellence. A unique feature of the display was an exhibit of Mangin mirrors, which ranged in size from thirty to seventy-five

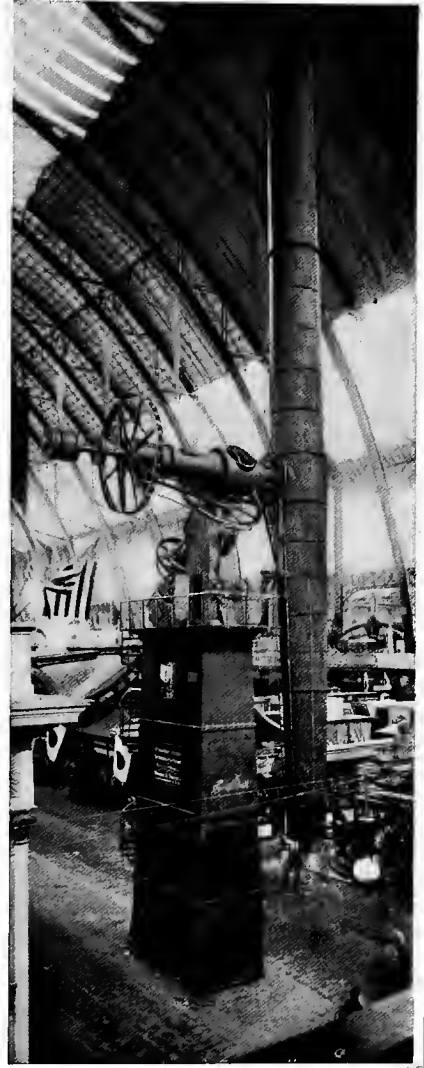
centimetres. Joseph Zeutmayer exhibited admirable microscopes, and E. H. Griffith showed some with objectives and turntables. E. B. Meyrowitz showed microscopes and microtomes. An exhibit of optical apparatus was made by the McIntosh Company, which had one of electrical apparatus also. F. A. Hardy & Co. showed oculists' instruments and apparatus for fitting the eye. Thermometers, with steam gauges, were shown by the Hohmann & Maurer Company. T. H. McAllister displayed stereopticons and magic lanterns. William H. Monroe and Benjamin F. Quimby had exhibits of microscopic slides of Illinois trees and of insects respectively. R. S. Rhodes exhibited audiphones. Some of the famous makers of optical instruments in Germany had a display in a spare corner of the Electricity Building of their telescopes, microscopes, and the like.

Group 152 embraced civil engineering, public works, and constructive architecture. It was arranged in the following classes: 877. Land surveying, topographical surveying—surveys and locations of towns and cities, with systems of water supply and drainage. 878. Surveys of coasts, rivers, and harbors. 879. Construction and maintenance of roads, streets, pavements, etc. 880. Bridge engineering (illustrated by drawings and models). Bridge designing—drawings and charts, showing methods of calculating stresses. Foundations, piers, abutments and approaches of stone, wood, etc. Arch bridges of stone, wood, or iron. Suspension bridges of fiber, iron chain, and cable. Truss bridges of wood, iron, and steel—pony, bowstring, and plate girders, lattice girders, Fink, Bollman, Howe, Pratt, Warren, Post, Long, Whipple, and other trusses of special design. Cantilever bridges, drawbridges, rolling and swinging machinery. Tubular bridges. Railway, aqueduct, and other bridges of special design not elsewhere classed. 881. Subaqueous constructions—foundations, piers, harbors, breakwaters, building of dams, waterworks, and canals. 882. Irrigation—irrigating canals and systems. 883. Railway engineering—surveying, locating, and constructing railways. 884. Dynamic and industrial engineering—the construction and working of machines; examples of planning and construction of manufacturing and metallurgical establishments. 885. Mine engineering—surveying underground, construction of tunnels, subaqueous tunnels, etc.; locating and sinking shafts, inclines, and winzes; driving levels, draining, ventilating, and lighting. 886. Military engineering—construction of earthworks, breastworks, and temporary fortifications. 887. Permanent works—fortifications, magazines, arsenals, mines. 888. Roads, bridges, pontoons, etc.; movement of troops and supplies. 889. Constructive architecture—plans of public buildings for special purposes; large and small dwelling houses. Drawings and specifications for foundations, walls, partitions, floors, roofs, and stairways. Estimates of amount and cost of material. Designs and models of special contrivances for safety, comfort, and convenience in the manipulation of elevators, doors and windows, etc. Working plans of the mason, carpenter, and painter; designs and models of bonds,



arches, coping, vaulting, etc. ; plastering and construction of partitions ; painting and glazing. Plans of appliances for hoisting, handling, and delivering building materials to artisans—scaffolding and ladders, special scaffolding for handling great weights ; portable cranes and power elevators. Illustrations of the strength of materials. Plans and sections of special architectural forms. Metallic floor beams and girders ; hollow bricks and other architectural pottery for heating and ventilation ; metallic cornice and conduits, shingles and sheathing, glass roofs, floors and accessories, architectural hardware. Methods of combining materials. Protection of foundations, areas, and walls against water. Working plans for paving and drainage.

The bulk of the exhibits in this group consisted of useful and ingenious improvements in house architecture to promote economy, safety, comfort, and convenience. I. L. Landis exhibited metallic curbing for streets, and the Wakefield Company sheet piling. Designs in school architecture were offered by F. S. Allen, designs for church furniture by E. Hackner, and architectural plans by Filippo Luigi Santi. A. Edgcumbe Rendle exhibited glass roofing, Samuel Loag a substitute for stained glass, the Bodine Roofing Company wood-fiber roofing, the Sykes Company iron and steel roofing in a pagoda house, the Byrkit-Hall Company wooden sheathing lath, R. Hoffheims wood floor covering, the Columbia Paving Company concrete paving, and George Poppert blinds, doors, and stairs. Mrs. Henry Dormitzer exhibited window seats and platforms of excellent design. James G. Wilson showed rolling shutters in steel and wood and blackboards and doors also. The Willer Company showed window blinds and screens, the Minneapolis Folding Shade Company its folding window shades, and Herring & Co. an automatic shade carrier. Reversible windows were exhibited by Francis V. and Mary A. Greene, Peter Habel, and Samuel C. Taylor. Mrs. J. H. Wolfenden showed an apparatus for removing and replacing windows. Models of a safety gravity elevator and



THE GREAT YERKES TELESCOPE  
OF THE UNIVERSITY OF CHICAGO.

of one with automatic floors for closing the elevator shaft to prevent falling or arrest the spread of fire, illustrated inventions of Mrs. Harriet Ruth Tracy. D. S. Arnold showed an ingenious water-closet indicator. William E. Wall had an exhibit of graining. Improved forms of the sash balance and lock were displayed by Washington Berry and the McMillan Company, and the Gardner Company showed another sash balance.

Group 153 was confined to exhibits illustrating government and law, classified as follows: 890. Various systems of government illustrated: government departments—legislative, executive, and judicial. 891. International law and relations—facsimiles of treaties, etc. 892. Protection of property in inventions, patent offices and their functions, statistics of inventions and patents. 893. Postal systems and the appliances of the postal service. Letter boxes, pouches, mail bags, postage stamps, etc. 894. Punishment of crime—prisons and reformatories, prison management and discipline, transportation of criminals, penal colonies, houses of correction, reform schools, naval or marine discipline, punishment at sea, police stations, night lockups, etc.; dress and equipment of prisoners, examples of convict workmanship.

Besides documents and statistics, there were found in this group the mail chutes and boxes manufactured by the Cutler Company, a new form of mail box designed by Mrs. James M. Stoner, and the mailing cases for liquids supplied by the United States Mailing Case Company, of Boston. The Russian Government exhibited the methods of carrying the mails by models of troikas and ox carts, sledges drawn by reindeer, mountain climbers in the Caucasus, and camels in Transcaucasia, even in boats rowed by women in Archangel.

Group 154 contained exhibits relating to commerce, trade, and banking, divided into the following classes: 895. History and statistics of trade and commerce. 896. Railway and transportation companies. 897. Methods and media of exchange—money, coins, paper money, etc. 898. Counting houses, stores, and shops—arrangement, furniture, fittings; methods of management, bookkeeping, devices for distributing change and goods to customers. 899. Warehouse and storage systems—grain elevators. 900. Boards of trade and their functions illustrated. 901. Exchanges for produce, metals, stocks, etc. 902. Insurance companies. 903. Banks and banking—illustrations of buildings, interiors, methods, and statistical information, clearing houses, etc.; savings and trust institutions. 905. Bookkeeping—books and systems of bookkeeping and accounting, commercial blank forms, etc. 906. Express companies, freighting, etc.

Useful mechanical aids employed in banking and mercantile business formed an interesting group. The Abbott Machine Company exhibited check perforators, dating perforators for railroad tickets, check punches made to suit the money of any country, canceling machines, and money changers. Another check punch was that of the Lightning Check Punch Company, and the Acme Company had a check perforator. The Bates

Company showed numbering machines. W. N. Durant had an exhibit of counters for printing presses, turnstiles, and the like. Cash and parcel carriers, mailing cases, etc., were displayed by the Lamson Company, of Boston, and the Lamson Store Equipment Company showed registering measuring machines. The National Time Register Company and the Standard Autograph Time Recorder Company exhibited their registers and recorders. A New York Company had an exhibit of vending machines. Mrs. James Cary, Jr., showed the chart and stamp system used by the Young Women's Christian Association. The system of the New York Life Insurance Company was illustrated by diagrams. The Office Men's Record Company exhibited a system for locating errors by an instantaneous index, and Horatio C. Burchard exhibited tables for computing bullion values.

Group 155 contained exhibits of institutions and organizations for the increase and diffusion of knowledge. Its classes were :

907. Institutions founded for the increase and diffusion of knowledge, such as the Smithsonian Institution, the Royal Institution, the Institute of France, British Association for the Advancement of Science, and the American Association, etc. ; their organization, history, and results. 908.

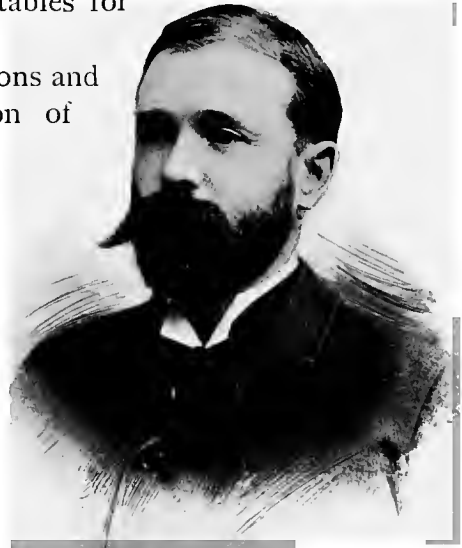
Academies of science and letters—learned and scientific associations, geological and mineralogical societies, etc. ; engineering, technical, and professional associations ; artistic, biological, zoölogical, medical, astronomical societies and organizations. 909. Museums, col-

lections, art galleries, exhibitions of works of art and industry ; agricultural fairs, State and county exhibitions, national exhibitions, international exhibitions, international congresses. 910. Publication societies. 911. Libraries—public and private ; statistics of operations.

912. Libraries—public and private ; statistics of operations.

The principal exhibits in this group were made by the Women's Educational Union, of Chicago, the Illinois Grand Lodge of Good Templars, and the State of New York, which presented a history of its soldiers' monuments.

Group 156 took in social, industrial, and co-operative associations, of the following classes : 912. Social organizations—clubs—political, military, university, travelers', press clubs, science clubs, and others. 913. Political societies and organizations. 914. Workingmen's unions and associations—their organization, statistics, and results. 915. Industrial organizations. 916. Co-operative trading societies. 917. Secret societies. 918. Miscel-



VICTOR F. LAWSON,  
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laneous organizations for promoting the material and moral well-being of the industrial classes.

Group 157 contained exhibits of religious organizations and systems—statistics and publications. The subdivision was as follows: 919. Religious organizations and systems. Origin, nature, growth, and extent of various religious systems and faiths. Statistical, historical, and other illustrations; pictures of buildings; plans and views of interiors. 920. Religious music, choirs, hymnology. 921. Missionary societies, missions, and missionary work; maps, reports, statistics. 922. Spreading the knowledge of religious systems by publications; Bible societies, tract societies, and their publications. 923. Systems and methods of religious instruction and training for the young; Sunday schools, furniture, apparatus, and books. 924. Associations for religious or moral improvement. 925. Charities and charitable associations connected with ecclesiastical societies.

The exhibits made by religious organizations consisted mainly of tracts and religious literature. The American Bible Society made a large display of English Bibles, and showed Bibles printed in two hundred and forty other languages, besides the translation for the Gilbert Islanders that had just been completed. The other exhibitors were the Catholic Historical Society, the American Humane Association, the Peace Society, the American Tract Society, the Church of Christ, the United Brethren, the Concordia Publishing House, the Congregational Denomination, the Lutheran Church, the Methodist Book Concern, the Methodist Episcopal Church, the National Christian Association, the National Temperance Society, the New Jerusalem Church, the Norwegian Lutherans, the Presbyterian Church, the Seventh-Day Baptists, the Society Apostleship of Prayer, the Unitarian Church, the Society of Christian Endeavor, the Universal Peace Union, and the Young Men's Christian Association. Frank Vanecek exhibited an altar and E. Hackner church furniture. The Methodist Book Concern made a full display, and there were collections of the books published under the auspices of the Methodist Church, of the Epworth League, the Church of Christ, and of those of the National Temperance Society and the National Christian Association. The American Bible Society had an exhibit covering its work during the seventy-six years of its existence. The American Tract Society showed a large collection of its publications, and along a corridor were ranged the books and periodicals printed for the Presbyterian, Congregational, Unitarian, New Jerusalem, United Brethren, and Seventh-Day Baptist denominations.

Group 158 comprised music and musical instruments—the theater. It was divided into classes as follows: 926. History and theory of music—music of primitive people. Crude and curious instruments. Combinations of instruments, bands, and orchestras. Music books and scores. Musical notation. History and literature of music. Portraits of great musicians. 927. Self-vibrating instruments—drums and tambourines; cymbals, trian-

gles, gongs, castanets, "bones." Bells, chimes, and peals. Bell-ringers' instruments. Musical glasses. Glockenspiels, xylophones, marimbas. Music boxes. 928. Stringed instruments played with the fingers or plectrum. Lutes, guitars, banjos, and mandolins. Harps and lyres. Zithers, dulcimers. 929. Stringed instruments played with the bow. The violin. The viol, viola, viola da gamba, viola di amore. The violoncello and the bass viol. Mechanical instruments—hurdy-gurdy and violin piano. 930. Stringed instruments with keyboard—the pianoforte, square, upright, and grand. Actions and parts of a piano. The predecessors of the piano—clavicytherium, clavicymbal, clavichord, manichord, virginal, spinet, harpsichord, and hammer harpsichord. Instruments and methods of manufacture. Street pianos. 931. Wind instruments with simple aperture or plug mouthpiece. The flute, flute-à-bec. Syrinx. Organ pipes. Flageolet. 932. Wind instru-



EXHIBIT OF O. NEWCOMBE & CO., TORONTO.

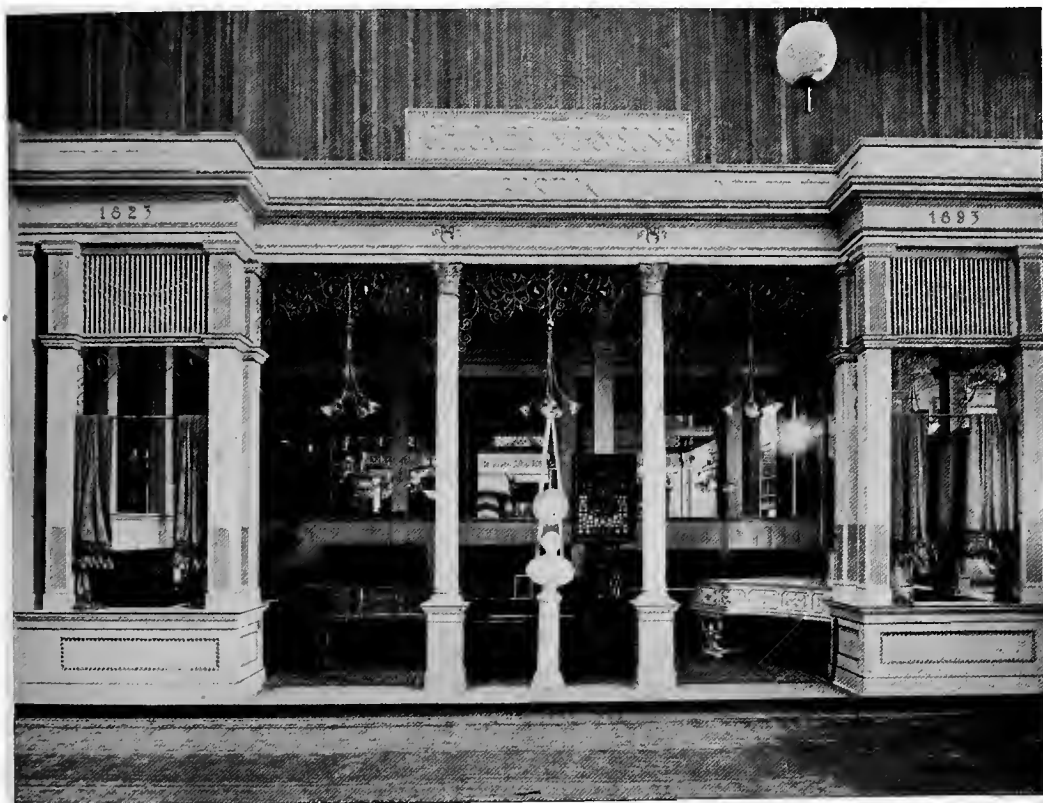
ments with mouthpiece regulated by the lips. The clarinet, oboe, and saxophone. 933. Wind instruments with bell mouthpiece, without keys. The trumpet (simple) and the bugle (oliphant). Alpenhorn. The trombone (with slide and with finger holes). The serpent, bassoon, and bagpipe. 934. Wind instruments with bell mouthpiece, with keys. Key bugles, cornets, French horns. Cornopeans, orphicleides. 935. Wind instruments with complicated systems. The pipe organ. Reed organs, melodeons, and harmonicas. Accordions, concertinas, and mouth organs. Hand organs and organettes. Automatic organs, orchestrions, etc. 936. Accessories of musical instruments—strings, reeds, bridges. Conductors' batons, drum majors' staves.

Mechanical devices for the orchestra. Tuning forks, pitch pipes, metronomes, music stands, etc. 937. Music in relation to human life—musical composers. Great performers. Great singers. Portraits. Biographies. Concerts and the concert stage. The opera. The oratorio. Masses. Church music and sacred music of all periods. Hymnology, ballads, folk songs, and folk music of all lands. National airs. 938. The theater and the drama. The stage. Plans and models of stages and theaters. History of the drama so far as can be shown by literary record. Portraits of actors. Relics of actors. Playbills, etc. Costumes, masks, armor. Scenery. Appliances of illusion, etc. Plays of all ages and people.

The liberal appropriation for music was handled by Theodore Thomas. The most famous and familiar oratorios and cantatas of Handel, Bach, Mendelssohn, Brahms, Berlioz, and other older and later masters were produced with impressive effect by well-schooled and artistic musical bodies, such as the Apollo Club, of Chicago, the Liederkranz, of New York, and the Cincinnati Chorus. The Exposition orchestra was composed of one hundred and fourteen players carefully selected in the United States and Europe, as accomplished a band of musicians as could be found in the world, who not only accompanied the choral works, but gave frequent orchestral concerts in which the best instrumental works of the masters of all schools were correctly interpreted. Besides the two fine halls for the serious performance of musical masterpieces, popular music of the best sort was constantly furnished from the three band stands by the Cincinnati band and two other military bands as good as any in the country. Festival Hall opened on May 22 with a magnificent programme of selections from Wagner, for it was his birthday.

The choral force of the Apollo Club was supplemented by the much larger Columbian Chorus and by a chorus of children, all trained by William L. Tomlins. And these formed the regular and resident vocal corps. Mmes. Materna and Nordica and other noted singers assisted in special musical festivals. Visiting orchestras, such as the New York Symphony Society and the Boston Symphony Orchestra and Kneisel's string quartette, played concerted pieces. Mr. Thomas yielded the baton at times to other conductors. Thus Dr. Richter, of Vienna, conducted a series of concerts during July. In the early autumn Dr. A. C. Mackenzie directed another series, and later M. Saint-Saens. The names follow of the vocal societies that contributed to carry out the magnificent musical scheme: The Apollo Club, led by W. L. Tomlins, the Germania Maennerchor, conducted by Henry G. Schoenefeld, both of Chicago; Theodore Thomas's Festival Association and the Apollo Club, led by B. W. Foley, both of Cincinnati; the Vocal Society of Cleveland, of which Alfred Arthur was the conductor; the Festival Association of Indianapolis, directed by F. X. Ahrens; the Choral Union of Ann Arbor and the Musical Society of Detroit, both trained by Albert A. Stanley; the Milwaukee Arion Club, having Arthur Weld for leader; Samuel V. Baldwin's Musical Associations of St. Paul and Minne-

apolis ; Joseph Otten's Choral Symphony Society of St. Louis ; the Mozart Club of Pittsburg, conducted by James P. McCollum ; the Baltimore Oratorio Society, under the direction of Fritz Fincke ; the Orpheus Club, directed by Michael Cross, and the Mendelssohn Club, directed by W. W. Gilchrist, both of Philadelphia ; the Vocal Society and the Liedertafel of Buffalo, both conducted by Joseph Mischka ; the Orpheus of New York and the Musical Association of Albany, both of which had Arthur Mees for leader ; Dudley Buck's Brooklyn Apollo Club ; the Rubinstein Club, Metropolitan Musical



PAVILION OF CHICKERING & SONS, BOSTON.

Association, and Apollo Club, all three directed by William R. Chapman ; Frank Damrosch's Musurgia ; the Mendelssohn Glee Club, conducted by Joseph Mosenthal, the Arion, under the leadership of Franz van der Stuckin, the Deutscher Liederkrantz, conducted by Heinrich Zoellner, and the Oratorio Society, directed by Walter Damrosch, all New York societies ; the venerable Handel and Hayden Society of Boston, led by Carl Zerrahn, and the Salem Oratorio Society and the Worcester County Musical Association, both of which have him for their leader also ; the Apollo Club and Cecilia of Boston, both directed by Benjamin J. Lang ; the Hampden County Musical Association of Springfield, conducted by G. W. Chadwick ; the Portland Haydn Society, conducted by Hermann Kotschmar ; the Arion



of Providence, led by Jules Jordan ; and D. W. Loring's Loring Club, of San Francisco.

The instrumental organizations that took part in the musical performances during the Fair were, besides Theodore Thomas's Chicago Orchestra : The Symphony Orchestra of St. Louis, of which Joseph Otten was director ; the New York Philharmonic Society, trained and conducted by Anton Seidl ; Walter Damrosch's Symphony Society, of New York ; the Peabody

Orchestra from Baltimore, having Asgar Hamerik for leader ; and the Symphony Orchestra, directed by Arthur Nikisch, and the Mendelssohn Quintette Club, of which Thomas Ryan then was conductor, both of Boston.

Bagpipers tramped up and down in front of two or three of the shows. There were a Turkish, an Egyptian, and an Algerian orchestra, all three of the same model, consisting of a gigantic mandolin, a violin played like a cello, and drums beaten by hand. A Chinese orchestra invited people into the theater where the popular dramas of the Ce-



PAVILION OF HARDMAN, PECK & CO., NEW YORK.

lestial Kingdom were rendered to the accompaniment of a very large orchestra of strange, high-keyed instruments. Equally strange, but softer and more agreeable to the Western ear, was the music of the Javanese theater, produced by mild flutes, a series of zithers, and a kind of violin. In the German and Austrian villages a number of military bands gave music of a high class every day under the leadership of accomplished musicians.

Oliver Ditson & Co., S. Brainard's Sons, and the Thompson Music Company had exhibits of sheet music and books, and Clayton F. Summy, publisher of the Musical Review, exhibited music books and education material. C. J. Heppe & Son exhibited a musical chart. The Clinton H.

Meneely Company manufactured the chime of bells that were rung in the central clock tower, and Vanduzen & Tift cast those that played chimes in the southeast bell tower of Machinery Hall. Joseph Bohmann displayed a collection of his mandolins, zithers, guitars, and banjos, and one of violins, violas, and cellos. L. P. Wildman exhibited some of his violins. Albert Krell also made an exhibit. August Gemunder & Sons had a choice display not only of violins, but of cellos, violas, guitars, and other stringed instruments. John Friedrich & Brothers exhibited their violins, violas, etc. John C. Haynes & Co. exhibited guitars, banjos, mandolins, zithers, and violins. Hartmann Brothers & Reinhard had one of guitars, zithers, and mandolins. S. S. Stewart showed a variety of banjos. The Lion Company had guitars and mandolins as well as banjos. Banjos and banjorines were displayed by F. W. Kreling & Sons. Eugene J. Albert exhibited violins, violas, cellos, etc., and an improved violin tailpiece; Lyon & Healy displayed the Washburn guitars, banjos, and zithers. Mandolins and mandolas were shown by Angelo Manello. The phonoharp was displayed, with zithers, by the Phonoharp Company. Joseph Rogers, Jr., exhibited banjo and drum heads. A collection of guitars was shown by John W. Banks.

While some of the noted manufacturers of pianos withdrew, the instruments of Chickering & Sons, the Schubert Company, Charles M. Stieff, Julius Bauer & Co., the Schomacker Company, J. & C. Fischer, Boardman & Gray, the Everett Company, Hardman, Peck & Co., Henry F. Miller & Sons, C. Meyer & Sons, A Reed & Sons, Sohmer & Co., the Knell Company, Adam Schaaf, the Mehlin Company, Ivers & Pond, Jacob Brothers, C. Hintze, J. Evetts, Jr., the Colby Company, Hallet & Davis, Kranich & Bach, Keller Brothers & Blight, Francis Bacon, Behr Brothers, the Bush & Gerts Company, the A. B. Chase Company, Chase Brothers, the Shaw Company, James M. Starr & Co., Starck & Strack, Wegman & Co., Vose & Sons, C. A. Gerold, the Consolidated Manufacturing Company, E. G. Harrington & Co., and the Estey Company maintained sufficiently the reputation that American piano makers have long held of producing instruments of the fullest and richest melodious tone, and, where cheapness is desired, the sweetest and most durable of cheap instruments. Numerous new improvements were shown, such as the patent tuning fork fastening on the Wegman piano. Alfred Dolge & Son exhibited felt hammers and other pianoforte materials, Herrburger-Schwander & Son and Wessell, Nickell & Gross actions and parts, Strauch Brothers piano actions, and the Trenton Iron Company music wire.

Mason & Hamlin made an elaborate display of organs and pianos, and received a diploma for their patented method of stringing pianos that holds the strings more securely and keeps the instrument long in tune. George P. Bent, the Chicago Cottage Organ Company, W. W. Kimball, the Needham Company, B. Shoninger, and the Waterloo Organ Company also exhibited pianos and reed organs. The Malcolm Love pianos, made by the

last-named, contains a harmony attachment, a very loud pedal that automatically silences discords, invented by James H. Phelps. The Automaton Piano Company exhibited pianos with the automaton attachment. C. F. Zimmermann Company exhibited the autoharp, an instrument shaped like



DISPLAY BY THE MASON & HAMLIN ORGAN AND PIANO CO., BOSTON.

a zither, having bars or padded mutes, which, in connection with a system of figured music, enables any person to play comparatively difficult airs and chords. The Estey Company made an elaborate display of reed organs for halls and homes. E. P. Carpenter, the Columbian Company, the Lawrence Organ Company, Mason & Risch, H. Lehr & Co., the Fort Wayne

Organ Company, the Story & Clark Company, and the Western Cottage Organ Company exhibited reed organs. The organs of Newman Brothers have patent air-circulating reed cells, giving a melodious pipe tone. A similar pipelike quality distinguishes the Peloubet church organs of Lyon & Healy. The latter firm and Henry Pilcher's Sons, of Louisville, exhibited pipe organs.

Drums and cymbals, with other band instruments, were shown by Lyon & Healy, who had further a varied collection of musical accessories. J. W. Pepper and C. G. Conn exhibited band instruments. Harry Coleman displayed various brass instruments, and J. Howard Foote, besides collections of flutes and of stringed instruments, exhibited cornets, horns, etc. John Albert had a double-bass viol. J. W. Pepper made a good display of band instruments. A music leaf turner was exhibited by the Ledden & Hernon Company; a music cabinet attachment by Libbie Pick. The Tonk Company had music stools and cabinets. An exhibit of tuning forks was made by Levi K. Fuller. M. Steinert, of New Haven, loaned a fine historical collection of clavichords, spinets, virginals, harpsichords, hammer claviers, and pianofortes. M. J. Partello, of Washington, contributed his collection of violins.



Gymnastic apparatus shown by the Narragansett Machine Co., Providence, R. I.

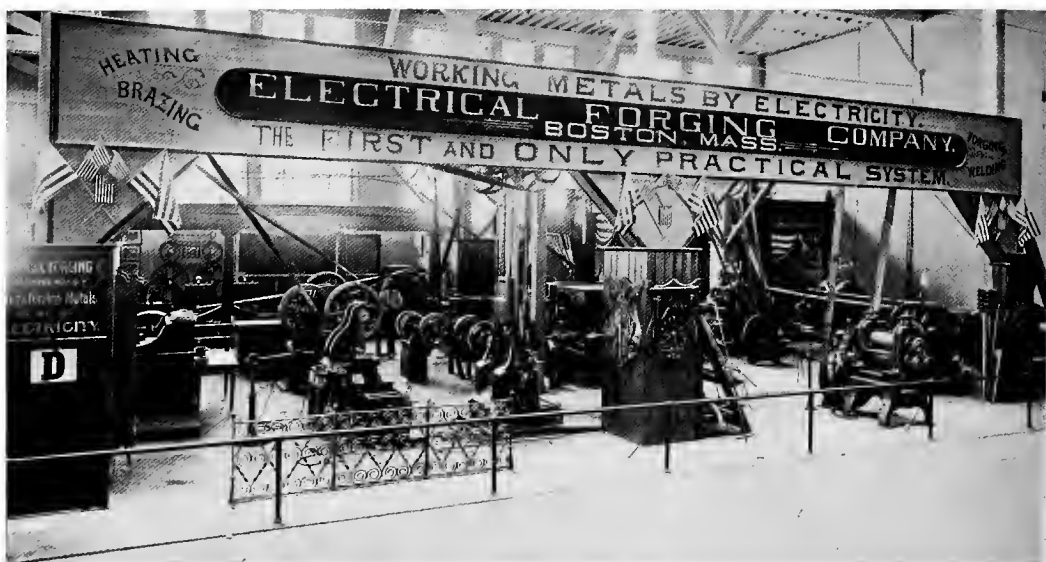


Exhibit of the Electrical Forging Co., Boston.

## CHAPTER XII.

### THE ELECTRICAL EXHIBIT.

Comprehensiveness of the exhibit—Advance of the Exposition of 1893 over that of 1876

—Motors used by the Exposition and exhibitors—Participation of foreign countries—

Group comprising apparatus illustrating the phenomena and laws of electricity and

magnetism—Group devoted to apparatus for electrical measurements—Group con-

sisting of electric batteries—Group embracing machines and appliances for producing

electrical currents by mechanical power—Group dealing with the transmission and

regulation of the electrical current—Group of electric motors—Group covering the

application of electric motors—Group comprising lighting by electricity—Group

embracing heating by electricity—Group comprising electro-metal-

lurgy and electro chemistry—Group composed of electric forging,

welding, stamping, tempering, bracing, etc.—Group compris-

ing the electric telegraph and electric signals—Group com-

prising the telephone and its appliances—Group embrac-

ing electricity in surgery, dentistry, and therapeutics

—Group composed of the application of electricity in

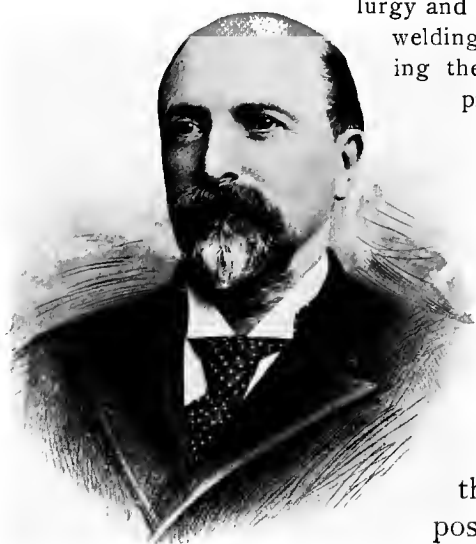
various ways not hereinbefore specified—Group devo-

ted to the history and the statistics of electrical

inventions—Group devoted to the progress and de-

velopment in electrical science and construction,

as illustrated by models and drawings.



ROBERT C. CLOWRY,  
Member of the Directory.

THE development of trolley railroads, improvements in electric lighting, the transmission of power by electricity, the use of the storage battery for limited purposes, the long-distance telephone, the utilization of electricity for the development of heat, and the new invention of electric forging and welding,

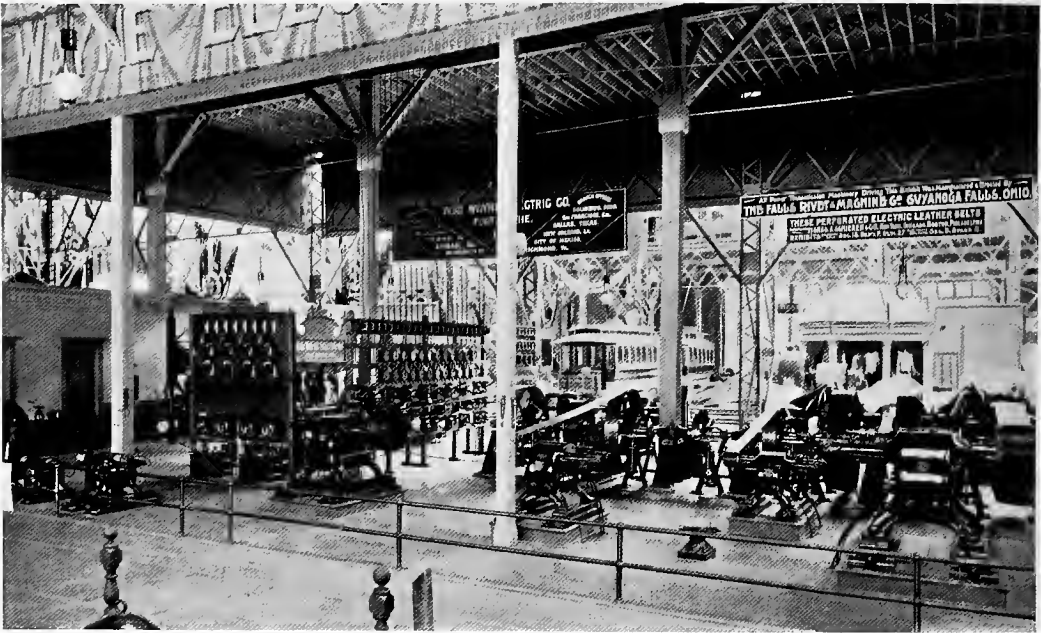
were the principal achievements in the practical application of electricity made between 1876 and 1893. The show of electrical appliances and systems, although limited to comparatively few firms, was remarkably comprehensive, covering practically every recent advance in applied electrical science.

The chief advance of the Exposition of 1893 over that of 1876 lay in the development of electricity as an agent in the transmutation, transmission, and distribution and application of power. When President Cleveland pressed an electric button, and by that touch turned the wheel of the Allis engine of two thousand horse power one thousand feet away and started the fountains, he set in motion not more than a fifteenth part of the total electric and power plant of the Exposition. As no steam was permitted in the Electricity Building, all the generators there shown in operation were driven by electric motors deriving their currents from the main generating plant in Machinery Hall. These generators, in order to have a continuous load, not infrequently supplied current to other motors, besides furnishing the individual lighting supply of the various exhibitors. Thus an exhibit generator, operated by derived electricity, became a subordinate central station, as in the cases of the Fort Wayne Electric Company and the Western Electric Company. All the direct-current incandescent lighting in the Electricity Building and a considerable proportion of the alternating-current incandescent and the direct-current arc lighting of individual exhibitors were thus provided. The power generated primarily for lighting was employed in part by exhibitors or *concessionnaires* for other purposes. For instance, four 150-kilowatt Edison generators that supplied a current to the electrical fountains were employed after ten o'clock at night to charge the storage batteries in the fifty-eight electrical branches, each of which was equipped with a four-horse-power motor. The Westinghouse Company used two of the single-phase lighting circuits to supply currents to its polyphase power plant, which was the central figure of its display in the Electricity Building. Other lighting as well as power currents were transformed in like manner by other exhibitors, so that the actual horse power of motors in operation in the building was greatly in excess of the capacity of the generators used simply for power purposes, and probably reached nearly nine thousand horse power. The work performed embraced almost every variety for which mechanical power can be used in the arts. The Exposition used one hundred and three motors, with an aggregate of eighteen hundred and eleven horse power, and exhibitors two hundred and twelve motors, aggregating five hundred and thirty-eight horse power, and a number of exhibitors in the Electricity Building had one large motor connected to the Exposition circuit and operating smaller motors. Except the roller chairs and the few steam launches, every means of transportation used at the Fair was operated by electricity.

The hope of American electricians that European companies would

make a typical exhibit of their machinery and practice, so that a comparison could be made between their machinery and ours, was disappointed. Germany alone, represented by its two great houses, made an interesting and valuable display, though a small one, of massive dynamos and arc lights and many devices for measuring the electric current and testing lines. England showed absolutely nothing, and France exhibited only a few generators with direct and alternating currents, and these performed no useful or instructive functions.

The Department of Electricity was divided into eighteen groups. Group 122 comprised apparatus illustrating the phenomena and laws of electricity



DISPLAY OF THE FORT WAYNE ELECTRIC CO., FORT WAYNE, IND.

and magnetism, of which the following classes were made : 757. Statical electricity. 758. Thermal electricity ; thermo-electric batteries. 759. Magnets, temporary and permanent. 760. Induction coils, converters, etc.

Statical apparatus was exhibited by E. S. Greeley & Co., with magnets and induction coils. The Pratt Electro-Medical Supply Company had exhibits of statical electricity and of thermo-electric batteries, with temporary and permanent magnets and induction coils. The Standard Underground Cable Company exhibited static arresters. Another exhibit of statical electricity was made by the Stanley Company, which showed transformers and induction coils. The Belknap Motor Company exhibited magnets ; Edwards & Co., a Ruhmkorff coil ; Wait & Bartlett, an induction machine ; the William Powell Company and the Anthony Electric-Instrument Company, induction coils ; the Diamond Company, induction coils and converters ; the



Electrical Forging Company and the Equitable Dynamo Company, converters; the Electrical Appliance Company, Elwell-Parker Company, and Taylor, Goodhue & Ames, transformers; the Thomson Electric Welding Company, induction coils and transformers; and the Fort Wayne, the General Electric, the Brush, the Western Electric, and the Westinghouse Companies, their forms of magnets and induction coils and systems of converters, transformers, and discharging apparatus. The McIntosh Battery Company had an exhibit illustrating the laws of electricity.

A puzzling object was the Columbus egg in the Westinghouse light exhibit, illustrating the effects of the two-phase rotary current, which was generated by a pair of large induction coils. Metallic objects began to spin round as soon as they were placed on a wooden table above these. Two copper eggs—one eight inches long and the other small—as the whirling motion increased, turned up on end and continued to spin. In the room provided for the exhibition of high-tension currents a series of transformers and Leyden jars was so arranged as to give heavy discharges over glass and rubber plates.

Group 123 was devoted to apparatus for electrical measurements, of which the classes were: 761. Standard resistance coils. 762. Standard condensers. 763. Standard batteries. 764. Instruments of precision—voltmeters, ammeters, wattmeters, etc.

Resistance coils and condensers were exhibited by the principal manufacturers, together with measuring and recording apparatus and standard testing instruments. Some of the exhibitors of batteries were E. S. Greeley & Co., C. J. Hirlemann, and Queen & Co. The Ansonia Company showed the Wirt voltmeter, direct and alternating ampère indicator, and portable testing set. J. H. Bunnell & Co. showed the rheostat and galvanometers used in the Naval Observatory. The Anthony Company exhibited galvanometers and differential indicators. George Cutter, the Electric Appliance Company, the Sloss Company, the Standard Company, and James White were some of the exhibitors of voltmeters and ammeters. J. C. Vetter and Waite & Bartlett exhibited milliamperemeters. The Weston Company exhibited bridges and Megohm boxes, standard cells, and wattmeters. Charles E. Lee showed a new battery test. An electric recording compass and recording log was the invention of Charles L. Jaeger. The Bristols' Company, of Waterbury, exhibited one of their new recording voltmeters, and two of these, one for direct and one for alternating currents, were used by the Committee on Awards in connection with life tests for incandescent lamps.

Group 124 consisted of electric batteries, primary and secondary.

The American Battery Company, the Elgin Telephone Company, E. S. Greeley & Co., Queen & Co., and the Western Electric Company exhibited primary and secondary batteries. Primary batteries were shown by the Hanson Company, C. J. Hirlemann, Joseph M. Hirsh, the International

Automatic Light and Power Company, James K. Pumpelly, the S. S. White Company, and J. C. Vetter & Co. The Union Electric Works showed the batteries of Walter A. Crowdus. The Mason Electric Company showed battery powder and zinc amalgamating powder with their batteries. The National Carbon Company showed carbon elements. The Ansonia Company exhibited a carbon open-circuit battery for burglar alarms, bells, clocks, telephones, gas lighting, etc., and the Leclanche Company showed the Leclanche cell battery for the same uses. Richard Pfund had a



DISPLAY OF QUEEN & CO., PHILADELPHIA.

plunge battery. Dry batteries were shown by J. L. Booth, William Burnley, and the Sloss Company. The Edison-Lalande single-solution non-polarizing battery was a notable exhibit, the special features being the steadiness and the intensity of the current, which could run an electric fan for a remarkable number of hours. G. F. Webb and the Pratt Company exhibited galvanic batteries.

The storage of electric energy received less attention at the Exposition than its importance in electric progress should indicate, owing to the fact that electric storage had not proved a commercial success in America. Nevertheless, there was one extensive demonstration of stored electricity in the fifty pleasure launches operated by storage batteries on the canals. The latest forms of storage batteries were shown in the Electrical Building by the Consolidated Electrical Storage Company, the Ford-Washburn Company, E. B. Meyrowitz, and the Union Electric Company.

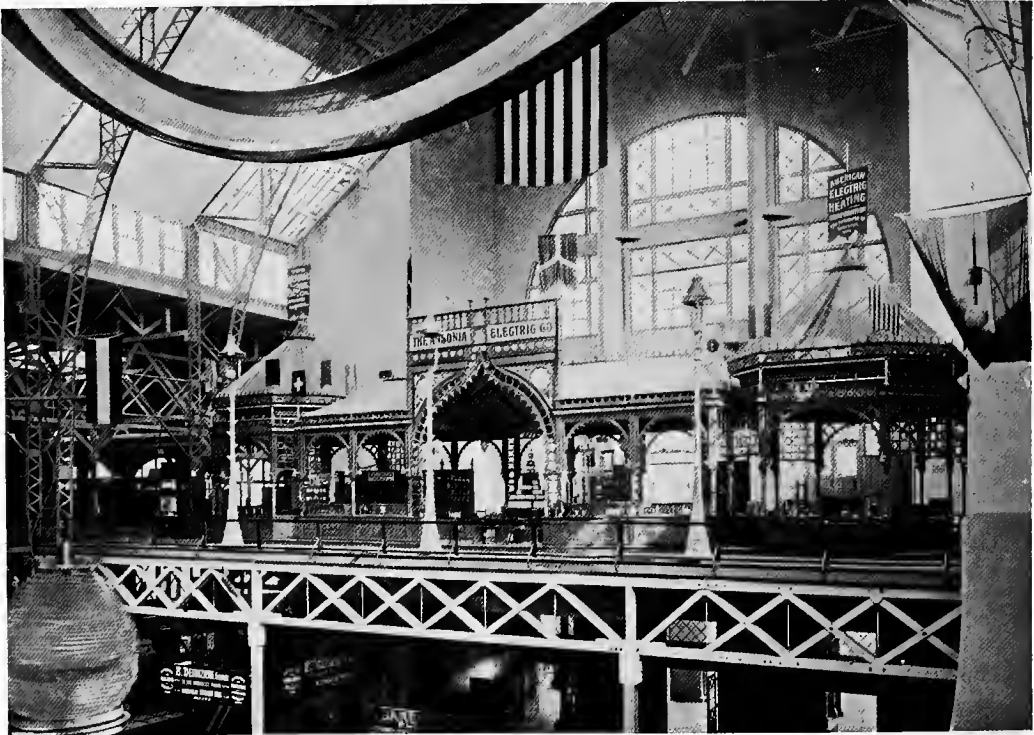
Group 125 embraced machines and appliances for producing electrical currents by mechanical power—dynamical electricity. The classes were: 765. Dynamos of direct current, constant electro-motive force; varying quantity. 766. Dynamos of direct currents, constant quantity, and varying electro-motive force. 767. Dynamos of alternating current, constant electro-motive force, and varying quantity. 768. Dynamos of alternating current, constant quantity, and varying electro-motive force.

The electric power generators for the Exposition were engaged from the Mather Company, the Eddy Company, the C. & C. Motor Company, the Westinghouse Company, and the General Electric Company. The power generators were located at the east end of the plant. There were four Mather generators, having a total of 800 horse power, driven by two tandem-compound Woodbury engines from the Stearns Company. Four C. & C. generators of 100 horse power each were driven by two Ide engines, one simple and one tandem-compound. Four Eddy generators of 250 horse power each were driven by Phoenix engines. There were four Edison 250-horse-power generators, driven by a Ball cross-compound and an Armington & Sims simple engine. An Edison double multipolar generator aggregating about 1,000 horse power was driven direct by a triple expansion engine made by the General Electric Company. These electric-power generators furnished current for motors driving line shafts, elevators, and machinery in the Manufactures, Agriculture, and other buildings, and for charging the storage batteries of the electric lanuches. The E. P. Allis Company had a 500-horse-power cross-compound engine with a Westinghouse multipolar railway generator on the engine shaft. Besides two C. & C. generators of 80 kilowatts each, and two Western Electric of  $137\frac{1}{2}$  kilowatts which had a voltage of 250, and one 80-kilowatt National and one 40-kilowatt Jenney of double this voltage, every generator at work in the building developed a current of 550 volts. They were: One Wood of 500 kilowatts, one Westinghouse of 373, two Mather of 225 each, four Eddy of  $186\frac{1}{2}$  each, two Mather of 120, and four C. & C. generators of 80 kilowatts—making the total power 2,804 kilowatts.

In the Westinghouse exhibit ten 1,000-light dynamos were coupled direct to a 1,000-horse-power compound engine, each dynamo having a capacity of 15,000 lamps of sixteen-candle power and weighing 150,000 pounds, with an armature weighing 42,000 pounds. The Intramural Railway had its own boiler and engine plant and its separate generating plant, which had a total capacity of 3,700 kilowatts.

The Brush Company, the pioneer in arc lighting, had a full exhibit of dynamos and lighting apparatus. The earliest Brush dynamo, built in 1876, differs from the latest in scarcely any particular, save that it had a Gramme armature, whereas now a laminated-core armature is used, with open coils. The latest was probably the largest arc dynamo yet constructed, having a capacity of 125 full arc, or 2,000 candle lights, making 525 revolutions a

minute, and giving nine and six tenths ampères at 6,250 volts. It is a four-pole machine, using two sets of brushes. The shaft is direct connected to a Williams engine set upon the same base, which works at a steam pressure of 160 pounds. Sixteen dynamos of the ordinary capacity of 65 lights were placed in Machinery Hall and used in lighting the grounds. The distinguishing features of the Brush dynamos were their simplicity, flexibility, and ease of repair. Like flexibility was noticed in the apparatus for incandescent lighting on the alternating system. An alternating dynamo for 3,000 lights, giving a current of 2,000 volts, had a stationary armature with ten bobbins.



PAVILIONS OF THE ANSONIA ELECTRIC CO., CHICAGO.

The same company showed direct-current incandescent lighting apparatus; a machine for 2,000 lights, having only one turn of wire on the bobbin, one for 1,000 lights having two turns, and smaller machines more.

The demand for electric power has led to the introduction of power generators and to the making of motors adapted to various purposes and used in connection with the generators. A Brush generator of one hundred and thirty horse power, giving a direct current of 1,000 volts, is a type that has come into extensive use for heavy work, such as pumping in mines. A mining motor, compact and steel-clad, giving 220 volts and running at only 700 revolutions, was of nine horse power.

The General Electric Company made a complete exhibit of dynamos, and so did the Card Company, the Elwell-Parker Company, the Equitable Com-

pany, E. S. Greeley & Co., and the Wagner Company. The Fort Wayne Company showed railroad and power generators, arc dynamos, and alternating dynamos on the Wood system, of high electrical efficiency. Direct-current dynamos were exhibited by the Belknap, Elektron, Ford-Washburn, Hanson & Van Winkle, Pratt Short Electric Railway, Sloss, Standard, L. J. Wing, and Zucker & Levett concerns. Motor dynamos were shown by the Crocker-Wheeler Company and arc dynamos by the Excelsior Company. The National Carbon Company exhibited carbon brushes. Queen & Co. had cradle dynamometers. Exhibitors of alternating dynamos were the Electrical Forging Company and S. M. Pierce.

In the German section Siemens & Halske showed three-phase motors and transformers. In a step-down transformer for inside and a step-up for outside use, both of 50,000 watts capacity, air alone was used for insulation. A three-phase motor of sixty horse power had a startling arrangement consisting of a ring fastened to the armature shaft and revolving with the armature, which by means of conical bearings, screwing in or out, breaks or throws together the armature circuits. A three-phase motor mounted on a street-car truck and designed for a 600-volt circuit, dust and weather proof, though having external fields, had a capacity of twenty horse power, which could be trebled by the triangular connection; the motor was attached to one axle by a worm gear.

The German General Electric Corporation, which made the plant for the Lauffen experiment of transmitting 3,000 horse power at 30,000 volts to the Frankfort Exposition, had three-phase motors more effective than the ones then used. This company showed electric clocks controlled by a lamp circuit from a central station and set automatically to the right time by lowering the electro-motive force of the generators. This exhibit contained several new features that were previously unknown in the United States. One was the adoption for the fields of direct-current motors and generators of Dobrowolski's polar ring, consisting of a cylinder of soft iron about an inch thick that envelops the armature and connects with the pole pieces of the field magnets. The object of it is to prevent sparking, and its efficacy in that respect is said to more than compensate for the magnetic short circuiting that it induces. A novelty of real merit was a flexible coupling for directly connecting two shafts, consisting of two heavy iron disks, one of which has upon its face a series of radial slots, and the other a series of brushlike rays of several thicknesses of sheet-iron gearing with the slots and so flexible as to work even if the shafts are perceptibly out of alignment and to take up any moderate sudden strain or slip the cogs and take them up again in case of excessive strains.

A two-pole dynamo in the English section of Machinery Hall generated electricity at the rate of eighty-five per cent of the indicated horse power of the engine to which it was attached.

Group 126 dealt with the transmission and regulation of the electrical

current, and was divided as follows : 769. Cables, wires, and insulaton ; rheostats, switches, indicators, registering meters; ammeters, voltmeters. 770. Safety and protective appliances ; lightning rods, lightning arresters, insulators, fusible cut-outs, safety switches, etc. 771. Conduits, interior and underground.

The Ansonia Company exhibited moisture-proof insulated copper wires and cables ; Benham & Burnham, a feed wire for electric railway tracks ; W.



VIEW IN THE GERMAN SECTION.

R. Brixey, Day's insulated electric-light wires and feeders ; the Bi-Metallic Wire Company, a copper wire with a steel core. Insulated conductors were shown by the Campbell Electric Supply Company ; submarine, conduit, and overhead wires and cables, by the Enterprise Electric Company ; rubber insulation and wire, by the Indiana Rubber and Insulated Wire Company and the India-Rubber Comb Company ; cables and wires, by the New York Insulated Wire Company ; electric cables and cords, by the India-Rubber and Gutta-Percha Insulating Company ; electric-light cables, by the Norwich Insulated Wire Company ; wire rope, by A. S. Leschen & Sons Company ; okonite wires, by the Okonite Company ; light cables and wires, by the Washburn & Moen Company ; cables and cable boxes, by the Standard Underground Cable Company ; wires and cables, by Taylor, Goodhue & Ames ; insulating sheets and vulcabeston, by the H. W. Johns Company ; supplies and appliances, by Roessler & Hasslacher ; insulating compounds and

tape and paper, by the Standard Paint Company; braiders, winders, and measuring tools, by the New England Butt Company; insulating compounds, by the Massachusetts Chemical Company and the Johns Pratt Company; copper for bearings, by the Eureka Tempered Copper Company; wires and supplies, by the Chicago Electric Wire Company; celluloid for insulation, by the Celluloid Zapon Company.

Rheostats, switches, indicators, and registering meters were exhibited by the Anthony, Bryant, Brush, Central Electric, C. & C., Electrical Forging, Enterprise, Fort Wayne, General Electric, E. S. Greeley, Mather, Thomson Welding, and Western Electrical Companies. James White showed electrometers, rheostats, and indicators; J. Lang, single and double pole switches; Pass & Seymour, cut-outs and switches; H. T. Paiste, switches and meters; the McIntosh Company, rheostats and rheotomes; McDougall & Cummings, rheostats and starting boxes; J. C. Vetter & Co., a carbon current controller; George S. Searing, incandescent switches; C. S. Van Nuis, O. S. Platt, and the Electric Specialty Company, various switches; the Electric Appliance Company, switches for arc and incandescent lighting; the Cutter Electric Company, a push and key switch; the Carpenter Enamel Rheostat Company, the Curtis Company, and George Cutter, rheostats; the Railway Equipment Company, resistance boxes, insulators, and switches; Queen & Co., meters and balances; the McNeill Tinder Company, indicators and meters; and Charles L. Jaeger, an automatic current regulator. T. J. Murphy showed a novel switchboard.

The Westinghouse dynamos were controlled from the largest switchboard ever constructed. It was made of white marble, in two sections, the lower one controlling the dynamo loads and the exciter wires and the upper one the line mains. Nearly two hundred and fifty cables ran from the board.

The Brush Company had a fine exhibit of switchboards for electric lighting. One built for an alternating current plant of 30,000 lights' capacity in Manila had panels, each representing a dynamo, which could be moved along when another dynamo was added without change of wires. A feature of the arc switchboard was the placing of live currents at the back of the boards, where they can not injure even a careless operator.

The Brush arresters and safety appliances, the safety appliances, lightning arresters, and cut-outs of the Anthony Company, the Mather Company, the Western Electric Company, the General Electric Company, the Standard Electric Company, and the Stanley Company insulators, fusible cut-outs, and safety switches of the Electrical Forging Company, protective appliances of the Ellwell-Parker Company, electric-light locks of the Electric Selector and Signal Company, and the non-arcing, the tank, and the discharge lightning arresters, and other protective and controlling appliances of the Westinghouse Company formed very complete exhibits. E. S. Greeley & Co. exhibited lightning-rod supplies and protective fuses; the Gould Company, a



controlling apparatus on a triplex electric tank pump; the Hope Company, cut-outs and safety switches; Charles E. Lee, an automatic battery cut-out; the Railway Equipment Company, fuse wire, brackets, and hangers; W. A. Vail, swinging-ball lightning arresters; N. C. Gault & Co., the Schoonmaker lightning rods, with machine at work; the Munson Company, improved lightning conductors; the Fort Wayne Company and the Electric Appliance Company, other lightning arresters. The Electric Heat Alarm Com-

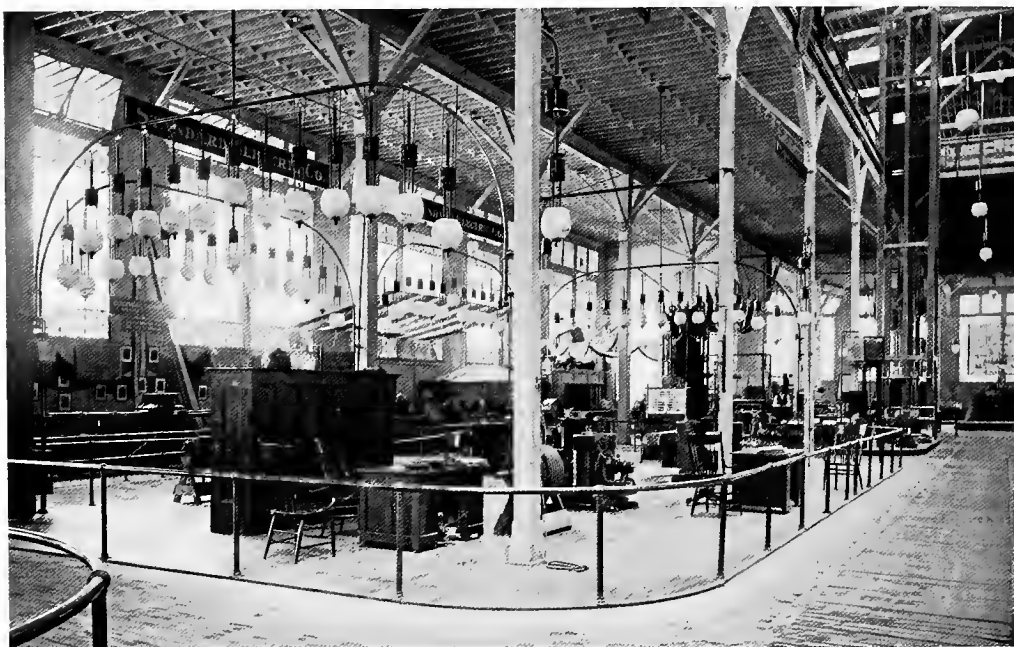


EXHIBIT OF THE STANDARD ELECTRIC CO., CHICAGO.

pany showed appliances for warning against fire. The Empire China Works showed hard-porcelain electrical supplies; the India-Rubber Comb Company, non-conducting tubing and sheeting; H. W. Johns Company, molded mica and asbestos; the Pendleton Works, cast glass; the Massachusetts Chemical Company and the Standard Paint Company, armature varnish and paints. The Safety Insulated Wire and Cable Company supplied the Exposition with one hundred miles of lead-covered underground conductors for arc-light circuits, two hundred miles of rubber-covered overhead conductors for arc lights, three hundred miles of telephone wire, and forty miles of insulated underground conductors for police and as much more for fire-alarm service. Conduits of various kinds and materials were shown by the Central Electric Company, Electrical Conduit Company, Chicago Electric Wire Company, Fiber Conduit Company, Indiana Rubber Company, H. W. Johns Company, New York Insulated Wire Company, Standard Electric Company, and Western Electric Company.

Electric wire for all purposes was exhibited by Felton & Guillaume, and

Hartmann & Braun showed electrical measuring instruments and other apparatus.

Group 127 was the group of electric motors, divided as follows: 772. Direct constant current. 773. Direct constant E. M. F. 774. Alternating current.

Motors of both constant and alternating currents were exhibited by the Card, Crocker-Wheeler, Elektron, Enterprise, Excelsior, Fort Wayne, General Electric, Wagner, and Westinghouse Companies; direct constant current motors, by the Ansonia, Consolidated Electric Storage, E. S. Greeley, E. B. Meyrowitz, Smith Pneumatic Transfer, Standard Electric, Chicago, Union Electric, and Western Electric establishments; direct constant potential motors, by the American Graphophone, Baxter, Colburn, Commercial Cable, C. & C., Eddy, Edison, Jenney, Leavitt, Mather, Rockford, New York, Union Electric, L. J. Wing, and Zucker & Levett Companies; electric motors both of constant current and constant electro-motive force, by the Belknap, Brush, Elwell-Parker, Hanson & Van Winkle, and Pratt Companies; and alternating motors alone, by the Electrical Forging, Electrical Appliance, and Stanley Electric companies.

Group 128 covered the application of electric motors, and was classified as follows: 775. Street, underground, mining, and other railways. 776. Elevators, pumps, printing presses, and general machinery. 777. Toys, novelties, and domestic appliances.

The Intramural Railroad, which carried without serious hitch or accident nearly 6,000,000 passengers during the term of the Exposition, solved, apparently, the problem of electric traction on elevated railroads. It is described in the chapter on Intramural Transportation, in Vol. I.

The power plant served as an exhibit for the General Electric Company of the largest railway and power generators and the various methods of hanging and driving the armature. There were five enormous generators—one of 500 kilowatts with four poles, driven by a belt, and three direct-connected to engines of various makes, one six-pole of 250, one twelve-pole of 400, one of 750, and one of 1,500 kilowatts, the largest dynamo that had till then been constructed. Jackson & Sharp's electric-railway system was seen in the Intramural Railway. Railway motors were exhibited by the Ansonia, Elwell-Parker, Mather, Short Electric Railway, and Westinghouse Companies; motors for street railways, by the Curtis, General Electric, Western Electric, and Sperry Companies; an underground traction system, by the Kennedy Electric Company; a street railway truck and rails, by W. Wharton, Jr., & Co.; a working model of cars and boats, by A. C. Mather; a closed electric car, by the Laclede Car Company; electric-motor trucks, by Dornier & Dutton and the McGuire Company; air-brake equipment, by the New York Air Brake Company; street-railway trucks, by the Bemis Car Box Company, the Curtis Company, the Robinson Company, John Stephenson & Co., and the Taylor Electric Truck Company; trolley wheels, by the Illinois

Alloy Company ; car wheels, by the Griffin Company ; an accelerator car, by the Brownell Car Company. The electric launches of the Electric Launch and Navigation Company carried passengers on the lagoons, and the Union Electric Company had one there too. The Crane Elevator Company had a passenger elevator and power pump in service in the Woman's Building. The Elektron, Frisbie, Otis, and Mather elevators and machinery were on exhibition. The Lidgerwood Company exhibited a mining hoist. Electric pumps were shown by Goulds Company, the Knowles Works, Otis Brothers,

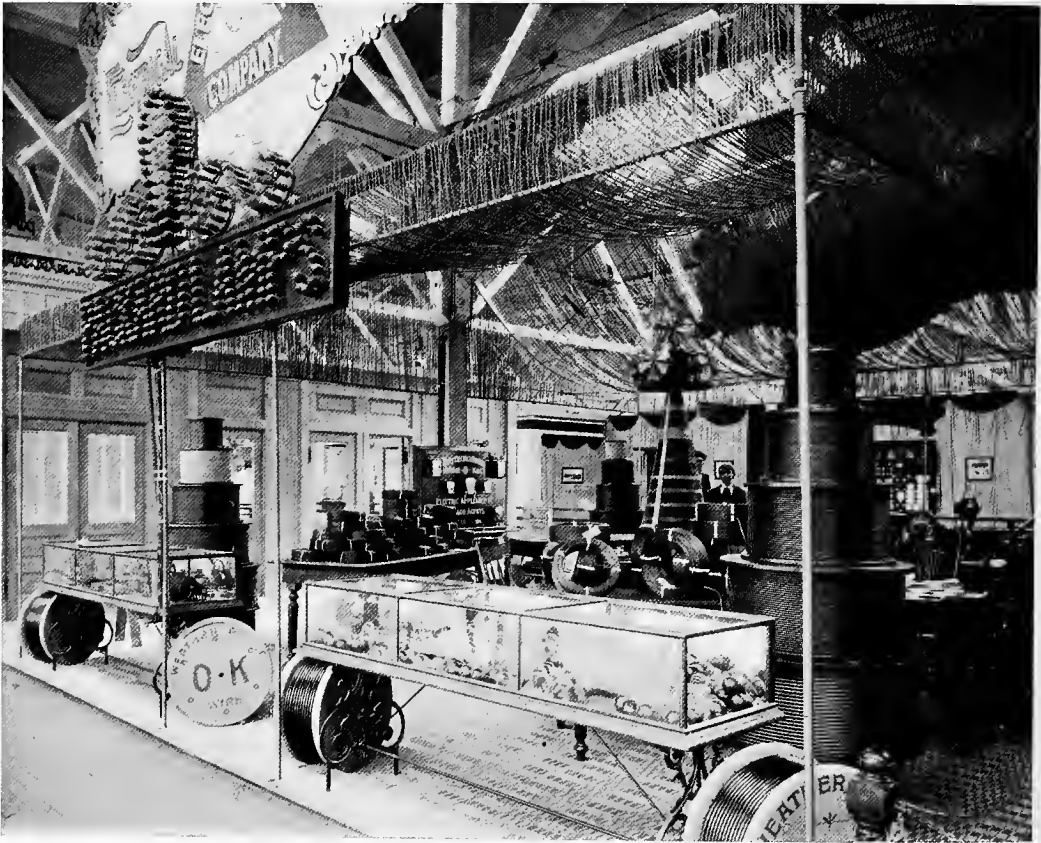
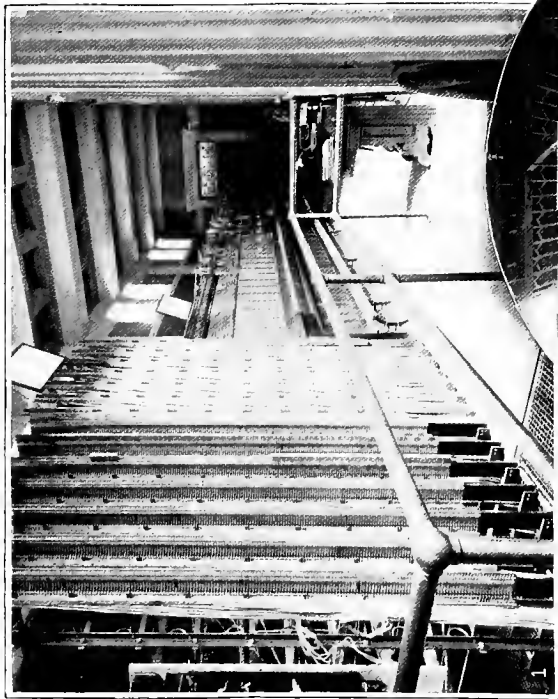
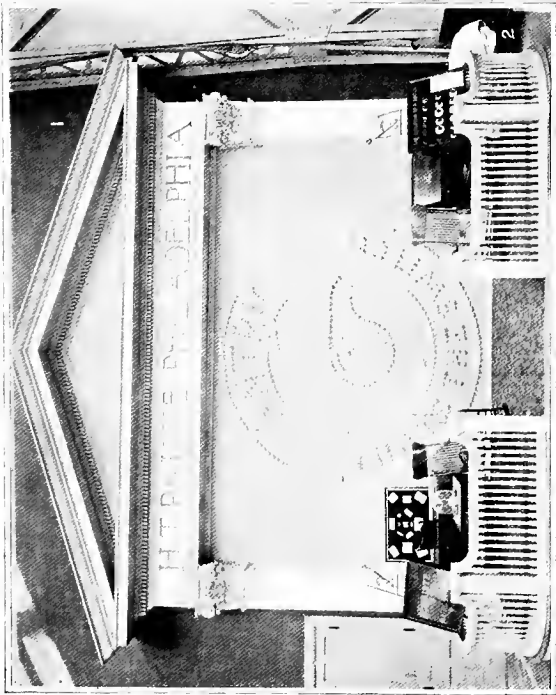


EXHIBIT OF THE ELECTRIC APPLIANCE CO., CHICAGO.

and Henry R. Worthington. The Zucker & Levett Chemical Company exhibited cranes, pumps, and organs.

Electric power has not hitherto been used in mining as extensively as in other industries because it has not been adapted to all the various purposes for which power is used, especially in mining. The Westinghouse and the General Electric concerns, each following its distinct method, had rival exhibits of electric transmission of power that were so complete as to remove all idea of the lack of flexibility of electricity. The General Electric Company exhibited a practical commercial plant in which the three-phase system illustrated in the Frankfort-Lauffen experiment was employed, while the





1. Brush Electric Company, Cleveland. 2. H. T. Paiste, Philadelphia. 3. Leclanche Battery Company, New York. 4. Felten & Guilleaume, Mülheim.  
A GROUP OF ELECTRICAL EXHIBITS.

Westinghouse Company employed the Tesla two-phase system. Both exhibits assumed a waterfall as the original source of energy, but they obtained their water power by different methods. The General Electric Company employed a deep-mine triplex pump, capable of raising water against a head of 650 feet, which was operated by a 100-horse-power, 220-volt, direct-current motor that received current from Machinery Hall by the Edison three-wire system. The water from the pump was directed against the buckets of a Pelton water wheel, which was direct-connected with a 35-kilowatt three-phase generator, whence the current passed to step-up transformers having a ratio of twenty to one, were transmitted at the higher potential on three wires within a short distance of the model mining power plant, then transformed down to 110 volts, and carried to a distributing switchboard, whence radiated a circuit that operated a bank of incandescent lamps, a circuit of arc lamps, as well as one operating a series of small three-phase motors.

The Westinghouse transmission plant received its energy from two alternating currents in quadrature, derived from the two armatures of one of their 750-kilowatt generators in Machinery Hall. The currents at 2,000 volts and 7,200 alternations were transformed down to 200 volts, and then led to a two-phase Tesla alternating-current motor of 500 horse power. This power, supposed to be derived from a Pelton water wheel, drove a 500-horse-power alternating-current generator, on one side of which were taken from four collecting rings two alternating currents in quadrature with each other, having about 4,000 alternations and a potential of 360 volts. On the other side, connected with the same winding, was a direct-current commutator from which could be delivered a direct current at 500 volts. All three circuits were led to terminals on a switchboard where the currents were controlled and distributed. The alternating currents operated a 500-horse-power Tesla motor, connected also as a rotary transformer, which by means of special field connections could be started as a two-phase motor and changed over by a switch, after gaining its speed, into a self-exciting synchronous motor. It was employed as a motor to drive a Worthington pump and a forty-light Westinghouse alternating-current arc-light dynamo, while as a direct-current generator it furnished current at 500 volts to two 30-horse-power street-rail road motors, to a 60-horse-power motor that actuated an Ingersoll-Sargeant air compressor, and to a series of constant-potential arc lamps.

Another circuit from the switchboard was connected to a 60-horse-power two-phase motor and transformer receiving an alternating current at 360 volts, and delivering a direct current at 60 volts, suitable for electrolytic or similar work and used actually to operate one of the Schuckert search lights.

Another circuit from the switchboard supplied current to a synchronous Tesla motor of 60 horse power that was direct-connected to a 45-kilowatt constant-potential alternator used for incandescent lighting, and still another circuit furnished current to incandescent lamps without transformation.

L. J. Wing & Co.'s disk fans and motor performed a very useful service, and their exhaust fans and ventilators were actively employed. The Mason Electric Company exhibited motors, operating fans, and sewing machines. T. M. Pierce showed fan motors, the Brush Company a fan and motor, and the Emerson Company an alternating fan motor. The C. & C. Company had an exhibit showing the direct operation of traveling cranes, hoists, pumps, blowers, fans, and machinery of all kinds by electricity. Gilmer Crowell had a pressure blower and reservoir. Exhibits of motors generally applied were made by the Ansonia Company, Crocker-Wheeler Company, George Cutter, the Ford-Washburn Storelectro Company, the General Electric Company, the Mather Electric Company, the Rockford Company, Taylor, Goodhue & Ames, the Union Electric Works, the Western Electric Company, and the Westinghouse Company: A Belknap motor operated coffee mills, and small ones domestic appliances. The new cloth-cutting machine of the Electrical Machine Company was able to cut through many thicknesses of cloth at the same time. The Ingersoll-Sargeant Company showed electrical air compressors, rock drills, and coal cutters. The McKay Company exhibited reciprocating tools for cutting, drilling, molding, and carving all kinds of stone, and others for riveting boilers and calking ships. The Steam Stone Cutter Company, of Rutland, had an electric channeling machine. J. E. Storey, of Boulder, Col., exhibited mining drills. The General Electric Company showed a portable machinist's drill with a flexible shaft to drill holes up to two inches in diameter in pieces of metal too heavy to be moved. Merrill Brothers showed an electric drop hammer and trimming press. The Pelton water wheel was an interesting exhibit. Electrical machinery with special oil caps, valves, and trimmings was shown by the William Powell Company. Dynamo belting was shown by the Jewell Belting Company, Charles Munson Company, who had on exhibition the largest belt ever made under a hydraulic press, seven feet wide, Charles A. Schieren, who had special electric belting and the perforated leather rawhide rope, and the Page Belting Company. The Western Electric Company exhibited motors applied to novelties. The K. A. P. Electric Novelty Company had one moving a model globe. The Jenney Company showed a number performing novel duties. E. S. Greeley had some operating sewing machines, a rotary fan, and chimes. The Commercial Cable Company exhibited motors working telegraph instruments. Electric motors for dental appliances were exhibited by the S. S. White Dental Manufacturing Company. The Pratt Electric Medical Supply Company showed a number of novelties. L. K. Scofield had jewelry machinery operated by electricity. Motors for domestic operations were shown by J. C. Vetter & Co. and G. F. Webb. The Franklin Electrical Appliance Company exhibited an electrical mop machine, and Knight's Coin Company showed how boots are blacked by electricity. The Electric Cash Register Company exhibited an electric cash register. The McIntosh Battery and Optical Company had batteries and machines applied



to novelties. The Hicks Troy Electric Door Company had an electric automatic door opener. Alonzo L. Brumfield showed an illuminating prismatic revolving sign. Batteries working electric toys, novelties, and household appliances were shown by the American Battery Company and the Sloss-Stein Company had fan motors worked by batteries.

Group 129 comprised lighting by electricity of the two classes. 778. The arc systems, their lamps, fixtures, and appliances. 779. The incandescent systems, their lamps, fixtures, and appliances.

The arc lighting was divided among six firms: The Brush Company, the Fort Wayne Company, the Standard Company, the Thomson-Houston Com-



EXHIBIT OF THE WESTINGHOUSE ELECTRIC AND MANUFACTURING CO., PITTSBURGH.

pany, the Excelsior Company, and the Western Electric Company. The arc dynamos were all fifty- or sixty-light machines, and where engines of more than two hundred horse power were employed it was necessary to have a countershaft and belt running back to the machine. There were sixteen Brush dynamos belted direct to five Ball & Wood engines. The block of Fort Wayne dynamos was driven by five Buckeye engines. In the block of twenty Standard dynamos, four were belted direct in tandem pairs from

an Erie City engine, and the others driven by countershafting from a two-hundred-horse tandem compound and a six-hundred-horse double tandem Russell engine. In the annex were sixteen Thomson-Houston dynamos, driven by a simple, a tandem, and a cross-compound Lane & Bodley Corliss, ten more Thomson-Houston driven by a tandem compound Atlas engine, and six Excelsior machines driven by a cross-compound engine from the Bass foundry. The Western Electric dynamos were driven by a Watertown double-tandem compound and by three small Russell engines, one Erie City, and one New York safety—all simple engines.

The Belknap Motor Company and H. T. Paiste exhibited appliances for both arc and incandescent lighting. The Card Company, the Fort Wayne Company, George Cutter, and the Zucker & Levett Company displayed arc and incandescent lamps and fixtures. Arc lamps, fixtures, and appliances were shown by the Electric Forging Company and the Excelsior Electric Company, and fixtures by the General Fixture Company, whose fixtures for incandescent lights were utilized on the battle ship. Arc-light cut-outs were the exhibit of the Electric Selector and Signal Company. Exhibition installations of both arc and incandescent systems were made by the Ansonia, Brush, Elwell-Parker, Equitable, E. S. Greeley, International, Taylor, Goodhue & Ames, Western Electric, and Westinghouse companies. Arc lamps for incandescent circuits were exhibited by the General Incandescent Arc Light Company, E. S. Greeley & Co., the Helios Electric Company, and McDougall & Cummings. J. Lang & Co. showed switches for arc and incandescent circuits; the Electrical Specialty Company, a single-push flush switch. The Standard Underground Cable Company exhibited a lamp cord. Arc carbons, solid and cored, formed a part of the exhibit of the National Carbon Company. The Star Iron Tower Company erected a tower and mast arms for electric lights, the Walworth Company showed arc-light poles, and L. J. Wing showed a suspension outfit for arc lamps. The Lowell-Spofford Company exhibited a carbon calcium arc lamp. Power generators for an arc system were shown by the Eddy Electric Company, while the C. & C. exhibited generators for power and lighting plants for mills, factories, electric railways, etc. Queen & Co. exhibited arc lights for projection.

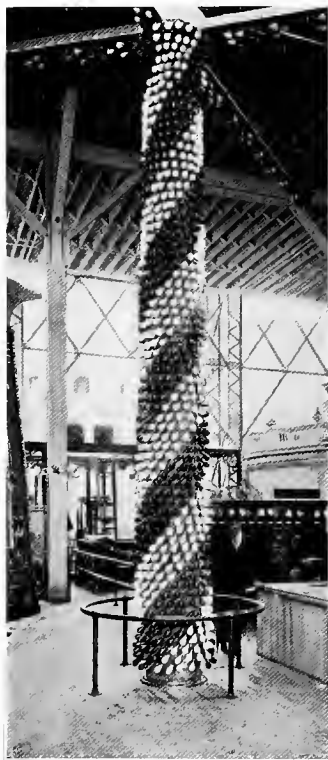
Four of the search-light projectors of Schuckert & Co., of Nuremberg, were placed on the Manufactures Building, one at each corner. One of these required one hundred and fifty ampères and fifty volts. The mirror was fifty feet in diameter, and the thickness nearly an inch. The surface intensity of this mirror was 194,000,000 candle power—a light so brilliant that it could be seen at a distance of eighty-five miles, and was sufficient to enable one to read a newspaper eight miles off. An American search light placed on the Colonnade had a reflecting lens not quite as large as the German, but with two hundred ampères of current developed one hundred thousand candle power, magnified by the reflector to two hundred millions, the lower and upper carbons, one and a quarter inch thick and fifteen and twenty-

two inches long, being set in such relation to each other that the reflector absorbed all the incandescence of the carbons in addition to the light of the arc. The American search lights and arc system used were those of the General Electric Company, the inventions of Thomas Edison, whose lights were used also to produce the luminous effects of the electrical fountains, one of the chief glories of the Exposition.

The incandescent lighting for the whole park was let to the Westinghouse Company, which agreed to furnish the wiring as well as the dynamos, lamps, and switchboard. This was the largest and most prominent section of the electric-power plant. There were twelve 10,000-light alternating-circuit dynamos, requiring about one thousand horse power each. The Allis engine, of two thousand horse power, the Fraser & Chalmers, the Buckeye, the Atlas, and the McIntosh & Seymour engines, of one thousand horse power, and four direct-coupled Westinghouse engines, turned the dynamos. The dynamos in Machinery Hall had an aggregate capacity of 158,000 sixteen-candle-power lamps, and these machines operated forty-five miles of wire covered with rubber or lead for the arc circuits, with about forty miles of conductors besides. This installation constituted the largest and most complete central station ever erected in the United States, furnishing current for practically all the incandescent and a large part of the arc lighting in the grounds and buildings.

The Edison system of incandescent lighting was installed by the General Electric Company on the Intramural Railway, in the battle ship, and in various parts of the grounds, affording an opportunity to observe the efficiency of the Edison feeder system. On a central pillar in the Electricity Building were hung more than a thousand Edison lamps in different colors, surmounted by a gigantic and very powerful incandescent lamp. The Western Electric Company, by means of automatic switches and motors, produced a current that illumined successively different series of lamps, making beautiful alternating zigzag waves of red, white, and blue light. The same automatic device for closing the circuit was made to illuminate in rapid succession the letters in a sign. In the Brush pavilion was exhibited a system of interior illumination devised by J. R. Prentiss for theaters and halls. The lamps are concealed behind a cornice, whence a reflector throws the light upon a domed ceiling that diffuses it through the room. The lamps are connected with a number of different circuits, and as there is no need of large resistance coils there is a great saving of power when less light is used. Systems of incandescent lighting were exhibited by the Colburn, Electric Forging, Elektron, Excelsior, Ford-Washburn, Hanson & Van Winkle, Jenney, and Mather corporations. The Union Electric Company had incandescent lamps operated by secondary batteries. Appliances and fixtures for incandescent lighting were exhibited by the Bryant and H. W. Johns concerns. The New York and Ohio Company showed the Packard lamp of five to five hundred candle power. The Star Electric Lamp Company had an exhibit of incan-

descent lamps, and the Waring Company showed a lamp that is said to maintain full candle power at the initial efficiency during its life. The Western Electric Company had a pavilion illuminated from the interior to show the soft effects of diffused electric light and its application in scenic theaters. Sossman & Landis furnished scenic stages and curtains. Incandescent screen reflectors formed the exhibit of the American Reflector and Lighting Company. Healey & Millet had a display of ornamental glass for electrical



PILLAR  
OF ELECTRIC LIGHTS  
with colors alternately illuminated.

effects, and the Phoenix Glass Company made a brilliant showing of cut and colored glass for electrical illumination, besides electroliers, globes, and shades. Incandescent lamps with and without vacuum were shown by Joseph M. Hirsh. A new incandescent wiring system, with socket, was shown by the K. A. P. Company. J. C. Vetter & Co. had an incandescent current adapter and tap. Otto Randa showed scarf pins gleaming with tiny electric lights.

Group 130 embraced heating by electricity and was subdivided as follows: 780. For warming and heating apartments. 781. For heating flatirons, soldering irons, and other objects used in industrial operations. 782. Maintenance of constant high temperature in ovens. 783. Electric heating furnaces.

In the exhibit of the American Electric Heating Company were shown electrical heaters for all purposes and in great variety, and the utility of such heaters for cooking was demonstrated by cooking operations. There were electric water heaters, ovens, and flatirons in use all the time. The exhibit comprised, besides ovens and heaters for cooking, a system of heating houses by electricity, heating appliances in industrial operations, and electric furnaces. Industrial heaters and high-temperature ovens were shown also by the Western Electric Company and the Ansonia Company, which exhibited in addition a method of warming houses by electricity. Electric heaters were shown also by the Cooper Electric Heater Company, E. S. Greeley & Co., the International Automatic Light and Power Company, and F. H. Leveridge. The Burton Electric Company displayed heating appliances and apparatus for heating flatirons. Electrically heated flatirons were shown by George Cutter, with a general heating apparatus and car-heaters. Taylor, Goodhue & Ames showed cooking by electricity. The K. A. P. Electric Novelty Company showed electric hair-curlers. The Electrical Forging Company, with a two-

hundred-horse-power heating plant, driven by two motors, exhibited an electrical cooking apparatus in addition to machines for rolling metals and forging. The Consolidated Electric Storage Company showed the application of storage batteries to heating. H. W. Johns Company had an exhibit of asbestos sheathing and fire felt.

Group 131 comprised electro-metallurgy and electro-chemistry, and was classified as follows: 784. Electrotyping. 785. Electroplating, gilding, and nickeling. 786. Electro-deposition of iron and other metals. 787. Electrolytic separation of metals from their ores and alloys.

Exhibits of electrotyping were made by the Colburn, Eddy, Excelsior, Greeley, Hanson, and Zucker & Levett Companies. F. A. Ringler had an exhibit of photo-electrotyping. Gilding and plating, with pure nickel anodes and chemicals used by platers, was well exhibited by the Hanson & Van Winkle Company, together with polishing and buffing and lacquering materials. A similar outfit for nickel and electroplating was displayed by the Zucker & Levett Company, who have a special improved dynamo for electrotyping and electroplating. Batteries for electroplating, gilding, and nickeling were displayed by the McIntosh Company, electroplating dynamos by Taylor, Goodhue & Ames. C. F. Hall exhibited a special method of electroplating; Joseph M. Hirsh showed the electroplating of aluminium; J. J. Fern made an exhibit of plating, burnishing, and finishing; and other exhibits of electroplating, gilding, and nickeling were made by the Colburn, the Eddy, and the E. S. Greeley establishments. Hanson & Van Winkle showed a new process of gold, silver, and nickel plating. The Westinghouse Company exhibited electroplating with the alternating-current power transmission exhibit. Exhibits of the electrolytic deposition of metals were made by the Colburn, Excelsior, and Zucker & Levett Companies and F. A. Ringler, and the deposition of aluminium by Joseph M. Hirsh. Instruments for electro-chemistry and for electro-metallurgy were exhibited by the Elwell-Parker Company.

The H. W. Johns Company exhibited insulating material and Roessler & Hasslachner isolatine. The Electrical Forging Company exhibited the electrolytic separation of metals from ores in conjunction with an automatic electrical forge. Other exhibits of electrolytic separation processes were made by the Excelsior Company, Hanson & Van Winkle Company, and the Zucker & Levett Chemical Company, and F. A. Ringler. Joseph M. Hirsh exhibited the electrolytic separation of aluminium. Alfred Guillaume showed a smelting furnace.

Group 132 was reserved for electric forging, welding, stamping, tempering, brazing, etc. It was divided into two classes: 788. Apparatus for, and methods of forging, welding, or joining iron, steel, or other metals. 789. Brazing, stamping, tempering, etc.

Billings & Spencer, of Hartford, exhibited forged commutator bars and construction tools. Electrical brazing and engraving were exhibited by

A. H. Phelps. L. K. Scofield had a stamping machine. Joseph M. Hirsh showed apparatus for forging, welding, and joining aluminium.

The most surprising and memorable exhibits, perhaps, of the whole Exposition to the general public were the applications of electricity to the heating and working of metals by the Burton system, shown by the Thomson Electric Welding Company and the Electric Forging Company. Electric welding was a Massachusetts invention, and was now for the first time shown to the world, although it had been developed for several years in the form of a practical machine. Various improvements had been made in de-



C. K. G. BILLINGS,  
Member of the Directory.

tails since the first utilization of the process, especially in the designing of clamps to hold various kinds of work. A machine was shown that would weld in a few minutes the ends of iron pipes six inches in diameter. The machine required a current of eighty thousand watts, equivalent to one hundred horse power. The application of the process to railroad track-construction was shown by specimens of chairs welded directly to the rails, and by a three-way crossing containing six different welds, each about twelve square inches in cross section. A railroad crossing of rolled steel was welded together to form one solid piece. The largest electrical weld yet made had a section of forty-eight square inches.

The electric forging of metals formed a comprehensive exhibit. Appliances for forging and welding, brazing, and rolling taper pins and balls were in regular operation, being actuated by an electric motor. A large drop forge was used for making horseshoes. A large electric heater having several holders was used both for heating bars and for welding tubes. Pieces of different diameters and lengths were heated at the same time, the heater dividing the current automatically by a regulator or governing rheostat. Four holders close to the rolling machine kept the operator supplied with heated rods. The heat emanating from the heater was very slight, the metal beyond the immediate effect of the electric current remaining cool. The metal thus heated was not oxidized or burned. A portable heating apparatus for rivets used in building or for use in isolated places consisted simply of a pail containing water connected with a conductor of an electric current, while a pair of tongs was connected with the other pole. The current may be obtained from an electric light or trolley wire. The action of the current was very rapid. It was one of the marvels of the Exposition to see a bar of iron raised instantly to a glowing

heat by being plunged into a vessel of cold water. The metal may be melted and become white hot. Iron or steel is not oxidized in the process because a jacket of hydrogen is generated that envelops it, affording protection from the action of the oxygen. The phenomenon is that of arc heating. The moment the metal is plunged in the water it is enveloped in hydrogen gas decomposed from the water, and this envelope parts the water and metal, forming an arc which raises the surrounding gaseous envelope to an enormous temperature, and almost instantly this temperature is communicated to the metal. A flame of burning hydrogen appears round the rod on the surface of the water. A carbon rod subjected to the process, as developed by Lagrange and Hoho, became amorphous carbon, proving that the temperature reached  $4,000^{\circ}\text{C.}$ , and with double the voltage used in the apparatus shown in the Belgian section twice that degree of heat has been attained. This apparatus consisted simply of an ordinary wooden pail three quarters filled with slightly acidulated water, in which was a lead plate dipping to the bottom and connected with the positive pole of an incandescent dynamo of one hundred and ten volts, capable of giving over one hundred and fifty ampères. When an iron rod connected with the negative pole was dipped into the water it rapidly rose to a melting temperature, while neither the water nor the metal outside of the water became very warm.

To show what could be done by the new and secret Slavianoff electric welding process, a table was covered with cast-iron pulleys, gear wheels, copper tubes, and the like, broken in many pieces and afterward restored. The chemicals used in the process were inclosed in a case under glass.

Group 133 took in the electric telegraph and electric signals. Its classes were: 790. Various systems of transmitting and receiving. 791. Chronographs. 792. Annunciators. 793. Thermostats. 794. Fire-alarm apparatus. 795. Police, telegraph, and burglar alarm apparatus. 796. Railroad signal apparatus.

The modern rapid automatic system of transmitting cable messages was shown by the Mackay-Bennett Company, with a resistance cable having similar resistance to that of the Atlantic cable, sending and receiving instruments being placed side by side. To avoid the possibility of error, the message was first punctured out on a strip of paper and then run through the sending instrument. The receiving instrument was the siphon recorder, having a hairlike tube of glass which draws the ink from the reservoir and marks a zigzag line, crossing a straight center line on the strip of paper. The motion is imparted to the siphon needle pen by the varying movement of the galvanometer receiving instrument. The multiplex system of telegraphy was shown in this exhibit. The General Electric Company exhibited dynamos for quadruplex telegraphy. A secret telegraph service was one of the exhibits of the Electric Selector and Signal Company. A printing tele-



graph was exhibited by E. Fitch, of Sherman, N. Y., and an instantaneous and automatic system by the Enterprise Electric Company.

In Gray's tele-autograph an operator at one instrument wrote with a pencil, which had elastic bands attached near the point to steady it, and as the pencil moved over the tablet a distant pencil moved in unison in another instrument, making an exact copy. A telemeter and recorder were exhibited by the Todd-Applegate Company. W. F. Gardner showed a transmitting table and apparatus for sending time signals, with an electrically controlled and converted transmitting clock for sending time signals, a thermostat electrically controlled for testing chronometers, and a detaching device and time ball of the kind used in the United States Naval Observatory. J. H. Bunnell showed the keys, sounders, transmitters, and repeaters adopted by the Naval Observatory. There was an exhibit of the transmitting and receiving apparatus of the Strowger Automatic Telephone Exchange, of Chicago. An electric dining service menugraph was the exhibit of Nathaniel L. Holmes. Systems of transmitting and receiving, chronographs, annunciators, thermostats, fire, police, and burglar alarm apparatus, and railroad signals were all in the exhibits of E. S. Greeley & Co. and the Western Electric Company. C. L. Jaeger showed an electric revolution counter. Walter N. Durant's electrical counting register records the strokes or the revolutions of a machine at any distance from it. Electrical clocks were shown by the Dulaney Clock Company, the Eco-Magneto Clock Company, and O. F. Goldfuss. Stevenson & Hoggson, of St. Louis, exhibited a perpetual calendar with date and time stamp operated by electricity. The Newman Clock Company exhibited watchman's electrical and mechanical clocks. Watchman's time detectors formed the exhibit of the Cleveland Electric Company, together with a watchman's time recorder. Non-magnetic watches and appliances were shown in variety by the Non-Magnetic Watch Company. The Ansonia Company exhibited the gravity needle annunciator in different sizes. Annunciators, guest calls, and alarm signals were shown by the Newman Clock Company. E. M. Edgerton had an automatic guest call, and Harry A. Lawton and Kennon Mott an electrical call and clock annunciator. A. Striemer showed another guest-call apparatus. John Rauscher made a display of push buttons. H. W. Axford showed a fire-alarm thermostat. A number were exhibited by the Electric Heat Alarm Company. The Electric Thermostat Company showed another automatic thermostat. The Copenhagen Fire Alarm Company showed thermostats and fire-alarm devices. A. Striemer exhibited his fire alarm. The Wilder Company made a good exhibit of its messenger and fire-alarm boxes and burglar alarms, and the Gamewell Company a full one of fire-alarm and police-signal telegraphs. Police telephone and signal apparatus was well exhibited by the Police Telephone Company, of Chicago. John F. Hurd showed an electric coat-thief and pickpocket detector, and William Pinkham a letter box with an electric telltale attachment. Among the railroad signaling ap-

paratus was an automatic switch and signaling device. There was also a model of an electric signal tower. The Consolidated Electric Storage Company exhibited a system of signals. A block signal apparatus with safety signals was shown by the Rowell-Potter Company, and the Electric Selector and Signal Company exhibited its system of block signals, while the Tate Company showed still another. The Elwell-Parker Company also showed a railroad-signal apparatus.

Japan exhibited full-sized models of the delicate instruments used in determining the extent and duration of earth vibrations in earthquakes. In the German section was a wonderful electric clock:

Group 134 comprised the telephone and its appliances: phonographs.

Its subdivision was:

797. Cables; construction and underground work. 798. Special protective devices. 799. Switchboards. 800. Transmitting apparatus. 801. Receiving apparatus. 802. Signaling apparatus. 803. Long-distance systems. 804. Various systems of operation. 805. Subscribers' apparatus—numbers, code, registers, etc. 806. Phonographs—receiving and recording apparatus. 807. Apparatus for the reproduction of recorded sounds and articulate speech.



APPARATUS SHOWN BY THE GAMEWELL FIRE-ALARM TELEGRAPH CO., CHICAGO.

The Norwich Insulated Wire Company and W. R. Brixey exhibited telephone cables; E. S. Greeley, the Standard Underground Cable Company, and Washburn & Moen showed wires as well as cables, and the former had exhibits of protective devices and switchboards and of telephone supplies of all kinds. Rubber-covered conductors and cables of the Exposition service were furnished by the New York Insulated Wire and Cable Company. The National Conduit Company exhibited an underground conduit. The Western Electric Company had a comprehensive exhibit, including construction and underground work, transmitting and receiving apparatus, long-distance systems, systems of operation, and subscribers' apparatus in the World's Exposition telephone exchange, which was equipped with the modern switchboard and devices for facilitating connections. Long-distance machines were exhibited in an admirable way. In one room visitors could listen to a concert in the Midway Plaisance, and in

another to one going on in New York and to conversation carried on in that city.

The Pratt Company furnished an exhibit of transmitters and receivers for long- and short-distance work. A convenient attachment for holding the telephone to the ear, combined with an adjustable writing tablet, leaving both hands free to write down messages and records, was the invention of William N. Marcus. William Ebert exhibited an electric messenger service, and the National Electrical Manufacturing Company a model nickel messengers' box. Signaling apparatus exhibits were made by Edwards & Co. and the Electric Selector and Signal Company. The Elektron Company exhibited motor generators for telephone central stations. The use of storage batteries in telephony was demonstrated by the Consolidated Electrical Storage Company. The Bell Company had an historical exhibit of the development of the telephone. O. L. Wullweber exhibited a receiving and a transmitting apparatus for telephones. The Elgin Company had an exhibit of its acoustic telephone and apparatus. Clare L. Sponholz showed telephone register directories. The Strowger Telephone Exchange exhibited switchboards and devices for the operation of telephones, which were shown also by the Standard Underground Cable Company.

Phonographs and appliances were exhibited by the North American Phonograph Company. The Graphophone Company exhibited its sound-recording apparatus and talking machines.

Group 135 had to do with electricity in surgery, dentistry, and therapeutics. It was classified as follows: 808. Cautery apparatus. 809. Apparatus for the application of the electrical current as a remedial agent—surgical and dental. 810. Apparatus for diagnosis. 811. Apparatus for the destruction of life.

Cautery apparatus and therapeutic batteries and appliances were exhibited by the Consolidated Electric Storage Company, E. S. Greeley, the McIntosh Company, the Mason Electric Company, Dr. J. Meeker, Dr. A. Owens, Queen & Co., the Sloss Company, the Union Electric Company, the Union Electric Works, J. C. Vetter & Co., Waite & Bartlett, and G. F. Webb. The Electro-Medical Battery Company, New York and London Association, and the Pulvermacher Galvanic Company had portable and pocket batteries. A dynamic cautery apparatus was shown by the K. A. P. Company. E. B. Meyrowitz exhibited electrodes. The Pratt Electric Medical Supply Company had a large exhibit, including cautery apparatus, appliances for therapeutic work and surgical and dental remedial agencies, a microphonic stethoscope, and batteries and appliances for electrolysis. The Electric Storage Company, E. S. Greeley, the K. A. P. Company, the McIntosh Company, and others exhibited surgical and dental apparatus. The General Electric Company showed a motor applied to a dental drill; the Mason Company, dental lamps and motors; the Union Electric Company, aluminum head lamps, dental engines, and apparatus for diagnosis; the Union

Electric Works, electric dental engines and electro-pneumatic engines and mallets; S. S. White, a variety of dental surgical apparatus. An electrical dynamite gun was the exhibit of N. G. Worth.

Group 136 was given up to the application of electricity in various ways not hereinbefore specified, of the following classes: 812. Ignition of explosives; gas lighting, etc. 813. Control of heating apparatus by electricity, as applied to steam and hot-air pipes and registers. 814. Electric pens. 815. Application in photography.

In this group were placed the electric gas-lighting devices of George Cutter, the Electric Gas Company, E. S. Greeley & Co., the Sloss Stein Company, and the Western Electric Company; the igniting devices for explosives exhibited by the last-named and by E. S. Greeley and J. C. Vetter; the apparatus for isolated electric lighting of L. J. Wing & Co.; the electric automatic burner of the Holtzer Carbon Electric Company; the high-tension and high-frequency discharges of the Westinghouse Company; the heat-regulating appliances of the Franklin Electric Appliance Company and Charles E. Lee; the electric incubators of H. W. Oxford; the writing apparatus of the Commercial Cable Company; and the electric pens of the Western Electric Company.

Group 137 was devoted to the history and statistics of electrical inventions, and contained two classes: 816. Objects illustrating the development of the knowledge of electricity and of the application of electricity in the arts. 817. Collections of books and publications upon electricity.

An historical collection of lightning rods was loaned by Knapp & Buckley and another by the Munson Company. One of the dynamos came from the Ansonia Electric Company, in which was the original Farmer dynamo. Thomas A. Edison made an historical exhibit, from which it was seen that his earliest dynamo, which has been in constant operation since 1880, differs from those built to-day only in minor details. The Fort Wayne Company showed an historical working dynamo and arc lamp. Elisha Gray, the General Electric Company, and the Western Union Telegraph Company had historical exhibits. The Thomson Electric Welding Company also showed objects illustrating electrical progress. The jewelers' engraving machine was exhibited by the National Engraving Machine Company. The publishers of electrical journals and books made a display. The Bell telephone exhibit contained a set of the models made by Bell. Queen & Co. displayed apparatus for educational purposes, as did the McIntosh Battery Company.

A collection illustrating the historical development of electrical knowledge and art in Germany included the magnet induction needle telegraph made by Stohrer in 1817 and the Gauss-Weber apparatus of 1830. There was an historical collection of the inventions of Dr. Siemens.

Group 138 was devoted to the progress and development in electrical science and construction, as illustrated by models and drawings of various countries. It was divided into two classes: 818. United States Patent Office

and other exhibits of electrical models and drawings. 819. Foreign exhibits of electrical models and drawings.

William G. Creighton exhibited drawings of an electric street-railway conduit; Elisha Gray, models and drawings; G. T. Woods, electrical diagrams; the Western Electric Company, models of inventions; and the General Electric Company, a collection of patents. Electric railroad models and plans of central stations were shown in the German section.

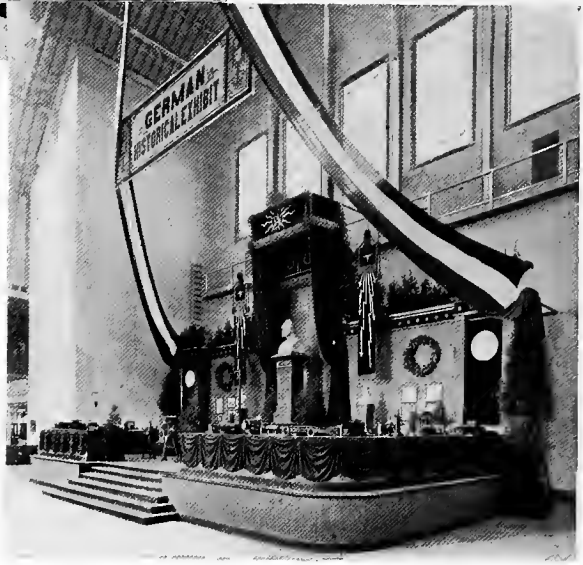
A supplementary group attached to the 138th contained the following intercalated classes:

A. Construction tools, repairing tools, apparatus used in electrical construction. B. Apparatus used for transmission of power to electrical generators (steam, compressed



air, turbine oil friction, gearing, belting, etc.). C. Process of electro-engraving. D. Carbon and its application. G. Metals and their application in the construction of electrical apparatus. H. The kinetograph. J. Direct couple engine dynamos. K. Electric lubricators. L. Application of electricity in testing and aging liquors. M. Electric tanning.

Apparatus and tools for construction and repairs were thoroughly exhibited by Billings & Spencer, the Curtis Company, the Electric Forging Company, the General Electric Company, and the Western Electric Company. E. S. Greeley showed trolley fixtures and construction tools; the Railway Equipment Company, of Chicago, trolley clamps, feeder cars, and pole rackets; the Electric Manufacturing Company, of Dayton, pulleys and wire holders; H. M. Loud & Son, octagonal poles for a railway track; the Walworth Company, railway and arc-light poles; the Electric Railway Equipment Company, of Cincinnati, iron poles for railways. Cable construction tools



SOME HISTORICAL EXHIBITS.

were exhibited by the Standard Underground Cable Company. Orlando P. Briggs showed an automatic electrical machine attachment. Oval, zigzag, and other special forms of pipe work were shown by the Electric Pipe Bending Company. A. J. Oehring exhibited a multiple drill press. A. Groetzinger & Sons had a machine for making rawhide pinions for electric work, also gearing and belting. Electric machinery belting was displayed by Graton & Knight, the Jewell Company, the Charles Munson Company, the Page Company, and Charles A. Schieren & Co. The Chicago Belting Company showed rivetless dynamo belts. The Falls Rivet and Machine Company exhibited special line shafting and clutches. The J. L. Case Engine Company, the Lake Erie Works, and the McIntosh & Seymour Company exhibited engines driving dynamos. The General Electric Company had a water wheel coupled to dynamos, and the Western Electric Company a varied exhibit of the transmission of power to generators. The Jewett Supply Company showed an antifriction device for car bodies.

In the ingenious electric engraving machine of the National Engraving Machine Company the cutting point receives its impulse from the electricity in the form of rapid pulsations, and if the operator is a skillful draughtsman he need only guide the tool as he would a pencil in making a sketch, and the design is engraved almost as quickly as a pencil drawing could be made. The Brush Company, the General Electric Company, and the Western Electric Company exhibited carbon and its applications; the Central Electric Company, an electric-light battery and brush carbons; the National Carbon Company, carbon brushes; and N. P. Stevens, the splicing of electric-light carbons. Metals in electrical construction were exhibited by the Electric Forging Company, the General Electric Company, and the Western Electric Company. The Illinois Alloy Company showed aluminium bushing, and an antifriction metal for dynamos and motor bearings; the Union Electric Company, the electricon antifriction or lubricating metal; Billings & Spencer, commutators, bars and rings, and eyebolts. The Eureka Tempered Copper Company's exhibit of copper cast without alloy and without blowholes, and copper hardened by the new process, included commutators, trolley wheels, insulated wire, electrical brushes, gear pinions, armature bearings, warranted to have the greatest conductivity, the greatest tensile strength, unequaled antifriction qualities, and twice the life of any other metal used for electrical work. Direct-coupled dynamos were seen in the exhibits of the Brush Company and the Elektron Manufacturing Company. Edison exhibited his, then quite new, kinetograph in connection with the phonograph by a series of photographs taken during a conversation, and reproducing the movements of the lips and face with the tones of voice of the speaker.

In the German section were poles of seamless tubes for telephones, telegraphs, electric lights, electric railroads, and elevated railroads, several exhibits of carbon pencils, carbon for Leclanche elements, and the electric engraving apparatus of Lubszynski.



The Rhode Island Coast. By Worthington Whittredge.

## CHAPTER XIII.

### THE FINE ARTS EXHIBIT.

The classification of the department—The American section—Paintings—Engravings, etchings, and prints—Pen-and-ink and wash drawings—Retrospective exhibit of American paintings—Loan collections—British paintings—French paintings—Spanish paintings—Italian paintings—German paintings—Austrian paintings—Belgian paintings—Holland paintings—Paintings from Norway and Sweden—Russian paintings—American sculpture—French sculpture—The collection sent by the Bureau des Monuments Historiques—German sculpture—Swedish sculpture—Italian sculpture—English sculpture—The art of Japan.



CHARLES L. HUTCHINSON,  
Member of the Directory and  
Chairman of the Committee on Fine Arts.

THE Art Palace contained 10,040 distinct exhibits, of which half were oil paintings, and the other half pastels, water colors, engravings and etchings, drawings in charcoal, ink, etc., statuary, architectural designs, and other productions properly distinguished as works of art.

The first group in the Department of Fine Arts was 139, that of sculpture, which was divided into the following classes: 820. Figures and groups in marble; casts from original works by modern artists; models and monumental decorations. 821. Bas-reliefs in marble or bronze. 822. Figures and groups in bronze. 823. Bronzes from *cire perdue*.

The other groups of the department were in their order as follows:

Group 140—Paintings in oil.

Group 141—Paintings in water colors.



Group 142—Paintings on ivory, on enamel, on metal, on porcelain or other wares; fresco painting on walls.

Group 143—Engravings and etchings; prints.

Group 144—Chalk, charcoal, pastel, and other drawings.

Group 145—Antique and modern carvings; engravings in medallions or in gems; cameos, intaglios.

Group 146—Exhibits from private collections, including a retrospective exhibit of American paintings and a loan collection of foreign works from private galleries in the United States.

Architecture as a fine art was exhibited in paintings, drawings, engravings, and carved models scattered among the other exhibits.

The collection of paintings was the most important, the most catholic, and the most complete exhibition of all schools that has been made in modern times, not excepting the Paris Exhibition of 1889, in which the Germans had no part. Such a collection of the best works of the American painters, of artists whose studios are in Paris, and of those residing in London or Rome or the German homes of art, as well as of those who live and work at home, was never before assembled. The whole left an impression of the artistic activity of the American nation and of the correct feeling and tendency of the art and the technical proficiency of American artists that raised us above some countries where the art of painting is an old and proud tradition, though of the native school, the genuine American art, there was yet no sign. The collection was generally permeated with French influence, except the works of artists trained in Munich or Düsseldorf. Most distinctively American were the landscapes, and of these the best were often the ones that showed the least French impress. The working of English tradition was seen in the artists of home training who affected romantic, sentimental, or humorous subjects.

There were in the American section over eleven hundred oil paintings, most of which had before been exhibited in Europe or America. The range of subjects was very wide, covering everything—ideal, allegorical, sacred, rarely historical, and pastoral themes, portraiture, landscape, seascape, still life, domestic and society *genre*, realistic compositions of popular life, and humorous extravaganza or mystic fantasy.

The painters of the earlier period who felt the influence of romanticism chose subjects from American life or literature, such as *Breaking Home Ties*, by Hovenden, and Frank D. Millet's *Anthony Corlaer, the Trumpeter*.

The decorative manner of treatment was well exemplified in Edward H. Blashfield's *Christmas Bells* and T. W. Dewing's series of *Days*, and in Kenyon Cox's *Eclogue* and George W. Maynard's *Pomona*,

Of the religious subjects, Abbot Thayer's *Virgin Enthroned* was handled in a novel decorative and coloristic style. Frank Vincent Du Mond conveyed a serious and reverential feeling in his *Christ and the Fishermen* not-

withstanding its bold unconventionality, and a similar religious spirit is expressed in his Monastic Life.

Julian Story's *Mademoiselle de Tombreuil* treated an episode of the French Revolution in a powerful manner. Equally impressive and masterful in technical details was the *Flagellants*, sent by Carl Marr from Munich. F. A. Bridgman, of Paris, had a large composition full of life and color representing the *Passage of the Red Sea*. The same artist had a half dozen



VIEW IN THE RUSSIAN SECTION.

Algerian scenes. Munich methods were admirably reflected in Orrin Peck's *Love's Token* and Toby Rosenthal's *Dancing Lesson of Our Grandmothers*. Walter Shirlaw was represented by his *Toning the Bell*, *Sheep Shearing in the Bavarian Highlands*, and *Rufina*. Whistler, of Paris, erst of London, was introduced to his native country by six characteristic canvases. Walter McEwen exhibited *Sorceresses*, a bold conception, with firelight playing in the faces of the figures. The *Viking's Daughter* was a romantic fancy by Frederick S. Church. Charles Sprague Pearce in *Village Funeral in Picardy* presented a carefully studied and well-executed group. Mrs. M. L. Macomber's *Annunciation* was loftily conceived. Frank H. Tompkins's *Good Friday* was a religious picture remarkable for the fine drawing of the prone figure. Walter Gay contributed two large compositions pitched in a subdued gray

tone—Charity, showing a cottage interior, and The Plain Chant, a class of girls singing in a French conventual school. Stacy Tolman's Etcher was very expressive of the subject's concentrated attention on his work. Edmund C. Tarbell's In the Orchard was a group of young people in the open air, very lifelike and characteristic and very luminous. His Girl with Horse was likewise typical and instinct with life. Mrs. Lilla Cabot Perry had half a dozen pictures of children that were true types delicately interpreted. J. H. Hatfield showed a Doll's Bath and Letter from Papa, the sentiment of which was very manifest.

A forceful example of Parisian impressionism was W. T. Dannat's row of Spanish Women. Winslow Homer exhibited fourteen of his racy portrayals of American life. An example of impressionism worked out in a finished and wonderfully transparent result was Childe Hassam's Grand Prix Day.

A lovely small landscape was Evening, by D. W. Tryon, and there were a dozen more of his inspiring interpretations of nature. Purely American landscape painting was well represented, as by the fifteen contributions from George Innes and Homer Martin's four pictures. John J. Enneking contributed five landscapes painted with vigor, especially October Twilight and Autumn Afternoon. A Quiet October Morning, by Charles J. Hayden, was well conceived; and in Abandoned, Charles H. Davis conveyed a strong sentimental impression. A reposeful work of good quality was Thomas Allen's Moonrise. Charles Herbert Woodbury's North Sea Dunes was impressive. Jerome Elwell sent four landscapes, of which Moonrise at Dornberg was remarkable for the choice quality of the somber tones. One of the most striking works from an American living abroad was the Brooklyn Bridge of Frank M. Boggs. Very good cattle pieces were C. M. McIlhenny's On the Beach, W. H. Howe's Norman Bull, and H. S. Bisbing's On the River Bank. The earnestness, integrity, and conscientious work marking so many of the American pictures appeared to great advantage in the numerous large figure pieces, well conceived, well studied, well executed, thorough and sincere in composition, drawing, coloring, and *chiaroscuro*. Such were Jules L. Stewart's Hunt Ball, Yachting, and The Baptism, Frank C. Penfold's Herring Season, Charles Ulrich's Italian Idyl, the Lawn Tennis Party of Orrin S. Parsons, the Three Beggars of Cordova of E. Lord Weeks, Carl Marr's Summer Afternoon, Seymour Thomas's Innocent Victim, Elizabeth Nourse's Family Meal, and L. C. Tiffany's Market at Nuremberg. A. C. Howland's Fourth of July Parade was racy of the soil. Charles Curran's Sealing the Letter was a neatly painted interior, and so was the Melody of Frank S. Holman. Louis P. Dessar's Evening and Walter Nettleton's November Sunshine were good studies of light. Walter Palmer's Early Snow was quite effective and natural. William M. Chase, besides a strong, effective study of clear, bright light called Lakeside, had two spirited portraits, full of character—Miss M. and Alice. R. Gordon Hardie sent Portrait of Mrs.

Hardie ; Fred W. Freer, *Lady in Black* ; and Carroll Beckwith, *M. Isaacson*. Julia Dillon's *Peonies* was an admirable flower piece. Prosper L. Senat's *Gulf of Ajaccio* was a luminous marine. Eugene Vail had a pleasing water painting with figures in a boat. R. W. Sewell's *Sea Urchins* was a sprightly work representing boys bathing on a beach. Walter L. Dean's *Peace* was a neatly conceived and finished picture of men-of-war in harbor. His *Open Sea* and *Seiners' Return* were bright, cheerful paintings. William E. Norton, a capable New England artist, sent over from England *The Return of the Herring Fleet*, *Moonlight on the River*, and *A Moment's Rest*. A somewhat startling effect of movement was produced skillfully by A. H. Munsell's *Ship Ahead*, showing a vessel's prow apparently bearing down on the beholder.



CARROLL BECKWITH,  
Painter.

In the portrait class Eastman Johnson and John S. Sargent were well represented. A large portrait of *A Lady*, by Frederic P. Vinton, was noticeable. Frank W. Benson's *Portrait in White* and *Girl with a Red Shawl* were painted with refinement and charm.

The American water colors, of which there were over two hundred, often revealed a free, fresh, spontaneous Americanism that was absent from the oil colors. Some of the exhibitors were Edward A. Abbey, William Hamilton Gibson, Frank D. Millet, Arthur Rotch, and W. D. Smedley.

The collection of engravings, etchings, and prints consisted of more than six hundred examples of the works of Carlton Chapman, Samuel Colman, Charles A. Platt, Alexander Schilling, J. Alden Weir, Whistler, and many others.

The collection of pen-and-ink and wash drawings was important and interesting, because in no country has work in black and white been more cultivated or developed with such high results as in the United States. The monthly magazines fostered a demand and the improvements in the mechanical work of reproduction opened the artistic field for such work. Among nearly five hundred examples were Shakespearean illustrations of Edward A. Abbey, A. Castaigne's sketches of incident, humorous and figure subjects from C. D. Gibson, and some of the finest productions of Kenyon Cox, Harry Fenn, William Hamilton Gibson, E. W. Kemble, Alfred Parsons, Charles S. Reinhart, Frederick Remington, and others.

A retrospective exhibit of American paintings loaned from private collections contained many good examples of Gilbert Stuart, Benjamin West, Copley, Peale, Allston, and the other pioneers of art on this continent, and

at least one from each of the dead leaders of the modern school—William M. Hunt, Arthur Quartley, Kensett, McEntee, and the rest.

Another loan collection of a hundred works from American private galleries contained a congeries of masterpieces of the modern French schools such as could with difficulty be matched even in Paris, comprising some of the most famous works of Millet, Corot, Troyon, Diaz, Rousseau, Daubigny, Fromentin, Delacroix, Decamp, Meissonier, De Neuville, Mauve, Ingres, Gérôme, Fortuny, Degas, Manet, Cazin, and many others. There were good examples also of the English masters Constable, Swan, Morland, and Watts.

The English painters, who are scarcely more familiar to Americans than those of Austria or Russia, were determined to make a fuller and more creditable exhibit than they had at Philadelphia, and they succeeded so well in their purpose that none of the other art galleries was so thronged with admiring gazers, whose delight was amply justified, for Sir Frederick Leighton and his fellow-commissioners had made a most careful selection from the most prominent works of recent years, forming an exhibit equal in general excellence to that of any other country. Besides the best works of forty-eight of the leading members of the Royal Academy, living and deceased, there were the choicest products of the Hibernian and Scottish academies and noted paintings of outside artists characteristic of each new school and tendency.



CHARLES S. REINHART,  
Painter.

Among the notable British pictures were the following: Portrait Group, by Orchardson; Dedication to Bacchus, by Alma Tadema; Orni-thologist, by Sir John Millais; Last Muster and Miss Grant, by Hubert Herkomer; When the Sun is Set, a landscape by B. W. Leader; George Clausen's Brown Eyes and Plowboy; portrait of Walter Crane and Love and Life, by G. F. Watts; Gambler's Wife, by Marcus Stone; and A. Chevalier Taylor's Peddler. C. Green's Pickwick Club and Frederick Hall's Result of High Living were examples of English humor in art, as T. B. Kennington's Curse of the Family and Yeend King's Lass that Loved a Sailor of sentiment, and Maddox Brown's Trial of Wyclif and C. W. Bartlett's Incident in the Life of the Dauphin of the equally characteristic national taste for historical subjects. The allegorical pictures of Love and Life, by G. F. Watts, and Freedom, by Walter Crane, were also thoroughly British. G. Clausen's Plowboy and H. Fisher's Midday Rest were lovely

out-of-door scenes. The life of seamen and fishermen furnish subjects for some of the finest inspirations of English art, such as Walter Langley's *Departure of the Fleet*, H. S. Tuke's *Sailors playing Cards*, John Reid's *The Yarn*, and W. Osborne's *The Ferry*. F. Walton's *Wreck of the Spanish Armada* was a seashore landscape poetically treated. C. E. Perugini's *Summer Shower*, a delicious conception well carried out, like S. M. Fisher's *Summer Night in Venice* and W. Logsdail's *Flower Gathering in the South of France*, successfully rendered the clearer atmosphere of southern Europe, while J. B. Knight's *Hadley Church* gave a true impression of the lights of the English sky. Arthur Hacker's *Christ and Magdalen*, furnishing an English idea for the modern treatment of holy subjects, could be compared with other experiments of the sort in the American, French, and Austrian sections. A large composition done in the masterful and vigorous English style was W. Logsdail's *Ninth of November*, and another impressively pathetic was W. H. Y. Titcomb's *Primitive Methodists*.

Out of more than three thousand works offered by the two principal associations of artists in France and from the national collections, the Government Commissioners selected five hundred paintings in oil, one hundred water colors, and one hundred and fifty sculptures. The paintings were thoroughly representative of the different methods and manners of the French school, but in quality they were not as good a representation as the English and German, because the French painters sent few pictures except unsold ones. One of the best was *Girls going to Mass*, by Jules Bréton. Raffaelli's *Grandfather* was an effective impressionistic work. There were portraits by L. Doucet, François Flameng, and Yvon. Telling pictures were Julien Dupré's *In the Valley*, Veyrassat's *Last Load of Wheat*, and Henry Cain's *At the Louvre*. The tragic and the terrible can be dealt with realistically by French painters with powerful effect, as in Maignan's *Death of William the Conqueror*, Auguste Glaize's *The Blind Man and the Paralytic*, and *The End of a Romance*, by E. V. Luminais. Demont-Bréton's *Young Sailor's Training*, Adolphe Binet's *Lovers*, A. P. M. de Richmont's *Sacrifice*, and J. A. Muenier's *Sunshine of Life* were tender and graceful in their different manners. Rozier's *Fish-monger* was well handled. Berthelon's *Storm at Yport* was a powerful marine, and there were other fine sea pieces showing other aspects of Nature, such as Chigot's *At Etaples*, Dauphin's *Iphigenia*, a carefully painted ship, and Nozal's *Bay of San Michel*. Fine bright landscapes were Quignon's *Wheat Sheaves* and Dameron's *Flower Growing near Nice*. *The Return*, by A. Marais, was a landscape with cattle, and Léon Barillot had a couple of cattle pieces. Seneschal de Herdrevet's *Return from the Oyster Beds* was a fine delineation of shore life. Courtois had one of the most elegant portraits. There were numerous compositions full of well-drawn and well-posed figures, such as Bramtot's *First Communion*. The lives of the industrial toilers and of the common people inspire many of the finest of recent French paintings, such as the *Rolling Mill* of Ernest Bordes, T. E. Duverger's *In-*

temperance, G. Latouche's *Miners on Strike*, *A Good Haul*, by Victor Gilbert, *Passing the Ring*, by A. Barthelome, Léon Couturier's *At the Capstan*, Trupheme's *Singing Lesson*, Aublet's *Old Sailors at Treport*, and Adan's *Return of the Grape Pickers*. Military paintings of merit were Guignard's *Flying Scouts* and Delort's *Capture of the Dutch Fleet in the Texel*.

The paintings in the Spanish exhibit, though the principal masters of Spain were absent, were all of fair merit and remarkably even in quality.



VIEW IN THE RUSSIAN SECTION.

The Spanish paintings were characterized by bright coloring and sunshine. Scenes in Columbus's voyage of discovery and like historical subjects were treated in many of them, and there were scenes of bull fighting, dancing, and pictures of anecdote and incident and of still life, usually handled adroitly with technical skill. A couple of military pictures, full of action, were cleverly painted in an impressionist manner. A painting of *Don Quixote and Sancho Panza*, by José Moreno Carbonero, was one specimen out of many of artistic drollery. Some of the notable Spanish pictures were the *Last Breath*, of Guillon-Pedemonte; the *Punishment by the Lash*, of Galofre y Oller; the *Sisters of Charity*, of Agrasot y Juan; the *Old Clothes Market*, of



L. Jiminez-Aranda; José Jiminez-Aranda's Who will be cheated? Moreno-Carbonero's Get up, Donkey; Under the Awning, by Bermudo-Mateos; Father's Advice, by Frances y Pascual; and the Coast of Normandy, by Morera v Galicia. In sculpture Spain was well represented.

Italy sent a collection of some two hundred oil colors that were fairly illustrative of contemporary Italian art, at least the light and pleasing phase of it, which seemed redundant, consisting so largely of young female figures in gay costumes, very well drawn and excellent in harmony and depth of coloring. There were sea pieces also correct and pleasing, Venetian scenes in the open



ANGELO DEL NERO,  
Fine Arts Commissioner from Italy.

air with charming female figures, and some pieces of domestic *genre* not lacking invention and diversity. A Village Fête, by Armanesi, was a considerable composition filled with joyous peasant figures painted with agreeable realism. Mancini's Charge of Cavalry was a clever representation of a long line advancing at full gallop. In Corrodi's Overflow of the Nile a gorgeous sunset effect at the Pyramids was finely rendered. Zanetti had some fine studies of the atmospheric appearance in Venice and its neighborhood, notably the Canal at Torcello. Among several admirable paintings of still life the Venetian Fruitseller of Novo was notable for its brilliant rendering of heaps of fruit. Angelus on St. Peter's Day, by Corelli, was a strong sunset view of harvesters in the Campagna. Guerra's Fortune Teller

and Tiratelli's Country Life were finely typical. Bennachini's Insane was a striking and deeply impressive work, and Augusto Corelli's Serenade a cleverly executed tragic conception. R. Santoro's Naples, F. Cortese's Pæstum, and Barucci's Lake in the Apennines were fine interpretations of nature. Guarda-Cassi's Mayor's Wedding was a gay piece with many figures, and Battaglia's Gleaners a rare delineation of peasant life.

The Germans made a special effort to form a collection of their best works on this occasion. Their artists were as eager to exhibit their work as those of any other nation, and, besides their contributions, the National Gallery of Berlin and the Bavarian Government loaned many choice paintings and sculptures. The galleries of Düsseldorf, Dresden, Weimar, and Carlsruhe also loaned some of their finest examples of the recent schools of German art. A bronze statue of Wilhelm I was loaned by the Royal Academy of Berlin. The catalogue of the German section enumerated five hundred and four paintings, one hundred and eighteen pieces of sculpture, and fifty

engravings and etchings. Max Koner's portrait of the present Emperor was remarkable for the strong and original treatment of flesh tints and textures. The patriotic loyalty of the Germans was manifested in portraits of the three emperors in every uniform, attitude, and scene, by various artists. Prof. Saltzmann had an imposing canvas representing the Emperor whaling in the North Sea. Prof. Werner Schuch's picture of him reviewing troops had high merit as a military painting. A monster canvas by Prof. Keller pictured the apothe-

tosis of Kaiser Wilhelm I as the foun-

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A stirring military scene conscient-

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A very effective historical

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There were representative examples of the Munich, Berlin, Düsseldorf,

Dresden, and Weimar schools, and of others of less note. The collection

was best in historical and domestic *genre*, landscape, and portrait. The Navy

Yard, by Hochhaus, showing the construction of one of the German war ves-

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work might have been spent. Noteworthy too were Otto Friedrich's Death

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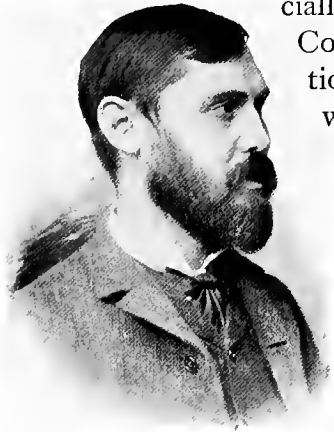
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herds, and the Duel behind a Fence, by Knauss, and W. Velten's Outposts. Going Freely, by Schnauss-Alquist, was a fine marine piece. Paul Hoecker's On Board the Deutschland was a powerful composition, full of movement. Peter Paul Mueller's Forest of Beeches was a characteristic landscape, and Hugo Koenig had one with figures called On the Way Home, and Walter Leistikow two powerful works called Dusk and The Brickyard. Hans von Bartel's Surf was a magnificent study of waves. Richard Friese's In the Lagoon was a realistic picture of lions devouring a buffalo. Adolf Hoelzel in Light expressed religious sentiment with effect. E. Henseler's Mowers' Breakfast was a very natural scene. Karl Knabel's Rafting on the Isar was carefully painted and full of action.



KENYON COX,  
Painter.

Austria sent a good selection, consisting of about a hundred paintings, admirable in technique and allied to the German schools, in which the proportion of serious and impressive religious painting was especially noticeable. Schmidt's Suffer the Little Ones to Come unto Me was a very pathetic and novel interpretation of this hackneyed subject. Christ and the Women was also an attempt to invest a Scriptural subject with human interest. A classical subject vigorously handled was Hirschel's Prometheus. Among several fine portraits an ideal picture of Washington on horseback, by Huber, was full of character and dignity. Julius von Payer in Never Retreat treated a dramatic military episode forcefully in somber tones. Vocslav Brozik, in Fenstersturz at Prague, handled an historic subject with French technique. The most striking work in the collection was the decorative allegorical series of the Five Senses, by the departed genius Makart, nude figures in attitudes symbolizing sight, hearing, feeling, smell, and taste. None of the Austrian landscapes were strong.

Small figure subjects of amusing incident and types of character were happily chosen and neatly painted, such as the Photographer and the Antiquarian of Ludwig Gloss and Hamza's Dicers. Josef Gisela's Lottery was a composition worked out with artistic skill, and Leopold Müller's Market Day in Cairo was one under a southern sky. Early Spring was a fine landscape by Robert Russ. H. Temple had a remarkable portrait of W. Unger in his laboratory.

In a collection of about thirty water colors from Austria, those of Rudolf Alt was noteworthy for artistic lights and shadows and surface textures, combined with elaborated architectural drawing, as in his Interior of St. Mark's.

The Belgian paintings contrasted with the French and Italian in their somber tones and serious or pathetic sentiment. The sea pieces were rarely fine and clear. A painting of a curling wave by Bouvier was an original

study of the changing green reflections in a bright light. Stroobant had a faithful rendering of the Old Canal at Bruges. A picture full of figures, in which the grief of parting was portrayed in the faces, was the Embarkation of Emigrants at Antwerp, by Farasyn. Sober grays and browns predominated in the landscapes of Bayart and De Schampheler. The Cupid and Chase was an interior in which the marble of a bath was well painted in fine



VIEW IN THE HOLLAND SECTION.

contrast with the nude bather. A large composition by the deceased master De Keyser was Holy Week in Seville, representing a priestly procession. Briele Poort, by Meyers, was a conscientious study of light and brick architecture. Courtens had some studious, quiet, well-balanced landscapes and canals. There were several good bits of still life and some portraits, of which that of Jerome Becker, by Vanaise, was particularly good and had a happy and original background, the city of Antwerp in the distance. J. von Snick's Lace Makers was a fine interior, and De Vriendt's Charles the Sixth one with historical adjuncts. Large animal groups were the Watering-Place Martyrs of Jan Verhas and Tschaggeny's Horse Fair at Tongres.

Holland sent a fine representative collection of two hundred oil paintings, in which somber tones, quiet subjects, and serious, restrained treatment pre-

vailed even more than among the Belgian artists. The large number of woman painters was remarkable. They dealt mostly with subjects of still life, in which the Dutch show themselves very proficient and not unlike their earlier masters in the mode of treatment. The pictures of Hubert Vos, who lives in London, especially his portrait of the Queen of the Netherlands, reflected very clearly the influence of the old Dutch school. The peaceful landscapes and seascapes and views across dikes and canals, the boats and shipping, the interior of homes and street scenes, the popular types and facial expression of large figure subjects, revealed a living national school, but one that neglects anatomy and technique.



THE BUFFALO HUNT,  
By H. K. Bush-Brown.

Among the Dutch painters Josef Israels, their acknowledged chief, was strongly represented by *Alone in the World*, *Sweet Home*, and *Fisherwomen at Zandvoort*.

The canals and windmills of Jacob Maris were new to America, as well as the works of his brother William.

Other examples of the Dutch school were : *A Sandy Road*, by F. P. ter Meulen ; *Flowers*, by Mrs. Rosenboom ; an *Autumn Sunset*, by Apol ; and a *Frugal Meal*, by Blommers. There were several works by Mauve, J. L. de Haas, and the Mesdags. On the *River Vecht*, by Du Chatel, and H.

J. van der Weele's *Plowing in Spring*, Roelof's *Pasture near the Dunes and Mills near Rotterdam*, Bakhuyzen's *Driving Cattle Home*, and Klinkenberg's *Sunset on the Canal at Amsterdam* were good examples of the school by artists not generally known.

Otto Eerelman's *Horse Fair* was a large composition in which there was considerable movement, and *Surprised*, by J. E. Boks, was a humorous anecdote full of life. The Dutch painters are very successful with homely subjects, such as the *Woman and Child*, *Mother's Joy*, and *Sober Meal* of Albert Neuhuys ; *Offerman's Village Carpenter* ; *At the Well*, by W. Martens ; *Fall in the Fields*, by Artz ; the *Knitting School* of G. Henkes ; E. Verveer's *Waiting for the Boats* ; and *Washing Day and Shrimping*, by B. J. Blommers.

There were more than a hundred Dutch water colors not inferior to the oil paintings nor very different in style and subjects.

The paintings from Norway and Sweden were not true examples of the best in Scandinavian art, being mainly hasty productions, impressionistic in manner, ill drawn, and unfinished. There was in the Swedish collection a good portrait by Count von Rosen of Nordenskiöld, with his ice-bound ship in the distance. A very pleasing Swedish picture was A. L. Zorn's *In the Omnibus*. Ida von Schubsenheim's *Greyhounds* was well painted, and *Bird Shooting*, by Bruno Liljefors, was exceedingly effective.

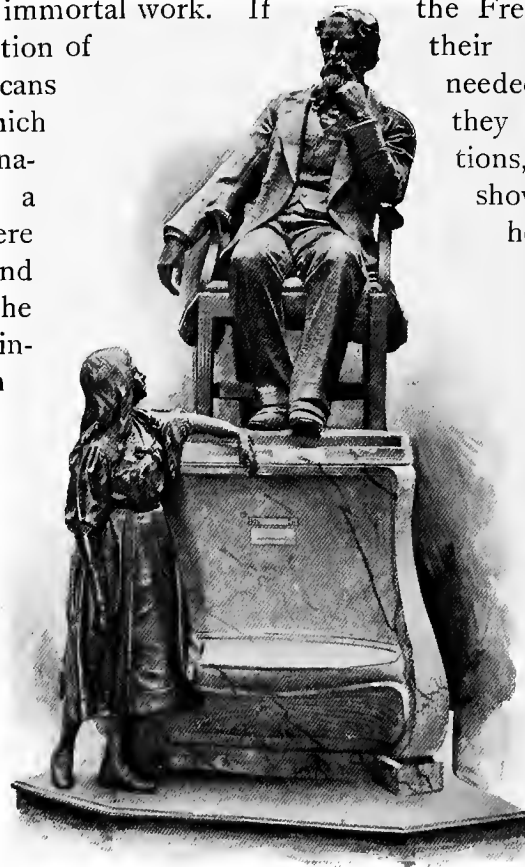
The Imperial Academy of Fine Arts at St. Petersburg sent a magnificent representation of the Russian school, consisting of more than one hundred paintings, all fine examples of the best contemporary Russian painters and of all who have lived in this century. The animated figures, the clever grouping and effects of light, and the rich, brilliant coloring of the Russian masters produced a strong impression, which was enhanced by the strange interiors, costumes, postures, and facial types. Many of the finest paintings of the exhibition were in this section, notably those of Makovsky and Verestchagin, as well as the scenes from the life of Columbus by Aivazovsky. Makovsky's *Moscow Rag Fair* contained a great number of carefully painted figures. Misoiedoff's *Flight of Gregori Otrepier* was full of action, and his *Harvest Time* a poetic and vivid reaping scene. Korsukhin's *Nuptial Party*, Sagorski's *At Breakfast*, Koutznetzoff's *In the Garden*, Vassili Golynsky's *Mushroom Gatherers*, T. A. Pelerin's *First Born*, and Pasternac's *Returning Home* were spirited and sympathetic portrayals of Russian life. Rudolph Phrenz's *At an Inn* was a fine animal picture, and Kiwchenko's *Sorting Feathers* and *At the Crater of Lendji*, Pavel Kovalevsky's *Excavation in Rome*, and Orenburgsky's *Drowned Man* were truthful and powerful paintings. Bodarevsky's *Wedding in Little Russia* in grouping, drawing, expression, and textures was a finished production. One of the most perfect of modern paintings is Repine's *Cossack's Answer*, in which the derisive scorn with which the warriors of the steppe received the summons of the King of Poland to pay homage and tribute was rendered with intensely dramatic interest.

In the American section one hundred and forty-eight pieces of statuary were shown. Those American sculptors whose style was formed by classical studies or under the influence of European schools made a very good showing beside their competitors of other countries. Those who have drawn their chief inspiration from Nature and life on this continent furnished some of the strongest and most original work that was seen at the Exposition. In the *Buffalo Hunt*, by Bush-Brown, a semi-nude Indian on horseback is plunging an arrow into a buffalo that is in the act of tossing the rider's horse. In Mr. Dollin's *Signal of Peace*, which shows French influence, an Indian is sitting a horse barebacked, with his spear resting on the horse's back and a flag of truce in his hand. Mr. Tilden's *Indian Bear Hunt* is a fine monumental group, as also is *The Closing Era*, by Preston Powers, which represents in life size an American Indian gazing upon a dying bison,

meditating on the rapid extinction of his own race as well as that of his quarry.

Mr. Elwell's Dickens and Little Nell is a very poetic conception, and that of Shakespeare, by W. O. Partridge, showed much thought. Mr. Gelert's Struggle for Work represents an old man and a boy trying to snatch a work ticket from a man holding it aloft.

Daniel C. French's Angel of Death, a fine idealistic conception, represents a young sculptor stricken by the he is completing an immortal work. If an adequate exhibition of perhaps that Americans to French art, which above all other nature as admirable a if the Exposition were were two hundred and of sculpture in the but this number in-historic collection reau des Monu-rique. The new about equal to in number. ment and tech-tion the French all the other freshness of of treatment the New World palm. In the as in M. Cain's tacked by Tigers, the same life as in American groups. eral large groups in



CHARLES DICKENS AND LITTLE NELL,  
By F. Edwin Elwell.

tion. In Danger, by M. Houssin, represents a young woman bearing two children in her arms and gazing with a look of alarm into the distance. In Gustave Michel's The Blind Man and the Paralytic, a work instinct with the ennobling and softening traditions of the French school and powerfully executed with regard to form and expression, a blind man carries on his shoulders an aged paralytic. The finest skill of the French school was evinced in some of the smaller works. M. Beguine's Charmer is a young nude woman holding two horns in her outstretched hands, with their ends in her mouth, a piece that is full of bright and joyous delight. The Bac-

angel at the moment when the French failed to make their painting, feeling needed no introduction they study and admire tions, in French sculp-showing was made as held in Paris. There forty - one pieces French section, cluded a large sent by the Bu-ments Histo-works were the American While in refine-nical perfec-work excelled sculpture, in ideas and vigor the sculptors of bore off the animal groups, Rhinoceros at-there was not some of the There were sev-the French sec-



chante of Moreau-Vauthier was in form and technique a master work, showing what complete anatomical studies lie at the foundation of French sculpture. There were other works betraying intimate researches into the expression of the passions, as M. Marioton's Chactas, having blank despair depicted in his countenance. The Conqueror of M. Sanson represents a nude man holding in his right hand a short sword resting against his shoulder, pointing with his left hand in haughty triumph at his victim on the ground. The Phryne of M. Hannaux and Diana of M. Lombard are studies of the nude,



THE ANGEL OF DEATH AND THE SCULPTOR.

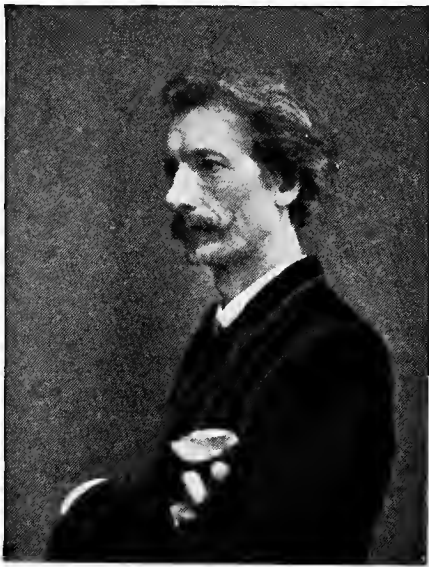
By Daniel C. French.

resembling the work of the ancients in eclectic purity and delicacy of form. M. Bartholdi had a group of colossal size representing the meeting of Washington and Lafayette. There were few portrait busts in the French collection, in contrast with the American and English sections, where these abounded. Small figure subjects of an ideal or allegorical character were seen, some of the most pleasing of which were by Hector Lemaire, especially his Eclipse of the Moon.

The collection sent by the Bureau des Monuments Historiques was a gift to the city of Chicago. It consisted of replicas in plaster of sculptures on historic French buildings made between the eleventh and the fifteenth centuries. There were over one hundred and fifty of these, some of them of immense size, standing in the middle of the court. Among them were a portion of the west façade of Amiens Cathedral, a doorway from Notre Dame of Paris, and like examples from Rheims, Rouen, Sens, Chartres,

Gaillan, and Limoges, besides reproductions from works of Jean Goujon, Lehongre, Masson, Michel Colombe, and other early sculptors.

The Germans were not as well represented in sculpture as in painting, and their collection, in spite of notable exceptions, betrayed a marked inferiority to the French in technique and in perception of the true artistic value of sculpture. There were many allegorical figures of Sleep and similar subjects. The National Gallery of Berlin loaned a number of patriotic statues showing the last three emperors in various attitudes. The works of Adolf Bruett were distinguished for truthful modeling. These were Phryne and Girl Bathing, nude figures, both of Teutonic type, and Saved, a group representing a weather-beaten fisherman with the inert figure of a half-drowned girl in his arms. Max Baumbach's figures of Dancers were spirited and typical.



WALTER SHIRLAW,  
Painter.

In the Swedish section a statuette representing Columbus first setting foot in the New World was skillfully carved from Turkish boxwood with considerable artistic feeling, though the sculptor, A. E. Norman, was a carpenter.

The sculpture exhibited by Italy was essentially different in treatment and execution from the other sections. It seemed to be all designed for decorative purposes, with an entire absence of idealism. No nude figures were shown. The display was very large, filling two spacious rooms. The numerous Parian-marble figures were attractive for domestic decoration, but partook rather of the character of artistic handicraft than of true art, not from lack of invention and finished modeling, but because of their triviality. The size of the pieces was smaller than in the other collections, and their purpose was plainly the adornment of private houses. Hence the homeliness of the subjects and the importation of textures and other adjuncts to set off the skill of the stone carver. The allegorical statues of Europe, Asia, Africa, and America were far from ideal. Portraits of peasant girls and busts and figures of women in costume were executed with fine technical skill. Flower girls, fruit sellers, fisher boys, gypsies, and like subjects were seen in abundance. The trick of representing faces covered with veils and similar commercial devices were common. There was a fine collection of Italian bronzes from ancient portrait busts and of candelabra, etc. A. Appolloni had a Beatrice in relief and a statue of America that belong on the higher plane of modern Italian sculpture, idealized types that are yet realistic in detail.

England made no great showing in sculpture. There were fifty-three sub-

jects, consisting largely of portrait busts. Among other sculptors, Sir F. Leighton, G. F. Watts, T. Woolner, Hamo Thornycroft, Onslow Ford, Nelson Maclean, and Harry Bates were represented. Their contributions were mostly small subjects, not at all ambitious in conception, treated sometimes with realistic fidelity, sometimes with sprightly fancy, but deficient in force, and especially in the thoroughness of modeling that is the first condition of sculptural success.

The art of Japan had never before been represented in an international exhibition. Recognizing the radical difference between the methods, conceptions, and materials of Japanese art and those of the Western world, the Art Department did not bind the exhibitors to the formal classification established for other nations, but invited such a thorough and characteristic national exhibit as would be presented in Japan itself. The Japanese commissioner, M. Tegima, made the most of the opportunity thus offered.

The Japanese exhibit, consisting mainly of a collection of paintings and sculptures of the highest artistic merit, excited the surprise even of those who had visited the island empire and were familiar with Japanese art, for most of these priceless treasures had been guarded in the private apartments of the Mikado's palace. The liking for Japanese art is almost universal now among the Western nations, and while there is a widespread demand for objects of the ordinary commercial grade, so general that many have feared that the mercantile spirit might degrade the national taste, there has been lately an increased foreign demand for the finest Japanese artistic skill. It was partly this and partly the realization of the fact that a special effort was needed to prevent their hands from losing their cunning that has brought about a remarkable revival of Japanese art of the purest style, following Japanese feeling and tradition as first developed from the impulse received originally from China. This Japanese renaissance was represented in all its phases by articles selected from those of the highest merit. The fine-art collection contained some four hundred pieces, including sculptures in wood, plaster, and bronze and other metals, carvings in wood and ivory, paintings, prints, *cloisonné* enamels, pottery and porcelains, lacquers, metal work, and architectural models. Of the carvings in wood, one of the most remarkable was Yamada Kisai's Wrestler, which reveals the strength and the limitations of Japanese art in the representation of the nude, anatomically incorrect and exaggerated, yet vibrating with an intense effect of movement, which is obtained by very simple means. The same artist had a panel representing an ancient military procession, in which the men and horses are reproduced with great truthfulness and all the details are accurate. There were two large carved panels by Telsirdo, one called A Royalist, representing an armored warrior holding a sword across his forehead and two others kneeling on either side, their expression grim and realistic. The other panel represents the goddess Kannon, partly in low relief, but with the details of the headdress quite free. The same goddess was represented in an exquisite wooden statuette by Brun Ni-

shimra and again in a beautiful ivory statuette by Ishikawa Mitsuaki, the largest carving in ivory ever done in Japan. Shimaiusa had an equally fine small ivory, *The Warrior*, a typical Japanese figure. A teakwood figure of Ikkyu, a Japanese philosopher, who warns his hearers of the vanity of human wishes, pointing to a skull, which latter, of ivory, was made by Asahi Gyokza, while the figure was the work of Asahi Eizo. The most remarkable of the large carvings in wood was a life-size figure, by Tamara Koun, of an ape holding in his hand the feathers of an eagle that has escaped from his grasp. Two



PART OF THE JAPANESE SECTION.

interesting allegorical statues in plaster were by Fujita Bunzo. One was *Temptation*, represented by a hideous horned female figure, with outspread wings, gloating over an infant that sucks evil from her breast. The other was a representation of *Victory*, a majestic female figure standing on a globe beneath whose weight a dragon is writhing. Okazaki Sessei had five pieces in bronze, two of them large panels representing dragons over water; another a panel representing Benten, the goddess of music, standing out from a flat background and playing a musical instrument; one was the statue of a *Strong Man*, a powerful and dramatic figure, treading upon a dragon which he is about to dispatch with uplifted sword; and the last was a wonderfully wrought

eagle, with outstretched wings spreading five feet, each particular feather chiseled with exquisite care. Otaki Norikani exhibited other remarkable bird pieces, but Chokichi Suzuki's Twelve Bronze Falcons, each bird shown in a different attitude and each cast in a different metal or plated with a different gold, silver, or copper alloy, surpassed in naturalness and delicacy of execution all the other bronzes in the exhibition. To execute this work, representing the dozen birds that were selected from all Japan and ceremoniously set apart for the Shogun's use, the artist consumed four years, keeping young falcons constantly by him to study in their natural state. The collection contained admirable examples of small metal work, especially plaques engraved or decorated in relief. A small panel representing Herons by Reeds, by Kano Natsuo, was a specimen of *kalakiribori* work, in which lines are cut in varying depth and thickness to produce effects of light and shade. No part of the design stands in relief, and gold and silver are used in details or to emphasize certain parts, while copper and iron form the main materials. Another example of this chiseled work was a plaque, by Kagowa Katsushiro, representing a group of monkeys playing with insects, with flowers in gold and silver as decorative accessories.



EDWIN H. BLASHFIELD,  
Painter.

The Japanese display of paintings was large, and was notable as proving that, while many brilliant Japanese artists have been trained in the tendency to Western methods and ideas, there are others, perhaps more vigorous and important, that under the influence and teaching of the Japanese Academy of Fine Arts adhere faithfully to the traditional forms and methods. In the collection exhibited, only three paintings in oil were executed in the European style. Among the numerous examples of genuine Japanese painting, *A Festival of Sannon at Yeddo*, by Ogata Jekko, commanded attention by reason of its brilliancy of coloring and vigorous drawing. *A Cherry Flower Picnic in the Middle Ages*, by Taniguchi Kokyo, was equally spirited. Kose Shoseki had an historical painting portraying the philosopher Shotoktaishi reading a lecture to four students. Ikeda Shinjiro's *Kawanakajima Battle* was a large painting representing in the foreground a group of mounted warriors engaged in a sharp combat, in which distorted foreshortening, rigidity of expression in the countenances, and hardness of drawing scarcely detracted from the wonderful effect of strenuous action. Among numerous

animal pieces some were masterpieces judged by the purest canons of art. Kishi Chikdo had a huge portrait of a tiger starting from his sitting posture and snarling at the spectator, drawn with great power in a thoroughly natural manner. There was a great variety of landscapes. A series of six Scenes in Nikko, by Sukzi Kason, exemplified the power of Japanese artists in transferring to paper the salient realities of Nature. The tapestries and textile pictures were as remarkable and almost as expressive as the paintings. Jimbei Kawashima's Festival Procession at Nikko, a huge tapestry containing hundreds of figures with a rich background of architecture and foliage, was a more striking picture than any of the paintings, none of which surpassed it in delicate and truthful drawing and color, and varied and lifelike expression of faces. The fabric was what is known as Tsuzure Nishiki tapestry, which is woven chiefly by hand with very little aid from machinery, the cross threads being adjusted by the fingers and finally put into position with a comblike instrument. This piece, twenty-two by thirteen feet, was made by the constant work, day and night, of several sets of weavers employed simultaneously and continuously for two years. The collection of porcelain was not large. It would have been insignificant but for the loan of the private collection of Hayashi Tadamasa, containing several hundred small colored pieces of great variety and richness, and of Nimikawa Soske's collection of one hundred and fifty pieces by the celebrated Takemoto Hayata, who had died a little over a year before without revealing the secrets of his processes. In *cloisonnés* the most striking examples were three magnificent works by S. Suzuki, two vases nearly nine feet high and a censer not much smaller, the largest pieces ever made in Japan, remarkable for their superior decorative style and the finish and execution. The collection of lacquer work was small, but it included some interesting examples. There were four specimens of the masterly work of Morishita Morihachi, two of them boxes decorated with butterflies and flowers, and fans decorated with landscapes rendered with minute detail and exquisite delicacy. Most of the lacquered specimens were small, but they were executed with great care. The largest object was a cabinet by Morimra Ichitaro, decorated with landscapes. There were four architectural models, one representing a palace in Shizuoka and the others temples or parts of temples. These also were wonderful specimens of artistic workmanship, executed in colors, with the carvings and metal work carried out in detail with the utmost fidelity.

From the nature of the case, our illustration of this chapter necessarily falls far short of the pictorial character of the subject. Not all the worthy works could be represented, if we gave the whole volume to it. Hence we have thought best to confine the illustrations mainly to portraits and general views. Other works, notably *The Art of the World*, have presented good engravings of a large number of the separate pictures.

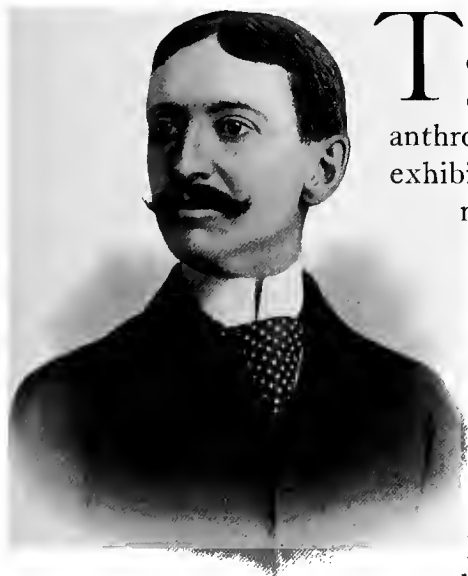


Prehistoric New Mexican pottery exhibited by Henry Hales, Ridgewood, N. J.

## CHAPTER XIV.

### THE ETHNOLOGICAL EXHIBIT.

The official classification of the department—Archæology—Ethnological collections—Ancient religious games and folklore—Physical anthropology—Ethnography—Section of history—Natural history—The State and foreign buildings.



ROBERT A. WALLER,  
Member of the Directory.

THE Department of Ethnology, in addition to ethnological exhibits, included the several groups of archæology, history, natural history, and the anthropological laboratory. Besides the systematic exhibits in the Anthropological Building there were many special exhibits that were novel and rare, highly important, and of fascinating interest.

In the center of the hall was placed the archæological exhibit of the Government of Greece, a large collection of casts from sculptures illustrating the different periods of ancient Greek art. There were eighteen sculptures of the archaic, seventy-four of the classical, and nineteen of the Hellenistic and Roman periods, and these were supplemented by collections from the Chicago Art Museum.

The official classification announced for the Department of Ethnology, Archæology, and Physical Anthropology is given below :

Group 159—Views, plans or models of prehistoric architectural monuments and habitations : 939. Caves, natural and artificial ; dwellings, natural and artificial. 940. Lacustrine dwellings—dolmens, tumuli, menhirs, cromlechs, alignments, cup stones, graves, cists, crematories. 941. Cliff and other dwellings—models of dwellings, shelters, skin lodges, yourts, huts (of bark, grass, etc.), wooden houses. 942. Appurtenances—sweat houses (models), totem posts (originals and models), gable ornaments, locks.



Group 160—Furniture and clothing of aboriginal, uncivilized, and but partly civilized races : 943. Household utensils and furniture. 944. Articles serving in the use of narcotics—pipes, etc. 945. Articles used in transportation. 946. Clothing and adornment.

Group 161—Implements of war and the chase.

Group 162—Tools and implements of industrial operations : 947. Gathering and storing food other than game ; water vessels. 948. Articles used in cooking and eating. 949. Apparatus of making clothing and ornaments, and of weaving.

Group 163—Athletic exercises ; games.

Group 164—Objects of spiritual significance and veneration ; representations of deities ; appliances of worship.

Group 165—Historic archæology ; objects illustrating the progress of nations.

Group 166—Models and representations of ancient vessels, particularly of the period of the discovery of America.

Group 167—Reproductions of ancient maps, charts, and apparatus of navigation : 950. Charts and maps of the world anterior to the voyage of Columbus. 951. Charts and maps following the discovery. 952. Charts and maps of the period of the early colonization of America. 953. Charts and maps of America and the world at the period of the Revolution.

Group 168—Models and representations of ancient buildings, cities, or monuments of the historic period anterior to the discovery of America.

Group 169—Models and representations of habitations and dwellings built since the discovery of America.

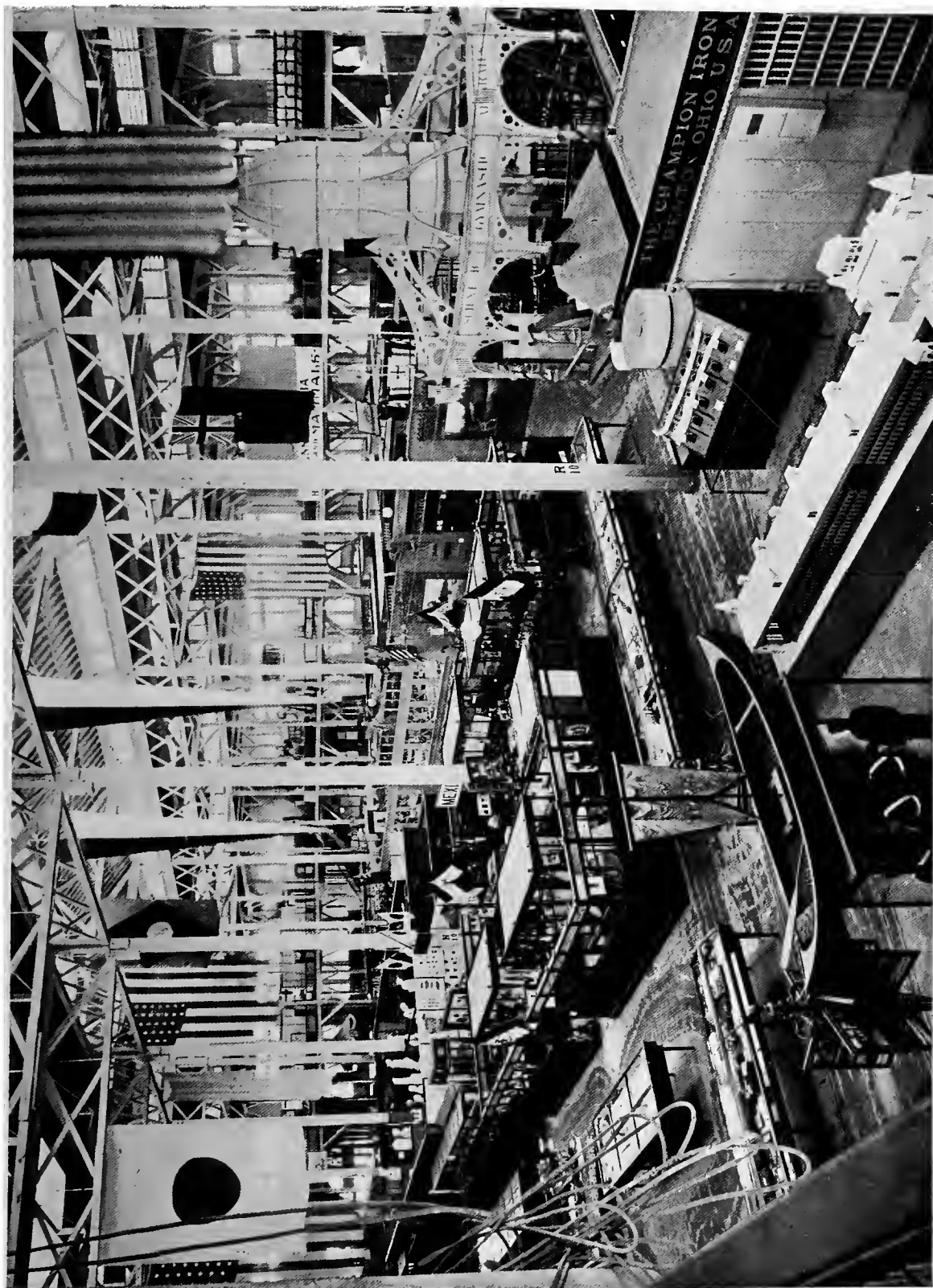
Group 170—Originals, copies, or models, or graphic representations of notable inventions.

Group 171—Objects illustrating generally the progress of the amelioration of the conditions of life and labor : 954. The evolution of the dwelling and its furniture. 955. The evolution of the plow and other implements of the farm and garden. 956. Evolution of tools—the axe, saw, and other implements of handicraft. 957. Labor-saving machines and their effects.

Group 172—Woman's work.

Group 173—State, national, and foreign government exhibits.

Group 174—The North American Indian : 958. Special monographic exhibit of the tribes of America. 959. Villages or families of various tribes engaged in their native occupations. 960. Specimens of their special work and industries ; collections of Indian "trinkets" or curiosities. 961. Books or papers, written or printed, in his native tongue. 962. Means and methods of communication between tribes by "sign" language and "picture letters," etc. ; status of females under tribal regulations. 963. Treaties and acquisition of territory from the various tribes, and how obtained. 964. Progress of Indian civilization through the efforts of the Government, missionaries, or by his own efforts and choice ; his industrial pursuits and capabilities, as



GENERAL VIEW IN THE ANTHROPOLOGICAL BUILDING.



exemplified in the shop, on the farm, and in the schoolroom ; inventions, etc. 965. Music ; the "Columbian Indian Band," consisting of sixty or more instruments. 966. The allotment of lands to families and individuals, and its effects ; the Indian as an American citizen ; the hope of the Indian. 967. Other attainments and industries not specially mentioned.

Group 175—Portraits, busts, and statues of great inventors, and others who have contributed largely to the progress of civilization and the well-being of man.

Group 176—Isolated and collective exhibits : 968. The Latin-American Bureau.

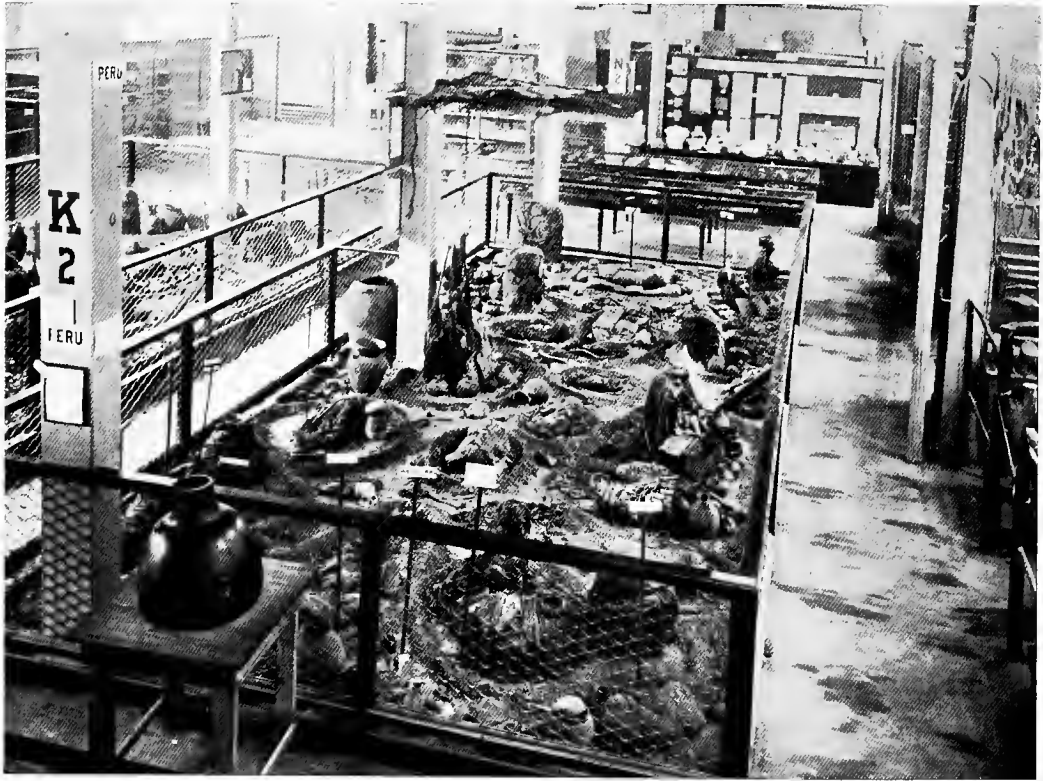
The Department of Ethnology had valuable collections of American archæology to exhibit, the result of explorations made under the direction of Frederick W. Putnam, its chief, by the following explorers : In Ohio, C. L. Metz, W. K. Moorehead, H. J. Smith, M. H. Saville, Allan Cook, and G. A. Dorsey ; in the Delaware Valley, Ernest Volk ; in Maine, C. C. Willoughby ; in Mexico, Zelia Nuttall ; in Honduras, the commissioner of the Peabody Museum ; in Guatemala, J. G. Owens ; in Peru, La Plata, Chili, and Bolivia, G. A. Dorsey ; in Yucatan, E. H. Thompson ; in the West Indies, F. A. Ober ; in Peru, W. E. Safford ; in South California, Stephen Bowers.

Relief models were made of the Turner and the Clark, or Hopewell, groups of earthworks in Ohio and of Serpent Mound Park.

E. E. Ayer's large and interesting collection of Mexican idols and copper, obsidian, and stone implements, and stone pots and mortars from California and Colorado was one of several private exhibits illustrating the prehistoric civilization of the continent. F. G. Logan exhibited his collections, made by H. N. Rust, of stone implements and pottery from California and other places. C. H. Green loaned a large collection of relics of the cliff dwellers of Colorado, Utah, New Mexico, and Arizona ; and Henry Hales sent one of ancient Pueblo pottery from New Mexico. The State of Colorado exhibited mummies, pottery, implements, and weapons illustrating the life and customs of the ancient cliff dwellers. A collection of the archæological remains of Indiana was made for that State by W. W. Borden and Mr. Green. The Wisconsin Historical Society exhibited copper and stone implements and tablets showing the outlines of typical effigy mounds, with the grouping of the mounds. Ohio made a State exhibit of drawings of Indian mounds and of ancient stone implements and ornaments. A large collection of stone implements from Missouri was arranged as a State exhibit by W. J. Sewer. Ludlow F. North sent a collection of bone and copper implements from Wisconsin ; H. H. Hayssen, another collection of Wisconsin antiquities ; the Wyman Brothers, copper and stone implements from Wisconsin, Illinois, and Missouri ; C. W. Riggs, pottery and stone implements from St. Francis Valley, Ark. ; H. L. Johnson, stone implements from Kentucky and Tennessee ; E. H. Williams, stone implements from the site of an ancient habitation in Bristol, Conn. ; J. E. Knowlton, collections from the shell heaps of

Damariscotta, Me.; Theodore Kamensky, collections from Florida shell heaps; H. I. Smith, implements and ornaments from village sites, and caches of stone implements from the Saginaw Valley, Mich.; and E. S. Golson's collection from Saginaw, consisting of a copper celt and awl, bone implements, and a cache of implements. H. W. Phillips showed a collection illustrating the methods of stone chipping. There was a collection of skulls and skeletons from the Peabody Museum, with Indian relics from the Penobscot Valley.

The archæology of Ontario was illustrated by an official Canadian exhibit of prehistoric relics. An interesting exhibit, made by Charles H. Bennett,



REPRODUCTION OF A PERUVIAN BURYPING GROUND.

was a section of the pipestone quarries at Pipestone, Minn., from which the Indians used to procure the reddish stone of which all their pipes were made. Photographs of ancient structures in Central America, taken by A. P. Maudslay, were exhibited by the British commissioners, and the French Minister of Education sent casts and hieroglyphs from the ancient ruins of Central America from molds taken by Désiré Charnay. From molds taken by E. H. Thompson, the department erected out of doors facsimiles of portions of the wonderful ruins of Uxmal in Yucatan—the straight arch from the east façade of the house of the governor, the façade of the Serpent House, a part of the

north wing and a corner and the central part of the east wing of the House of Nuns, a monolith, and several sculptured stones—and of the portal from the central structure at Labna. The Government of Costa Rica sent maps illustrating the archæology and ethnology of that country and other parts of Central America, large paintings of the natives and their habitations, and a collection of pottery, implements, and weapons from ancient graves.

No such opportunity has ever been afforded to archæologists to study the remains of the cultured prehistoric races of North America. The combined exhibits of the Peabody Museum, the Berlin Museum, the Charnay collection, and the objects contributed by the Mexican and Costa Rican Governments and by private collectors comprised nearly everything that has been preserved from that extinct civilization. The collection of those curious and mysterious sculptures and tablets of hieroglyphs has never been equaled. Zelia Nuttall's Mexican collection consisted of charts illustrating her restoration of the Mexican calendar system, with a photographic reproduction of a portion of Sahagun's manuscripts and a number of painted shields. Pottery vessels taken from a mound in Yucatan were exhibited by D. P. Ingraham. A collection of sculptures from the ruins of Copan was sent by the Government of Honduras. The Royal Ethnological Museum of Berlin sent some interesting antiquities of Central America. Archæological collections from Mexico were contributed by the Mexican Government. Carl Lumholtz added one of human skulls, pottery, and other objects from ancient burial places in northern Mexico.

There was an official Brazilian exhibit of pottery and other objects illustrating the archæology of Brazil. A. Stübel, of Dresden, Germany, showed some casts of Peruvian antiquities. José A. Peralta's collection from Colombia consisted of gold and silver images and ornaments, stone objects, and pottery; W. B. Tisdell showed a similar collection of objects found in that country, belonging to Captain Harris; and Emilio Montes sent a large collection of pottery, wooden vessels, ornaments of gold, silver, and copper, and stone implements and weapons from the Cuzco Valley, Peru, illustrating the time of the Incas.

Exhibits of European prehistoric archæology were H. Wankel's collection from Moravia, including the skull and bones of a cave bear and the ancient pottery, flint knife, and horseshoe found near Rossbach and sent from Hamburg. A large and instructive exhibit of Egyptian antiquities was loaned by Armand de Potter, of Albany. Theodor Graf sent some ancient Greek portraits found in tombs at Fayum, Egypt. Japan sent an archæological and an ethnological collection from the Imperial Museum and from the Tokyo College of Science. A very large ethnological collection from Peru, Chili, Bolivia, the Paraguay River, and other parts of South America was loaned by Harvard College, important features of which were the pottery and garments of the Peruvian Quichas and a reproduction of an ancient burial place dug up at Ançon.

A curious collection of totem poles, idols, masks, canoes, apparel, and utensils illustrated the ethnology of British Columbia, which was more vividly presented by fourteen Quakuhl Indians brought by Dr. Boas from Vancouver Island, who by their strange songs, dances, and ceremonies interested men of science and entertained the public. Special collections were made by the department to illustrate the ethnology of the northwest-



EXHIBIT OF MAMMALS FROM MAINE.

ern coast of America, Queen Charlotte's Island, and Vancouver. Of particular interest was the facsimile reproduction of the village of Skidegate, with all its houses and totem poles.

Ethnological collections were made for the department by the following-named explorers: In Greenland, R. E. Peary; in Labrador, R. G. Tabor; in Queen Charlotte Islands, James Deans; in British Columbia, A. T. and Hugh Watt; at Bella Coola, Fillip Jacobsen; at Fort Rupert, George Hunt; at Neah Bay, J. G. Swan; at Puget Sound, Myron Eells; at Shoalwater Bay, L. L. Bush; in North Saskatchewan Valley, Isaac Cowie; in Alberta, John McLean; in Nova Scotia, A. R. Tisdale; in Canada, E. F. Wilson; among the Nez Perces of Omaha and Winnebago, Alice C.



Fletcher ; among the Nez Percés elsewhere, James Stewart ; in Ontario, T. P. Hall ; among the Mohawks, T. F. Colgate ; among the Sioux, G. A. Kaven and F. Conger Smith ; in Nova Scotia and New Brunswick, G. M. West ; in the valley of the Yukon, M. O. Cherry ; in Alaska and Siberia, Sheldon Jackson ; among the Cherokees, Frederick Starr ; in Montana, T. E. Adams ; in Idaho, T. L. Bolton ; in Indian Territory, W. H. Wilson ; in Minnesota, H. B. Montague ; in Wisconsin, Maxwell Riddle ; in Michigan, H. W. Ruoff ; in South Carolina, W. C. Hamilton ; among the Caribs of the West Indies, F. A. Ober ; in Peru and Bolivia, W. E. Safford and G. A. Dorsey ; in upper Paraguay, D. N. Bertolette.

There were numerous collections illustrating the habits and customs of various tribes of North American Indians. A collection of dress, utensils, etc., of Wisconsin Indians was contributed by the Wisconsin Historical Society. G. A. Lawrence exhibited the collection of T. E. Adams, illustrative of the life and customs of the Flathead Indians. Herman Haupt, Jr., had a comprehensive collection of costumes and other objects peculiar to various tribes. Portraits of Indians and photographs of Indian life were shown by John H. Grabill. James Brooks exhibited a collection of Indian photographs also, and C. S. Wake one of ethnological and archæological subjects. Mrs. Louise Catlin Kinney loaned twenty-eight paintings of Indian life made by George Catlin fifty years ago. A general collection illustrating Indian customs and costumes was contributed by D. B. Dyer. E. E. Ayer loaned a large ethnological collection from various tribes, including basketwork and beadwork, costumes, and ornaments. Customs and costumes of the Alaskan tribes were exhibited by Mrs. Alice Palmer Henderson. Harvey Shurtleff had a collection of Indian garments from Alaska and O. E. Stafford a general ethnological collection. Mrs. Franz Boas loaned collections of ethnological material from British Columbia and Baffin Land. A collection from Nova Scotia was sent by Père Armand. Newton W. Chittenden exhibited one from British Columbia. Alice C. Fletcher and Francis La Flesch exhibited the Omaha pipes of friendship and Alice Fletcher the results of her ten years' investigations on Indian music. Objects from the Sierra Madre of northern Mexico were loaned by Carl Lumholtz. The Government of Paraguay exhibited weapons, costumes, and manufactures of the native tribes of that and neighboring countries. The Argentine Republic sent an ethnological exhibit from the Museum of La Plata. Brazil made an official exhibit of the ethnology of Brazilian tribes. A collection illustrating the ethnology of British Guiana was presented by the commissioners of that colony. E. Remenyi loaned a collection of arms, scepters, royal insignia, and ornaments of the Zulus, and of silver, ivory, and horn ornaments and silk and feather royal mantles of Madagascar. J. McMillan showed many implements, weapons, ornaments, pottery vessels, and musical instruments of various tribes of the central coast of Africa, and S. B. Lingle a collection from the Congo River and the in-

terior of Africa. A collection of household utensils, ornaments, fetiches, musical instruments, etc., from western and Central Africa was contributed by C. L. Davenport, and W. S. Cherry showed an ethnological collection from the Congo basin. A general ethnological collection from Central Africa came from the Imperial Museum of Natural History in Vienna, which loaned also extensive Polynesian collections, consisting of weapons, implements, ornaments, etc., with musical instruments from the Sunda Islands. Mrs. Esther O. Putnam showed jade ornaments and implements, native cloth, etc., from New Zealand. There was an exhibit, collected by J. G. Peace for the French colonies, of ethnological material from New Cale-



NEW YORK STATE EXHIBIT OF SHELLS AND MAMMALS.

donia and other Pacific islands. New South Wales had an official exhibit consisting of costumes, weapons, and manufactures of the Australian natives of the colony.

In the section of ancient religions, games, and folklore were collected many objects illustrative of Oriental religions. Mrs. J. Mannheimer loaned a collection of articles used in Jewish ceremonials. Ancient Spanish crosses and crucifixes were contributed, with commemorative Columbus medals, by Mrs. Stewart Culin. From the University of Pennsylvania were brought

images of the gods of ancient Egypt and other objects illustrating early religion and folklore. H. C. Thomas sent Buddhistic sculptors and C. Wake various East Indian religious objects and photographs of ceremonial observances. R. J. Dunning's collection contained idols, fetiches, amulets, and other objects connected with religious observances of all times and countries. The Siamese Government exhibited characteristic religious objects and the games of the country. A collection of Chinese popular books belonged to John Culin. George F. Kunz collected gems and precious stones and arranged them in a way to illustrate the folklore of all nations regarding them. A collection of East Indian musical instruments was sent by the Austrian Imperial Museum of Natural History and one of Chinese instruments was shown by Quong Wah Sing & Co.

The collection of the games of all races and ages, the basis for which had been formed in the Museum of Archæology of the University of Pennsylvania during the preceding two years, taught the lesson of the unity of the race and the homogeneity of the human mind with vivid force. The main collection was supplemented by private exhibits, such as Chief Joseph Nicol's, of games of the Penobscot Indians; Frank H. Cushing's, of Zuni games; Henry B. Waterman's, of Chinese games; Rounseville Wildman's, of games from Johore; H. L. Scott's Kiowa game; C. Howard Colket's board for the Japanese game of *go*; Mrs. S. F. Fletcher's mythological game; Isabel Adams's game of Dr. Busby; E. J. Horseman's exhibit of games; John Culin's carved chessmen; curling stones from the Chicago Curling Club; Mrs. J. K. Van Rensselaer's historical collection of playing cards; W. H. Wilkinson's collection of Chinese playing cards; G. Goode's, of Italian geographical cards; and Charles E. Dana's collection of Italian, Frances C. Macauley's of German, and Mrs. T. Semtchkin's of Russian playing cards. The Department of Ethnology had acquired interesting collections of American games and the earliest American playing cards and of Burmese games through C. S. Bayne, and through C. H. Todd Crosthwaite had obtained from the Lucknow Museum a collection of East Indian toys and games. A. G. Spaulding & Brothers, the Milton Bradley Company, and the McLaughlin Brothers furnished all the games now popular in this country. Models of billiard tables and boards for similar games beautifully made for the Exposition by the Brunswick-Balke Company showed the evolution of billiards. Books about games were furnished by Dick & Fitzgerald, Lady Charlotte Schreiber, and Edward Falconer.

In the section of physical anthropology were exhibits of the anthropological, physiological, and psychological laboratories of the Universities of Berlin, Bonn, Chicago, Cornell, Geneva, Heidelberg, Illinois, Indiana, Leipzig, Paris, Pennsylvania, Rome, Strasburg, Tokio, Toronto, Tübingen, Turin, and Wisconsin, and Brown, Clark, Harvard, Johns Hopkins, Leland Stanford, and Yale Universities, and Columbia College and Wellesley College. Plans and photographs were shown of the Archæological and Ethnological

Museums of Berlin, Leipsic, Vienna, and Cambridge, Mass., as well as of the United States National Museum. The interior and workings of the Société d'Hypnologie, of Paris, were shown by photographs. Dr. L. Manouvrier, of Paris, exhibited charts showing the distribution of statures in that city, which are highest amid the best social conditions, and diagrams representing the mean proportions of the body according to age, sex, and stature. A. Corre, of Paris, had an exhibit of criminal anthropology. The anthropology of



INTERIOR OF VICTORIA HOUSE, THE ENGLISH GOVERNMENT BUILDING.

Great Britain was illustrated by John Beddoe. Prof. Frederick Starr exhibited finger prints of Indians. Composite statues were exhibited by Dr. Wallace Wood, who separated the nervous types from the muscular and the robust from the soft. Dr. H. P. Bowditch and Dr. J. S. Billings exhibited composite photographs.

Types of European skulls and faces were exhibited by Prof. J. Kollmann, of Basle. Dr. Bernhard Bannwarth exhibited photographs of skulls found in Switzerland. German types were shown by the Berlin Anthropological Society, Silesian skulls by Karl Hasse, crania from Mecklenburg by Albert von Brunn, other types by E. Schmidt, of Leipsic, and crania from Asia Minor by F. von Luschan. Crania and skeletons of some anthropoid apes

were exhibited for comparison. There were casts of the Neanderthal and Enghis skulls. The long and low skulls of northwestern Germany were peculiar. There was a series of ancient skulls from Italy. An ancient Greek skull was supposed to be that of Sophocles. The skulls of Armenians and Oriental Jews were remarkably high and short. The collection of skulls from New Guinea, New Zealand, and the Sandwich Islands was very interesting. The skulls from Melanesia were supplemented by casts of faces made by Dr. Finsch.

An interesting series of charts represented the physical development of 50,000 school children in different cities of North America : in Boston, by H. Bowditch ; in Oakland, by Earl Barnes ; in Milwaukee, by G. F. Peckham ; in St. Louis, by W. T. Porter ; in Worcester, by G. M. West. The department had charts representing the growth of children in Toronto and in Tokio. Its exhibit embraced, besides anthropological instruments and a library of anthropological works, crania of North American Indians, casts of various types of man, the charts illustrating the anthropology of North American Indians and half-breeds, compiled from the measurements instituted by Prof. Putnam, other charts illustrating the anthropology of mulattoes, and charts illustrating the results of tests of the senses, movements, judgments, and other mental processes. There was an anthropological laboratory showing the principal instruments and the results of anthropometrical investigations. This laboratory of physical anthropology was divided into anthropological, psychological, and neurological sections with a development room and a library. In the exhibit of the Hemenway Gymnasium of Harvard College were shown Prof. D. H. Sargent's researches in the anthropometry of American college students. Composite statues of the typical or average student, male and female, were objects of universal curiosity and interest. Harvard College exhibited also its psychological apparatus, and the medical school anthropometric instruments. The anthropometry of the American Indians was shown by charts based on 17,000 subjects measured by seventy-five students, who were engaged nearly two years on this work. Skeletons and crania of Indians were shown from Peabody Museum, and skulls of Polynesian races from the collection of Dr. Franz Boas. The effect of physical culture on the growth of students was shown by anthropometric studies of Prof. E. Hitchcock at Amherst and Miss M. Anna Wood at Wellesley College. In the laboratories the practical working of the apparatus was shown, and any person who wished it could have various tests applied, and could be measured and recorded on cards, which were given to the subject upon the payment of a small fee, while the record was made upon the charts and tables hanging on the walls of the laboratory to illustrate the various subjects. Jointly with the University of Wisconsin, the department established a working psychological laboratory, in which by the aid of a variety of apparatus tests of sensation and simple mental processes were made, and the methods of research were made clear to visitors.

Dr. E. Spitzka and F. X. Dercum exhibited anthropoid brains, and the latter brains of different races ; Isaac N. Kerlin, brains of idiots ; William P. Northrup, children's brains ; Dr. J. W. Blackburn, casts of the brain ; William Fuller, cases of dissected brains illustrating anatomical points ; E. Hektoen, specimens illustrating normal brains ; R. Jung, a model of the medulla ; Hugo Muensterberg, Aeby's wire model of the brain ; H. M. Lyman, cross sections through the entire brain ; F. T. Miles, sections of the brain in plaster ; R. W. Reid, of the University of Aberdeen, cerebral photographs ; Lea



THE LAFAYETTE ROOM IN THE FRENCH GOVERNMENT BUILDING.

Brothers & Co., photographs of the brain ; James B. Bulitt, dissected specimens of brains impregnated with paraffin ; D. J. Cunningham, of Dublin University, cerebral topography at different ages ; Prof. Ebersteller, of Graz University, charts showing the typical sulci ; Dr. Manouvrier, statistics of the weight and volume of brains among various classes ; Prof. B. G. Wilder, charts showing the development of brain surfaces ; C. O. Whitman, of Chicago University, and Adolph Ziegler, of the University of Freiburg, wax models illustrating the development of the brain and sense organs ; Dr. M. Allen Starr, of the New York College of Physicians and Surgeons, illustrations of the fiber anatomy of the brain ; C. E. Beever, of London, specimens

to show the anatomy of the spinal cord by means of degeneration ; Dr. S. Exner, of Vienna, a chart for post-mortem record and a model illustrating the localization of function from the study of disease in man ; Truax, Greene & Co., models illustrating the central nervous system ; and M. H. Knapp, protographs of nerve fibers and nerve cells. Victor Horsley, of University College, London, showed by charts the localization of functions. H. C. Bolton, William Bryan, and W. P. Lombard showed curves and charts illustrating researches in psychology. Dr. C. F. Hodge had charts illustrating fatigue of nerve cells. H. Windler, of Berlin, exhibited various anthropological apparatus. Apparatus for anthropometry was shown by the Narragansett Machine Co., Wilhelm Walb, of Heidelberg, and the Massachusetts Board of Health. Boehm & Wiedemann, of Munich, showed instruments for craniometric measurements. The tachycraniograph of Zambelli & Co., of Turin, draws rapidly cross sections of the skull in any desired direction, full size, or half size, or one third size. E. Zimmermann, of Leipsic, showed a kymograph. Dr. J. W. Seaver exhibited a pantograph for recording spinal curvature. F. O. Schultze showed a microtome used at the University of Würzburg, with sections. Rudolf Rothe, of Prague, showed apparatus for the color sense and other psychological purposes. Optical apparatus was exhibited by H. Bishop, Dr. Carmalt, Levy Dibble, F. C. Hotz, D. W. Hunter, C. S. Jefferson, B. J. Jeffries, Meyrowitz Bros., J. L. Minor, R. C. Moon, H. Nichol, J. H. Pillsbury, Queen & Co., and Emmons Welsh, and by H. A. Lediard, an English maker. R. Jung and Wilhelm Walb, of Heidelberg, showed apparatus for sense tests, and the Cambridge Scientific Instrument Co., of England, sent similar instruments. Psychological apparatus of various kinds was exhibited by C. W. Fitz, C. L. Franklin, and E. S. Ritchie & Sons, American makers, and by H. Elbs, of Freiburg, D. B. Kagemaar, of Utrecht, Max Kohl, of Chemnitz, Carl Krille, of Leipsic, F. Mayer, of Strasburg, Stoehrer & Son, of Leipsic, and Charles Verdin, of Paris. The Milton-Bradley Co. showed accessories for psychological tests.

For the section of ethnography the department, besides bringing a house from Skidegate, Queen Charlotte's Island, and reproducing the village, with its totem poles, obtained a colony of Fort Rupert Indians, who were seen living in their native fashion in a large house with totem poles, and produced a family of Eskimos from the Eskimo village. There were, moreover, skin tents of the Eskimos of Labrador and others of the Arctic highlanders, the latter collected by Lieutenant Peary in northern Greenland ; also striking objects illustrative of the customs of the Indians of British Columbia, such as a heraldic column from Fort Simpson, memorial columns from Bella Coola, and house posts from Nanaima, and besides these canoes from the north Pacific coast, a buffalo-hide tepee, a Winnebago mat house, and other Indian habitations. E. E. Ayer loaned two large totem poles from the northwest coast. The State of Colorado exhibited a Navajo *hogan* and a family of Navajos. H. E. Hunt, Indian agent at Oldtown, Me., induced four families



of Penobscot Indians to come and live on the grounds in their birch-bark wigwams and paddle their birch-bark canoes on South Pond. An exhibit of the Iroquois confederacy consisted of a small Indian village, in which were representatives from all the Six Nations. The wigwams were built in the ancient style, and there was a reproduction of the long house in which the councils were held. Canoes and fancy wood, bark, and bead work were shown, and at various times illustrations were given of the customs, habits of life, and folklore of the Iroquois. These Indians also paddled in Indian fash-



A ROOM IN THE GERMAN GOVERNMENT BUILDING.

ion on South Pond in their bark canoes and dugouts. There were colonies enough of Indians to illustrate all the types found on the continent. While the Quackuhl Indians of British Columbia lived in wooden huts, the Crees of the Northwest Territory occupied bark wigwams. The Penobscot Indians from Maine made their habitations of birch bark and the Winnebagos and Chippewas from Wisconsin and Minnesota constructed theirs from hides and bark, while the Navajos and Apaches built their characteristic tepees.

Representatives of many native races of Central and South America were brought to the Exposition to illustrate their ways of living and exhibit their skill. There were Venezuelan Lake Dwellers ; Guaranians from Paraguay, who

wove fine laces from vegetable fibers or served *yerba maté*, the native tea; and Mayas from Yucatan, who molded clay figures and pottery.

The Cape of Good Hope had a good collection of assegais, oxhide shields, trumpets, daggers, knives, clubs, headdresses, snuffboxes, dishes, and other



NORTHERN END OF THE FRENCH GOVERNMENT BUILDING.

implements and utensils of the natives of South Africa, with photographs of the Zulus and various Kaffir, Hottentot, and other types.

In the section of history the departmental exhibit was a pioneer log cabin, with characteristic furnishings and inmates dressed in colonial costumes and engaged in spinning, weaving, and other employments of old times. Ohio made an historical exhibit. Pennsylvania reproduced the York building. Collections of coins were contributed by W. S. Hoopes, H. H. Hayssen, and W. Nelson, and one of coins and postage stamps by the Scott Stamp and

Coin Company. Demetrius Bourilin sent from Russia a collection of Greek, Roman, and ancient Russian coins. Max Jaensch loaned a collection of German firearms, W. S. Kimball antique pepper boxes, George H. Laxton some famous old clocks, and Marietta Lloyd colonial chairs.

There was a large exhibit of fresh-water shells and mammals, from the New York State Museum, and fossils, including the celebrated skeleton of the mastodon found at Cohoes. The Province of Ontario furnished a large and fine collection of Canadian mammals and birds. Pennsylvania and Ohio exhibited their native birds, Maine its mammals, and Colorado the Rocky Mountain insects. The general natural-history exhibit of the Agassiz Association gave a good idea of the work and aims of that association in increasing the love and study of zoölogical science. The State of Nevada exhibited some of the most important prehistoric relics from a quarry in a spur of the Pine Nut Mountains, near Carson, Nev., which consisted of footprints, found in 1882, of human beings, horses, and birds, mammoth teeth, and two jawbones of a horse, found in a deposit assigned to the Upper Pliocene or Quaternary. Indiana exhibited a palæontological collection. H. H. Haysen showed fossils from Wisconsin. Brazil sent a collection of mammals, birds, and reptiles. Mrs. John N. Sorup had a large collection of butterflies from all parts of the world. Attractive examples of the new art of artistic and realistic taxidermy were the group of mounted otters and the mounted heads of musk ox, moose, and caribou done by W. W. Hart & Co., A. E. Robinson's mounted elk, deer, and antelopes, John Miller's mounted heads, the mounted deer of Leander Styles, and the productions of Gustav Stanisky & Co. The most remarkable achievement in this art ever seen was that of groups of mammals in a conventionalized but sufficiently illusive landscape seen in the Kansas State building.

The entire south gallery of the Anthropology Building was filled with collections of fossils and casts of famous fossils, shells, and corals, mounted specimens of mammals, birds, reptiles, batrachians, and fishes, and mounted skeletons of animals from Ward's Natural History Establishment, of Rochester, N. Y. On the main floor was the exhibit of human anatomy. These exhibits with collections in mineralogy, geology, petrology, and palæontology in the Mines Building and collections in invertebrate zoölogy, comparative anatomy, etc., formed a systematic collection of natural history, the largest ever made in the United States. It was valued at \$100,000 and was acquired by the Columbian Museum, of Chicago.

The State and foreign buildings and their exhibits belonged in this department, as well as the exhibits of the Midway Plaisance. The architects of the State buildings adopted the forms of architecture most intimately connected with the history of each State, in many cases reproducing the details of historic structures. The foreign buildings in style and features were likewise typical of national architecture and history. For description of the buildings, see Chapters XVI and XVII in Volume II.



Group at the Bohemian Garnet store, in Old Vienna.

## CHAPTER XV.

### THE MIDWAY PLAISANCE AND ISOLATED EXHIBITS.

The attractions of the Midway—The Irish villages—The German village—Old Vienna—The Moorish palace—Cairo street—An Egyptian temple—The Turkish corner—The East Indian bazaar—The Chinese village—The Japanese bazaar—The Javanese village—The South Sea Islanders—The Dahomey village—The World's Congress of Beauty—Hagenback's circus—The model of St. Peter's Church—The United States Submarine Diving Company—The zoöpraxographical hall—The Libbey Glass Works—The Barre sliding railway—The Ferris wheel—The Eskimo village—The cliff dwellers' habitations—The Liberty bell.

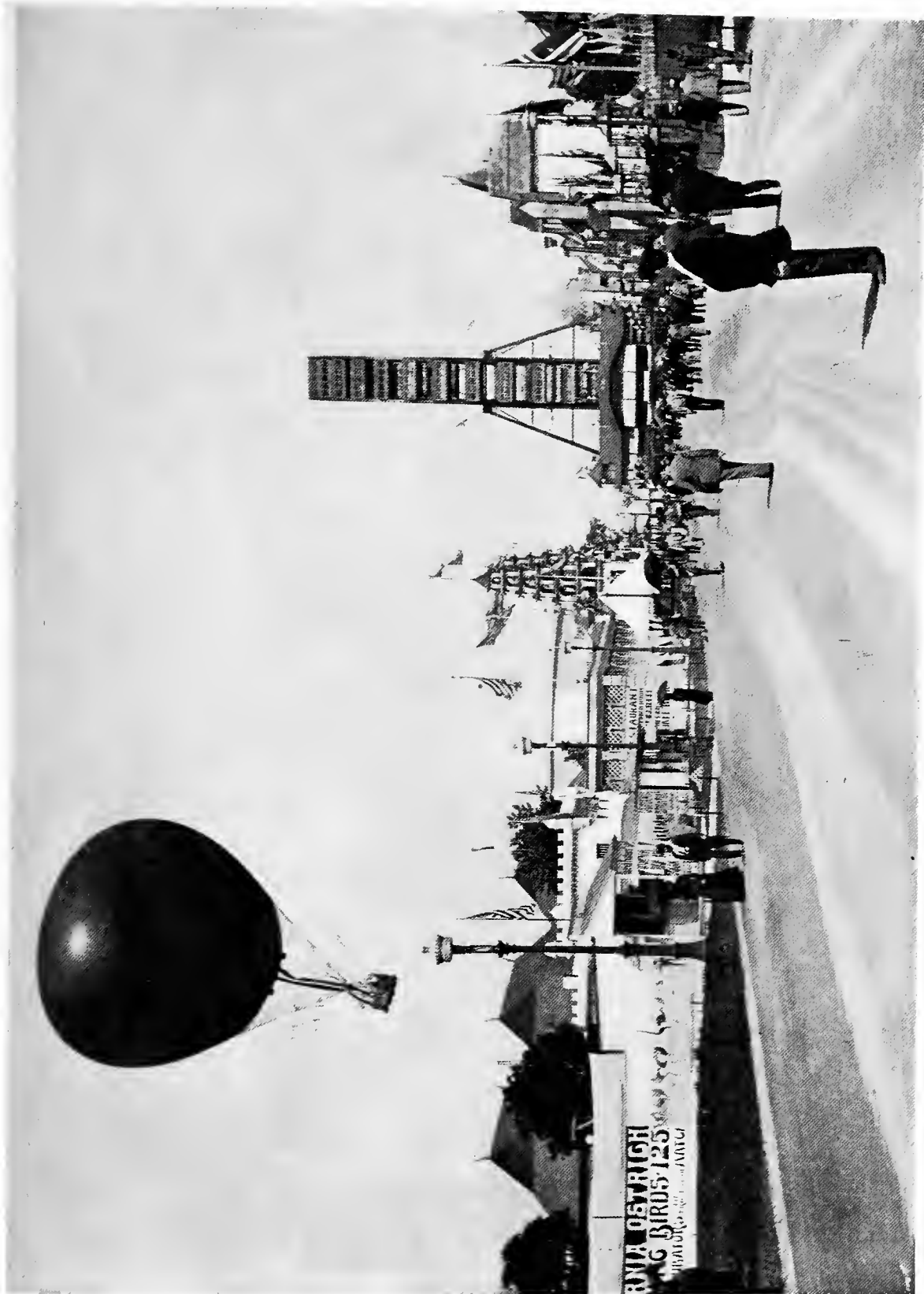


ARCHAGUE KHAN COROYANTZ,  
Commissioner from Persia.

THE open mart and caravansary of nations called the Midway Plaisance was placed in the group of isolated exhibits in the Department of Ethnology appropriately enough, for here the ethnologist could study not merely the physical types and characteristics, not merely the utensils, implements, costumes, habitations, and products, but the actual daily social, religious, industrial, and domestic life and customs of the nations and peoples of every clime and continent, typical representatives of all the varieties and races of mankind. A knowledge of strange peoples of far countries is as keenly sought by the unlearned as by the man of science when it can be read in the book of Nature and when by observation and communion face to face one can mark the subtle kinship that unites and the racial characters and national habits that distinguish the tribes of men. Here was an opportunity to see these people of every hue, clad in outlandish garb,

living in curious habitations, and plying their unfamiliar trades and arts with incomprehensible dexterity ; to listen to their barbaric music and witness their heathenish dances, their acrobatic feats, and curious theatrical spectacles. There were three thousand of these denizens of the Midway gathered from all quarters of the earth, many of them led thither by the hope of gain, and many influenced still more by the desire to visit this wondrous land of general well-being, of universal intelligence, more modern than Europe, more transformed by steam and electricity, teeming with a livelier commerce and a busier industry.

There was a street scene in Constantinople, with a theater, restaurant, and bazaars ; a Cairo street scene, with Egyptian museums, theater, and temple ; a Dutch East India village, with a Malay theater, music, and pantomimic performance ; a Moorish palace, with native goods for sale and a museum and chamber of horrors ; a reproduction of a mosque in Tangiers ; an Algerian village, with streets, bazaars, and *café* ; a Persian building, with booths for the sale of Persian goods and a musical entertainment ; a Chinese village, with theater, joss house, and tea garden ; a Japanese bazaar for the sale of Japanese curios and knickknacks, while on the Wooded Island was a Japanese tea garden ; a Hungarian concert pavilion and *café*, with musical and theatrical performances ; a quarter of old Vienna, with beer gardens, wine taverns, and music ; a German village and castle of mediæval times, with wine and beer restaurants ; an exhibition of antiquities and retail booths ; an East Indian bazaar for the sale of native wares ; a Johore bungalow ; a Bulgarian booth for the sale of curiosities ; a Lapland village ; a Dahomey village ; a Brazilian concert hall ; Sitting Bull's cabin ; an American Indian village ; an Ottoman hippodrome or Wild East ; two typical Irish villages, one containing the tower of Blarney Castle, with booths for the sale of Irish laces, beleeck chinaware, metal work, and the like ; models of the Eiffel tower and of St. Peter's Cathedral ; a German Wienerwurst establishment ; the Nuernberger Bratwurst Gloecklein, where one could listen to German music while eating savory broiled sausages ; a log-cabin restaurant containing colonial relics and providing old-time New England dinners served in the fashion of our grandfathers by young women with powdered hair, dressed in the mob caps, kerchiefs, short-waisted gowns, and large brooches and earrings brought forth from old chests in the New England garrets ; a South Sea Island village ; a Vienna bakery and *café*, with a theater attached ; another that was a copy of one in Vienna, selling the same fine breads and sweets and aromatic coffee to be enjoyed with accompanying Hungarian music ; a panorama of the Bernese Alps, giving the views across the Grindelwald and Lauterbrunnen Valleys from the Maennlichen peak ; an electric scenic theater, depicting in a realistic way every change of Nature from dawn till night in the Swiss Alps ; a panorama of the Kilauea volcano ; the Barre sliding railway ; an ice railway ; a pavilion where cider was made in the French way from apples brought from France ; an electro-photographic



THE CAPTIVE BALLOON, ON THE MIDWAY PLAISANCE.





tachyscope, which depicted with bewildering accuracy the real movements of animals; a zoöpraxographical hall; stereopticon views of Pompeii; a beauty show of women from more than forty countries; a natatorium; a factory where Venetian glassware and mosaics were made; another where glass spinning was done and the goods of the Parisian Art Glassware Company were sold; a model American glass factory established by the Libbey Glass Company, of Toledo; a *camera obscura*, where views of the World's Fair grounds were obtained; an exhibition of submarine diving; a Colorado mining camp, where the modern method of gold mining was shown; a California ostrich



DONEGAL CASTLE.

farm, with a troop of twenty-eight live ostriches of all ages, seven to ten feet in height, and weighing from one hundred and twenty-five to two hundred and sixty pounds; Hagenbeck's animal show; a captive balloon; a building for the display of the products of the Diamond Match Company; and the workingman's home, built by the social-service section of the Philadelphia Woman's Auxiliary as a specimen of 172,000 cottages owned by workingmen in Philadelphia.

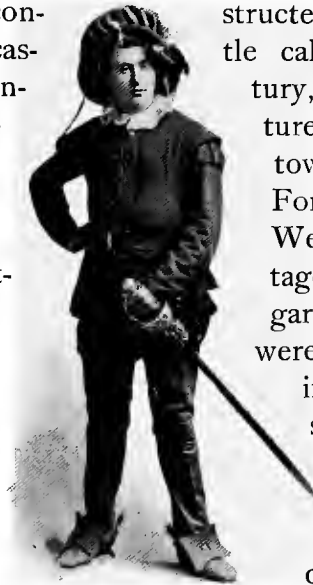
The Irish village of the Irish Industries Association, over which the Countess of Aberdeen has presided since its foundation, was intended to show what that benevolent organization has accomplished in the way of instruction and encouragement to revive and foster the household industries of the Irish peasantry. Grouped around the four sides of an ancient square, in

the midst of which rose the square tower of Blarney Castle, were typical peasant cottages, in some of which the finer products of these industries were exposed for sale, while in others Irish peasant girls were seen working at their various occupations, such as needle point-lace making as taught in the Presentation Convent at Youghal, County Cork ; tambour and run lace making from the Limerick school ; *appliqué* and guipure lace making from Carrickmacross, County Monaghan ; crochet work from the Irish Industries Association at Clones, County Fermanagh ; pillow lace making from Garryhill, County Carlow ; hand-loom weaving from Carrick, County Donegal ; knitting from Valentia Island, County Kerry ; sprigging from Garryhill ; box oak carving from the Irish Industries Association of Dublin ; wood carving represented by a working carver from the Home Arts and Irish Industries Association of Ireland ; the making of antique jewelry by a representative from the workshops of the Dublin Association ; and glass engraving by a Dublin engraver. A working dairy was managed by three students from the Munster dairy school, who were brought over by the Countess of Aberdeen expressly to illustrate the progress of Irish butter making and dairy produce in the preceding three or four years. Besides the reproduction of Blarney Castle, in which was a fragment of the wonder-working Blarney stone, the village contained a model of the old ruins of the rock of Cashel and a facsimile of the cloisters of Muckross Abbey. The proceeds of the village were devoted to the establishment and development of home industries in Ireland.

The Irish village established by Mrs. Ernest Hart, founder of the Donegal Industrial Fund, was intended to show the possibilities of Ireland by exhibiting some of the best Irish work of the past and the present, and to illustrate the idea that the chief hope of that country lies in industrial development. The profits of the village were devoted to the furtherance of the industrial and technical teaching work of the Donegal Industrial Fund, a philanthropic organization that had done pioneer work and exercised considerable influence during the ten years of its existence. The village contained a representative exhibit of Irish industry, art, and antiquity. On passing through the mediæval gateway, which was an exact reproduction of the St. Lawrence gate of Drogheda, the visitor entered a street of industrial cottages picturesquely grouped around the village green, in which was the carved market cross. On this green, jigs were frequently danced by the villagers to the stirring music of an Irish piper. In one cottage Irish villagers showed the whole process of dyeing, carding, spinning, and weaving homespun cloths ; in the next lace making was going on ; in a third, wood carving and designing of Celtic crosses ; in another, linen weaving, sprigging, and embroidery. At the village smithy artistic ironwork was wrought on the anvil. The dominating structure was a reproduction of Donegal Castle, one half its size, within which were portraits of illustrious Irishmen, Irish works of art, facsimiles of Celtic illuminated manuscripts, engravings

of old Irish crosses, reproductions in gold and silver of antique Celtic jewelry, and the Kells embroideries, laces, homespuns, linens, hosiery, wood carvings, etc., executed in various parts of Ireland by the trained workers of the Donegal Industrial Fund. There was a concert hall in which Irish music was rendered, and in another hall lectures were given on Irish industry, art, history, and literature. A round tower, copied from one of those ancient monuments, had at its base models of a cromlech, Druidical holes, Ogham stones, and early Christian crosses. In a beer garden were given Irish character dances and comedies in costume. A wishing chair, copied from that of the Giant's Causeway, with a real stone from the Causeway for the seat, stood on Irish soil brought over for the purpose.

The German village of the German Ethnographic Exhibition, a limited company, was projected by Dr. Ulrich Jahn, and was built first in Germany after the designs of Karl Hoffaker, of Berlin, and the parts were transported in boxes to be reconstructed in Chicago. The village consisted of a moated castle the style of the fifteenth century, surrounded by examples of urban and rural architecture such as a Hessian rural town hall with carved woodwork, an outer staircase, a Black Forest house, a house of the Spreewald, a steep-gabled Westphalian peasant home, and an upper Bavarian cottage with dormer windows. There were restaurants and gardens where genuine German food and beverages were served. The castle bridge gave access to the castle inclosure. Within the castle was a museum of old sculptures, tapestries, carvings, and other German antiquities, the chief part of which was a collection of sixty full suits of mail and of weapons and implements of the chase of all periods, from the prehistoric to the Renaissance. Two full regimental bands, one of forty-eight members in the uniform of the Prussian foot guards and one of twenty-six in the cavalry uniforms of the bodyguard, gave concerts twice daily in the spacious concert garden.



CASTLE GUARD IN THE  
GERMAN VILLAGE.

Old Vienna, one of the most popular places in the Midway, was an acre of the Austrian capital, the part called the Graben, as it appeared two hundred years ago, with its restaurants, theaters, concert gardens, and seventy shops, all conducted in the manner of the joyous and urbane Viennese, and containing many of the novel and useful products for which Vienna is noted. In the two banqueting halls visiting organizations frequently gave special dinners. Manufacturing processes typical of Viennese or Austrian industry were carried on for visitors to see, such as wood, ivory, amber, and meerschaum turning, and carving, engraving, and painting on

glass, modeling of statuary, bronze founding, embroidering, lace making, and the making of leather wares, jewelry, and enamels. Vienna waltzes and Austrian airs were played by the fine military band directed by Court-Chapelmaster C. M. Ziehrer, and Hungarian and gypsy music by a famous Hungarian orchestra. A collection of curiosities contained paintings two thousand years old from the tombs of Fayum, Egypt, a face mummy of the



ENTRANCE TO OLD VIENNA.

time of Christ, the earliest manuscript of the Bible written on papyrus, and other antiquities.

The Moorish palace contained a garden of palms and a waxwork show, a chamber of horrors, a labyrinth, a room of mirrors, and a theater of optical illusions.

The Algerian and Tunisian village covered a considerable space with handsome buildings and many-colored kiosks. The entire village was decorated with tiles brought from Algiers. There were fifty booths, in some of which native daggers, swords, shields, jewelry, and fancy goods were for sale, while in others artificers were shown at work making the native clothing, embroideries, and jeweled trinkets. The bazaar proper contained a choice selection of rugs, tapestries, hammered brass work, and all the goods peculiar to Algiers. In a Tunisian *café* the cooking and service were Tunisian. Native Algerian Arabs dwelt in a gaudy Algerian tent, and in a Kabyle tent a Kabyle family spun and wove native fabrics. In the kiosks natives prepared the sweets and candies peculiar to the Orient. Arab horse-

men, musicians, and snake charmers contributed to the amusement of the Plaisance, and in a theater Algerian, Tunisian, and Kabyle songs and dances were presented, including the *assiaeu* or torture dance.

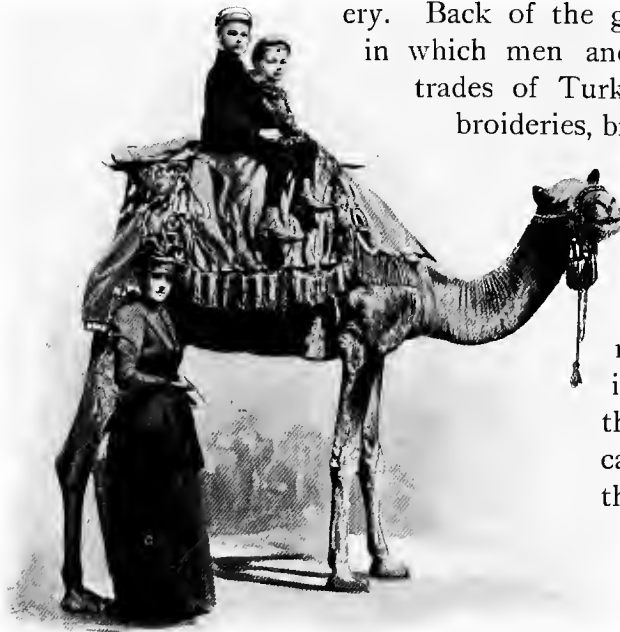
One of the most popular and interesting resorts was the picturesque Cairo street, copied from mediæval Egyptian architecture, and peopled with Copts and Cairenes, Nubians, and Soudanese, who carried on their trades and avocations, their games and festivals, precisely as at home. Egyptian women with veiled faces sold flowers ; coffee houses furnished the Oriental decoction of powdered mocha ; tobacconists made and sold Egyptian cigarettes ; shopkeepers offered for sale all sorts of Levantine handiwork ; and camel and donkey drivers hired their animals for a jaunt through the street. At regular intervals a mock wedding procession passed along and an exhibition of acrobatic feats and jugglery and marvelous sword play took place in the square. At other times it was a *mouled* or birthday festival that was celebrated with jousts and games, or a market fair was held in tents. The street consisted of a temple, a mosque, theaters, sixty-two shops, two *sebils* or drinking fountains, and a merchant's residence of the fifteenth century. The mosque with its *sebil* was copied from one built in the time of the Sultan Kaitbay, who reigned in the fifteenth century. Native Egyptians manufactured or had for sale Egyptian and Arabian jewelry, brasswork, embroidery, smokers' articles, potteries of Upper and Lower Egypt, tents, decorated cloth for hangings, furniture, antiquities, Red Sea shells, perfumes, Egyptian signets and seals, and verses from the Koran ; also Soudanese articles, such as household utensils, whips, spears, and shields. In a theater dancing girls performed the Egyptian *danse du ventre*, swaying from side to side and waving their arms, and, with trained command over the abdominal muscles, moving their undulating bodies in rhythmic time to Arab music played upon lutes and tambours. There was an Arab house in which the domestic customs of the people could be seen. In one booth an Egyptian fortune teller practiced her profession ; in another an Oriental mind reader demonstrated his mysterious powers ; and in a third a conjurer mystified his customers with tricks of legerdemain. At one end of the inclosure was a Soudanese village, where in front of savage huts the blacks of the Soudan performed wild dances and droned chants of love and war.

An Egyptian temple resembled the Temple of Luxor, with its obelisks, colossal statues, and sphinxes. On the outer walls were sculptured scenes of battle and worship. Two obelisks were facsimiles in wood of original syenite monoliths, seventy-five feet high, with hieroglyphic inscriptions carved in the wood and gilded. The interior of an ancient Egyptian temple was reproduced ; also the tombs of Thi and Apis, with facsimiles of the mummies of ten of the Pharaohs.

The Turkish corner of the Midway Plaisance reproduced a section of Constantinople as it was when Constantine I entered the city. Here a reduced copy of the mosque of St. Sophia was erected by order of the Sultan

to provide for the religious needs of the three hundred Turks who attended the Exposition ; and within it the exercises of the Moslem religion were performed by the faithful, whose observances could be spied by others through the windows. A hospital was also provided for Turkish subjects by their Government. All the products of the Turkish Empire were shown, and the daily life and vocations of all classes could be observed. The grand bazaar consisted of forty booths, where Turkish embroideries, rugs, carpets, silverware, filigree peculiar to the Orient, brass wares, precious stones and imitations, jewelry, old arms, and antiques could be bought. In a refreshment pavilion Turkish temperance drinks, fruits, and sirups were served. In the *café* one could drink Mecca coffee and smoke *tymbok* in the nargile, and in

a neighboring restaurant enjoy a regale of Turkish cookery. Back of the grand bazaar were eleven cottages, in which men and women worked at the different trades of Turkey, making carpets and rugs, embroideries, brass work, etc. An Arab sheik and



IN CAIRO STREET.

his family and part of his tribe were encamped near by, having brought with them camels and dromedaries, Arabian horses, and the arms and implements of the nomad Arabs ; and here they lived in essentially the same fashion as in the desert. Next to this Bedouin camp was a reproduction of one of the finest palaces in Damascus. One section of the Turkish display was devoted to the Holy Land, and there was a bazaar of relics and mementos, such as rosaries and caskets cut from wood from the holy places.

Opposite the mosque was a reproduction of Cleopatra's Needle as it stands in Stamboul. A serpentine column was copied from a bronze monument erected at Delphi to commemorate the destruction of the host of Xerxes at Plataea. In a theater hung with Bokhara rugs, with branches of the cedar of Lebanon bearing its shapely cones interspersed along the wall, performances were given by sixty-five actors and black-eyed Turkish actresses. The drop curtains represented the Jordan near Jericho, Bethlehem, and scenes from Beyrout, Damascus, and other historic places in the East. The scenes presented on the stage were purely Oriental, showing the manners and customs of the various countries constituting the Turkish Empire, such as a wedding in Damascus, the Kalamounic drama *Antar*, Son of Sheddad, a Kurdish drama, etc. The most striking feature was the dancing of both men and women, including Syrian

dances, the Ziebekly dance, Turkish quadrilles, the Constantinopolitan dance, a Thessalonian dance, the whirling dance of a *danseuse* who could spin round for fifteen minutes within a space six inches square, a dance of Mesopotamia, and the Albanian dances. In the theatrical sketches and dramas, fencing and war scenes, wedding and funeral celebrations were introduced, and all the features of social and domestic life among the inhabitants of the Arabian desert, Kurdistan, Damascus, Mount Lebanon, Jerusalem, Nazareth, Bethlehem, Mesopotamia, and other places and sections famous in sacred and profane history. The weird Oriental music was performed on the peculiar instruments of the tribes of Turkey by Oriental musicians who were acknowledged artists, and the dancers were such as had won a high reputation in their own countries. Sedan chairs with native bearers were on hire in the Turkish village, ready to carry visitors to all parts of the Exposition grounds.

In the Persian palace were booths where rugs and jewelry were made and sold. In a theater Persian musicians and dancing girls performed.

In the East Indian bazaar Banyan and Parsee traders had for sale gold and silver enameled jewelry, curtains, fabrics, embroideries, shawls, Indian carpets, rugs, and pottery, Vizagapatam workboxes, Benares brass ware, inlaid metal work, native arms and shields, musical instruments, idols, toys, carved blackwood furniture, carved sandalwood and ivory caskets, etc.

There were in the Chinese village typical shops and a dwelling house illustrating the mode of life in China. The joss house contained idols and a representation of the Buddhistic heaven, with hundreds of angels, also the infernal regions and the forms of punishment. In the bazaar many articles of Chinese manufacture were exposed for sale, including beautiful solid ebony furniture hand-carved and inlaid with pearl. In the Chinese theater were given scenes from historical dramas, many of them pertaining to famous emperors, in which war scenes and love-making were depicted, interspersed with singing, dancing, and juggling. All the furnishings and fittings of the theater and the gorgeous costumes and masks were brought from China for the purpose.

In the Japanese bazaar articles were for sale that were manufactured in Japan especially for the World's Fair, consisting of porcelain, carved ivory, lacquer goods, *cloisonné*, bronzes, metal goods, fans, silk handkerchiefs and shawls, teas, bamboo goods, toys, and various fancy articles. The collection of porcelain was particularly large and exquisite in colors and workmanship. Such a variety of Satsuma and Kaga pottery could nowhere be found outside of Japan, containing vases that ranged from ten cents to a thousand dollars in price. On souvenir cups, some as cheap as fifteen cents, some as dear as twenty dollars, Japanese painters had made pictures of the Exposition buildings. Japanese tea was also offered for sale in packages from sixty cents a pound up to twenty times that price.

One of the most attractive spots in the Plaisance was the Javanese village, populated by one hundred and twenty-five of the neat and deft Malays of the



Dutch colony, of whom thirty-six were women. The village was composed of curious little bamboo houses covered with matting and thatched straw. It was an exact representation of a native village as found in the Preangar regencies of west Java. The Javanese plied their trades on the balconies in front of these houses, precisely as they do in their native country, spinning and weaving and painting complex and beautiful designs upon cloth. They carved wood also, and made mats, sunshades, and hats of split bamboo in ornamental designs and color patterns. The colony included tree dwellers and a few of the ferocious head-hunters of Sumatra. This Dutch East Indian colony was the largest of the foreign communities. It was about equally



AN INTERIOR VIEW OF OLD VIENNA.

divided between workmen, who came in advance to put up the houses and theaters and prepare for the arrival of their wives and children, the artificers and salesmen and their families, and the performers in the theaters. One of the most powerful of the sultans of Java sent his musical bands and court performers, stipulating that priests should accompany them to attend to their spiritual wants. The company included actors and actresses, wrestlers, and several bands of musicians. One band consisted entirely of gong players; another of performers on one of the simplest of musical instruments—a long bamboo reed having within it a ball that is free to roll from one end to the

other, which is grasped in the middle and shaken violently, producing different tones according to the distance of the ball from the end. The piece enacted in the theater was the *wajang wong*, a sort of pantomime, in which the actors do not speak, their parts being recited by the *delang*. There was also dancing accompanied by the *gamelan*, or native orchestra, which consisted of twenty-four men.

The South Sea Islanders constructed four houses in the Plaisance for the exhibition of their life and customs. The largest house, composed of fully ten thousand separate pieces of wood, had been transported from Samoa,



INTERIOR OF JAVANESE VILLAGE.

where it stood in the village of King Mataafa. It was made of the wood of the breadfruit tree, thatched with the leaves of the wild sugar cane. Twenty-five Polynesians, inhabitants of Samoa, Fiji, Rotumah, and the Wallis Islands, made up the colony, in which the muscular, symmetrical frames of the men and the singular beauty of the women in face and form were remarkable. Goods and curios of native manufacture were offered for sale, and at intervals the songs and dances of the South Sea Islands were performed. Five Samoan canoes were among the village exhibits, including a large war canoe, made of hewed timbers sewed together with cocoanut fiber, not a nail or screw being used in the construction.

The Dahomey village consisted of thirty native houses, with a population

of sixty-nine people, of whom twenty-one were Amazon warriors. Sight-seers regarded with wonder and intense interest the actions of these chocolate-hued West African barbarians and were fascinated with the savagery of the fetich war dance performed by the Amazons. There was a museum of native arms, and the Dahomeyans worked at their rude arts of goldsmithing, weaving, and blacksmithing.

The Lapland village contained six Laplanders and their wives and eight children and six Dalecarlien girls. They had thirteen reindeer and five dogs, with sledges and snowshoes.

In the Captive Balloon Park a vaudeville company gave vocal concerts and a Mexican orchestra played popular music. In the Brazilian concert hall dances were performed by thirteen natives of the interior of the State of Maranhao. Brazilian curiosities were sold here, such as flowers made of feathers, colibris of all colors and varieties, pictures, shell articles, and jewelry.

The American Indian village consisted of Pottawatomies, Winnebagos, and Sioux, men, women, and children. Their tents were scattered about the inclosure, and in each the Indians were shown working at various native industries.

Sitting Bull's original cabin was brought from the Standing Rock agency in North Dakota, with the arms used in the arrest and killing of that chief, an oil portrait of him, and his buckskin shirt, trimmed with porcupine quills and human scalps. There was a collection of arms and guns found on the battle ground where General Custer fell; also a large variety of Indian work and curios. Pretty Face, niece of Sitting Bull, who is the best bead worker in the Sioux Nation, exhibited her handiwork, and Chief Rain-in-the-Face, who was with Sitting Bull at the Custer massacre, was on exhibition.

During the last two months of the Exposition within a structure copied from the architecture of the ancient Aztecs, a band of Mexican Indians portrayed their domestic life and home industries, their sports, pastimes, and ceremonies. They were engaged in weaving *serapes* and working in metals, and sang and danced for the amusement of visitors, and sold to the latter curiosities and trinkets from their native district.

The World's Congress of Beauty, or international dress and costume exhibit, consisted of living representatives of different nationalities, races, and types, each dressed in distinctive national or racial costume. Nearly all were beautiful young women who were genuine and typical representatives of their countries, engaged many of them in light occupations, such as they are accustomed to in their native lands. They represented types common in the United States, Canada, England, Wales, Scotland, Ireland, France, Germany, Switzerland, Bavaria, Italy, Greece, Denmark, Norway, Sweden, Bohemia, Poland, Russia, Finland, Hungary, Turkey, Syria, Arabia, China, Japan, and other countries, with the special creole, Acadian, octoroon, Bedouin, and other variations.

Hagenback's circus was an exceedingly attractive exhibit of the tri-

umphs of German lion tamers and trainers of animals, consisting of lions that drew chariots and rode on a horse's back, of royal Bengal tigers and polar bears that climbed ladders, of panthers and jaguars that played with lapdogs and raccoons, of performing wild boars, of a female dog suckling lion's cubs, of an entire menagerie of ferocious beasts that took their stations in the ring and went through performances and evolutions at the call of the trainer.

In the scenic theater the darkness of night was first relieved by the Alpine glow, caused by the reflection of the rising sun's light on the distant mountain tops. In the dim, misty twilight the Tyrolese warblers of Franz Reilhofer's troupe raised their tune-

ful yodel to greet the opening day, which gradually unfolded the splendors of a typical Swiss landscape lit by the bright summer sun. Then the sun having passed the zenith, dark clouds began to gather, and a heavy storm

passed over the valley. When daylight again appeared it soon gave way to the falling shades of evening ; once more the summits glowed under the parting rays of the sun, and then the moon and stars appeared and shed their soft light over the darkened scene. All these effects were created by two hundred and fifty incandes-

cent lamps operated in view of the audience from in front of the stage. The lamps on the stage were arranged in sets of shades containing twelve lights each. These lights were controlled by thirty-six switches and worked through German-silver resistance coils. The model of St. Peter's Church was with a substance that imitated

carved wood, covered el of St. Peter's Church was with a substance that imitated marble of the exact color of the original. It was constructed on a scale of one-sixtieth part of the size of the cathedral, being thirty feet long by fifteen wide and fifteen high. In the interior were portraits of famous popes and papal coats of arms. Models of ancient buildings were placed in the corners : A carved facsimile, thirty-one inches high, of the Milan Cathedral ; a carved wooden model of the Piombino palace, erected in 1572 ; and the original model, made for Pope Innocent X in different colored marbles, of the exterior and interior aspects of the Church of St. Agnes, the model measuring twenty-four inches long by sixteen broad and sixteen high. The attendants were dressed and armed like the Swiss guard of the Vatican.

The United States Submarine Diving Company displayed the most modern appliances and machinery for effective deep-sea work, and gave practical illustrations of the principles and methods of diving operations. Two experienced divers were constantly at work in the mammoth tank containing forty thousand gallons of water, while the manner in which air was supplied for breathing, the pressure of the water and the air, the use of the life line,



ANIMAL-TRAINER.

the heavy weights carried by the divers, accidents to divers and their many causes, the system of signals, the submarine telephone, the length of time that it is possible to remain under water, the maximum depth it is possible to reach, the use of the submarine electric lamp, and other facts in relation to diving were explained to the onlookers. Through large plate-glass windows in the sides of the tank divers were seen sawing and nailing wood, breaking rock, recovering articles thrown into the water, and writing messages.



EAST INDIAN PALACE.

In the zoöpraxographical hall Eadward Muybridge gave illustrated lectures on the locomotion of horses, dogs, birds, insects, and other animals, as detected by instantaneous photography.

In the Libbey Glass Works the whole operation of glass making was presented. Vases and bottles were shaped in imitation of cut glass. Other workmen were engaged in actually cutting and polishing glass. A fascinating sight was the spinning and weaving operations. A man would hold a piece of glass in a flame until it became soft, and then draw out a point through the flame to a revolving wheel, which spun off the substance in a continuous filament, as pliable apparently as flax. Near by were young women weaving this thread into a fabric which had a beautiful luster like satin and was seen made up into garments. Twelve yards of this cloth that were made into a dress for the Princess Eulalie required twelve million feet of the filmy thread. On entering the main door one found himself





THE FERRIS WHEEL, ON THE MIDWAY PLAISANCE.



in the glass house where the glass is melted and blown. In the center, under the wide dome, was an immense glass-melting furnace, twenty-five feet in diameter at the base. The tapering stack rose through the dome to the height of over one hundred feet. The fire clay and brick used in such a furnace must be of the highest grade, for no ordinary material will stand the intense heat necessary for the proper melting of glass, and to prepare the huge blocks of fire clay required over six months. To manufacture the pots, or crucibles, in which the glass is melted is also the work of many months. A railing separated the visitors from the open furnace by a space of twenty feet, within which the busy workmen were seen at work. Brisk gathering boys thrust long irons into the crucibles and by a dextrous twist drew forth the hot waxy glass, which they passed to the artisans, one of whom would blow and fashion it into a handsome vase of symmetrical proportions achieved by the eye alone, while others would fashion bowls, tumblers, or the like with equal accuracy or bend the plastic mass into the form of a basket or a candlestick. A young apprentice would gather from a crucible a large piece of the molten metal and drop it into a press, whereupon the presser pulled the lever, and then instantly opened the press and brought from the mold an Exposition souvenir. All the methods of the glass-blower's art and of glass manufacture were exhibited in this department. The materials were sand, lead, saltpeter, potash, and soda, the batches of which were thrown into the pots through the same windows out of which the molten glass was taken after the batch had been shut up tight in the crucible for at least twenty-four hours under a temperature of 2,200° Fahrenheit. In an upper gallery glass cutting was carried on by forty skilled workmen, who sat at their frames cutting intricate and beautiful patterns in glass. The glass was cut on a steel wheel, smoothed on a stone wheel, and polished on wooden and brush wheels. In an adjoining room skillful decorators were engaged in painting souvenir designs with a fine camel's-hair brush in mineral colors, the article being afterward fired in a kiln.

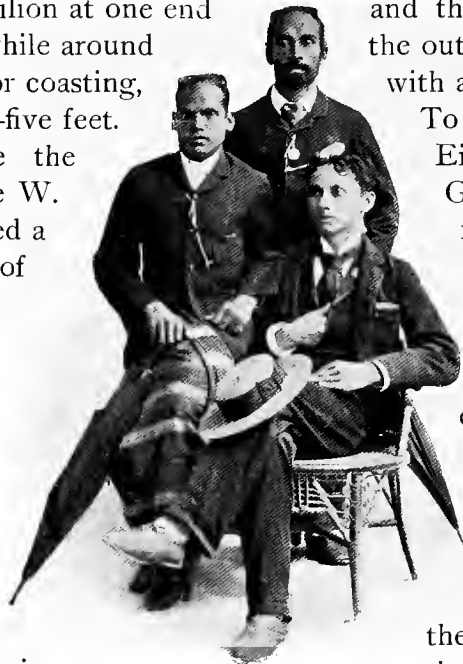
Salviati established in the Midway a branch of his celebrated establishment for the manufacture of Venetian glassware and mosaics. The Venice and Murano Exhibiting Company exhibited and manufactured in their building on the Midway Venetian blown and hand-made glass, both colorless and colored, in chandeliers, candelabra, electroliers, wall brackets, vases, *tazze*, and table sets; also imitations of antique and Venetian Renaissance, of old Phœnician, Assyrian, Egyptian, Greek, Roman, Norman, and mediæval glass, reproductions of art gems to be seen only in the museums, palaces, and churches of Europe—*graffiti*, murrhines, cameo glasses, diatretes, Christian plates, Oriental and Renaissance glasses, filigree and lace work, etched and frosted glass, aventurine, sapphire, carnelian, agate, topaz, jasper, onyx, amethyst, and hyacinth glass. All these forms, colors, and styles of ornament were worked before the furnace by skilled Venetian artists. Other artists executed mosaics, both figure and ornamental work

for mural decoration, ecclesiastical, sepulchral, or domestic, exterior or interior. The enamels made at Murano, the reproduction of the ancient *smalti*, achieved after long experimentation, and the mosaic work produced were identical with the products of the famous *atelier* in Venice.

The Barre sliding railway was an elevated structure with a broad flat rail, over which glided the iron shoes that supported the body of the car, lubricated by water that was fed into a cavity in the shoe under pressure and which escaped between the rail and the shoe during motion.

In John C. De La Vergne's concession ice and snow were artificially made by his refrigerating machinery, over which crowds could slide to the jingle of sleigh bells. The concession occupied a space of sixty by four hundred feet, with a pavilion at one end and the boiler and machine at the other, while around the outer edge were erected tracks for sleighing or coasting, with a total length of eight hundred and seventy-five feet.

an observatory like the is Exposition George W. designed and executed a original structure of ble and attractive more difficult work was a great wheel, izonal axis, and ery thirty-six pen-seating forty per-revolution of the fourteen hundred a height of two hun-in the air, giving to eye view of the Exposi-city of Chicago on the sensation of a balloon



GROUP OF CINGALESE.

To serve the purpose of Eiffel tower of the Par-G. Ferris, of Pittsburg, more singular and iron, one more suita-too, and a finer and of engineering. It revolving on a hor-carrying in its periph-dulum cars, each sons. Thus one wheel could carry and forty people to dred and fifty feet the passengers a bird's-tion on one side and the other, and the soaring ascent. The wheel was

composed of two wheels of the same size, held together with rods and struts to within twenty feet of the periphery. Each wheel was composed of hollow square beams of curved outline, twenty-five and a half by nineteen inches, and forty feet within were the crowns, composed of lighter curved iron beams, held together by an elaborate trusswork. Within the smaller circle there appeared to be nothing between the beams and the immense iron axle, thirty-two inches in diameter and forty-five feet long. They were connected with the hubs, which were sixteen feet in diameter, by spoke rods only two and a half inches in diameter, placed in pairs thirteen feet apart at the crown. The construction was that of a bicycle wheel, with the difference that the Ferris wheel hung by the axle. The lower half was suspended from the axle by the spoke rods running downward, and

the upper half was supported by the lower half. The carriages were hung from the periphery at equal intervals. Each car was twenty-seven feet long, thirteen wide, and nine high, and had a heavy frame of iron, with plate-glass windows on each side, the weight being thirteen tons. The wheel with its cars and passengers weighed twelve hundred tons. The axis was suspended at either end by a pyramidal skeleton iron tower, forty by fifty feet at the bottom, six feet square at the top, and one hundred and forty feet high, the inner sides being perpendicular and the outer ones slanting. The four legs of each tower rested on concrete foundations, twenty-foot cubic blocks connected by crossbars of steel. The wheel was operated and controlled by a thousand-horse-power reversible engine turning a shaft with cogwheels at either end. There were cogs six inches deep and eighteen inches apart in the outer crowns of the wheel, the power being applied at the bottom, fifteen feet from the ground, by means of an endless chain revolving on sprocket wheels placed with their centers sixteen feet apart. The wheel was two hundred and fifty feet in diameter and thirty feet wide, and could be stopped in case of accident by a Westinghouse air brake.



COTTAGE IN THE IRISH VILLAGE.

In Jackson Park concessions were granted for half a score of exhibits and enterprises requiring the payment of a fee—namely, electric and steam launches, Venetian gondolas and state barges, a whaling bark, the mammoth crystal cave in Horticultural Hall simulating the cave near Deadwood, the movable sidewalk, the electric Intramural Railway, the Eskimo village, the cliff dwellers' exhibit, and the Nippon tea house.

The Eskimo village, representing a trading post in Labrador, consisted of twelve huts, a representation of a snow house, and a seal-skin tent. The majority of the colony that was encamped in Jackson Park over the winter to become acclimated deserted when the summer heat became oppressive, but those who remained sufficiently exemplified the ethnological characteristics and the life and customs of this strange race. They had thirty-seven Eskimo dogs, two reindeer, sledges, spears, whips, and specimens of the curious things that they make, and kyaks also in which they paddled on the pond.

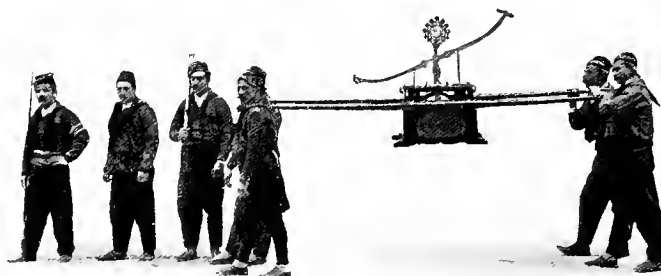
The exhibit of cliff dwellers' habitations was made by the H. I. Smith Exploring Company, who with a structure of timbers, iron, stones, and staff imitated the contour and appearance of Battle Rock in the McElmo Valley of Colorado reduced to one twentieth its natural size. The cavern that was the entrance opened into a cañon, high up in the sides of which were repro-

ductions of the dwellings of the extinct, industrious, and semi-civilized race of men that once inhabited the *mesas* of the southwestern regions of the United States. On climbing by steep paths to the niches in which these houses were perched, they were found to be one sixth of their natural size; but portions of the real houses were shown to convey an exact sense of their true proportions. In a museum below were several thousand objects taken from the ruins in the cliffs, including pottery, implements, weapons, ornaments, clothing, and remains of mummified bodies.

In the large Japanese building erected by the Tea Merchants' Guild of Japan with the object of familiarizing the American public with the best varieties of Japanese tea, and with Japanese methods of preparing it, booths were constructed for the ancient tea-drinking ceremonial called *cha-no-yu*.

The cold-storage plant and building, destroyed by fire on July 10, were constructed by the Hercules Iron Works. In the engine room were two of their ice-making machines of one hundred and twenty tons capacity each and another half as large. The can and plate systems were both used in the ice tanks, from which the product was removed to the ice storage house, where a thousand tons were constantly kept on hand, being replenished at the rate of one hundred tons or more a day, sufficient to supply the entire Exposition. The cold-storage and freezing rooms, 600,000 cubic feet in extent, were divided into compartments of different sizes for *restaurateurs* and exhibitors. The fifth floor of the palace was fitted up as a skating rink, where ice was produced by a brine piping arrangement over a surface of two hundred and eight by fifty-four feet, insulating paper being laid on the floor and again on the false floor above an air space and immediately under the leaden tank in which the pipes maintained a thickness of six inches of ice.

The great liberty and peace bell, cast at Troy, N. Y., weighed 13,000 pounds and was seven feet in height and seven feet four inches in diameter at the mouth, while the tongue and bolt weighed seven hundred pounds. There were worked up in the metal of which the bell was cast bullets from the battlefields of the civil war and swords, cannon, and rifles, rings, jewelry, coin, plate, and pennies contributed by a quarter of a million children.



Turkish Fire Patrol.



The Assembly Hall in the Woman's Building.

## CHAPTER XVI.

### THE EXHIBITS BY WOMEN.

The participation of women in the World's Columbian Exposition—Agriculture—Horticulture—Live stock—Fish and fisheries—Machinery—Transportation—Manufactures—Ceramics—Art metal work—Glassware and stained glass in decoration—Wood carving—Leather carving, pyrogravure, and embossing—Silk fabrics—Weaving of cotton, linen, and woolen goods—Clothing and costumes—Handmade laces—Embroidery and tapestry—Fans—Artificial flowers—The Woman's Library—Statistics, records, manuscripts, and music—Carved panels—Scientific exhibit—Colonial exhibit—Exhibits made by State boards.



MRS. JOHN A. LOGAN,  
Member at Large of the  
Board of Lady Managers.

ONE of the most distinctive and successful features of the Columbian Exposition proved to be the part taken in it by woman. So ready and generous was the response made by the women of the world to the invitation extended to them that the result was vastly greater than the promoters of the idea had dared to hope. In this first universal accumulation of woman's work, this starting point from which all future efforts of the kind will be measured, her exhibits showed a surprising range of endeavor, covering a wide field in the classification. In the Woman's Building alone twelve departments, seventy-three groups,

and one hundred and thirty classes were represented by the eighty thousand articles there installed. Some branches of the classification were naturally more fully represented than others, the preponderance being in manufactures, liberal arts, and the fine arts ; while in live stock, fisheries, electricity, and forestry the representation was very slight. Woman's work entered to some extent into nearly every exhibit ; but this review deals only with those in which the work was entirely her own and with enterprises conducted by women.

*Agriculture.*—Woman's representation in this department was small, considering the number of women engaged in agriculture, but the difficulty of making individual exhibits existed here as well as in other lines of work where men and women share in the production of the same article. In agriculture especially are they so intimately connected that woman's work is almost universally classed and exhibited as that of man ; while the marvelous success of the farmer of the United States is largely due to the economy, industry, thrift, and unselfish devotion of the women that have assisted in the work of the farm. An examination of the exhibits in this department showed, however, a few notable examples. Fine specimens of cereals were exhibited by women owning farms and ranches in the great grain-growing States. An example of Indian corn in decoration was given by the women of Iowa in the Corn Pavilion in the Woman's Building ; and Mrs. Harriet W. Strong, of Whittier, Cal., showed the ornamental possibilities of pampas grass by her pavilion in the Agriculture Building. The women of New Mexico also made there a fine display of the grasses of that Territory, especially of alfalfa, the cultivation of which is greatly on the increase on account of its hardy, productive, and nutritious character. The best exhibit of canaigre, or sour dock, was made by the women of San Juan County, New Mexico. This plant is extensively used in the West for tanning, and is attracting attention as a substitute for the failing supply of oak bark. Together with the canaigre were shown specimens of rough and manufactured leather tanned with this plant. Under the head of The Dairy and its Products, the most important exhibitor was Mrs. Laura D. Worley, of Ellettsville, Ind., in charge of the Indiana State Dairy Exhibit, the only one of its kind intrusted to a woman. Mrs. Worley not only made an exhibit that was creditable to her State, but showed what excellent business possibilities the dairy industry offers to woman.

*Horticulture.*—This department seemed to afford more opportunity for woman's individual effort than did that of agriculture. The raising and preservation of fruits, flowers, and vegetables are especially adapted to her tastes and housewifely skill. Fruits (fresh, dried, and canned), jellies, jams, and preserves, homemade wines and vinegar, were received from Alabama, California, Colorado, Idaho, Illinois, Iowa, Missouri, New York, Pennsylvania, Montana, North Carolina, and New Mexico. These exhibits were most tempting and attractive, especially from the great fruit-growing State of California, which furnished twenty-six exhibitors in these lines. Among

them Mrs. Mary A. Davis, of San Bernardino, and Mrs. J. C. Joplin, of Tustin City, received awards for dried and canned fruits; Miss L. H. Hatch, of Fresno, for a fine exhibit of raisins; and Miss Clio L. Lloyd for olives. Vegetables, dried and canned, catsup, pickles, sauces, etc., were offered from various States and countries. In viticulture the only exhibits were from Spain, that country being represented by seventy-two women who make wines and spirits, two makers of vinegar, and one of vermouth and bitters. In floriculture Mrs. S. D. Spear, of Los Angeles, Cal., made a fine showing of roses; and Mrs. Anna B. Nickels, of Laredo, Texas, of cacti. Judging by the great quantity of herbarium exhibits, the preservation of flowers, ferns, and mosses is a favorite feminine occupation, and one to which women bring a peculiar delicacy of touch. Specially to be noted was the superbly mounted flora of Minnesota; also those of Colorado, Montana, and Oregon, collected under the auspices of the woman's boards of those respective States; the beautiful wood mosses of Oregon collected by Mrs. Congers, of Claskania; the wonderful Pacific coast algæ gathered by Miss Mary J. Westfall, of Pacific Grove, Cal.; the ferns of Mrs. Walter H. Webb, of New York; and the ferns and seaweeds from New South Wales.

*Live Stock.*—Women's exhibits in this department were confined chiefly to entomological collections and taxidermy, in both of which lines some extremely good work was shown. Miss Cora H. Clark, of Jamaica Plains, Mass., had a rare exhibit of caddis worms, and Mrs. Black, of Racine, Wis., a fine one of butterflies and moths. Mrs. Virginia Jones, of Circleville, Ohio, sent a remarkable series of hand-painted plates showing the eggs and nests of the birds of Ohio. In taxidermy, mounted birds and animals from Iowa, Minnesota, Montana, and North Carolina were to be seen. Mrs. Violet S. Williams, of Coralville, Iowa, showed great skill in mounting the birds and animals of her State, and Miss A. W. Duffy preserved in the same way the aquatic birds and animals of North Carolina. The most interesting and unusual exhibit of this kind, however, was that from New South Wales, the commission from that country having made special efforts to reproduce both its flora and its fauna.

*Fish and Fisheries.*—Ingenious fish-scale, shell, and coral work was seen in both the Fisheries and the Woman's Building. Mrs. A. B. Stanley, of Ashton, R. I., curiously portrayed in this way the Landing of Roger Williams on Slate Rock, the Landing of Columbus, The Angelus, and other scenes.

*Machinery.*—Women's exhibits in this department were confined mostly to the invention of machines for domestic use, such as weaving and reeling devices; washing, pleating, and dish-washing machines; pressing and ironing boards; household conveniences and articles for use in various industries. One exhibitor of a dish-washing machine not only had an exhibit in Machinery Hall, but had her machines in satisfactory operation in nearly all the large restaurants on the Exposition grounds. Mrs. Harriet Ruth Tracy, of New York, showed a notable invention of a rotary shuttle, lock, and chain-



stitch sewing machine, whose lower bobbin carries more than a thousand yards of thread—an achievement that has baffled a generation of masculine inventors. Mrs. Tracy also exhibited a parlor sewing-machine table, a fire escape, and a gravity safety elevator.

*Transportation.*—A decided novelty was afforded in this department by the car-ceiling decoration sent by Miss Caroline B. Kelly, of Wilmington, Del. Miss Kelly is superintendent of this branch of work for the Harlem and Hollingsworth Company of Wilmington. In marine transportation the original lifeboat of Grace Darling bore silent testimony to one woman's heroism. Mrs. Martha J. Coston, of New Brighton, N. Y., exhibited her

system of signal lights. The Blue Anchor Society, of New York, showed the results and method of its relief work done by women among wrecked sailors.



CACTUS EXHIBIT OF MRS. ANNA B. NICKELS,  
LAREDO, TEXAS.

*Manufactures.*—

The general character of woman's work in this department may be judged from the following extracts taken from Mrs. Candace Wheeler's report to the Board of Lady Managers upon Ap-

plied Art in the Woman's Building: "The exhibits of Applied Art and Art Manufactures in the Woman's Building were sufficiently varied to excite surprise at the new directions in which women have chosen to exercise their artistic ability, and so excellent is the application of principles of beauty as to warrant the belief that the best era of art manufacture has fairly begun. Expectation was certainly fulfilled in the beautiful and always feminine manufacture of laces. To the strictly feminine arts of lace making, embroidery, domestic weaving, etc., were added those of modeling and painting of china, wood carving and inlaying, designing and painting of glass, glass mosaics, book making in all its artistic details, designing and printing of textiles, and other artistic pursuits not heretofore practiced by women. By far the largest part of the United States embroidery consisted of wrought linens for domestic and table use. The American embroiderers, almost without exception, used original modern designs, both graceful and characteristically American, while the foreign pieces were wrought after seventeenth and eighteenth century forms.

"In the exhibit of embroidery and tapestry by the Associated Artists of New York, the two arts of embroidery and weaving were used in common, with a result which considerably enlarged the possibilities of either when used alone. The group of weavings also shown by this business association of women and artists would have attracted attention even in the Manufactures Building for beauty of design and coloring, as well as for originality of invention. In china painting the work of the National League of Mineral Painters, and of one or two local societies, was abundant and surprisingly excellent. In book making, the covers and illustrations by Mrs. Whitman, Miss Morse, and the Misses Armstrong were especially noticeable for beauty of design and originality of treatment."

*Ceramics.*—The excellence and beauty of the ceramic exhibits by the women of the United States was very gratifying, especially when we consider that the phenomenal development of this art industry in our country dates only from the Centennial Exposition of 1876. In the Woman's Building alone 227 exhibitors from twenty-two States and Territories sent 1,511 exhibits, while there were many large collections in the Manufactures Building and in nearly all the State buildings. Women have learned not only to decorate and burnish, but to originate designs, to analyze clays, discover pigments, experiment with new processes, and invent new kilns. Ohio and Wisconsin carried off the greatest ceramic honors among the States. The *coterie* of women composing the Cincinnati Pottery Club, who have done so much toward raising the standard of this art in the United States, were represented by some of their best productions in the Cincinnati room of the Woman's Building. To Miss Anna L. Dodge, of Milwaukee, is due the introduction into this country of the decoration known as "jeweling." Her designs of gold settings and turquoise and opal jewels nearly equal the Coldsport ware. The Healey sisters, of Washington, D. C., had fine installations of their chryso-ceramic ware, it being a revival of old Chinese gold enamel by a process discovered by themselves. There was much fine individual work in the collections sent from decorative art societies and woman's exchanges in the various cities. The finest foreign exhibit among women was that of the Widow Ipsen in the Denmark section of the Manufactures Building. Her fine display of terra cotta in both ancient and modern forms and designs was one of the features of the Danish section.

*Art Metal Work.*—The exhibits in art metal work, enameling, etc., while not so numerous as in some other groups, included some fine specimens. Articles in hammered brass and copper, metal etchings, and *repoussé* work were received from various parts of this and foreign countries. The best examples of figure work were given in the Michigan copper statues—the work of Mrs. Theo. Ruggles Kitson—that served as electroliers in the Rotunda of the Woman's Building; also the bronze fountain by Miss Anne Whitney, occupying the center of that building. Etchings on metal were shown by Miss M. Louise McLaughlin, of Cincinnati. France, Great Britain, Ger-

many, the Cape of Good Hope, Japan, Spain, and Sweden were the countries best represented in this group. Worthy of special mention were the worked silver book cover and the screen in pierced brass and copper of Mrs. Calverley Bewicke, of London ; the plaque Lords and Ladies, by Miss Laura Bray, of Shere, England ; the chased copper urn and goblets of Mrs. Rosalie Juel ; the drinking cup and goblets of Miss Anna Menkow, the chased silver cup and book cover of Miss Julie Grafstrom, all of Stockholm, Sweden ; and the beautiful enamel work of Miss Emma Luthmer, of Germany.

*Glassware and Stained Glass in Decoration.*—The display of glass in the Columbian Exposition was pre-eminently interesting in one new phase—the many and brilliant examples produced by women. Women exercised in the painting, decorating, and glyphic ornamentation of glass a common skill with men. The United States alone has women whose designs have attained honor for their poetic and fitting conceptions, and there is also a yearly increasing number from the art schools of New York, Boston, Chicago, Cincinnati, San Francisco, St. Louis, Milwaukee, and other parts of the country, who have made such wondrous borders, ornamental pieces, and door panels, as well as glass pictures, as showed an aptitude of great promise. One of the finest specimens of the Exposition was the window of Miss Mary Tillinghast, formerly from Ohio, exhibited in the Woman's Division of the Manufactures Building. The Massachusetts window in the Assembly Room of the Woman's Building, designed by Elizabeth Parsons and Edith Brown, both of Boston, was excellent in execution and fine in conception. Miss Margaret Armstrong, of New York, showed a fine window with a design of poppies ; Miss Anna Seidenberg, of Cincinnati, decorated glassware in enamel and painting, as did also Miss M. E. Weighell, of Cincinnati. Miss Marie Herndl showed her conception of The Queen of the Elves in a stained-glass window, and Miss Bessie Young, of the Pittsburg School of Design, depicted The Spirit of Fire on a glass screen. Miss Elizabeth J. Abel, of Philadelphia, conducted a working exhibit in glass-cutting in the Process Room of the Woman's Building. As a designer of domestic windows, Lydia Emmet's figures are exceptionally good. Her Autumn, shown by Tiffany, was very poetic, and the manner of leading, following the outlines of the head, shoulders, and drapery, was most graceful. Some of the most beautiful antique lamps and globes in this exhibit were also the creations of women.

*Wood Carving.*—The extent and variety of the exhibits in wood carving was a matter of surprise. The records of the Columbian Exposition show that 137 women, from 32 States, sent 247 articles of carved wood of original design and excellent workmanship to the Woman's Building, besides what was placed in the other Exposition buildings and in the State buildings. The most remarkable case of natural, untaught genius was that of Amelia Martinez, of the Republic of Colombia. She was only seventeen years of age at the time of the Exposition, and resided in a small, interior provincial town, which afforded her no opportunity of seeing sculpture work or pictures

of such work. But she sent to Chicago fifty statuettes, one inch and a half in height, cut in rosewood with the same nicety of detail that is found in those of ivory of the same size. The characters delineated were her neighbors, the good priests, and the toiling Indians.

*Leather Carving, Pyrogravure, and Embossing.*—This kind of work was often found in conjunction with wood carving, the two arts being combined in the same piece of furniture. Many chairs and stools of beautiful and artistic design in embossed, painted, and cut leather, wood carving, and pyrogravure were well made by women of the



SPECIMENS OF TAXIDERMY,  
shown by Mrs. Violet S. Williams,  
Coralville, Iowa.



United States, Germany, Great Britain, and Mexico, and exhibited in the Woman's, the Manufactures, and the State buildings. In leather pyrogravure the work of Miss Lillian O'Hara, of San Francisco, Cal., was of the highest order of merit, as shown by her leather *por-*

*tières* in the Woman's Building and her work in the California Building. The music stool of cut and embossed cowhide sent by the Princess Victoria of Wales; the stool of carved oak and cut and embossed cowhide made by the Princess Maude of Wales; and the corner chair of carved oak and cut and embossed cowhide, the work of the Princess of Wales, were objects of great interest in the British section of the Woman's Building.

*Silk Fabrics.*—Since the weaving of silk, as well as of other textiles, has been taken so much out of woman's hands by the introduction of machinery,

it is gratifying to record the success of the Associated Artists of New York in this industry. They exhibited silk goods and brocades of absolute purity of dye, even combination of colors, excellence of basic material, and superior fineness and finish, in a variety of distinctively American designs. They also showed a line of weavings of silk with silver and gold that could not be excelled by the most luxurious foreign fabrics of the kind. The Woman's Silk-Culture Association of Philadelphia also made a daily exhibit of silk weaving in the Agriculture Building, turning out from the great Jacquard looms all sorts of souvenir articles; while a primitive hand loom in the Utah exhibit in the Woman's Building ran off a good plain web. The goods from Cyprus were worthy of notice as being home products manufactured on very crude looms. The exhibits from Greece, sent through Madame Skouzis, of the Woman's Syllogue, of Athens, were mainly confined to beautiful tissue fabrics in stripes of gold, silver, and silk, woven with a soft, pleasing mingling of colors. The Countess di Brazzà made an elegant exhibit in the Woman's Building of sample velvets and silk damasks of marvelous beauty in color and pattern, recalling all the ancient splendor of the silk fabrication of Italy. A unique exhibit in the Woman's Building was the case of silks, velvets, and satins made sixty years ago by the women of the Economy Society of Economy. This was the result of the first attempt at silk raising in this country, when, in 1826, a plant of cocoons, with instructions in silk culture, was sent from Europe to George Rapp, founder of the colony.

*Weaving of Cotton, Linen, and Woollen Goods.*—It was a remarkable fact that nearly one fourth of the total number of Spanish exhibitors at the Fair were women, and that among them fourteen were manufacturers of cotton and woollen goods. Among the things worthy of special notice in the Blarney Castle Industrial Village were the fine linens from Skibbereen, woven by girls in the convent there. The beautiful linens for domestic and art purposes and the woolens, carpets, and rugs exhibited by the women of Norway and Sweden, bore testimony to the beneficent influence of the Scandinavian societies for encouragement of home industries. Germany and Russia also sent fine linen, Japan contributed cotton fabrics, and India sent her characteristic native webs from various provinces. The weavings from Mexico were quite remarkable as to variety, quality, and color. One of the most attractive parts of the British exhibit in the Woman's Building was the hand loom operated by a Welsh woman in national costume, representing the Home Industries of Wales, under Lady Aberdeen, president. Nearly one thousand yards of flannel were there woven and sold during the Exposition.

*Clothing and Costumes.*—As was to be expected, France had in the Woman's Building and in the Manufactures Building many very large and beautiful exhibits in these lines. The dainty *lingerie* from Madame Franck, the charming costumes from Sara Mayer, and the marvels of Parisian hats from Mesdames Marguerite and Esther Meyer, were objects of much admira-

tion. England, Germany, Sweden, Norway, Russia, Bulgaria, New South Wales, China, Denmark, Japan, Mexico, Spain, and the United States exhibited beautiful clothing and costumes of all kinds made by women. In fact, a special effort was universally made to represent national costumes, this being done both by means of life-size figures and costumed dolls. The doll was lifted out of its place as a child's plaything and made to perform an important rôle at the World's Fair. The history of dress in general, its present forms, and the costumes adopted by various orders of women, were all shown in this way. The evolution of dress in the United States since the landing of the Pilgrim Fathers was illustrated by the New York Doll Exhibit; and the History of Dress, prepared by the French society of L'Aiguille, of Paris, was represented by a large number of dolls costumed as celebrated characters in history, and showing the European evolution in dress. Nearly a dozen life-size figures, dressed with perfection as to details, showed the peasant costumes of the various provinces of Spain. Denmark and Mexico also illustrated national characteristics in the same way. Mrs. Viola A. Fuller, of Mitchell, S. Dak., excited much envy by her large handsome opera cloak made of prairie-chicken feathers, than which a costly fur could not be more desirable. A cap and muff of pelican feathers, made by Miss Alice M. Clarisse, of New Orleans, La., had also a distinguished appearance.

*Hand-made Laces.*—The hand-made lace exhibit was doubtless the largest and finest ever collected. In the French section of the Woman's Building Madame Franck exhibited a magnificent collection of ancient artistic point and pillow laces, containing types of almost every country and epoch. M. Lefebvre also showed his superb tablier, or dress front, in point de France, which took the "grand prix" at Paris in 1889, and was purchased by the Paris Society of Decorative Arts for its museum as the best exponent of the art and methods of the period in fine needle point. The exhibit included every variety of fine needle-point and pillow lace in original and ancient designs, wrought into flounces, fans, scarfs, handkerchiefs, hosiery, etc., all executed with the greatest skill. The collection of Italian laces gathered by the Countess di Brazzà for the Woman's Building has never been surpassed in historical value and interest.

The influence of the South Kensington School has done much to increase the technical and artistic merit of Irish lace, as has also the aid afforded by the Irish Industrial Association under the inspiring leadership of the Countess of Aberdeen. This society has been in existence since 1886, and has done noble work in establishing local centers for the development of industries, providing designs and courses of art training, and securing a market for the goods. A full exhibit of the methods of making these laces was to be seen in the Irish Industrial Village maintained at the Exposition by this society. Another efficient worker in the development of Irish cottage industries is Mrs. Ernest Hart, who in 1885 organized the Donegal Industrial Fund. This society also maintained an Irish industrial village at the Fair,

where were shown fine specimens of Irish lace and crochet work, and a lace worker from Limerick gave a working illustration of its manufacture.

Among the German laces those of the Royal School of Schmiedeberg took precedence, its examples including all the well-known varieties of lace.



ORIENTAL RUGS SHOWN BY MARSHALL FIELD & CO, CHICAGO.

The Würtemberg School of Needlework also showed good point and pillow lace. The dress made by the lace workers of Schmiedeberg and presented to the Empress on the occasion of her silver wedding was graciously loaned for display at the Exposition. The laces sent by Austria were very creditable,



and consisted for the most part of samples from the different schools of Vienna.

The Russian exhibit in the Woman's Building was due to the zeal and enterprise of Madame Narishkine and her able coadjutors. It showed both point and pillow laces of good but mostly heavy manufacture. The patterns were sinuous and meandering, distinctively Russian. National designs of the sixteenth and seventeenth centuries were to be seen in original specimens as well as in reproductions. The element of color was present in the point lace and drawn work, suggesting Oriental influence. The province of Vologda led in both the quality and quantity of lace, much of which was very beautiful. Native flax, bleached and unbleached, and native silk, white and black, were used in these fabrications. Of the Danish laces the most valuable were rare specimens of old point coupé loaned by the Princess Louise of Denmark as part of the Danish loan exhibit sent through Mrs. Oxholm, of Copenhagen. These laces were made by the peasant women of Zealand, were well preserved, and were exceedingly attractive on account of their peculiar designs. The Swedish and Norwegian laces were mostly of the pillow varieties, with a few specimens of Venetian point.

In the Latin-American countries lace making is chiefly confined to drawn work, which has been carried there to perfection. The specimens of this work from Mexico were endless, and some of them were wrought from fabrics so fine and airy (often of pineapple cloth), that in order to draw the threads it had been necessary to hold the material between the eye and the sun.

*Embroidery and Tapestry.*—A great and marvelous display of these kinds of art handiwork was gathered from nearly every nation and country of the globe, wrought by women of all ranks. The most venerable relics of antiquity were shown side by side with the work of modern nations. From the banks of the Ganges and the Indus, through the peoples of northern Asia, Egypt, and Greece, came to us the continuous succession of this wonderful art, from its earliest forms to those of the present day.

The Austrian Imperial and Royal Institute for Art Embroidery furnished an educational exhibit of great practical value, showing the progressive steps in its course of training. Other exhibits, notably those of Mrs. Anna Markl, Herminie Cohn, and the Working Women's Society of Vienna, were also similarly arranged.

Very fine ecclesiastical embroidery was shown from Belgium by Made-moiselle Denis, of Brussels, an altar cloth of gold embroidered in silver being quite remarkable. Madame Kerchove de Mayer also sent fine linen embroidery. The work of Danish women in the past, as well as their modern industries, was fully represented in the great variety of embroidery exhibited, which was all of antique conventional designs. A novel exhibit was a series of embroidered panels worked in botanical designs with crewels upon woollen cloth by Madame Ida Hansen. Each panel portrayed a single plant, the

flowers, leaves, stems, seed pods, and roots being so natural that a botanist would have coveted them for his herbarium.

As was to be expected of France, she showed in this as well as in other lines of work a pre-eminence resulting from generations of art culture. Her exhibit of colored silk embroidery contained a great number of pieces, of which some are unequaled, like those of Madame Leroudier, who founded and still directs the school of embroidery in Lyons. Her most important work was a series of twelve panels representing the twelve months, after Audran, to the production of which she devoted several years' labor. The



THRONE CHAIR OF MEXICO.

pupils of the House of the Legion of Honor exhibited an immense window hanging of red satin embroidered in flowers, besides other pieces; and those of the Israelitish House of Refuge at Neuilly-sur-Seine showed their proficiency in flower embroidery. Messieurs Vaugeois-Binot sent a trophy in gold embroidery, which was one of the most remarkable pieces in the Woman's Building. It was a panoply of helmets, swords, and bucklers in striking relief, giving the impression of the most perfect carving.

From Germany, so justly celebrated for the excellence of her schools, many varieties of work were shown. The Lette Society of Berlin, the Industrial Schools of Reutlingen and of Rheydt, the Sophien Institute of Weimar, and the Woman's Educational Society of Breslau sent not only rich embroideries, but also work showing the house-

wifely accomplishments of plain sewing, mending, darning, etc. Fine linen embroidery was shown by Frau von Wedell, and art work by Frau Auguste Gerson. A fine piece of tapestry by Barbara Wolf, of Munich, was very much admired. It was a true copy of a painting by Jean van Eyk, representing a hunting scene in the fifteenth century.

The influence of the Royal School of Art Needlework, or the South Kensington School, as it is commonly called, was pre-eminent in the British exhibit, to which the articles contributed by the royal family added special interest. Specimens of work by her Majesty the Queen and by her Royal Highness the Princess Louise were to be seen, as well as a great variety

from all parts of the kingdom and colonies of Great Britain. There were cushions designed by Princess Beatrice and Princess Victoria of Wales, needlework by Princess Christian, and table napkins made from flax spun by the Queen. Of screens there was a large variety, one of which, by the Countess of Tankerville, was a charming copy of a Watteau, time of Louis XV. Footstools, cushions, caskets, and table covers, sumptuously embroidered in silk and gold, were included in the exhibit of the school, in which must also be mentioned a fine wall hanging after a cartoon by Burne-Jones. From Scotland came a piece worked by Ann, Countess of Aberdeen, in 1740, and an old hanging used in the last Stuart reign. Another piece of embroidery was worked in 1606.

Of the modern embroideries from Ireland, many fine specimens were seen in the two Irish industrial villages. Most noteworthy in the Donegal village was a kind of embroidery devised by Mrs. Ernest Hart. Early in 1885 Mrs. Hart, desiring to find employment for needy women in Ireland, originated what is known as the "Kells embroidery." Her aim was to use native Irish materials, and for this purpose she employed polished flax threads worked on various colored linens specially designed and woven for the purpose on hand looms in the County Armagh. The dyeing, spinning, and weaving being all done by women.

There were two interesting collections of handiwork from India. One sent by Lady Bailey, of London, was gathered by English women resident in India. It included silk embroidery on cotton by Manipur women; Suzanni embroidery from the Punjab; the work of pupils from schools in Madras and Poona, sent by Miss Manning; and garments from Benares and Assam of native material and design. The second collection came from the American Lutheran Mission School at Guntur, under the patronage of Lady Wenlock. This exceedingly beautiful work was done by Mohammedan women in the school, according to their native designs and technique. The threads of burnished gold, fine as gossamer, and of various metallic tones of color, were made in India. They were braided together by the needle or twisted in some occult way so as to appear like drops of dew or golden beads.

The exquisite embroideries of the Japanese women were not surpassed by those of any other nation. A table spread representing the Japanese zodiac, some paneled screens, especially an iridescent peacock screen, and a fine collection of *kakamonos*, all designed and worked by women, were among the things to be remembered in the Woman's Building. The Chinese embroideries and hangings, both ancient and modern, showed the same technical skill as did those of the Japanese.

The embroideries from Mexico were of many kinds, and the fact that two hundred and eighty medals were given to Mexican women in this department of art needlework seems to be proof positive of its excellence. A great specialty was what is called photographic or lithographic embroidery. This is done with an exceedingly fine, filmy silk thread on a white-silk back-

ground. The stitches are so fine that it is impossible to discern them with the eye, except by raising them from the surface with a pin ; and amazement grows when it is noticed that they do not show on the wrong side, being dexterously inserted between the warp and the woof of the foundation. The shading is as fine and artistic as in a steel engraving.

Two great classes of needlework were shown from Mexico, as well as from the other Latin-American countries, one resulting from Spanish taste and training and the other of Indian origin. Of this last there were in all more than a hundred examples of embroidered *huipiles*—a cotton outer garment resembling a short chemise. The material, being spun and woven by hand in rude Indian looms, retains a silken luster and softness not found in machine-made goods. The designs were purely aboriginal and characteristic.

It is impossible to give in condensed limits an idea of the varied merits of Russian embroidery. Representing provinces totally unlike, and also successive centuries of progress, these exhibits embraced a greater range of *motif* than did those of any other country. Schemes of color were as numerous as the provinces themselves, and in the schools of needlework, under the care of the Government, great pains is taken to preserve the national feeling by the use of the old designs and colorings. Many of the exhibits came from the schools founded by philanthropic women in the provinces of Tambov, Simbirsk, Karkov, Orenburg, and others, also from the schools of Madame Schepelersky and Lepeshkine in Moscow, and from those patronized by the Grand Duchess Elizabeth Feodorovna in St. Petersburg. This bewildering aggregation could only be appreciated by seeing it.

The pavilion and exhibits of Siam were characteristic with their gold, silver, and silk embroideries in national technique and design. There was a gorgeous display of screens, pictures, cushions, pillows, and royal garments covered with embroidery resembling flowers and foliage cut from one solid sheet of burnished gold. Much of the embroidery was done by pupils in the Industrial School for Girls at Bangkok. A great deal of the mother-of-pearl inlaid work of Siam, for which several awards were given at the Exposition, is done by women.

The influence of the Moors in Spain is as strongly emphasized in the feminine arts as in architecture. The work sent from the convents and schools was brilliant with gold and silver, and the gorgeous coloring of the Alhambra was reproduced in altar covers and priests' garments. The Woman's Committees of Saragossa, Valencia, Osenza, Barcelona, and Madrid, all sent interesting examples of embroidery on linen and wool, besides exquisite specimens of art embroideries, embroidered portraits, and antiques. Havana also sent works of great merit, especially a triptych with a figure of St. Paul and a gorgeous bishop's miter. A chair wrought by Justina Gonzales, of Madrid, to represent scenes in the life of Columbus, was remarkable for variety of stitches, good coloring, and technique. The assortment of embroidered handkerchiefs was astonishing.

In Sweden the Society of Art Handiwork has done much to encourage the revival of national decorative art needlework on artistic principles. The idle looms of the peasant houses have been set to work, and art weavings in the form of wall hangings, *portières*, and even carpets have been produced, vying with their ancestral heirlooms. The home-woven tapestries have been revived with fresh designs of national interest and importance, a fine example of which was the linen Chattaduk wall hanging of Mrs. Cilluf Olsson. In this great *portière* the antique, grotesque figures and geometric borders were happily arranged in perpendicular stripes of much dignity. Among the best embroidery was an altar piece, designed by Agnes Branting. The same class of energetic women who have rejuvenated women's industries in Sweden have also begun a line of progress in Norway. Ladies of distinction in these two countries have their own looms, and are encouraging the revival of ancient art handiwork.

The best collection of Bohemian work was that sent by Madame Josefa Naprstek, of Prague, as a gift to the Board of Lady Managers, containing articles worked in red on



EXHIBITS OF THE BALTIMORE DECORATIVE ART SOCIETY.

homespun linen of exquisite texture. The best Algerian embroidery was seen in the pavilion of Madame Luce Ben-aben, who succeeded admirably in giving to conventional Oriental designs a new rendering. The exquisite finish of the embroideries of the Turkish Compassionate Fund in the Woman's Building surpassed any other display from that country.

The embroideries of the United States gave promise of an artistic development in this line that in time may rival that of Europe. Indeed, it was gratifying to note that the work of our women was distinguished for purely American characteristics in design, beauty of color, and unusual artistic treatment. The whole exhibit was a great delight and a source of gratification as a national accomplishment. The display of the New York Decorative Society included the most noticeable articles—one a beautiful bedspread embroidered in gold and silk on white silk in German style, another of Portuguese design in brilliant colors on changeable silk, a wall hanging in Italian *baroque*, and luxurious cushions in Spanish and Egyptian style. The dainty

and effective embroidery of the Boston School of Art was a great pleasure. The exhibit of the Associated Artists of New York was notable as making an important advance in art manufacture. The Philadelphia School of Art Needlework sent a large number of pieces, all of original designs, one of which, a centerpiece of white linen in design of mignonette, lacked nothing but the fragrance to make it real. An altar cloth embroidered in colors on white silk was a fine example of the church work for which this school is famous. The Baltimore Decorative Art Society showed original and artistic designs and superior excellence of workmanship. A large collection of exquisitely embroidered table linen was shown by Marshall Field & Co., of Chicago. In the chapel of the Tiffany exhibit in the Manufactures Building was a miter rigid with heavy gold *appliqué* and gems. Miss Mary A. Williamson, of Indianapolis, Ind., showed herself a very ingenious and original worker in *appliqué*. Indeed, she may be said to have founded a school, and in her collective exhibit of the work of the women of Indiana were seen the productions of many of her followers. Miss Belinda Fluke, of Kittanning, Pa., deserves mention for two linen centerpieces, one in design of orchids and another in pale-pink roses. A linen tablecloth embroidered by Mrs. Bresleau, of Washington, D. C., in pale-pink orchids, was bought by a foreign nobleman as a gem of American embroidery. Miss Sallie Minnis, of Philadelphia, showed a dinner cloth in drawn work and embroidery that was one of the most perfect productions of its kind at the Exposition. The work of Miss Cora Scott Waring, of Saratoga, N. Y., of the Fjelde sisters, of Minneapolis, Minn., of Miss Christine Oberg, of Portland, Ore., and the embroidered landscapes of Mrs. Austin J. Peters, of Jamaica Plains, Mass., also deserve special mention. The assortment of early American embroideries was quite remarkable. A sampler worked in 1760, lent by Mrs. George Waddington, was one of the very best.

*Fans.*—Few of the products of genius or skill in the Woman's Building were more admired than the fan in its various forms. Among one hundred and ten awards given for painting and other decoration, twenty were entirely the work of women in design and execution.

From the South American countries came most dainty and unique work done wholly by women at home, in which the natural products of forest and field were employed. In six of these states—Brazil, the Argentine Republic, Uruguay, Chili, Peru, and Ecuador—and also in the West Indies, about half of the work of fan manufacture is done by women, and in Mexico nearly all the patient labor of decoration is performed by them.

In the exhibit of the Vienna Woman's Industrial Association was a magnificent fan with mother-of-pearl handle painted by Clara Jacquemar, an ancient Austrian fan with figures and garlands painted by Marie Hoerner, and other fine examples. The Woman's Working Society of Vienna exhibited fans both of modern and antique design. To the painted screen sent by her Imperial Highness Marie Theresa, two fans or hand screens were at-

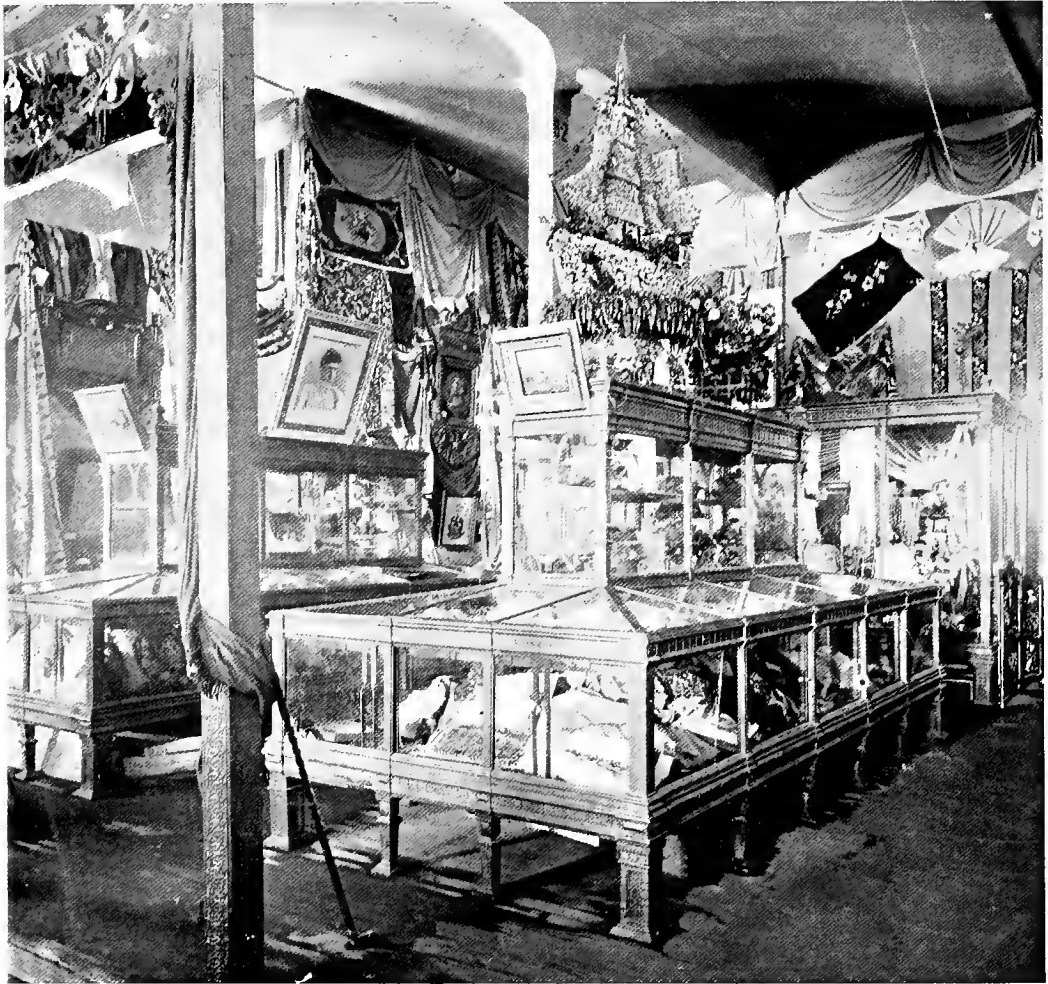
tached, wrought most beautifully with flowers and leaves of ribbon. In the Belgian exhibit Mademoiselle Massin, of Brussels, had three exquisite fans, to one of which, painted with a flight of butterflies, an award was given. Madame Gasparoli had a charming landscape fan set in a harmonious frame. The preeminently choice laces of Belgium were shown to their best advantage in fans, those of Madame Daimeries being particularly beautiful. Of modern fans the three most attractive in the French section were those of Mademoiselle Louise Abbéma, Madame Rodiguèse, and Madame Cecile Chennevière. That of Mademoiselle Abbéma was a painting on parchment of A Woman Surrounded by Poppies, Madame Chennevière's was a most successful imitation of the Japanese, and Madame Rodiguèse represented The Hours. Besides the collective exhibits of M. Buisson and M. Ahrweiler there were many by individual artists, including the Countess Greffuhle, the Baroness Gartempe, Mademoiselle de Bardin, and the Marquise de Grollier. The latter, who has exhibited on several occasions in Paris, chose for her subject at the Columbian Exposition an elegant painted and engraved ivory fan of the style of Louis XVI. The German collection included thirty-nine numbers, many of which had already won exposition prizes, among them the work of Miss Elizabeth Ankermann, of Berlin, Miss Emma Bauer, of Stuttgart, and others.

*Artificial Flowers.*—The display of artificial flowers at the Columbian Exposition was a surprise to all. The variety of materials composing them was great, and the species represented were numberless. They came not only from France, the home of their highest perfection, but from England, New South Wales, Siam, the Canary Islands, Norway, Japan, Mexico, the South American states, and, in fact, from nearly every nation on the globe. They were made of shells, fish scales, leather, bullion, charcoal, corn husks, porcelain, cloth, wood shavings, paper, worsted, bark, rice, velvet, lace, feathers, crape, wax, cotton, linen, silk, iron, papatla, gutta percha, and whalebone. There were skeletons of real flowers, flowers dried in heated sand, flowers pressed, polished, and varnished, flowers made of seed, and flowers from an interminable variety of spangles, braids, ribbons, cords, and beads. Those from France surpassed all others in color, grace, and quality. The orchids, roses, and lilacs of M. Patay were such perfect imitations that they were rather objects of art than of industry. The lace flowers from Spain deserved special notice, not as flowers, but because they were fairy structures of stitches, fine as a spider's web and airy as the lightest feathers. Superb feather work was shown from Brazil, Mexico, and the other Latin-American States. The Misses Heath & Co., of Buffalo, N. Y., deserve particular mention for their beautiful and attractive paper flowers and novelties. They were the first to establish this industry in our country, and their trade has developed into an immense business, giving employment to a large number of women.

*The Woman's Library.*—Of this collection of over 7,000 books, more



than 5,000 were contributed by forty-one States and Territories of the Union, the remainder coming from foreign countries and representing eighteen different languages. Only twelve of these languages appear in the printed catalogue, the titles in Oriental tongues having been translated into English or changed to the Latin text. The foreign countries thus repre-



WORK OF MEXICAN WOMEN.

sented were Arabia, Austria, Belgium, Bohemia, Brazil, Canada, China, Cuba, Finland, France, Germany, Great Britain, Greece, Holland, Italy, Japan, Norway, Peru, Poland, Portugal, Spain, Sweden, and Turkey. Among these, France sent over 1,000 volumes; Great Britain and Spain, nearly 600; Germany, about 400; Italy and Bohemia, 300; Belgium, Sweden, and Norway, each nearly 200; and Holland, 60.

A glance at the titles and names of authors showed some of the most brilliant names the world has ever known in every field of thought, from the lightest fiction and poetry to the most abstruse treatises in science and phi-

losophy. The parts of the United States represented were Alabama, Arkansas, California, Colorado, Connecticut, Delaware, Florida, Georgia, Illinois, Indiana, Iowa, Kansas, Kentucky, Louisiana, Maine, Maryland, Massachusetts, Michigan, Minnesota, Mississippi, Missouri, Montana, Nebraska, New Hampshire, New Jersey, New York, North Carolina, North Dakota, Ohio, Oregon, Pennsylvania, Rhode Island, South Carolina, Tennessee, Texas, Utah, Vermont, Virginia, West Virginia, Wisconsin, and the District of Columbia. Among these, New York sent 3,000; Illinois and Pennsylvania, each nearly 600; New Jersey, 400; Connecticut, the District of Columbia, Massachusetts, and Ohio, each between 100 and 200 volumes. The New York collection was historic and chronologic, representing not only writers of the present day, but also many of the eighteenth century and the early part of the nineteenth. The earliest works, those of Mrs. Charlotte Ramsay Lennox, bore the date of 1752; Mrs. Bleeker followed in 1793, and in 1828 Mrs. Lindley Murray and Cynthia Bullock came before the public. There were the pioneer records of Mrs. Kirkland in Western wilds near Detroit; Mrs. Arabella Wilson's *Lives of the Three Mrs. Judsons*; Caroline Chesebro's works; those of the Carey sisters and the Misses Warner; Emily James Smith's translations from the Greek of Lucien, and Mrs. Sawyer's translations of Herder's prose poems, *Leaves of Antiquity*. In foreign tongues there were Miss Fielde's books and dictionary in Swatow (Chinese dialect); the two Mrs. Judsons' books in Burmese; Miss Jackson's in Arabic; and Mrs. Humphrey's in Hindustani. In religion there were several books by Mrs. Palmer that have reached their fiftieth edition. In philanthropy there were many authors besides Mrs. Cooper and Mrs. Lowell; in medicine, many besides the Drs. Blackwell and Jacobi; in science, others than Mrs. Phelps and Miss Youmans; in music, Mrs. Knapp and Jeanie Morris Swift, and Mrs. Crosby Brown with her superb *Musical Instruments and their Homes*. In history there was a long list, from Mrs. Bloss-Brewster of *Ancient-History* memory down to Mrs. Alice Morse Earle with her *Sabbath in Puritan New England*. In art history there was Mrs. Stranahan's valuable *History of French Painting* and Miss Fuller's *Manual of the Art of Wood Engraving*. Of the treasures by other writers it is impossible to enumerate the list, so wide was its scope.

*Statistics, Records, Manuscripts, and Music.*—These collections were installed in the two Record Rooms, one on the north and the other on the south of the Library. The statistics and records regarding woman's organizations for purposes of all kinds, and showing her universal, social, and industrial condition, were compiled by home and foreign commissions at the special request of the Board of Lady Managers. They were sent in the form of books, manuscripts, pamphlets, and wall charts from the Argentine Republic, Australia, Austria, Bohemia, Belgium, Canada, China, Denmark, France, Germany, Great Britain, Holland, Italy, Japan, Mexico, New Zealand, Norway, Portugal, Russia, the Sandwich Islands, Spain, Sweden, Switzerland, Syria,

Turkey, and the West Indies, besides from all parts of the United States. Among all these the French statistics were the most complete and the most ingeniously displayed by means of finely executed wall charts and handsomely bound and engrossed albums. This collection in general was considered to be one of the most profitable and interesting of exhibits, either domestic or foreign, and was acknowledged by many official statisticians to be a new and important departure in exposition work. Among the many valuable manu-



NEEDLEWORK FROM SWEDEN.

scripts—including autograph letters, documents, and originals of celebrated books—were those of Queen Isabella, and many others sent by the Queen Regent of Spain. Here also was seen the handwriting of Maria Edgeworth, Miss Burney, Jane Austen, Mrs. Gaskell, Charlotte Brontë, and George Eliot. The first page of Adam Bede, with an affectionate note of dedication to George Henry Lewes, signed “Marian Lewes,” dated 1859, was one of the most touching things of the whole collection. In the same case with these manuscripts were three fine editions of the *Boke of St. Albans*, by Dame Juliana Berners. In the matter of music, both published and in manuscript, the collection from the United States was comparatively

small and unimportant, while the foreign list showed compositions ranging from the simplest to the grandest musical forms, including operas with full instrumental scores, oratorios, cantatas, orchestral works, etc. Belgium, France, Germany, Italy, Poland, Mexico, New South Wales, Norway, Spain, and Sweden were the foreign countries contributing to this exhibit.

*Carved Panels.*—The principal feature of decoration in these Record Rooms was the row of carved panels forming a continuous line above the bookcases. An attempt was made to have each State and Territory here represented, and thirty-two responded to the invitation. It was requested that the designs of these panels be of the Italian Renaissance school, in

harmony with the general style of the Woman's Building, but in many cases a preference was shown for something typical of the various sections of the country; Kansas, for instance, chose the sunflower; Oregon, the dogwood blossom; California, the poppy; Alabama, the magnolia; Alaska, the fern; and Wisconsin, the pine cone; while in other cases the State seal was the principal idea of the design. Four of these panels, those carved by Miss Mary Norton, of Alabama, Miss Ida Hazen, of Colorado, Mrs. C. E. Lyman, of Michigan, and Mrs. Anna Field Cameron, of Nebraska—were selected for excellence and harmonious blending in all respects, and were used in the decoration of the platform in the Assembly Room.

*Scientific Exhibit.*—As the knowledge of woman's accomplishments in the natural sciences prior to the Columbian Exposition was hardly known outside of the small circle of scientists interested in the same lines of investigation, it was decided by the Board of Lady Managers to attempt a collective scientific exhibit. Under Mrs. Sarah S. C. Angell, of Michigan, chairman, assisted by Mrs. Laura Gillespie, of Tennessee, a scientific collection was placed in the two scientific rooms of the Woman's Building that attracted much attention and received the commendation of scientists from all over the world. And this did not by any means include all of women's exhibits in scientific work; these were distributed throughout the State buildings, and the Agricultural, Anthropological, and Liberal Arts Buildings, in all of which they were acknowledged to be of high professional excellence. The botanical display in the Woman's Building was unusually fine, including pressed specimens from Colorado, Montana, Mississippi, New York, Oregon, Mexico, and South America; medicinal plants from the Bermudas, Spain, and Utah; skeletonized leaves and flowers showing the circulatory and fibrous life of plants; and an exquisite exhibit of Pacific coast algæ by Miss Mary J. Westfall, of California. Mrs. A. D. Davidson, of Oberlin, Ohio, was especially commended for her geological scientific collection. Mrs. Zelia Nuttall's charts, showing her interpretation of the supposedly lost Aztec calendar, proved the depth of her archæological researches. Conchology, entomology, palæontology, mineralogy, microscopy, chemistry, astronomy, and the medical sciences were also represented by noteworthy exhibits.

*The Colonial Exhibit.*—In the division of work outlined by the Board of Lady Managers to the Committee on Colonial Exhibit was assigned the duty of illustrating the life, customs, and state of civilization that existed in the colonies prior to and during the time of the Revolution. This committee—Mrs. Florence H. Kidder, of North Carolina, chairman—was composed of one member from each of the thirteen original States. But only nine of the original States—New York, North Carolina, New Jersey, Rhode Island, Pennsylvania, Delaware, Maryland, Connecticut, and Massachusetts—were represented in the exhibit. The colonial exhibit was one of the most inter-

esting historical features of the Exposition ; and there was perhaps no other that so forcibly emphasized, by comparison and suggestion, the progress and development of the United States.

*State Exhibits.*—In a few of the States little or nothing was accomplished by women for the Exposition, while in others they did unexpectedly good work, and brought forth proofs that they had succeeded better than was supposed in every art, calling, and profession open to them. The result of their participation in the Fair was most surprising and creditable. They made a



JAPANESE ROOM IN THE WOMAN'S BUILDING

record for energy, patriotism, and versatility of which the country may well be proud, and which affords many useful suggestions for future enterprises of the same kind.

In twenty-two States and Territories the work of the National Lady Managers was inseparable from that of the State boards. They were members of those boards, and as such assisted in securing State appropriations, contributions, and exhibits. These States were : Colorado, Delaware, Indiana, Iowa, Kansas, Louisiana, Maine, Minnesota, Missouri, Montana, Nebraska, Nevada, North Carolina, Ohio, Oregon, Pennsylvania, Rhode Island, Virginia, Washington, Arizona, New Mexico, and Utah. In six States—Alabama, Arkansas, Florida, Georgia, Idaho, and Maryland—the National Lady Managers alone secured the representation of women at the Exposition. In California, Connecticut, Illinois, Kentucky, Michigan, New Jersey, New York, North Dakota, South Dakota, and Texas the National Lady Managers and the State boards worked on separate and special lines. In Mas-

sachusetts the National Lady Managers, the women of the State Board, and a volunteer committee worked separately.

The woman's boards of the United States raised for their own use, by various means, the sum of \$126,035. The State Legislatures and World's Fair boards appropriated for woman's work the sum of \$243,879. These sums, exclusive of many private enterprises and of the appropriations made by Congress for the National Board, made a total of \$369,914 raised throughout the country for the use of women at the Exposition. In some instances these boards devoted themselves mainly to the decoration and furnishing of their respective State buildings; others, while not neglecting these, also provided exhibits for the general display in the Woman's Building and elsewhere; and still others preferred to make collective exhibits of woman's work in their own buildings.

Although Alabama did not officially partake in the Exposition, the women of that State, under the leadership of Mrs. Anna M. Fosdick, Lady Manager, were not without representation. The Woman's World's Fair Association of Mobile sent, as a special exhibit to the Woman's Building, the furniture and wainscoting of the platform in the Assembly Room, while the women of Selma sent a carved seat of native stone for use in the rotunda. The sixteen tree trunks requested from each State for the Forestry Building came from Alabama through the Mobile association, as did also the "magnolia panel," carved by Miss Mary H. Norton, of Montgomery, which was so much admired in the panel dado of the platform above mentioned.

The women of the Territory of Arizona were represented at the Exposition principally through the efforts of Mrs. Thomas J. Butler, Lady Manager from Arizona. The amount spent for this purpose was \$433, of which about \$200 was given by the Territorial Board and the rest was provided by Mrs. Butler. In spite of the difficulty of collecting an exhibit in a country so vast and unsettled as Arizona, an extremely creditable showing was made; and with its suggestions of life in a new country of fine natural resources and great possibilities—a country with a very recent history of Indian warfare—it excited much interest. The flora of the Territory offers a tempting field, as shown by the volume of water-color paintings of wild flowers by the artists, Mesdames S. P. Behan, M. Riordan, and C. Trairs, and the Misses Blake and Snyder. A unique onyx table was produced as an offering to the Woman's Building. Its frame was of the cholla cactus, ironwood, paloverde, and other desert growths, while the onyx came from a quarry in central Arizona. Mrs. Jenny Millay, of Phoenix, sent a volume of views in the Grand Cañon and other scenery. In order to get these views she often had herself let down by ropes into the cañons with her camera strapped to her shoulders. These photographs were objects of eager interest. Mrs. Butler contributed a valuable collection of Indian curios from the Moquis, Maricopas, and Pimas. Perhaps no part of Arizona's exhibit was examined with more interest than these curios—a case of baskets made by Indian women and a dis-

play of Navajo blankets in the Territorial Building. In that building also the life-sized portrait of General George Crook, by Miss E. E. Blake, of Prescott, was much noticed. A camp scene painted by Mrs. Hooker, Fort Grant; a painting of the white poppies of Arizona, by Miss E. E. Blake; and a unique and patriotic banner made by Mrs. W. O. O'Neill, of Prescott, of the badges of the army corps of the United States, were among the attractive decorations on the walls of the Territorial Building.

The women of Arkansas, though not provided for by the board that finally assumed control of World's Fair matters in that State, preserved their



DISPLAY OF ARTICLES PATENTED BY WOMEN.

previous organization into Columbian clubs, and worked for the furniture and decorations of the Arkansas Building. Most noticeable among these contributions were the large fountain in the rotunda, a bronze bust of General Albert Pike, with pedestal of native woods, a marble bust by Mrs. Caroline Brooks, and various works of art, heirlooms, ceramics, etc. Through the Texarkana Columbian Club means were furnished to place in the Woman's Building a group of Vinnie Ream Hoxie's statuary, including Miriam, The West, and America. A panel carved by the pupils of the Deaf and Dumb Institute at Little Rock was one of the most admired in the collection in the same building.

The Woman's Board of California, Mrs. E. O. Smith, of San José, president, was auxiliary to the World's Fair Commission of that State, which consisted entirely of men and controlled the expenditure of the legislative appropriation. The various counties also appropriated large sums to supple-



ment the State fund, in obtaining which the women did good service. They showed themselves most efficient in the collection, installation, and care of exhibits. A very fine general exhibit of woman's work was made in the California Building, some features of which were quite remarkable. Nearly 650 women from that State sent exhibits to the Fair. About ninety exhibited in the Exposition Buildings, while the others contributed to the various county departments, the art department, and the woman's department in the State building. This building had scarcely a rival among the States in size, beauty, and interest. Its pleasing and characteristic decorations, in which native palms, grasses, trees, and plants were used, were designed and supervised by Miss Mary D. Bates, of San Francisco. The Woman's Department covered a space of 120 feet by 20. The Commission expended about \$10,000 in the collection and care of this exhibit, which was one of the most complete and representative displays of woman's work at the Exposition, including every variety of woman's decorative work and handicraft. An attractive feature of the exhibit of San Francisco County was the San Francisco Woman's Room, formed by screens of carved and fire-etched redwood panels, six feet high, containing the contributions of San Francisco women to art, literature, music, and industry. Another charming place was the Poppy Room; designed to honor the California poppy—the State flower—and to show the decorative effects that may be obtained from its different shades, varying from the lightest lemon yellow to the deepest orange. Women from all parts of the State delighted to send contributions to this beautiful room, in which the experiment of a symphony in yellow was most successful. Beautiful also, as the ideas suggested by its name, was the Wild-flower Room, in which was shown a collection of water-color paintings of the wild flowers of the State, loaned by Mrs. Marianne Mathieu, of San Francisco, who had devoted twenty years of her life to classifying and painting them. In addition to the care of exhibits, the Woman's Board of California assisted the Commission in the hospitality so generously dispensed throughout the season, and gave several receptions under their own management. They also entertained the twenty-one prize children of the public schools of the State, who were given an excursion by the San Francisco Examiner.

The State Board of Colorado appropriated \$15,000 for an exhibit of woman's work, and this amount enabled Mrs. Laura P. Coleman, chief of the Woman's Department, assisted by an efficient corps of workers in the counties, to make a most successful display. These women sent to the Exposition 3,393 exhibits, having an estimated value of \$55,000. The articles were placed in seven of the general Exposition buildings and in the State building. In addition to this, the women of Denver raised \$1,000 for the Powers statue, *The Closing Era*, exhibited in the Art Building. The particular enterprises of the State board were an herbarium collection of the flora of Colorado; the compilation of complete statistics regarding woman's

work and her condition in that State ; and the exhibit known as the Indian Alcove, installed on the landing of the southwest stairway of the Woman's Building. The walls and ceiling of this alcove were draped with Navajo blankets, and the space was occupied with articles relating to Indian life, including a red sandstone bust of Ignacio, chief of the Southern Utes. An Indian woman weaving at a primitive loom furnished a vivid picture. The interior of the Colorado Building was beautified, through the efforts of the State board, with oil- and water-color paintings, plaster casts, books and music, wood carvings and decorated china, and a fine collection of minerals from Miss Jessie Sharpe Purrier.

The Connecticut Woman's Board had an independent appropriation of \$7,000, which was expended with good results under the presidency of Mrs. George H. Knight, of Lakeville, successor to Mrs. Morgan G. Bulkley, of Hartford. This sum was made to pay for the transportation of every article sent by the women of Connecticut ; for the collection of a large and remarkable literary exhibit ; for the publication of a book containing the works of short-story writers ; for the compilation of a complete set of statistics concerning the industrial condition of Connecticut women ; and for the decoration and furnishing of the Connecticut Room in the Woman's Building. A general exhibit consisting of oil and water-color paintings, china painting, needlework, designing in wall paper and silver, and photography was collected. Remarkable among these exhibits was the work of Mrs. Marie Kendall, of Norfolk, in photography, and of Mrs. Isabel Butler, of Bridgeport, in machine and art embroidery. The most important feature of the literary exhibit was the Stowe collection. Among other things contained in the cabinet in which it was installed was a copy of the first edition of *Uncle Tom's Cabin* (very rare), one of the latest reprint, and one of each of its forty-two translations. The furnishing and decoration of the Connecticut Building was intrusted to the Woman's Board. An interior of the time of the Revolution having been chosen, no articles were used that were less than a hundred years old. All these things were loaned by citizens of the State.

The Legislature of Delaware appropriated \$1,000 for the representation of Delaware women at the Exposition. Of this amount, the sums of \$600 and \$400 were made payable to Mrs. Ida M. Ball and Mrs. Mary R. Kinder, National Lady Managers, the former being charged with the collection of a general exhibit, and the latter with that of colonial relics for display in the Colonial Exhibit in the Government Building. About sixty-six exhibitors (besides those who exhibited in the State building) contributed articles of merit and interest to the Woman's Building. The women of the State board, under Mrs. Caleb Churchman, chairman, concentrated their efforts upon the furnishing of the Delaware Building. Pictures and books by Delaware artists and authors, old china, fine embroidery, and historic pieces of furniture rendered the interior of the Delaware Building homelike and attractive.

The Woman's Exposition Board of Illinois was favored with an appropriation of \$80,000 and independent control of it. The State was thoroughly organized into county Columbian clubs, and encouragement was given to women in all lines of work, with such good results that the general exhibit in the Illinois Building was second only to that in the Woman's Building. An exhibit of the books written and the magazines and journals edited by women was brought together. Among those thus represented were Mary



THE MODEL KITCHEN.

Hartwell Catherwood, Eliza Allen Starr, Amelia Geer Mason, and Myra Bradwell. The educational, professional, and philanthropic work of the women of Illinois was shown by a compilation of statistics published in pamphlet form, and also displayed in a handsomely engrossed and illustrated book. Relics pertaining to the early history of the State, to the pioneer work of women, and to the lives of Lincoln and Grant, formed an interesting collection. An active exhibit in bacteriological laboratory work was made by Miss Nettie Ayers, assistant scientist and instructor in the Agricultural Experiment Station of Illinois University. Miss Lydia M. Hart, official artist to the State Laboratory of Natural History, showed entomological drawings and paintings. Taxidermy, botany, and geology were also represented by notable collections. Sculpture was exemplified by Miss Julia Bracken's ideal figure of Illinois welcoming the Nations of the World, while heroic statues symbolizing Maternity, Justice, Charity, Faith, Learning, and Art, adorned the buttresses in the main exhibit space. Drawings, oil and water-color paintings, including the collection of the Chicago Palette

Club, and the ivory miniature painting of Miss Cecile Payen, of Chicago, made up an excellent art exhibit. The decoration of the reception rooms and library was designed and supervised by Miss Ida A. Burgess, of Chicago, assisted by other artists of that city. The main feature of this decoration was a deep frieze painted in panels illustrating the relation of woman to the arts. This board organized and maintained in daily operation a hospital and trained-nurse exhibit, a pharmacy exhibit, a corn kitchen, and a kindergarten. These four working exhibits were perhaps the crowning glory of the Woman's Exposition Board of Illinois. During the first half of the Exposition the school was conducted by the Froebel Kindergarten Association of Chicago, and during the last half by the Free Kindergarten Association of that city. The corn kitchen, conducted by the Illinois Board in the Woman's Building, was the outgrowth of a desire to place there a special exhibit worthily representing the women of Illinois and the interests of the State. The services of Mrs. Sara T. Rorer, of the Philadelphia School of Cooking, were therefore secured, and daily demonstration lectures and lessons were given in the proper cooking of Indian corn and its products. More than three hundred dishes were prepared from corn, and the product of each morning's cooking was given to visitors. Practical instruction was given every afternoon to a class of twenty girls upon making fires, the selection and care of cooking utensils, marketing, cooking of common foods, their chemistry and hygiene, and in the general management of a meal. The *personnel* of this class was changed every month, and the girls came from every part of the Union. The Illinois Woman's Hospital Building, in which were carried on the hospital and trained-nurse exhibit and the pharmacy exhibit, was erected for the board by President Higinbotham at his individual expense. This building, at the southwest corner of the Children's Building, was admirably adapted to its purpose, and was supplied with the best hospital appliances. Three resident physicians, representing the three principal schools of medicine, and one head nurse, assisted by many volunteer physicians and nurses, served during the Exposition. Twenty-two hundred men, women, and children were there treated free of charge in the private wards for emergency cases. The success of the pharmacy exhibit was largely due to the energy and ability of Mrs. Ida Hall Roby, Ph. G., of Chicago. As President of the Illinois Woman's Pharmaceutical Association, she represented all the registered woman pharmacists of the State, who numbered fifty-six. Mrs. Roby and two assistants filled more than a thousand prescriptions for World's Fair visitors.

That Louisiana had a State Building at all was due to the assistance rendered by the women of the State board. And when they had secured the building their efforts were directed to furnishing it and placing there a general exhibit of woman's work. Funds were raised among the women of the State, which, together with the legislative appropriation, amounted to somewhat more than \$5,000. Committees were formed in New Orleans and

the parishes, and under the direction of Mrs. Belle H. Perkins, president, good collections were made in education, literature, art, music, curios, State charities, the Christian Woman's Exchange, of New Orleans, and handiwork in general. That of the curios was most interesting from an historical point of view. The Louisiana Building, a facsimile of a typical plantation house, was filled with articles illustrating life in that State during the different periods of its history. There were many pieces that had a special interest by association with well-known names, such as Lafayette, Bonaparte, Henry VII, Henry VIII, Louis XIV, Louis XV, Garibaldi, Washington, Jefferson, William Penn, Henry Clay, and Zachary Taylor. A creole

concert was given on Louisiana Day under the auspices of Mrs. Belle H. Perkins and Miss Katharine L. Minor.

Mrs. William Reed, Lady Manager from Maryland,

was the only woman appointed on the World's Fair Board of that State. She was authorized

to form a subcommittee, and \$450 was set aside for its use, \$250 of which was provided for a colonial exhibit. Finding this sum in-

adequate, these women raised \$1,650 by

private subscription, but even this was

not sufficient. The special enterprise of

this committee was the compilation of

statistics showing the value and amount

of work done by women in factories, busi-

ness ventures, and educational, profession-

al, and benevolent lines. These statistics,

being the first of the kind ever gathered in

Maryland, have a special value. The women's

rooms in the State building were furnished by

private subscription, and contained many fine

pieces of porcelain, art metal work, carved fur-

niture, and embroidered hangings. Pictures by

forty woman artists of the State, some of them of great merit, and one

hundred and forty books, written by Maryland authors, were also placed

in the State building. A most interesting colonial exhibit, collected under

Mrs. Alexander Thomson, Chairman, was sent to the United States Building.

Massachusetts made no appropriation for woman's use in Exposition pur-

poses, but a volunteer organization known as the Woman's Columbian Ex-

position Committee of Massachusetts raised \$5,563.<sup>12</sup> for a general exhibit.

This committee was originally organized to collect colonial relics; but find-

ing that no State appropriation had been made, and that neither the National

Lady Managers nor the women of the State board had secured any display

of woman's work, it extended its original plan, and secured exhibits of prac-

tical and decorative work, as also of educational and scientific work. Its



MRS. BELLE H. PERKINS,  
Member of the Board of Lady Managers.

most faithful workers were Mrs. C. D. Homans, Chairman, of Boston, and Mrs. Ellen Richardson, of the same city, who installed and took charge of the exhibit in the Woman's Building. They were efficiently aided by Mrs. Charles G. Ames, Miss Louisa P. Hopkins, Mrs. C. G. Loring, Mrs. H. H. Rogers, Miss Edith Hawes, and others. The greater part of the colonial exhibit was shown in the Government Building, and many historical articles were placed in the State building, among them wearing apparel belonging to important persons of colonial times, portraits, and autographs. The representation of Massachusetts women in literature was justly a matter of pride to that State. Although some names that should have been there were lacking, the list of authors whose books were sent to the library in the Woman's Building included many of note.

The women of the World's Fair Board of Michigan, Mrs. Julia A. Pond and Mrs. J. S. Valentine, used for their general work about three fifths of an appropriation of \$2,500. Besides this they raised \$2,231 for the furnishing and decoration of the Michigan Building. Mrs. Sarah S. C. Angell and Mrs. Eliza J. P. Howes, Lady Managers from that State, secured by their personal efforts \$1,500 for the special exhibit representing Michigan in the Woman's Building. They chose two statues made of Michigan copper, to serve as electroliers in the Rotunda. One was the figure of a girl, and the other that of a boy, carrying aloft oak branches, from the tips of which the light proceeded. These figures were modeled by Mrs. Theodore Ruggles Kitson, of Boston, and the twelve hundred pounds of copper from which they were cast was the gift of the Calumet and Hecla Mines. A handsome framed chart giving statistical information relative to woman workers and taxpayers in Michigan was prepared by Mrs. Pond.

The Woman's Auxiliary to the Minnesota World's Fair Commission was a voluntary association, including one member elected by county organizations in each of the seven congressional districts. The Commission set apart \$6,000 for the use of this Auxiliary, and the women of Minnesota gave \$1,500 more. Subcommittees and auxiliaries were formed, which assisted effectively in presenting local exhibits, and also made special efforts for the Woman's Building and the State Building. As Minnesota had no State flag, one of the first efforts of this Auxiliary was to secure the adoption of a suitable banner. Prizes were offered for the best design, and from among the two hundred submitted that of Mrs. Amelia Carter, of Minneapolis, was selected. The Committee on Flora made a superb collection comprising nine hundred specimens of flowers, vines, and sedges, mounted on ledger paper, and classified and labeled. Miss Jennie Campbell, a botanist of national reputation, was a member of this committee. The Committee on Statistics compiled valuable information regarding women engaged in agriculture and manufactures. Under Miss Sarah L. Arnold the every-day school work of girls from six to fifteen years of age was shown in thirty large volumes. The Duluth auxiliary furnished a stained-glass window for the same building,

designed by Mrs. Weston, of Duluth, in which Minnehaha was seen standing by the historic falls that bear her name.

Missouri made no appropriation for woman's work, but the women of the State board organized auxiliary associations and raised \$7,000, with which they furnished handsomely seven rooms in the Missouri Building. Missouri women contributed paintings, embroideries, and decorative articles for its further embellishment. A remarkable picture of The Christ was painted by Mrs. C. J. Barton, of Kansas City, after the description given of him in a supposititious letter sent by Publius Lutulus, Governor of Judea, to the Roman Senate. (That letter, however, is known to be a forgery, written as late as the fourteenth century.)

The work accomplished by the women of Montana was one of the World's Fair surprises. Montana appropriated \$6,300 for the use of this board, and county Columbian associations raised other funds for special purposes. About one hundred and ten exhibitors were represented in six of the general departments. The special enterprises of this board, of which Mrs. Laura E. Howey was Secretary, were an herbarium collection of the flora of Montana, a collection of the work of native Indian women, and the production of the "Montana nail," as it was called. This was the last nail in the Woman's Building, driven by the President of the Board of Lady Managers at the opening ceremonies. This nail, made of native copper and silver, was combined with a medallion in the form of a brooch, the nail being detachable for use in the ceremony. On the medallion were shown the coat of arms and shield of the State, the design being worked out in gold, silver, and copper, and set with a large sapphire.

In Nebraska a woman's board of thirteen members, auxiliary to the World's Fair Commission of that State, was appointed, and the sum of \$1,500 was set aside for its use. Mrs. John S. Briggs, Lady Manager, having resigned the presidency of this board in July, 1892, Mrs. M. Allan Bock was elected to that office. Committees were formed to collect exhibits in the various departments of woman's handiwork, and to gather statistics regarding women in general. Several special exhibits for the Woman's Building were received from Nebraska, the most notable of which were the Nebraska hammer and the silver candelabrum. The head of this hammer, which was used for driving the "last nail" previously mentioned, was of silver, and the handle of Nebraska woods. The silver candelabrum or electrolier, which, with its carved pedestal, stood on the Assembly Room platform. Indian corn and the sugar-beet—two of Nebraska's staple products—furnished the *motifs* of the design, which was developed by Mrs. Anna Field Cameron, of Chester, in a way to show that much beauty may sometimes be found in common things. Contributions of all kinds were also sent by the Nebraska Woman's Board to the State building.

The exhibit of the work of New Jersey women was in charge of a State Board of Woman Managers, Mrs. Edwin Stevens, chairman. By a judi-



cious expenditure of an appropriation of \$7,000, and by energetic work in organizing committees, they secured an excellent representation for the women of the State. Comprehensive and interesting statistics regarding philanthropic work in New Jersey were secured by Mrs. Robert Adrian and Miss Rosa Murray. Mrs. Charles B. Yardley, in charge of the literary exhibit, sent three hundred and ninety-six books to the Woman's Library, duplicates of which were placed in the State building. Mrs. Yardley also compiled the New Jersey Scrapbook, containing selections from the published works of two hundred and seventy-four contributors to magazines and newspapers. This was the first collection ever made of the writings of New Jersey women. The work of the Colonial Committee, Miss Mary S. Clark, chairman, included the collection of relics from the New Jersey display in the Government Building, the furnishing of the office of the Board of Lady Managers in the Woman's Building with antique furniture, and the compilation of a descriptive catalogue of colonial and Revolutionary relics in the possession of citizens of the State. This catalogue was a large book of three hundred closely printed pages. A committee from this board rendered great assistance in the decoration and furnishing of the New Jersey Building.

New Mexico had reaped the benefit of her women in the appropriation of \$1,500 for the World's Fair by Mrs. Edward L. Bart-bright, Lady Managers of the Terri-Board, and even with this limited amount her fine exhibits in mining, agriculture, and education showed the varied abilities of the New Mexican woman. A fine display of ricolite was made by Mrs. Caldwell, who owns and operates the only ricolite mines in the world. Mrs. Ellis Clark showed a relief model of the famous Lake Valley mine. In the Department of Agriculture there were fine specimens of



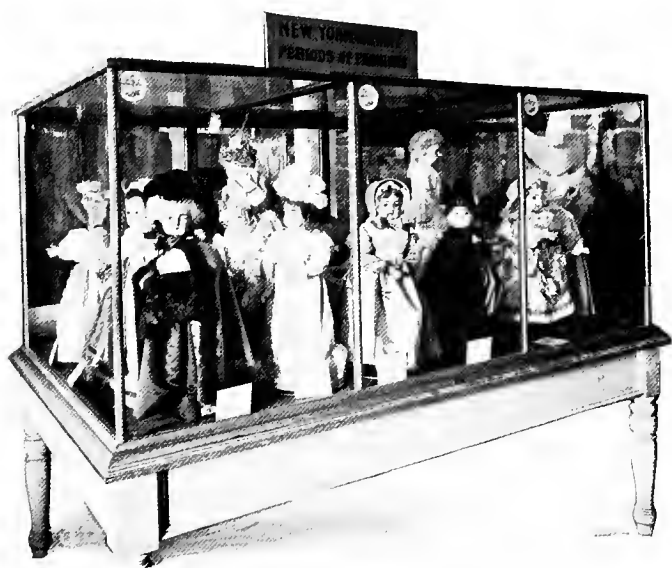
THE CANDELABRUM  
in the Assembly Hall.

honey, alfalfa, vegetables, corn, oats, and barley, grown by irrigation. The exhibit of canaigre, or sour dock, was remarkable. Some of the finest fruits in the Horticultural Building were exhibited by the San Juan County Auxiliary. The women of this county deserve especial credit, as they were fifty miles from a railroad. The chairman of this committee, Mrs. L. R. E. Pauline, has a record as chairman hardly matched in the history of woman's work at the Exposition. She drove alone on a buckboard, day after day, for months to isolated ranches and settlements, with her three-year-old

daughter strapped to the seat and her six-months-old baby tied to her waist. The flora of San Juan County was collected by Miss Maud L. Waring, a teacher of eighteen years. Equipped with trowels and cases, she made her botanical expeditions on horseback, and secured a complete variety of specimens. The special offering of this county to the Woman's Building was the Navajo blanket hung in the doorway between the offices and the session room of the Board of Lady Managers. It was the work of Mirandy, the best blanket weaver of the Indian reservation. Another fine offering was the gold and silver filigree table received from the women of Santa Fé County. Medallions in silver *repoussé* showed the old Church of San Miguel, the Indian Pueblo of Tesuque, the Capitol, the Spanish Palace of the Conquistadores, where General Lew Wallace wrote Ben Hur, and representations of the mines and localities from which the minerals came.

New York appropriated for woman's work at the Columbian Exposition the generous sum of \$60,000, for the proper disbursement of which a board of woman managers was appointed. This board, consisting of twenty-one members, Mrs. Erastus Corning, president, and Mrs. Florence C. Ives, chief executive officer, worked most efficiently in promoting the interests of the Exposition and in bringing out a representative exhibit of the achievements of New York women. About two hundred and nine exhibitors were registered in the general buildings and two hundred and sixteen in the Woman's Building. The plans of the Committee on Philanthropy, Mrs. Arthur M. Dodge, chairman, included the working exhibits maintained in the Children's Building by the Buffalo Fitch Crèche and Training School for Nursery Maids, the New York Day Nursery, and the Kitchen Garden; also the trained nurses' exhibit in the Woman's Building. The workings of the first three are detailed in the chapter on the Children's Building, Volume I. Twelve of the largest hospital schools in New York and Brooklyn took part in the trained nurses' exhibit, and sent costumed dolls showing the dress of nurses; also pictures of their wards and nurses' homes, and articles pertaining to the profession. The plans of the Committee on Literature, Mrs. Frederick P. Bellamy, chairman, included the collection of books, of club chronicles, and of statistics relating to the work of women in magazine literature and journalism. Particular mention of the books is made in the general account of the library. Assistance was given in making this collection by the Wednesday Club of New York, and many of the authors, being requested to present their own works, did so. The chronicles of literary clubs, gathered by Sorosis, were comprised in seventy-five typewritten folios representing nearly or quite every club in the State. Each folio, bound in russet leather, contained the history of one organization, its constitution and bylaws, and four representative papers that had been read by members of it. The covers of the folios were designed by Mrs. James Pryor, of the Associated Artists of New York. The work of women in magazine literature and journalism, collected by the Graduates' Association of Buffalo, was

shown in thirty-nine typewritten folios. The appropriation made by the Woman Managers for the work of the Committee on Literature was \$3,300, which sum was augmented by the Wednesday Club by the gift of \$1,000. At the close of the Exposition this whole literary exhibit was removed to the State Capitol at Albany. The Committee on Music not only collected statistics concerning women in music, but obtained all the accessible data regarding musical societies and organizations in the State. Through the Committee on Fine Arts, Mrs. Leslie Pell-Clark, chairman, works of twelve painters and one sculptor were accepted, while one hundred other productions of New York women passed the scrutiny of the Jury of Acceptance and had



HISTORICAL DRESS COLLECTION.

places in the Fine Arts Building. The Sub-Committee on Applied Arts, Mrs. Candace Wheeler, chairman, placed in the Woman's Building an exhibit containing four hundred and fifty-eight articles representing the different classes of woman's handiwork of the quality required for the Exposition. The exhibit of the Associated Artists of New York was installed with this of the Applied Arts. The exhibit of women's schools and colleges was made

under Prof. Lucy D. Salmon, of Vassar College, acting in conjunction with Mr. Melvil Dewey, who had charge of the general educational interests of the State. The only representation of the colored women of the United States at the Columbian Exposition was the Afro-American exhibit made under the auspices of the Board of Woman Managers of New York, by Miss Imogen Howard. She first directed her attention to gathering statistics of the education of the women of her race, of their charitable, evangelical, and temperance work, and of instances in which colored women had distinguished themselves. The facts thus obtained made several pages of tabulated matter, which were bound and placed on exhibition in the Record Rooms of the Woman's Building. The Committee on Statistics of Woman's Work, Miss Anna Roosevelt, chairman, showed the results of its labors in tabulated statements mounted on a standard with winged frames, and interspersed alternately with photographs of the interiors of factories where women were at work.

The Board of Agriculture of North Carolina, by which that State was represented at the Exposition, recognized the official authority of the Lady Managers, who organized themselves into a committee of which Mrs. Sallie S. Cotton was chairman. Two appropriations of \$500 each were made for the use of this committee. The first was spent in the work of arousing general interest in the World's Fair, and in raising funds for the erection of a State building. The committee secured \$5,000 for this purpose, but the plan was finally abandoned and the money was devoted to local charities in the places where it was collected. The second appropriation, which was supplemented by \$800 given by the city of Wilmington, was used for general purposes. A few exhibits were sent to the Departments of Agriculture, Mining, Manufactures, and Liberal Arts, and to the Woman's Building. A colonial display, collected by Mrs. Florence H. Kidder, appeared with those made by the other original States in the Government Building. Through Mrs. Charles Price the quaint old furniture of the "Homespun Corner," or Press Room, in the Woman's Building, was secured. The Virginia Dare Association, of Wilmington, sent the Virginia Dare desk, a memorial to the first child born of English parents in North America. In its front and sides were carved panels representing historic scenes. The designing and carving of these panels was the work of a young girl, Miss Kate Cheshire, of Tarboro.

The Legislature of North Dakota made no appropriation for an exhibit of woman's work at the World's Fair, but the executive manager of the State board appointed Miss Sadie Davidson Superintendent of Woman's Work. With some assistance from the Lady Managers she organized Columbian clubs in all parts of the State, by which means more than \$3,000 was raised for an exhibit of woman's handiwork and for the furnishing of nearly the entire second floor of the North Dakota Building. The excellent collection of handiwork exhibited in this building included embroidery, needlework, oil and water-color paintings, drawings, and decorated china. There was also a curio collection, for which a quilt worked by Mary Queen of Scots while in captivity was loaned by a descendant of a maid of honor to the unhappy queen. From the Icelandic settlement near Pembina came a national costume for a bride.

The State of Oregon gave \$4,250 for an exhibit of woman's work, the disbursement of which was intrusted to Mrs. E. W. Allen and Mrs. Mary Payton, Lady Managers and members of the Oregon World's Fair Board. A small but excellent collection of woman's art and handiwork was procured, besides a general exhibit of the resources of the State, all of which were distributed according to the general classification. The philanthropic exhibit was of special interest, including that of the Chinese Woman's Home in Portland. Oregon's most notable contribution to the Woman's Library was the works of Mrs. Frances Fuller Victor, which are parts of the Bancroft Series of Pacific Coast Histories. The particular enterprise of the

Oregon Committee was the collection of the flora of the State. The specimens, mounted uniformly, placed in frames, and hung on pillars of Oregon oak, presented a fine appearance in the scientific rooms of the Woman's Building.

An appropriation of \$10,000 was set aside by the Pennsylvania World's Fair Board for the use of its Committee on Woman's Work, and donations were made by individuals for special purposes. There were three hundred and twenty-three exhibits from Pennsylvania in the Woman's Building, while many others were installed in the departments of Agriculture, Mining, Manufactures, Liberal Arts, Anthropology, and Archæology; also in the Government Building and the State building. The works of twenty-one artists were exhibited in the Fine Arts Building, while forty sent to the Woman's Building their best productions in oil and water-color paintings, etchings, pastels, statuary, and stained glass; and some of the best examples of applied art at the Exposition came from the women of Pennsylvania. The work of this committee was organized under Mrs. Harriet Anne Lucas, chairman and Lady Manager, by whom county auxiliaries were formed and the greatest interest was awakened. On the death of Mrs. Lucas, in May, 1893, Mrs. Matilda Hart Shelton succeeded her. Chief among the special enterprises of this committee was the exhibit of the Woman's Silk Culture Association of the United States, of which association Mrs. Lucas was president, and for which she secured a legislative appropriation of \$1,000. The interesting working exhibit of Miss Emma Garrett's School for Deaf-Mutes in the Children's Building and the working of stained glass carried on in the Woman's Building by Miss Elizabeth Abel were also assisted enterprises of the Pennsylvania Woman's Committee. Books to the number of five hundred, many of them on scientific and medical subjects, were sent to the Woman's Library. The school displays of all kinds showed a high degree of advancement, and among them those of the Philadelphia School of Art Needlework and the School of Design for Women were remarkable in their special lines. The artistic decoration and general attractiveness of the women's rooms in the Pennsylvania Building was due to the efforts of a committee of which Miss Emily Sartain was chairman. In the reception room were beautiful mural decorations by Jeanne Rongier, Gabrielle D. Clements, Sarah Dodson, Mrs. Bush Brown, and Mary E. Slater. Mrs. Fanny D. Sweeny designed and executed a stained-glass window that could hardly be excelled in conception and workmanship.

The Lady Managers and alternates of Rhode Island were appointed members of the World's Fair Board of that State, and the sum of \$1,775 was appropriated to their use. Miss Charlotte F. Dailey was further honored by the office of secretary and treasurer of the board. The particular enterprise of this State board was the compilation of the Rhode Island Woman's Directory, containing the name of every woman in the State, and statistics regarding her occupation, etc. For this purpose an advisory

committee of twenty-one members was appointed, each one representing a special line of work or section of the State. The results of the investigation were printed in book form. The books of thirty-nine woman authors were collected, and Mrs. Fanny Purdy Palmer compiled the names of all literary women, their productions and biographical sketches, under the title *A List of Rhode Island Literary Women, 1726-1892*.

The Texas Building itself, with its contents, was the exhibit of the Woman's World's Fair Association of Texas. After the plans of the original World's Fair Association of that State had been abandoned, this association, under the presidency of Mrs. Benedette B. Tobin, took up the work and issued stock to the amount of \$100,000. The money thus raised was expended in the erection and furnishing of the Texas Building and in the collection and installation of the Texas exhibit. The furniture of the spacious rooms was of native woods. A loan collection of works of art was gathered, and also an historical museum and library. Donations of special pride and interest were the statues of Governor Stephen F. Austin and Governor Sam Houston, given by the women and children of the State. They were the work of Miss Elizabeth Ney, of Texas. Specimens of native products were also shown in profusion. An exhibit of silk culture by Mrs. M. Lasker, of Galveston, showed the growth of that industry in Texas. Through Mrs. Rosine Ryan, Lady Manager, the literary works of the women of Texas were placed in the Woman's Library. The fragrant compliments of the women of Galveston came through Mrs. Caroline Willis Ladd in the form of Cape jasmine gratuitously distributed to all comers during the flowering season of that shrub.



MRS. M. B. CARSE,  
Member of the Board of Lady  
Managers.

The Woman's Board of Utah consisted of six members, Mrs. F. S. Richards, president, who formed auxiliary associations throughout the Territory. The collection of woman's work secured by this board, in which were many unique articles, was installed in the Utah Building; and besides the three large cases in which it was shown, there was another filled with the work of Indian women. A display of native linen formed an attractive part of this exhibit. One hundred women of Salt Lake City formed a committee, the result of whose labors was the furnishing and decoration of half of the Utah Building. A complete working silk exhibit from Utah was carried on, through the influence of Mrs. Margaret Blaine Salisbury, Lady Manager from that Territory.

The World's Fair Commission of Washington created a woman's department, appointing Mrs. Alice Houghton superintendent and appropriating \$5,000 for the purpose. Auxiliary clubs were established, and the work was divided into the departments of Fine Art, Art Needlework, Ceramics, Botany, Mineralogy, Ethnology, Antiquities, Benevolent Societies, and Pantry Stores. The articles collected were installed in the Washington Building. A characteristic feature of the decoration was a frieze of eighty-six panels of native woods, painted by the women of Spokane in fruits, flowers, birds, fish, and landscapes of the country. On one was the head of old Gerry, chief of the Spokane tribe. A fine exhibit of lace was made by Mrs. J. T. Weeks, of Spokane; of drawn work, by Mrs. Otis Sprague and Mrs. A. M. Cannon; of fine embroidery, by Mrs. E. J. M. Hale. The best display of needlework was made by Mrs. Turner, of Olympia, and fine work on velvet and satin came from Seattle. The eighty-five varieties of woods and sea mosses of Washington, exquisitely mounted on embossed cards by Miss S. C. Hyatt, and three hundred specimens of the State flora prepared by Mrs. George Crane, of Spokane, elicited much favorable comment.

The World's Fair Board of Wisconsin appropriated \$1,200 for the purposes of its exhibits by women, which sum was augmented by \$3,400 raised among them at large, and \$500 given by the Milwaukee Woman's Club as a prize for the best work of art produced by a woman of that State. With Mrs. Winans, of the State board, originated the idea of raising funds for the purpose of sending to the State building two works of art—ideal representations of Wisconsin. Designs were invited, and Miss Nellie Mears, of Oshkosh, and Miss Lena Miner, of Madison, were commissioned to execute the statues. Miss Mears chose to represent The Genius of Wisconsin by a female figure standing near a rock with her arm thrown around "Old Abe," the famous war eagle of the Eighth Wisconsin Regiment. Miss Miner's statue was the figure of a woman standing in the prow of a boat having the State motto "Forward" cut into the base on which the boat rested. To Miss Mears was awarded the prize offered by the Milwaukee Club. During the Fair these statues stood in the lobby of the Wisconsin Building, and now, reproduced in marble and bronze, they occupy places in the Capitol, at Madison. The designs of the gable decorations of the State building, of the graceful frieze in the ladies' parlor and lobby, and of the panels above the fireplace, were the work of Miss Ruth Winterbotham, while the carving of the latter was done by Miss Albertine Nordstrom. In the departments of Fine Arts and Liberal Arts a generous share of the exhibits were by women, but can not be particularized here.





United States Naval Observatory Exhibit, showing photoheliograph.

## CHAPTER XVII.

### UNITED STATES GOVERNMENT EXHIBIT.

The appropriations—Location of the exhibit—The Board of Management—Contributions of the several departments of the Federal Government—Exhibits of the Smithsonian Institution and the National Museum—The Fish Commission's display—Construction of the tanks—The salt-water aquarium—Comment and criticism.



G. BROWN GOODE.

THE participation by the Government of the United States as an exhibitor in the World's Columbian Exposition was decreed by the act of Congress that created the Exposition itself. The means provided by Congress for the expense of assemblage, preparation, care, and return of the articles of exhibit, for the erection and care of buildings to shelter them, and for the administration of the complicated functions entailed in this branch of the great enterprise, were more than twice the amount appropriated for any previous event of the kind, and more in the aggregate than the cost of all the governmental exhibits for all previous expositions in which the United States has been an exhibitor.

The law-making powers took the initiative in this regard, being subjected to no popular demand and to no other influence than their own appreciation of the importance of the event and the

excellence of the opportunity to bring to the people a more intimate knowledge of the affairs of their Government than was possible by any other means. The exhibit thus provided for became the largest, most comprehensive, and most costly single exhibit ever prepared by any government or organization for any World's Exposition, forming essentially one of the great departments of the Exposition.

The purpose to be served in the creation of the Government exhibit was stated in the act (approved April 25, 1890) to be "to illustrate the functions and administrative faculty of the Government in time of peace, and its resources as a war power, tending to demonstrate the nature of our institutions and their adaptation to the wants of the people." To this end, it was ordered that a Board should be created, whose duty it should be to select, prepare, transport, care for, arrange, and return the articles of exhibit; which Board, it was provided, should be composed of one person to be detailed by the head of each of the executive departments and scientific institutions of the Government, subject to the approval of the President; and the chairman thereof, it was provided, should be designated by the President.

Congress provided further that a building or buildings should be erected to house the exhibits of the General Government, at a cost not to exceed \$400,000—a sum five times as large as that appropriated for a like purpose at the Centennial Exposition. The aggregate of appropriations made at several sessions of Congress in aid of the Government exhibit was \$1,349,000, of which amount \$400,000 was disbursed by the Secretary of the Treasury for the erection of buildings, and \$949,000 was disbursed by the Board of Management in the creation, care, and return of the exhibit.

The site selected by a committee of Congress, in co-operation with the Exposition management, for display by the General Government was on the Lake Front of Jackson Park, about one third the distance from the northern extremity of the grounds, affording means for the installation of the marine and land branches of the Government in close proximity. Fourteen acres were set apart for the purpose, which, being filled in, sodded, and tastefully plotted, formed one of the favorite breathing-spots of the Fair, and afforded camping and parade ground for troops, marines, and cadets.

The exhibit was housed in ten different structures, seven of which were erected at the cost of the appropriations, and all of which together afforded a floor space of 260,000 square feet. The main building was 420 feet long by 350 feet in width, its main floor covering 157,500 square feet. Its galleries had an area of 33,500 square feet additional, making a total of 191,000 square feet of floor space. Of this area, about 175,500 square feet were devoted to exhibits and circulation, and 16,500 square feet to offices and corridors. The building was designed by W. J. Edbrooke, of Washington, the supervising architect of the Treasury, and was erected under his supervision. It was of modern Renaissance architecture, the main feature being a central dome 120 feet in diameter and 275 feet from the ground to the top of the



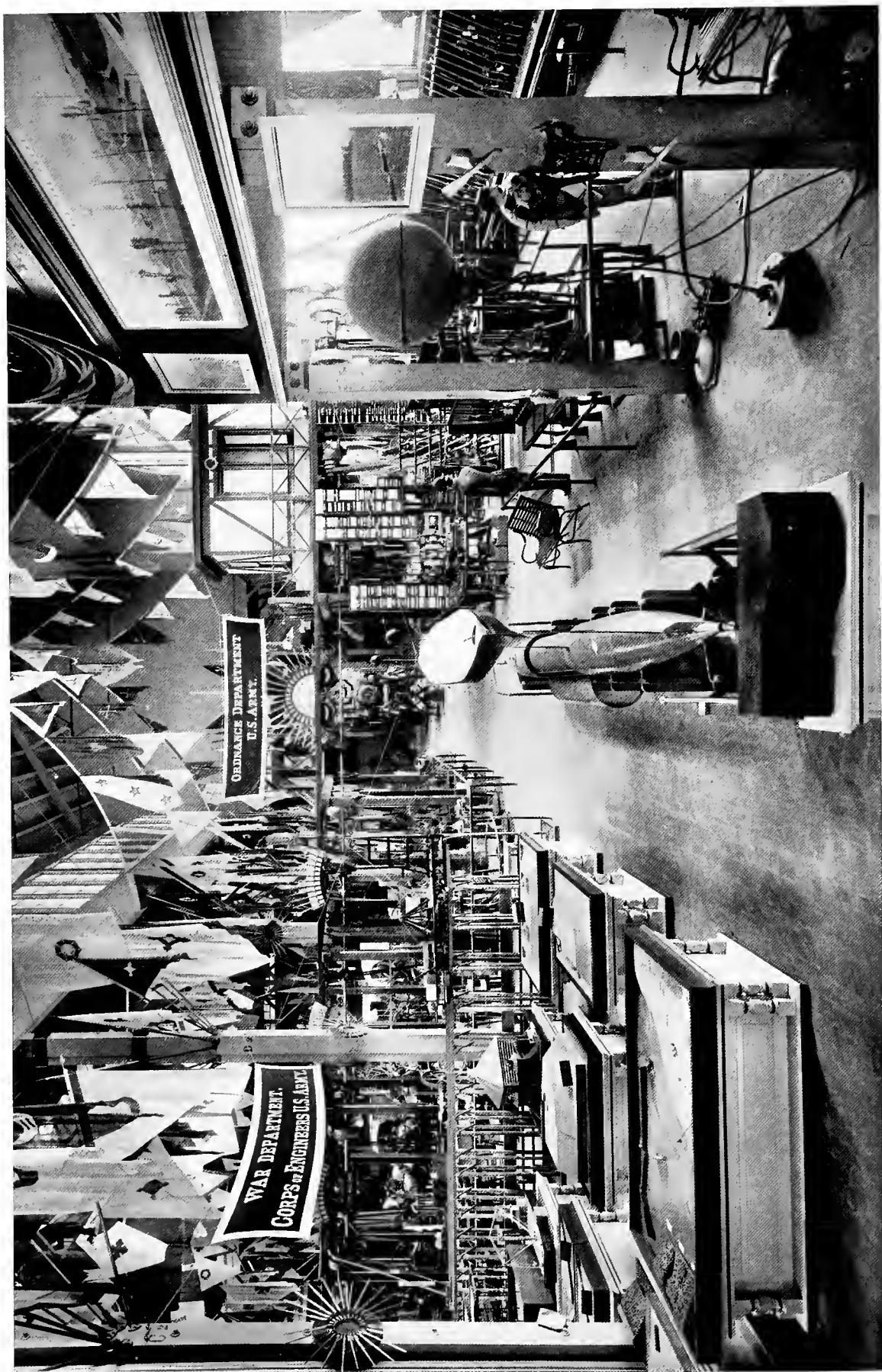


EXHIBIT OF THE UNITED STATES WAR DEPARTMENT.  
In the Government Building.

flagstaff. This dome was of steel, and was supported on sixteen columns. The entire cost of the building was \$325,000, or \$2.07 a square foot of floor area, or three cents a foot of its cubic space. From the remainder of the appropriation not consumed in the erection of the main building four auxiliary structures were erected, specially adapted to the exhibits of the United States Naval Observatory, the United States Army Medical Department, and the Weather and Indian Bureaus respectively.

The executive order naming the members of the Board of Management was promulgated on August 19, 1890, and the list was as follows: For the Department of State, Sevellon A. Brown, Chief Clerk; for the Treasury Department, Allured B. Nettleton, Assistant Secretary; for the War Department, Major Clifton Conly, United States Ordnance Corps; for the Navy Department, Captain Richard W. Meade, U. S. N.; for the Post-Office Department, Abraham D. Hazen, Third Assistant Postmaster-General; for the Interior Department, Horace A. Taylor, Commissioner of Railroads; for the Department of Justice, Elijah C. Foster, General Agent; for the Department of Agriculture, Edwin Willits, Assistant Secretary; for the Smithsonian Institution and National Museum, G. Brown Goode, Assistant Secretary; for the United States Fish Commission, Joseph W. Collins, Chief of Division. The Hon. Edwin Willits was designated by the President as chairman. The board met for organization on September 3, 1890, and elected F. T. Bickford, of Washington, D. C., Superintendent of the American Agricultural Section at the Paris Exposition of 1889, to be secretary.

The members of the Board were not relieved of their current departmental duties by reason of their tasks in connection with the Exposition, and the details of the work of preparation and administration necessarily devolved upon subordinates. The theory of the law, as interpreted by the authorities of the Treasury, enforced a unified exhibit, of which the contributions from the several branches were parts, the Board as a whole being responsible for all its agencies in all departments. To the heads of departments was reserved the right of designating the lists of articles from which selections were to be made by the Board; but with the performance of this duty their powers were exhausted, the Board having exclusive control in the matter of selection, purchase, preparation, care, custody, and return of exhibits, and of the employment of officers and assistants.

The more general duties of the Board, as a whole, devolved, of necessity, upon its secretary, to whose functions were frequently added those of executive officer and custodian of public buildings for the Treasury. The departmental duties of the representatives were performed by special agents, appointed for the purpose by the Board, upon the nomination of members. Supervision of all these agencies was had by means of special committees having jurisdiction of the several branches of the work.

The exhibit, consisting of such articles and materials as illustrate the functions and administrative faculty of the Government in time of peace

and its resources as a war power, presented an encyclopædic survey of North America. The national collections and the Washington museums contributed all their most interesting and important objects. History, ethnography, anthropology, numismatics, natural history, mail, and transportation—all were represented on a large scale.

From the Executive Mansion were sent the President's official seal and an exhibit of the workings of the office—the blank forms for referring communications to the departments, the form of nominations sent to the Senate, the blank warrant authorizing the Secretary of State to affix the seal of the United States to executive instruments, blank commissions for appointment of Cabinet officers, etc.

The contributions illustrative of the functions of the Department of State required for their display ten thousand square feet of floor space. The branch relating to domestic history comprised a collection of documentary mementoes of the birthday and youth of the republic—the petition to George III, the Declaration of Independence, the Articles of Confederation, and the Federal Constitution ; relics, autographs, and portraits of the fathers, among them the diaries and other papers of George Washington, purchased by act of Congress, and letters of Benjamin Franklin ; and many of the more important of the treaties entered into by this Government with foreign powers. The routine functions of the department were illustrated by sets of the current forms relating to the keeping, recording, and publication of the laws, the collection and dissemination of information concerning foreign markets, forms and samples of diplomatic instructions and notes, credentials of ambassadors and ministers, consular regulations, and the functions of the bureaus of statistics, accounts, indexes and archives, rolls and library, commissions and pardons, and passports, together with the seal of the United States and documents showing how it was designed and selected, and, in addition thereto, a considerable assemblage of articles of commerce and of photographs relating to the trade and people of Latin-American nations. A commercial exhibit made by the Department of State consisted of samples of goods used in the countries of South and Central America that are not manufactured or sold in the United States, illustrating the kind of articles demanded by their merchants and people, the styles, prices, qualities, and patterns, with the methods of packing and shipping required for successful competition in that trade with the manufacturers of Germany, France, and Great Britain.

Sevellon A. Brown, retiring from the service of the Government on February 17, 1893, was succeeded as representative by William E. Curtis, Director of the Bureau of American Republics ; and he, in turn, June 16, 1893, by the Hon. W. W. Rockhill, Third Assistant Secretary of State. The disbursements in behalf of this department's contribution up to December 31, 1894, were \$50,932.15.

The functions of the Treasury Department are, perhaps, more varied than

those of any other branch of the Government. Yet some of its most important subdivisions yield nothing of value for exposition purposes, as they relate to accounts and the custody and disbursement of public money ; while other subdivisions are among the most prolific of "articles and materials" that must form the bulk of any well-ordered exhibit. The preparation of the exhibit was begun under the direction of Mr. Nettleton, and, on his retirement from the public service, was continued under the direction of Frederick A. Stocks, Chief Clerk of the department. Small exhibits were made



MODEL LIFE-SAVING STATION, IN REAR OF WEATHER BUREAU.

from the Bureau of Statistics and that of Engraving and Printing, and from the offices of the Register and of the Supervising Architect, illustrative of their respective functions.

A large and brilliant display was made by the Lighthouse Board, comprising all the unfamiliar mechanical and scientific devices in use for coast and river lighting, from the mammoth hyperradiant lens, in which a dozen men might stand at ease—an instrument especially constructed for the Cape Hatteras light, and since installed there—down to the complicated and minute apparatus for the manipulation of revolving and flash lights. Views and models of all the lighthouses on both coasts were exhibited, hyperradiant and range lenses with constant-level lamps, revolving lenses of the Mahan system with Funck-Heap lamps, a fixed lens with occulting clock, set lamps, lanterns with time reservoirs, an electric spar buoy, the Stevens and the



Gamewell fog-bell apparatus, a siren with hot-air engine, light-vessels, gas buoys, and whistling buoys. Upon the plaza this bureau erected a lighthouse more than one hundred feet in height, which afterward was placed on one of the islands in New York harbor.

The Mint Bureau transported from Philadelphia one of the presses on which the larger coins are struck and had it in constant operation. Its output at the Exposition was a medal commemorative of the enterprise, made of composition, and sold for enough to cover the cost of operation. This press was at all times the center of an eager and interested crowd of spectators. The Mint Bureau also displayed one of the richest and most comprehensive numismatic collections in existence, including a complete series of the coins issued at the Mint from the time of its establishment, in 1792. The Register's Office displayed specimens of all the paper money and bonds ever issued by the National Government.

The Life-Saving Service established upon the plaza, in a building constructed for the purpose, one of its stations of the first class, fully equipped with all modern appliances for the saving of life at sea, and fully manned by a draft of the most experienced officers and men of this establishment. The station house was solidly made, and was designed to remain permanently in its position, as it had been determined that a life-saving station was required at that point, and the land had been set apart by the city authorities for such use by the Government. The station was always surrounded by a large crowd at the hour when the crew was called out and put through the drill of shooting ropes to a mock wreck on which were sailors who drew on board the hawser, breeches buoys, and tackle. The crew had one real call to save lives on the lake, to which they responded promptly. Some of the oldest appliances for life-saving were exhibited alongside of the latest apparatus, among them the earliest life car used in the United States, with its mortar and ball, the invention of Joseph Francis, with which two hundred persons were rescued from the Ayrshire, on the coast of New Jersey, in 1850. Lifeboats of every kind, launching-wagons, mortars, shot-lines and projectiles, breeches buoys, rockets, etc., made a complete collection of life-saving apparatus.

The Coast Survey and the Office of Weights and Measures (under one head) made an elaborate instrumental and documentary display, comprising the instruments of precision to which the demands of investigators in several related sciences have given origin and the publications of the Survey. The Coast Survey, which is the oldest of the scientific bureaus of the Government, prepared a relief map of the United States as large as a city square, with paths intersecting it to enable persons to trace rivers and mountain ranges. Exhibits were made of sounding-apparatus, tide-gauges, and tide-predicting machines. The steamer Blake exhibited the methods of exploration pursued by the Coast Survey, and a deep-sea sounding-machine capable of sounding at depths of twenty-seven thousand feet and an appa-

tus permitting the vessel to anchor in twelve thousand feet of water were exhibited.

The Marine-Hospital Service illustrated by models and apparatus the operations of the quarantine service, both coast and interstate, and its laboratory of hygiene comprised a complete bacteriological laboratory, with which the course of modern investigation pertaining to sanitary matters was continuously illustrated. Specimens of the germs of many of the more



MODEL OF MARINE HOSPITAL.

destructive disorders to which human kind are subject, all embalmed in transparent material and arranged for convenient display under the microscope, were at the command of the student visitor.

The allotment of floor space to the exhibits of the Treasury was twelve thousand square feet. The aggregate of expenditures was \$56,638.85.

Nearly all the functions of the War Department are spectacular, and afford available material for exhibit. Such was the amount at command that the task of selection became one of great difficulty, and the equitable division of space between the several contributing branches gave rise to many complicated problems. As the event proved, too much material was selected, and too little space was reserved for aisles and standing-room. The War Department section in the main building was one of the most popular. Its aisles were always congested, and guards were often required, to prevent physical injury from overcrowding.

The Signal Service displayed its signaling devices, including the latest—the balloon train—by which manœuvres of an enemy are communicated from a balloon through a telephone. In this section were seen also a military balloon train, a field-telephone kit with reel carts, the materials and instruments pertaining to military telegraphy, field and marine glasses, and the flags, lanterns, torches, and heliographs used in signaling.

The ordnance display comprised a good-sized machine shop in which

many of the operations of making guns and ammunition were carried on by a detail of skilled operatives from the Government arsenals, from which institutions also the machines for the purpose were sent. The latest methods of manufacturing Springfield rifles, revolvers, rapid-fire guns, field guns, mortars, and siege guns were shown, also illustrations of the evolution of gun manufacture. All types of breech-loading mechanism were shown, with carriages of field and fortress guns; the rapid-fire guns of William, Hotchkiss, Seabury, and Driggs-Schroeder models; the Gatling, Gardner, Requa, Union, Vandenberg, Guthrie and Lee, Hotchkiss revolver, and Maxim machine guns; breech-loading rifles of all types for paper cartridges or metallic ammunition; the Murata, Kropatschek, Mauser, Winchester, Spencer, Belgian, Vetterlin, Remington-Keene, Ward-Burton, Stickney, Scott, Ball, Henry, Chaffee-Reece, Hotchkiss, Clemens, Spencer, Swingle, Colt, Whittier, Collier, and Ellis repeating and revolving rifles; the quick-loaders devised by Colonel J. G. Benton, General Hagner, and others, forming a link between the tubular and the box magazine; the earlier Lee, the Livermore-Russell, Franklin detachable, German model of 1888, and most of the latest magazine rifles, including the Berthier, the Austrian .303 and other Mannlichers, the Schulhoff, the Rubin, the Mauser, the Bruce, the Sporer, the Schmidt, the Krag-Jorgensen of Denmark, the Lee-Speed of the British army, and various other guns brought before the recent United States magazine boards; army and navy revolvers of all kinds for paper and shell cartridges; loading tools and extractors; trowel bayonets of the different sorts; solid shot, shells, cored shot, shrapnel, electric welded shells, and all other kinds of service projectiles, including the shells for Zalinski's dynamite gun, with charges for cannon of all sizes, primers and fuses, and cartridges for small arms; ballistic gauges and the Shultz, Navez-Leurs, Vignotti, Le Boulenger, and Breger chronograph, Benton's thread and electric velocimeter, Sebert's velocimeter with instrument for reading record, the drop chronograph, and a self-registering projectile; aiming devices of Zalinski, Loraine, and others; the range-finders of Watkin, Paddock, Gautier, Weldon, Pratt, Gordon, Russell, Richards, and Labbez; gauges for ammunition, and the gun-making, cartridge, and testing machines used at Springfield and Frankfort arsenals. The historic collections of cannon, muskets, and pistols covered all countries and periods, and the relics included specimens of all the arms and projectiles used in the War of Independence and the civil war.

The Corps of Engineers of the War Department exhibited, by models constructed under the direction of Lieutenant-Colonel George L. Gillespie, the work done at the mouth of the Mississippi, the improvement of the Hell Gate channel in New York harbor, the harbor at Key West, the iron pier at Lewes, and the Delaware Breakwater; also the cutting of a ship canal through the Harlem River and Spuyten Duyvil Creek and the removal of the rocky barrier between them. The models, reduced to the different horizontal and vertical scales, were carved in wood from the plottings taken by the engi-

neers, and a gelatin mold was made, from which plaster casts were taken and the parts colored in accordance with conventional rules.

The clothing and camp equipments used in the army were displayed in the quartermasters' section, where there was a collection of historic flags and colors from the Revolutionary War to the War of the Rebellion; also a series of military uniforms worn in America from 1620 to the present day. The means of military transportation, army wagons, pack mules, etc., were



A PORTION OF THE ORDNANCE EXHIBIT.

fully displayed. In the veterinary and farriers' exhibit were specimens of the shoes and nails made in the school of instruction at Jefferson Barracks, Mo.

A specially planned structure sheltered the exhibit of the Army Medical Service. The display included a model hospital ward with equipments, hospital tents, means of transporting the sick and wounded by ambulance, railroad train, or steamers, anthropometrical apparatus and methods of identifying soldiers, many cases from the Medical Museum in Washington, and a complete laboratory under the charge of eminent bacteriologists, at all times ready to explain modern methods of investigation to interested visitors.

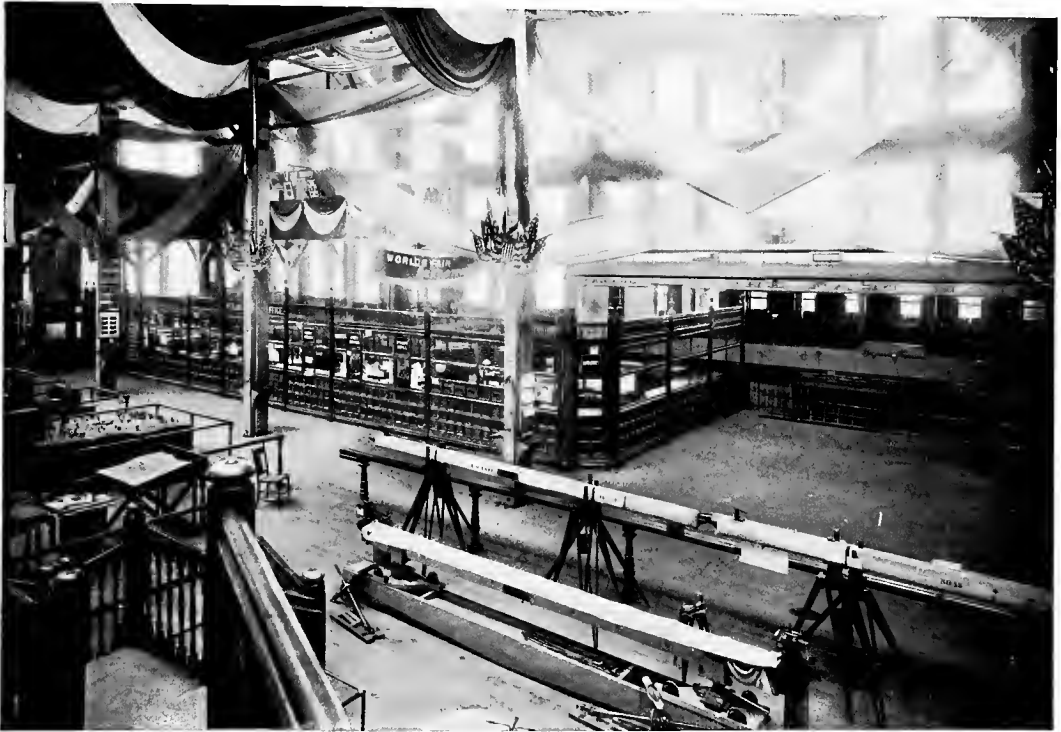
Two companies of infantry were encamped upon the plaza, exhibiting a model camp and affording guards for public property. An attractive feature of the Exposition was the encampment of West-Point cadets upon the plaza

between the main building and the Lake Front. Their daily inspection, guard mount, and dress parade were generally witnessed by as many visitors as could find standing-place around the borders of the parade ground.

The floor space allotted to the War Department was twenty-three thousand square feet, and the expenditures in connection with the exhibit were \$113,215.98. Major Conly was succeeded as representative of the War Department by Lieutenant Henry A. Harris, U. S. A.

The display of the Navy Department was unique. A model of a United States battle ship of the latest type represented the new navy. The Illinois, as the exhibit ship was called, was an exact copy of the new vessels of the Indiana type, and was built up by the use of wire lathing, cemented to the required depth, and resting on a brick foundation supported by piles driven into the Lake bottom. An imitation armor belt, seventeen inches thick, covered engine, boiler compartments, and magazines; and redoubts of the same thickness, carried up from the berth deck to three feet above the main deck, girded the forward and aft turrets, in which were mounted the thirteen-inch guns. Below the main deck were transverse curtains inclosing parts of the vessel and shutting out water in case a shell should knock in the side at any point. Even should the outer parts be carried away, the guns of the armored citadel can still be worked. In the model the magazines, one placed underneath each gun, were used as museums in which were displayed naval relics belonging to the department. The tops of the military tower in the forward part of the citadel were set with all-round machine guns, and directly below this the conning-tower, from which the commanding officer can watch the progress of the battle through minute ports and communicate his orders by means of electric buttons, bells, speaking-tubes, and telephones. At either end of the citadel was a turret containing a pair of eight-inch guns, while smaller guns were distributed along the casemate, all being mounted on carriages that enable them to sweep the horizon and concentrate their fire in any direction. In the interior were shown the apparatus for serving ammunition to the breech-loaders through bulkheads, and the tubes for launching Whitehead torpedoes. A torpedo net was spread on one side of the vessel. This imitation ship afforded quarters for the naval officers and sailors and marines during the Exposition, who maintained, as far as practicable, the discipline and conditions of life on a man-of-war in commission. The exhibit of the Bureau of Construction and Repair of the Navy Department embraced this hull and fittings with boats and gear, equipage, stores, and furniture, together with models of the battle ship Oregon; the coast-defenders Miantonomah, Monadnock, and Monterey; the armored cruisers Maine and New York; the protected cruisers Baltimore, Charleston, Newark, Olympia, Petrel, and Yorktown; the wooden cruisers Colorado and Kearsarge; the dynamite cruiser Vesuvius; the air port of the Raleigh; the fire room of a belted cruiser; and sections of the Chicago. The Bureau of Equipment exhibited boatswains', carpenters', and sailmakers' outfits, electrical material and apparatus of the United States Navy standard,

flags and signals, lamps and lanterns, the phototachometer employed in the Nautical Almanac Office for measuring the velocity of light in 1882, the whole scientific apparatus of the Naval Observatory, and navigation instruments and apparatus of every kind now in use. The Bureau of Medicine and Surgery exhibited the medicines, hospital stores and furniture, and surgical instruments and appliances used in the navy. The Bureau of Navigation made a full exhibit of its work and of the methods of chart construction and the instruments of deep-sea exploration and marine meteorology, and had a branch hydrographic office in the model battle-ship Illinois and an exhibit of the United States Naval Academy. The exhibit of the Bureau of



WORKING POST-OFFICE.

Ordinance included great guns (thirteen-inch, eight-inch, and six-inch) and mounts, the five-inch and four-inch Dashiell rapid-fire guns with recoil mounts, Hotchkiss and Driggs-Schroeder six-pounders and their carriages, Hotchkiss revolver cannon, one-pounder rapid-firers, and Gatlings; navy rifles and revolvers; ammunition for great guns, rapid-firing and machine guns, and small arms; electric and contact spar torpedoes with boat outfit, automobile torpedoes, gunpowder and gun-cotton mines, explosives, fuses, and all the fittings and processes of a torpedo station; and armor plates, gun models, and projectiles. The Bureau of Steam Engineering exhibited the engines, boilers, feed pumps, bilge pumps, and other machinery adopted by the navy. From the Bureau of Supplies and Accounts specimens of the navy ration and of all provisions, clothing, and other stores were shown, and

the Bureau of Yards and Docks exhibited models and plans of the navy yards, dry docks, quays, and workshops. A model camp of United States marines was situated near the Government plaza. The force, consisting of three officers and sixty men, lodged in tents of the United States Army pattern, and was in all respects a model as to arrangement, outfit, and police of a regular service camp for marines doing duty on shore.

The exhibit of the Naval Observatory, including the system of time distribution, was made in a small building on the plaza. A large time ball on the dome of the main building was dropped at noon daily by means of mechanism automatically operated from the Observatory at Washington. The floor space at the command of the Navy was forty-eight thousand nine hundred square feet, and the expenditures made in connection with its exhibits were \$125,468. Captain Meade was succeeded as representative of the Navy Department by Lieutenant-Commander Edward D. Taussig.

A working post office, manned by experienced men from the postal service and equipped with every device in use in the post offices of our country, fulfilled the double purpose of affording a spectacle of a model post office in operation and of distributing and delivering mail directed to persons connected with the Exposition or visitors who had their letters addressed to the grounds. In addition, lay figures and models illustrated former methods of transporting the mails, as well as the methods now in use on the frontier. These were brought into comparison with the latest developments in the line of transportation. A notable feature of this display was the collection of articles loaned or contributed by foreign governments. The exhibits of the Post-Office Department occupied a floor space of fifteen thousand square feet, and the expenditures from the appropriations to the Board on account of this department aggregated \$17,812.14.

The contributing bureaus of the Department of the Interior were the Patent Office, the Geological Survey, the Bureau of Education, the Census Office, and the Bureau of Indian Affairs.

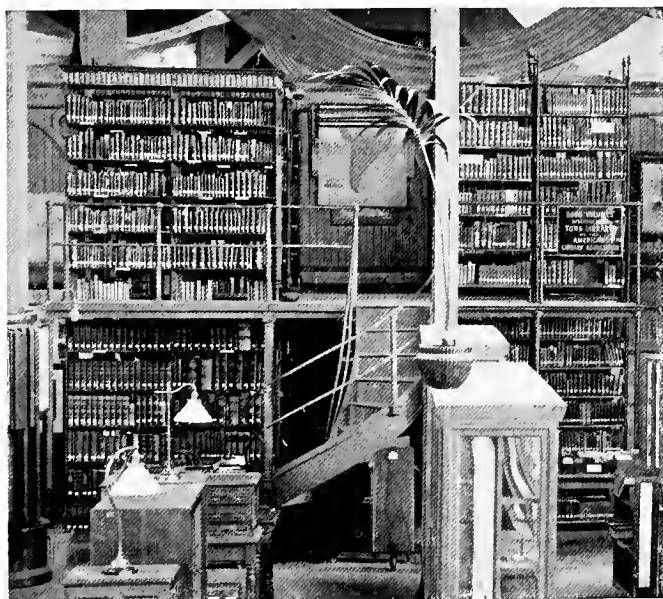
The Patent Office displayed a large number of models, classified so as to show the process of development in many of the more remarkable paths of modern progress, from the germ, the first crude model in any line, to the perfected device. Probably no better display for educational purposes was ever brought together than that assembled in the Patent-Office area at Chicago. It was prepared under the immediate direction of a board of the most experienced examiners in patents, and, by means of a systematic chronological arrangement of the models in each branch, from the earliest idea to the latest perfected device, it effectively served its purpose of illustrating to the public the part played by the American patent system in the progress and prosperity of the country and the enlightenment of the world. The development of firearms, from the earliest shoulder piece known to the perfected breech-loading magazine rifle adopted by the Government, was illustrated by 120 models, with complete sets of models showing the devel-



opment of the latest perfected revolver, the modern breech-loading gun, improvements in mounting ordnance, and the development of the machine gun. Marine propulsion was represented by a group of models including all the devices used, from the earliest to the modern steam-steering apparatus. Improvements in anchors were shown in a set of 27 models, and 8 models represented improvements in logs and sounding apparatus. A model of the earliest locomotive used was exhibited, and its development to the latest improved engines was traced in a group of 37 models. Steam pumps, steam engines, engine governors, and steam hammers, and their growth from the earliest forms, were represented, and 79 models illustrated the development of the perfected dynamo and electric motor of the present from the first attempt at a motor. The exhibit of models of telegraphy included the modern duplex and multiplex, as well as the printing and autographic telegraphs, and the development of the telephone was represented by 40 models. The wonderful improvements in the printing press were shown in a group of 106 models, including the first printing press used by the discoverer of the art and the latest perfected newspaper press. Models of the prehistoric distaff and spindle, and of the modern perfected spinning machines and looms, were exhibited, with straight and circular knitting machines, and cloth finishing, measuring, and cutting machines. The earliest sewing device, as well as the modern improved sewing machine, was shown. The development of boot- and shoe-making machines was illustrated by a group of 111 models; 18 models illustrated the development of the art of splitting and cutting leather, and models of the apparatus used in tanning and dressing hides were exhibited. Improvements in agricultural implements were shown in the models representing the development from the first rude forms of plows and cultivators, harrows and harvesters, seeders and planters, and apparatus for thrashing and cleaning grain, while 15 models illustrated improvements in farm gates, and 9 models showed those in means for stretching wire fences. Models of all kinds of metal-working machines were exhibited, including nail-making machines, screw-making machines, and wire-working machines, with sheet metal and soldering apparatus. Wood-turning and wood-working machines found place in the exhibit, as well as sawing and planing machines, cordage machines, excavating apparatus, including earth augurs, road scrapers and apparatus for ditching and dredging, stone crushers, and models illustrating brick and tile making to the number of 13 were exhibited. The publications of the office were represented by 109 volumes, including sets of the Official Gazette and the Decisions of the Commissioners.

The Geological Survey is one of the most prolific bureaus in material for exhibit, and the character and number of the contributions were beyond all precedent. The geological history of the country was illustrated by models, fossils, and charts, while its kindred resources were represented by complete collections of specimens. Geological and topographical maps of

various sections of the country included the Arkansas drainage basin, the grand cañon of the Colorado, and the Yellowstone Park, which was represented also by a collection of rocks and minerals; a curved model of the United States was shown, together with geological and topographical maps of Mount Shasta, and maps of the high plateaus of Utah, irrigated fields, Washington and vicinity, the Yosemite Valley, the Twin Lakes, Crater Lake, Cinder Cone, the Uintah and Wasatch Mountains, and the Elk Mountains. An interesting exhibit of the publications of the bureau was made, with proofs of illustrations, a photographic exhibit of the survey, and transparencies showing geological scenery. A collection of rocks and fossils illustrated



MODEL LIBRARY OF FIVE THOUSAND VOLUMES.

the geological column of the United States, and other rocks contained large slabs of fossil leaves, ripple marks, etc.

The Bureau of Education was greatly circumscribed compared with its field of operations at previous expositions. Education was included in the great Department of Liberal Arts of the Exposition, and all the educational institutions of the country were invited to make their displays in their own name therein. Moreover, the law relating to

the Government exhibit, which had been loosely interpreted in respect to all the earlier expositions, was now made to limit the work literally to the illustration of the scientific functions of the Government, which, as applied to education, comprise in substance the collection and diffusion of information respecting the organization and management of schools; but, notwithstanding the limitations, the zeal of the gentlemen in charge of this branch of the work found means to include several features of great popular interest. A model circulating library of five thousand volumes, brought together under the volunteer supervision of members of the American Library Association in co-operation with the experts of the Bureau, formed the central feature of the exhibit, combining the results of the widest experience in the selection, classification, and cataloguing of books, as well as in methods of library administration.

The Census Office displayed several of its computing and tabulating

machines, which were kept in operation by experts detailed from the office in Washington.

The Indian Office made its exhibit in a building specially constructed, at a distance from the area allotted to the Government. The exhibit consisted of an Indian school with forty Indian boys and girls reciting, studying, working at trades, and going through the daily round of life in a reservation school, while furniture and implements represented trained Indian handiwork. Pupils and teachers came in relays from the various Indian schools of the country. A novel feature of the exhibit of this department was a section of one of the big trees from Sequoia Park, California. This was twenty-six feet in diameter at the base and forty feet in height. It was cut into sections lengthwise, for convenience of transportation, but the parts were reunited so as to leave no doubt in the mind of the most incredulous that they had formed parts of one monster growth. The place of honor, the center of the rotunda of the Government main building, was accorded to this unique exhibit. The cost of its preparation and transportation was more than \$11,000.

The exhibit of the Interior Department filled twenty-six thousand square feet of floor space, and the aggregate of expenditure in connection therewith was \$102,739.54. Prof. Frank W. Clarke, of the Geological Survey, succeeded Mr. Taylor on the retirement of the latter from public service.

The Department of Justice affords but a meager supply of material from which to make an exhibit. The law publications of the Government, certain autographic relics from the Supreme Court and other courts of the United States, and portraits of the most distinguished of American jurists, formed the bulk of the exhibit, which filled two thousand square feet of floor space, at an aggregate cost of \$7,392.47.

The exhibit of the Department of Agriculture proved more difficult of preparation, and more costly, than that of any other. The department does not farm an acre of ground, and has no function, therefore, which would warrant the display of agricultural products such as make the great mass of exhibits of agricultural fairs. It has a field of enterprise, nevertheless, touching directly or indirectly all the more important of human interests, and a proper and adequate exploitation thereof would have an educational value second to nothing that the Exposition could afford. Its exhibit was designed to illustrate what the Government does to improve the quality and increase the quantity of American food and other farm products. From collections containing many thousands of samples of cereals, agriculturists could learn the effects on grain of planting in different soils, climates, and altitudes; how, for instance, the planting of Northern-raised corn in the South causes indentations to appear in the kernel and produces the varieties known as Dent corn. A collection of grasses and others of economical and medicinal plants were arranged in *herbaria*, and demonstrations were made of the best methods of forest culture, of the methods of protection and remedy against diseases of

fruit trees, of methods of cultivating small fruits, etc. The Bureau of Animal Industry illustrated the processes of meat inspection that have been developed largely since the introduction of American meat products in European markets; also the proper methods of transporting live stock, the correct



SECTION OF BIG TREE, IN ROTUNDA.

process of shoeing horses, and the defects and diseases that ensue from faulty horseshoeing, and the work of the Bureau in investigating and preventing the spread of germ diseases at its quarantine stations.

Experts from the principal divisions of the department were detailed for service at the Exposition; and, aided by models, apparatus, and selected material, they illustrated the process of study, experiment, and investigation carried on in the department. Thus the operations of the Weather Bureau, showing the methods of receiving reports, of making forecasts, and of publishing results; the methods of the Bureau of Animal Industry in the detection and stamping out of infectious diseases; the theories of the entomological division in respect to the encouragement of useful insects and the destruction of harmful ones; the distribution of wild animals and the means of protection from predatory birds; the variety, extent, methods of culture, and causes of destruction of forests; and the modification of crops by change of soil and climate, were among the features of the exhibit.

The Weather Bureau occupied a special structure, and the display of the experiment stations and agricultural colleges was accorded space in the Agricultural Building of the Exposition. The space accorded to the department in the Government Building was twenty-six thousand square feet, and the expenditures in connection with the exhibit amounted to \$142,613.75. The Secretary of the Board succeeded Mr. Willits as representative of this department on the retirement of the latter from public life.

The Smithsonian Institution and the National Museum are two organizations under one head, and together form the greatest scientific institution of the continent. Their joint field of operations is without limit, and they may properly claim, as within their functions, the investigation of anything in art or nature, in commerce or industry. Whatever does not more specially appertain to some other jurisdiction falls here. Estimates were submitted to Congress for \$585,000 for the display to be made by this branch alone—more than the amount appropriated for the entire Government exhibit at the Centennial; while ninety-five thousand square feet of floor space, more than the entire National Museum in Washington affords, was thought to be necessary for the display to be made in Chicago. But only a fraction of these demands was accorded by Congress and the Board. A large force of specialists, taxidermists, and mechanics was employed, and a wealth of rare material was gathered and prepared in the highest style of art known to modern museum management for the exhibit. The lifelike groups of aboriginal Americans, and of birds, animals, and fishes, the rare collection of minerals, bric-a-brac, and archæological specimens, partly drawn from the stores of the Museum itself, served to crowd constantly the area devoted to this branch of the work. The most interesting feature of the exhibits was the ethnological part, illustrating the racial characters, life, customs, and languages of the tribes of North American Indians, classified according to their languages. Figures of Indians of the different tribes as they were at the time of the taking of the continent by the whites, and busts of celebrated chiefs, formed part of the exhibit. The Smithsonian exhibit of ethnology gave an excellent comparative view of the native races of the United States and Alaska.

their physical characteristics and modes of dress. In glass cases were life-size figures of Indians of the various tribes, each in the peculiar costume of his nation, of Indian squaws, for instance, with papooses strapped to their backs, with their faces looking to the rear, and Eskimo women carrying their children so that they can look forward over the mothers' shoulders. Other rows of cases contained displays of the handiwork of these natives. In the Alaskan exhibit were collected samples of minerals, wares, and household utensils made by the natives, and of grain raised by them, revealing unsuspected richness of soil in the detached northern Territory. The handiwork of the Alaskan natives showed a degree of skill with which they were not generally credited, especially the carvings on ivory, horn, and wood, and the samples of ingenious metal work. The expenditures in connection with this exhibit aggregated \$134,640.93, and the allotment of floor space was twenty-six thousand square feet.

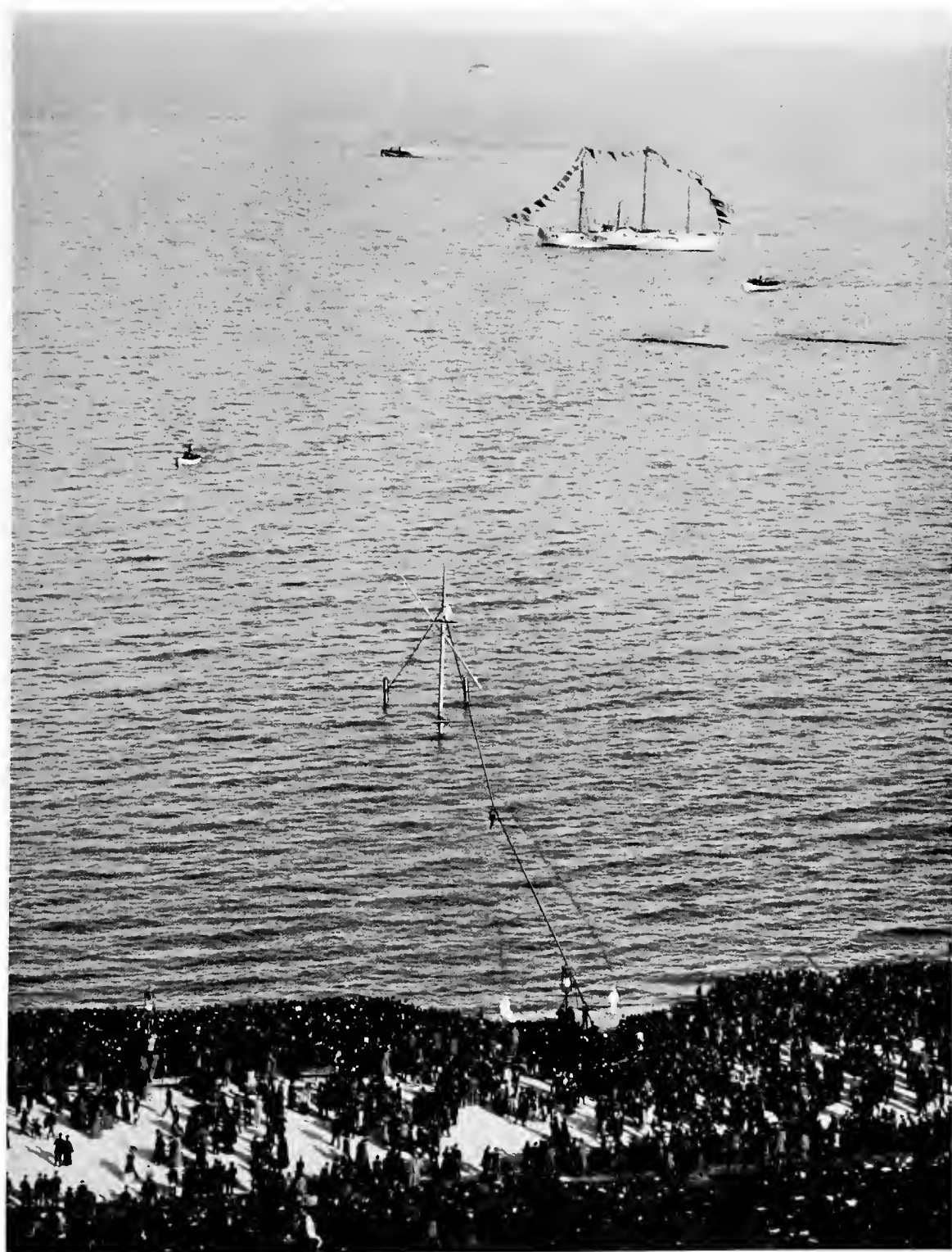
Although the United States Fish Commission is only an unattached bureau of the Government, it is recognized as one among the most prolific contributors of exposition material. Its aquarium was one of the most attractive spots in all the Exposition during the hours when the gates were open to the public. This was in the annex to the Fisheries Building of the general Exposition, and was fitted up by the Exposition authorities in accordance with plans prepared by experts of the Fish Commission.

On April 17, 1891, William P. Seal was appointed "in charge of construction of Exposition Fisheries Building," and this appointment was promptly confirmed. His appointment as "Special Agent United States Fish Commission in charge of Aquarial Exhibit, World's Columbian Exposition," was made July 1, 1891, by the Hon. Edwin Willits, Chairman of the Government Board of Control.

The original conceptions concerning the aquarium contemplated grand spectacular effects, which unfortunately never were realized. The aquarium was of necessity adapted to the architectural exigencies of a building already designed, and not, as should have been the case, provided with a structure adapted to the requirements of the work. It is unfortunate that an aquarium of such magnitude should have been built without an idea of permanence, as it should have cost no more to build it on a stable basis.

The ideas of the engineers were, that an economical construction for tanks could be devised of structural forms of iron and steel combined with concrete, and that the salvage therefrom at the close of the Fair would be considerable. The tank frames consequently were designed to be constructed of I-beams, T-rails, and concrete filling. There were some doubts concerning the stability of the ground on which the aquarium was built, and fears that there might be settling. It was first thoroughly flooded by means of one of the World's Fair fire engines, pumping from the Lagoon. The results were most satisfactory, but two lights of glass having cracked, an unprecedentedly low rate of breakage. In making the foundation for the larger series of





PRACTICE EXHIBIT OF THE UNITED STATES LIFE-SAVING SERVICE.





aquaria, heavy planks were laid on the ground, and on these was built the superstructure, composed of ten-inch-square timbers. On these came two lines of twelve-inch I-beams, held together by iron bolts and supporting a substantial brick arch, and on this arch was laid the heavy concrete base of the tanks. This was concave, one foot thick in the center and about three feet at the outsides. For the outside series of tanks it was intended to make a concrete foundation from the floor line up, but as winter had set in before this part of the work was reached, and there was fear that the effect of frost would militate against making a good job, a strong timber foundation was substituted. It was the original intention to use slate for the divisions of the inner line of tanks and for divisions, bottoms, and backs for the outer series; but it was finally estimated that it could be constructed more cheaply and quite as satisfactorily by the use of concrete and T-rails, and with considerable advantage in the saving of time.

As concrete is not impervious to water, it was necessary to cover all the interior construction of the tanks with some absolutely waterproof material, and it was also necessary that this material should be proof against the corrosive action of sea water, and that it should in no way affect it chemically. Such a material was found in the patent metallic lava asphalt of R. Stoddard & Co., London, England, which had the strongest testimonials from the officials of the great aquaria of England. This work was included in the concreting contract, and the contractors—the Probst Construction Company, of Chicago—imported sufficient of the material for lining all the tanks and reservoirs, and brought over a man skilled in applying it. But for this material, it is a question whether the salt-water reservoir could have been made sufficiently water-tight, as the bottom was considerably below datum and the upward pressure of the water was very great. Another advantage of the use of asphalt is to prevent the giving off of lime to the water from the concrete, and this is an absolute necessity in the case of salt-water tanks.

It was found impossible to procure glass of the sizes at first contemplated. Efforts were made to have it made in this country, and the Diamond Plate Glass Company, of Kokomo, Ind., becoming interested, endeavored to produce it, but did not succeed in making it thicker than one inch. As there was a question whether one-inch glass would stand the pressure of five feet of water, one-and-a-half-inch glass was insisted upon. The contract for the glass was given to the James H. Rice Glass Company, of Chicago, on a bid of a little more than \$11,200, to include the setting. This contract included 42 plates of glass,  $46\frac{5}{8}$  inches by 59 inches by  $1\frac{1}{2}$  inch thick; 42 plates,  $47\frac{5}{8}$  inches by 59 inches by  $1\frac{1}{2}$  inch thick; and 112 plates,  $32\frac{5}{8}$  inches by 59 inches by  $1\frac{1}{2}$  inch thick. The work of setting the glass was done expeditiously and satisfactorily.

The hard-rubber pumping plant was furnished by the Hard Rubber Company, of New York. It consisted of two double-acting pumps—size of cylinders, 5 by 10 inches—each having separate suction and discharge pipes;

and each was capable of delivering into the elevated tank 4,000 gallons an hour, the estimated requirement being 3,000 gallons. These pumps were operated by electric motors. The pump-and-motor room was under the main



WEATHER BUREAU BUILDING.

building, at the entrance of the East Arcade basement, through which ran the pipe lines, and in which were the filters and heating plant. This arcade

basement was planked on the sides and had a concrete floor. The floor of the pump-and-motor room was composed of two feet of concrete with a hard-finished cement surface. From the floor brick walls ran up to a height of two feet, and from this to the joists the room was inclosed with wood. As a foundation for the pumps, two ten-inch-square timbers were crossed at right angles with two smaller ones and bolted together with strong bolts passing through them. These were then imbedded in the two feet of concrete so that they were even with the surface of the floor when finished. This afforded a massive and substantial foundation. The salt-water reservoir was originally intended to be in size 20 by 40 feet by 15 feet deep, with a well at the bottom to pump from, so that it might be emptied. Changes in the depth were made necessary by the difficulties from inflow of water, and the well was abandoned. The depth finally found possible was nine feet. The walls were of rubble masonry three feet thick at the base and eighteen inches at the top. Inside of this, one layer of brick was laid in cement. It was lined throughout with Stoddard's lava asphalt. The return waste pipe entered the reservoir at a distance of four feet from the joists, and the depth below this was five feet. This gave the holding capacity of the reservoir as 20 by 40 by 5 feet, or 4,000 cubic feet—30,000 gallons.

For the control of temperature of salt water, the piping running from the pump room to the elevated tank was wrapped with heavy boiler felt, and for a greater portion of the distance boxed in. A steam pipe ran alongside in this boxing, and fed a radiator in the room inclosing the elevated tank. The piping under the arcade was also covered with felt. It was thought that, by heating the aquarium building by means of radiators distributed through it and fed by two boilers under the arcade (and if found necessary a lot of salamanders), and with the piping so covered and having the additional warmth of the steam pipes and the heat of the elevated tank room, there would be no difficulty in maintaining a favorable temperature.

Owing to the circular shape of the building and the curved arcade, there was more than usual difficulty in running the piping for supply of water and drainage. It was necessary to bend all the iron pipe, and special couplings of different angles were required for the hard-rubber portion. Because of the interference of the bracing of the foundation, running in a circle, the number of drainage pipes of the larger tanks was reduced to what was absolutely necessary, ignoring the question of convenience. A special twelve-inch pipe was laid to empty into the Lagoon, to carry off the overflow water from the aquaria and the discharge from the filters in cleansing.

The necessary plant for the filtration of the fresh water was furnished by the O. H. Jewell Filter Company, of Chicago. It consisted of two pressure filters, each six feet in diameter and having a capacity of about 12,000 gallons an hour. Such a plant would have cost at least \$2,500, and this was supplied in consideration of permission to place a sign on each side of the two entrances to the aquarium, and one over the entrance to the pump-and-motor room.

An additional consideration was that, in connection with the filter supplied by this company for the use of the live-fish exhibits of the Pennsylvania and Wisconsin Fish Commissions, they would be considered as exhibits and entered for competition. These filters proved thoroughly efficient, and provided an abundant supply of pure, clear water.

The desirability of high pressure or head of water in the keeping of live fish exists in the necessity for effecting a thorough aëration of the water by injecting into it fine streams having great force and carrying with them a large amount of air, which becomes thereby very finely comminuted and is



FISH HATCHERIES.

rapidly absorbed by the water. This method of water supply and aëration, introduced by Mr. Seal several years ago, has brought about a radical change in the methods of keeping live fish, and it is possible now to keep trout comfortably at a temperature of seventy degrees, or even higher, whereas previously it was deemed necessary to keep a very low temperature by the use of ice, at great expense and involving much labor. The salt-water filter was simply a box 4 feet by 12 by 2 feet deep, to be filled with sand, gravel, and

broken stone, after the usual manner of making such filters, running in layers from very fine to very coarse material.

The matter of securing the necessary supply of sea water for the aquarium was considered in the beginning a somewhat serious problem, as the transportation of 75,000 gallons of water a thousand miles from the sea would have involved a very great expense. It was finally decided by the United States Commissioner of Fisheries to undertake at the Station of the Commission at Wood's Holl, Mass., the reduction of the necessary amount of water to a strong concentrated solution of about twenty per cent of the bulk, thus reducing the cost of transportation to a minimum. In August, 1892, Mr. Seal was dispatched to Massachusetts to visit certain salt works and investigate as to the best and most economical method of conveying salt water to Chicago. It was found, first, that with a salt-making plant covering several acres it would take three months to supply the constituents of the required sea water. Before the order was given finally for this material the last drawing of the season had taken place and a portion of the constituents for which there is no commercial use had been thrown away, but, fortunately, enough of it was secured just in time from another and smaller salt works. This material was safely delivered at Chicago, the salt in bags and the bitter residue in carboys, which latter was stored in the aquarium building to prevent freezing.

One of the features proposed as a characteristic and attractive addition to the Fisheries exhibit was a series of outside ornamental ponds, in which would be shown seals, sea lions, sea otters, manatees, alligators, and other amphibian species, as well as ornamental pond fishes and aquatic plants. An elaborate plan was developed in this direction; but because of the fact that much of the space around the Fisheries Building was secured for restaurants, it was abandoned. In addition to these ponds was planned a series of cemented tanks for holding reserve stock of fish for the aquaria and for the State live-fish exhibits, to be built just outside of the Aquarium Building. But freezing weather arrived before the project could be carried out, rendering it necessary to postpone it until spring, and there were substituted for them six wooden tanks four feet wide by twelve feet long and three feet deep, to be placed under the East Arcade and connected with the waste pipe leading to the Lagoon. The construction of these tanks was allowed by the Council of Administration, but, owing to the resignation of Mr. Seal, the plan was not carried out.

In the main Government Building the Fish Commission occupied twenty thousand square feet, in which were displayed models of marine architecture, all approved varieties of fishing appliances, and the apparatus in operation for the hatching and distribution of fish. Its aquarium afforded eight thousand square feet of floor space, making a total for the Fish Commission of thirty-three thousand square feet. Its total expenditures were \$89,789.60.



Camp Herbert—United States Troops.

## CHAPTER XVIII.

### SCIENCE AND THE FAIR.

The modernity of scientific progress—Copernicus—Gilbert—Kepler—Galileo—Newton—Watt—The electricians—Science of the Fair, and science at the Fair.

BY THOMAS CORWIN MENDENHALL.



THOMAS CORWIN MENDENHALL.

THAT the best achievements of the human race during the four centuries that followed the discovery of America were illustrated in the great Exposition was evident to the most careless observer. With equal fidelity it reflected the advance of science during that period, and to the more thoughtful made good the claim that the best achievements of man are and must continue to be the results of scientific discovery in their application to the amelioration of the condition of his fellows.

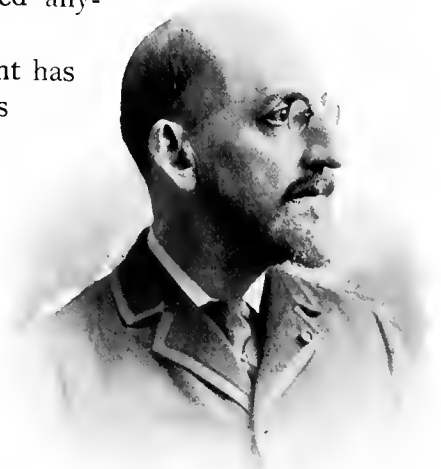
The official catalogue, with its two thousand closely printed pages, gave very little idea of the real extent of the display and of the vast number, counted by millions, of the separate articles placed on exhibition ; but if this enormous collection had been robbed of all in the production of which science had had the major part, but little would have remained. Of the fifteen great departments in which the collection was arranged, not more than two would



have survived, and even these would have lost much of their most interesting and valuable material.

Essentially the whole magnificent collection might be treated, therefore, as an assemblage of the spoils of the victories of science over the enemies of human progress; and these are to be looked for not only in the material environment of man, but as well in the superstition and ignorance by which he is beset. The magnitude of such a treatment, however, is prohibitory, and it will be attempted only to show in a general way the greater relations between the development of pure and applied science and the splendid exposition of human industry, skill, and accomplishment which in the Columbian Exposition of 1893 far excelled anything of the kind hitherto undertaken.

It is interesting to reflect that this development has mostly taken place during the four hundred years since the bold admiral made his first voyage, for in 1492 the world's knowledge of what is now called "science" was even more limited than its acquaintance with geography. Contemporaneous with the succession of courageous explorers, of whom Columbus was the leader, will be found an equally bold and courageous succession of men of intellect, the influence of whose performances has been much more potent in the development of modern civilization. To this development the discovery of another continent was not a necessity, although it was doubtless greatly hastened by it, and many foreigners who visited the Columbian Exposition carried away with them the conviction that on the new continent was to be found the highest exemplification of the world's progress.



GEORGE W. MAYNARD,  
Painter.

For nearly two thousand years before the time of Columbus there had been no memorable discovery relating either to man or to his surroundings. As far as relates to physical science, the work of Aristotle was a monstrous failure—monstrous because of the great influence attached to his name, so great that his erroneous philosophy blocked the way of progress for many centuries. Even the beautiful generalizations of Archimedes, whose pure and profound scholarship was all but successful in setting in operation the forces that have given us modern life a thousand years ahead of time—even these fine examples of sound logic applied to material things were lost sight of, and came to us only by almost accidental preservation. These years constituted what Whewell has called the "stationary period," and while not without an occasional genius or group of men of intellectual superiority, it was, on the whole, a period remarkable for unfruitfulness.

But with Columbus came a different order of things. Contemporaneous with the intrepid navigator was a Prussian named Kopernik, better known under the Latinized form of his name, Copernicus. Born in 1473, he was less than twenty years of age when the hitherto unknown hemisphere was made known to Europe. In his elaboration of what has since been known as the Copernician System of the Universe, he successfully wrought out the solution of a problem of vastly greater difficulty than that by which Columbus was confronted, and pregnant with more important consequences to mankind. He swept away the complicated system of eccentrics and epicycles by which man's conception of his place in Nature had for centuries been fatally befogged. Like that of Columbus, the hypothesis on which Copernicus worked was not absolutely new in his day ; but, also like Columbus, he was the first to give it definiteness of form and to make of it an undeniable explanation of the common phenomena of the heavens. To do this required not only high attainments as a philosopher, but the possession of moral courage of the first order ; for he was opposed by tradition that was regarded by many as sacred, and his theory was counter to that of Aristotle and all his followers. Too much praise can not be given to the work of this brave philosopher, who for the first time set the earth, the sun, the moon, planets, and stars in their proper relation to one another, who re-revealed to man the comparative insignificance of his own part in the universe, and who did much to free him from the intellectual slavery in which he had apparently been so long content to rest. It was the beginning of the present time, and the fact that it was coincident with the enlargement of the boundaries of material opportunity for which the world was indebted to Columbus was not fortuitous, but was really a matter of highest moment.

The great explorer of the system of the universe was more fortunate than the discoverer of the new continent, in that his name is inseparably joined with the results of his work ; but, like Columbus, he did not enjoy in large measure during his life that renown which was his due and which has since been generously awarded to him.

He was finally induced by his friends to publish his great work, and he died in 1543, just as the first copy came from the press, having only strength enough left to touch it with his hand. He was first in the line of distinguished men—not numerous, but unrivaled in their day—who, more than all others, made the Columbian Exposition possible ; and a brief account of their contributions to human knowledge will constitute the best introduction to a consideration of the share of science in its creation.

Fortunately, Copernicus was immediately followed by three eminent natural philosophers, who not only kept alive the flame that he had kindled, but blew it into a great, unquenchable fire, in consequence of which the pursuit of learning and a fondness for science are fostered to-day among all civilized peoples. Two of these made great discoveries along lines pointed out by Copernicus, for which he had cleared the way. The third entered a

field that had not been cultivated, and thus became the founder of a science that has influenced the recent advances of civilized man more than anything else. All these agreed as to the method of questioning Nature, rejecting that of the ancients, the use of which had been so unfortunate because so fruitless, and giving themselves to observation, experiment, and induction. William Gilbert, an Englishman, who was born three years before Copernicus died, was doubtless the first to use systematically the experimental method of investigation. He was the father of the science of magnetism and electricity, and he gave to the latter its name. To him, rather than to Bacon, should be given the credit for establishing inductive methods, and his carefully executed researches on magnetism and electricity are, both in matter and method, worthy of the closest study by modern philosophers. Although Aristotle and those who followed him knew as much as did Gilbert in the beginning of his researches on electricity, no sensible advance had been made, and had not this trio of experimental philosophers set out for themselves we might still be in the Elizabethan age, as far as our knowledge of pure and applied science is concerned. To Gilbert the world is especially indebted for the solid foundation on which he placed the previously scattered facts relating to the magnet, the skill with which he developed the few traces of knowledge concerning electricity, and the great impetus he gave to this then most curious study, now become second to none in scientific and practical importance.



RICHARD W. BOCK,  
Painter.

The contemporaries of Gilbert—Kepler and Galileo—contributed all that was lacking to the final acceptance and verification of the Copernican theory. Kepler was a German, born in Würtemberg in 1571. Possessing many of the characteristics by which his race is distinguished, he brought to the solution of the great problem that he attacked the qualities of patience, industry, and perseverance, which were essential to his final success. Adopting the system of the universe that Copernicus had advocated, he checked and corrected it by applying the test of observed astronomical magnitudes, with the result that he became convinced that the circle, which for centuries had ruled supreme in all celestial hypotheses, was not the real curve of planetary motion, and the so-called "perfect figure" was made to yield to the more general form—the ellipse—of which the circle is only a particular species. With infinite labor, Kepler made and tried his various hypotheses concerning the relation of distance, periodic time, and orbital velocity of the members of the planetary system, led by no general law or scientific principle, except the doubtful belief that some simple relation must exist. The

discovery of the three simple laws that bear his name, which was his final success, is thus characterized by Sir John Herschel : " These laws constitute undoubtedly the most important and beautiful system of geometrical relations which has ever been discovered by a mere inductive process, independent of any consideration of a theoretical kind. They comprise within them a compendium of the motions of all the planets, and enable us to assign their places in their orbits at any instant of time, past or to come." Indeed, as Prof. Playfair has said, his discoveries had a value far beyond what Kepler could have conceived, and it is difficult to overestimate their importance. They strengthened the foundations of the Copernican system, and at the same time paved the way for Newton and the law of gravitation.

But to the third member of this great trio must be given a rank far above that of his companions. Springing from the race that gave birth to the great explorer, and possessing not a few of his personal qualities, Galileo might not unreasonably be called the Columbus of exact science, and particularly of the philosophy of mechanics. A larger share of the material progress of the present century can be traced ultimately to his work than to that of any who preceded or followed him. He was born of a noble family in Pisa in 1564, and showed at an early age a great fondness for mechanical invention, a love for music, painting, and classical learning, together with a special talent for mathematics. Although destined to be a physician, he wisely determined to devote himself to the pursuit of natural philosophy, in which his career was one of unparalleled brilliance. When only nineteen years old he made the capital discovery of the isochronism of the pendulum, which was not only of prime importance in itself, but was unquestionably the door through which he easily passed to the consideration of the more general problems of dynamics. Archimides, nearly two thousand years earlier, had discovered the fundamental principles of statics, and had correctly solved the problem of the lever ; but he had not succeeded in general problems involving the motion of masses. Up to the time of Galileo, the philosophy of Aristotle still prevailed, notwithstanding it was little more than a tissue of absurdities, which the first trial by reason and experiment was sure to destroy. To this test it was subjected when, at the age of twenty-five years, Galileo denied the authority of the followers of Aristotle at the University of Pisa, where he had recently been made a professor. Quite alone, he appealed to fact as established by experiment, and succeeded in substituting a correct theory of force and acceleration for the traditional absurdities of the philosophy of the Greeks. Turning to astronomy, his courage was again put to the test when he accepted the Copernican system, which the Church then regarded as heretical. His most brilliant discoveries grew out of his invention of the telescope, by the use of which he revealed many hitherto unsuspected wonders in the heavens and demonstrated to the satisfaction of all thoughtful and unprejudiced people the truth of the hypothesis of Copernicus. He saw for the first time the satellites of Jupiter, the phases of Venus, the mountains

and valleys of the moon, and in an incredibly short time he revolutionized man's conception of his own environment. At no other time in the history of the world did human knowledge advance with such gigantic strides as during the days and nights that immediately followed the completion of that slender tube which is still to be seen in the Tribune of Galileo in Florence. The work of Galileo has been of the utmost importance in the evolution of the nineteenth century, and some of the more important relations of his discoveries to modern accomplishments will be pointed out presently. The lapse of time tends only to increase the esteem in which he is held by philosophers and historians, and there is little doubt that a consensus of opinion of those most competent to judge would declare him to be, on the whole, the most brilliant genius the world has yet produced.

He died in 1642, and in the same year was born one who, perhaps more than any other, would compete with him for this distinction. If Newton never had made any other discovery than that of the law of gravitation, he would have been entitled to lasting fame. The statement that any mass of matter, however large or small, attracted and was attracted by any other mass of matter, of whatever dimensions and however distant, was of itself a generalization of prime importance ; but the beautiful demonstration of the law of this attraction, by means of which it is always capable of quantitative expression, was an accomplishment that has rarely been equaled in human history. Aside from the astronomical aspects of this discovery, by means of which astronomy at once became the most exact of all sciences, it was of enormous value to applied mechanics, as it furnished a sure foundation for quantitative measurements on the exactness of which all real advance depends.

The discovery of the law of gravitation is justly regarded as the most notable single discovery ever made. Evidently it was clearly outlined in the mind of Newton when he was barely twenty-three years of age ; but his hypothesis of inverse squares was not verified at that time, owing to incorrect data relating to the dimensions of the earth. He abandoned the subject for a time, but about twenty years later, learning of the measurement of a new arc in France by Picard, he at once resumed his calculations, which now indisputably proved the correctness of his theory. Of his contributions to human knowledge in other lines of research it is unnecessary to speak, for many of them are well known and popularly attributed to him. Of him Macaulay said : " In no other mind have the demonstrative faculty and the



A. PHIMISTER PROCTOR,  
Sculptor.

inductive faculty co-existed in such supreme excellence and perfect harmony." Laplace declared his greatest work, the *Principia*, in which the law of gravitation was formally announced and demonstrated, to be "pre-eminent above all other productions of the human intellect." He died in 1727, at the age of eighty-five years. The Newtonian period was characterized by advances in all departments of physical science. Newton himself greatly enlarged our knowledge of optics, and important investigations relating to heat, its nature and influence upon the properties of matter, were made by his contemporaries and immediate successors. The results of these researches, together with the perfected mechanical philosophy of Galileo and Newton, prepared the way for the most memorable application of science to the amelioration of the condition of man that the world has yet known. James Watt, the Scottish engineer, philosopher, and inventor, who was born almost early enough to have touched hands with Newton, forms the last link in the chain of genius that joins Columbus and Copernicus with the nineteenth century, and to him must be accorded the honor of creating, by applications of the principles of physics, a new source of power that was destined to revolutionize social and political conditions. His fondness for experimental science and mechanical pursuits led him at an early age to adopt the trade of instrument maker, to perfect himself in which he spent one year in London. On returning to Scotland, he planned to settle in Glasgow; but, perhaps fortunately, the particular kind of trades union then existing, known as the Corporation of Arts and Trades, refused to allow him to open a workshop in that city. The professors in the University of Glasgow, however, were more liberal in their treatment of the young mechanic, and gave him a place of business within their own limits and also the title of Instrument Maker to the University. He shortly became the intimate friend of some of the learned professors for whom the university was then, as now, distinguished, notably of Black, the discoverer of latent heat, and from them he learned rapidly and well the principles of physics on which his inventions were to rest. The possibility of improving the steam engine, then hardly worthy the name of a prime motor, was the subject of frequent discussion with these friends, and in 1761 and 1762 Watt made some experiments looking in that direction without accomplishing anything of value. The real invention of the steam engine came three or four years later, and in order fully to appreciate its importance it is necessary to reflect that, up to that time, except where water power was available, the energy of men and animals, supplemented in some degree by that of air in motion, was the source of supply for the world's work. It is true that, more than a hundred years before the time of Watt, various forms of "steam" engines had been suggested, some of which had been constructed and a few actually used. They were of the crudest sort, however, requiring an enormous combustion of fuel, and their use was practically restricted to pumping water from coal mines, where fuel was cheap and the necessary machinery simple. It was, in fact, thought of as a pump, and

not at all as a machine, as is shown by the fact that in some instances it was actually employed to pump a stream of water, which fell on a water wheel, from which the power was drawn. The most perfect form of steam engine at the time Watt began to study it was that of Newcomen; and even this was hardly worthy of the name, being rather an atmospheric engine than a steam engine. The cylinder was vertical, and the piston was raised by a steam pressure slightly greater than that of the atmosphere, a heavy counterpoise at the other end of the horizontal lever or beam assisting in the operation. When the lower part of the cylinder was thus filled with steam, and the piston at its highest point, cold water was introduced, the steam being thus condensed and a vacuum produced. The atmospheric pressure on the upper face of the piston, which was open to the air, then drove it down, and lifted the pump rod at the other end of the beam. A model of the engine belonging to the University of Glasgow was put in the hands of Watt for repair about 1764. In the operation of putting it in order he discovered the serious imperfections of the machine, and set about trying to remove them. That which struck him most was the excessive amount of fuel required for the performance of a small amount of work, and he was at once convinced that a large share of the heat must be wasted in the working of the engine. In reaching this conclusion, he must have been guided by an almost unaccountable knowledge of the relations of heat and mechanical energy, for it must be remembered that practically nothing was known at that time of what a heat engine ought to do, and that the model on which he worked represented the most perfect development of the engine up to that hour. Watt made excellent use of the knowledge he had acquired at the university, and began a series of experiments, planned and executed in the most scientific manner, for the purpose of developing the laws and constants with which he had to deal in the improvement of the engine. In a comparatively short time he had discovered the vital principles of its construction, and its reconstruction immediately followed. He seems to have been unconsciously led by the principle of the conservation of energy, the establishment of which is one of the chief glories of the nineteenth century. Few people are aware how perfect the steam engine was when it came from the hands of Watt, and how few really important improvements have since been engrafted upon it. Indeed, most of these are due to superior workmanship, especially in the use of machine tools which the engine itself made possible. The importance of this remark will be made clear by examining the accuracy and perfection of finish



BELA L. PRATT,  
Artist.

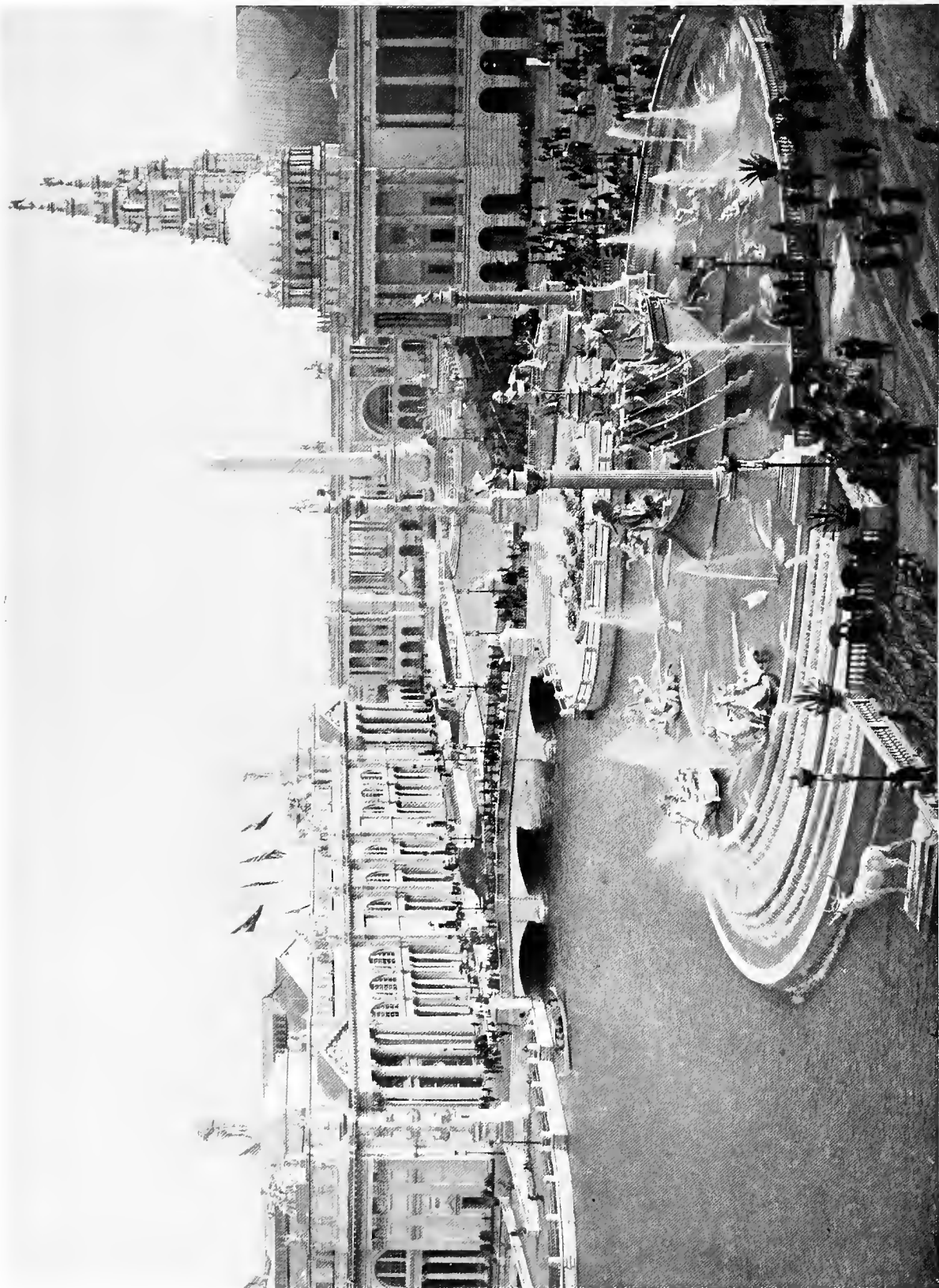


of a modern engine of high class, rivaling a fine watch in its performance, and remembering that Watt congratulated himself that one of his cylinders lacked but three eighths of an inch of being round. Indeed, so poor and so restricted in its use was the steam engine when Watt found it, and so perfect in performance and so comprehensive in application when he left it, that, more truthfully than in almost any other similar instance, it may be said that he was its inventor. How mankind has been and is benefited by this invention has been told over and over again. In England alone steam does the work of more than a hundred million men, and the greatness of the British Empire is more owing to James Watt than to any crowned head.

Copernicus, Galileo, Newton, and Watt—these are the men who have carried mankind from Columbus to the nineteenth century. Building upon the foundations they laid, it became the century of steam and steel, evolving all that is tributary, in a material sense, to such a display as the Columbian Exposition.

But this display would have lacked much of its striking beauty and many of its most important features had it not been for the directing presence of an extraordinary agency which is not material nor yet spiritual, but whose manifold uses and ready subordination to the demands of men make it a rival of steam in its influence upon political and social conditions. Steam and its applications do not alone constitute the glory of the present century, for even more characteristic of it, and especially of the last half of it, is the development of electricity. The germs of this development are to be found, it is true, in the work of Gilbert, already referred to; but, for reasons not difficult to see, there was comparatively little growth until about a hundred years ago, when a new order of things began. The story of discovery and invention in electricity is to the present generation much like the story of a battle to those who were in the front ranks of the contending armies, and therefore it is only necessary to refer to it in the most general way. All nations are concerned in it, and all languages would be necessary to its complete telling. A great Italian philosopher, Galileo, laid the foundations of modern dynamics and physics, and to two of the same race, Galvani and Volta, we are indebted for the beginnings of modern electricity. The splendid contributions of Oersted, Ampère, Ohm, Faraday, Henry, Gauss, Helmholtz, Kelvin, and many others, living and dead, are so recent that there are few who have not some acquaintance with them, and surely no one is ignorant of the results of these contributions as exhibited in the telegraph, ocean cables, telephones, electric light, and electric power transmission. It is a matter of continual surprise to those who are not quite familiar with the work of the first three quarters of this century that during the last two decades such prodigious advances in applied electricity have been made. Electric machinery, dynamos, and motors, although their entire history extends through barely a quarter of a century, are to-day far more nearly perfect than the steam engine after some hundreds of years of development. The explanation of this lies close





THE COLUMBIAN FOUNTAIN, WEST END OF THE COURT OF HONOR.

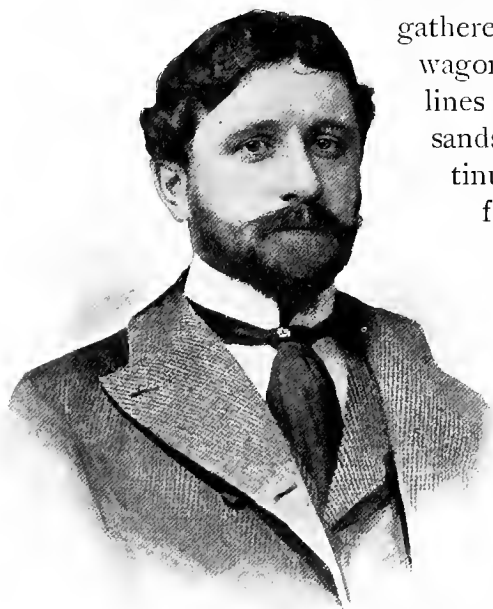
at hand, and is to be found in the interesting fact that in the evolution of the steam engine art, for the most part, preceded science, while in electricity science was first, and the art of electrical engineering was really created by the requirements of scientific men, who, largely for their own convenience, devised and adopted a most perfect system of units and measurements for electrical quantities, thus enormously diminishing the difficulties in the way of the practical application of their discoveries. While in nearly all other departments of engineering "rule-of-thumb" methods, empirical in their origin, are almost universal in the earlier stages, and are still in use in a large degree, applied electricity was an exact science from the start, and the immediate excellence of the results ought to put an end forever to the criticism of the claims of pure science or of the value of theory as contrasted with practice, in which some so-called practical men have been inclined to indulge. Every electric light that glows, every car that moves or wheel that turns by electricity, every telegraph or telephone message, is a possibility only by reason of purely scientific research, in support of hypothesis or theory, carried on by men without hope or expectation of pecuniary reward. And a recognition of this fact does not detract in the least from the very great merit of many ingenious and scholarly inventors, who have so skillfully cultivated the germs of great things thus provided, until this mysterious "electric effluvia or virtue," which was once supposed to confer a state of beatification upon one who was charged with it, has become a commonplace servant of man, ministering to his wants and enhancing his comforts in a hundred ways.

In thus passing in rapid review the most important advances in science and its applications during the four centuries that have passed since Columbus, it has been attempted only to refer to what may be broadly classified as the "physical sciences" and to their most distinguished exponents. Time and space have compelled this restriction; but it is also believed to be justified by the fact that these, far more than all others, were concerned in making such a jubilee possible. In saying this, it is not intended to disparage the value of the natural-history or biological sciences, or to detract from the importance of many brilliant discoveries made by men of genius who have cultivated these sciences. Especially valuable have been certain justly famous studies which enabled man to preserve his own life and health; and in the way of a splendid scientific generalization hardly anything can rival that of Darwin and his colleagues. Modern improvements in sanitation are particularly worthy of mention in connection with a celebration that assembled daily its hundreds of thousands of pilgrims from all parts of the world, and kept it going for months, with a death rate somewhat lower than if the people had remained at home.

If one wishes to form an idea of what science was to the Columbian Exposition, let him try to conceive of the Exposition with science and its applications taken out of it. It is not quite correct to say that nothing would be left, but certainly by far the greater part of the Exposition would vanish.

Suppose only that steam and electricity had been unknown or were "suppressed" during the jubilee year, and what would have been the result? A large part of the splendid collection would have been impossible, and it would have been impossible to collect and care for what remained. Assuming, however, that the display itself might have been gathered and arranged, by no stretch of the imagination can one conceive of the gathering of hundreds of thousands every day for its enjoyment. Only the methods of transportation of a hundred years ago would be available. For the sea the fitful and uncertain power of the wind must be depended on, and on land the power of animals and men. What caravans from remote corners of the world would have been necessary to the transportation of foreign visitors alone, and

who can conceive of the journeyings of the millions who gathered in Chicago, across half a continent by stage, wagon, or canal? Each of several of the different lines of railway that daily poured their tens of thousands of passengers into the hospitable city uses continually the power of millions of horses by transforming the energy imprisoned in coal, but set free by the inventive genius of Watt, and without this draft upon the buried resources of the earth the transportation problem would have had no solution.



ROBERT REID,  
Painter.

But, again, assuming the presence of the crowds that thronged the beautiful park, their local transportation could not have been accomplished; it is difficult to see how they could have been lodged; food supplies would have been practically impossible; disease must have broken out among them and contagion flourished; pestilence and death would have been the reward of the great majority of those who were courageous enough to undertake the long and difficult journey necessary to reach the great Fair and

the great city, which is itself a creation of modern applied science. Contrast all this with the actual conditions as they existed; consider the ease and comfort, even the luxury of travel, and especially the fact that the duration of the journey was measured by days where months would have been necessary under the conditions of a hundred years ago; remember how one was even then never out of touch with home and friends from whatever remote part of the world—that world which has so shrunk in dimensions that one is now always practically within hearing and speaking distance of another. Such reflections may enable one to measure with some degree of justice the share that science had in the most important international event of the century.

Even so inadequate a sketch as this of the science *of* the Fair should not be allowed to go without a word relating to science *at* the Fair, meaning thereby the many wonderful and suggestive displays that indicated the present state of science and its applications. Fortunately, these have given a fairly satisfactory account of themselves in the records of the Exposition, and especially in the lasting impression they made on the millions of interested and intelligent visitors. In some instances, like that of electricity, great buildings inclosed splendid and costly displays that were entirely the spoils of the victories of science during the memory of living men; but most interesting of all was the series of congresses relating to pure and applied science which were held in Chicago during the period of the Fair. Here were gathered, not the material results of scientific inquiry, but the choice spirits who were everywhere engaged in conducting that inquiry. One after another these conventions brought to us the leading men of the world, each bearing something of his special knowledge or skill, and all paying tribute to the enterprise, courage, and character of the youngest of all the great nations. It may safely be said that never before in the history of the world were so many of its intellectual leaders assembled in one place in a few short weeks, and the world's Columbian Exposition of 1893 takes incomparably higher rank than any preceding fair as an exponent of the accomplishments of science and scientific men.

















