

Scientific American.

ESTABLISHED 1845.

MUNN & CO., Editors and Proprietors.

PUBLISHED WEEKLY AT

No. 361 BROADWAY, NEW YORK.

O. D. MUNN.

A. E. BEACH.

TERMS FOR THE SCIENTIFIC AMERICAN.

One copy, one year, for the U. S., Canada or Mexico, \$3 00
 One copy, six months, for the U. S., Canada or Mexico, 1 50
 One copy, one year, to any foreign country belonging to Postal Union, 4 00
 Remit by postal or express money order, or by bank draft or check.
 MUNN & CO., 361 Broadway, corner of Franklin Street, New York.

The Scientific American Supplement

A distinct paper from the SCIENTIFIC AMERICAN. THE SUPPLEMENT issued weekly. Every number contains 16 octavo pages, uniform in size with SCIENTIFIC AMERICAN. Terms of subscription for SUPPLEMENT, \$3 00 a year, for the U. S., Canada or Mexico. \$6 00 a year to foreign countries belonging to the Postal Union. Single copies, 10 cents. Sold by all newsdealers throughout the country. See prospectus, last page. Combined Rates.—The SCIENTIFIC AMERICAN and SUPPLEMENT will be sent for one year, to one address in U. S., Canada or Mexico, on receipt of seven dollars. To foreign countries within Postal Union, eight dollars and fifty cents a year.

Building Edition.

THE ARCHITECTS AND BUILDERS EDITION OF THE SCIENTIFIC AMERICAN is a large and splendid illustrated periodical, issued monthly, containing floor plans, perspective views, and sheets of constructive details, pertaining to modern architecture. Each number is illustrated with beautiful plates, showing desirable dwellings, public buildings and architectural work in great variety. To builders and all who contemplate building this work is invaluable. Has the largest circulation of any architectural publication in the world. Single copies 25 cents. By mail, to any part of the United States, Canada or Mexico, \$2.50 a year. To foreign Postal Union countries, \$3.00 a year. Combined rate for BUILDING EDITION with SCIENTIFIC AMERICAN, to one address, \$5.00 a year. To foreign Postal Union countries, \$6.50 a year. Combined rate for BUILDING EDITION, SCIENTIFIC AMERICAN and SUPPLEMENT, \$9.00 a year. To foreign Postal Union countries, \$11.00 a year.

Spanish Edition of the Scientific American.

LA AMERICA CIENTIFICA E INDUSTRIAL (Spanish trade edition of the SCIENTIFIC AMERICAN) is published monthly, uniform in size and typography with the SCIENTIFIC AMERICAN. Every number of *La America* is fully illustrated. It is the finest scientific, industrial trade paper in the Spanish language. It circulates throughout Cuba, the West Indies, Mexico Central and South America, Spain and Spanish possessions—wherever the Spanish language is spoken. \$3.00 a year, post paid to part of the world. Single copies 25 cents. See prospectus.

MUNN & CO., Publishers, 361 Broadway, New York.

The safest way to remit is by postal order, express money order, or bank check. Make all remittances payable to order of MUNN & CO. Readers are specially requested to notify the publishers in case of failure delay, or irregularity in receipt of papers.

NEW YORK, SATURDAY, MAY 13, 1893.

Contents.

(Illustrated articles are marked with an asterisk.)

American boys and American labor.....	233	Letter boxes, street car.....	235
Reels, steel.....	232	Light, electro-mechanical.....	236
Line, new heart tonic.....	232	Locomotives of 1831 and 1891.....	239
ser, colored.....	235	Millstones, rock emery.....	235
ical action at low temperature.....	235	Mixer, quick delivery, Broughton.....	235
ure.....	237	Post office at Exposition.....	231
re, traveling.....	238	Power, transmission of, Edison's improvement.....	236
ectric systems at Exposition.....	230	Prints, blue, brown.....	231
ectricity at Exposition.....	237	Recorder, steam pressure, Lewis.....	235
osition, Columbian.....	238	Roadbed, metallic, Kaufman's.....	232
osition, Columbian, opening.....	238	Science, modern, conquests of.....	235
osition notes.....	231	Screens, magnetic.....	237
od, canned, industry.....	236	Steamer Christopher Columbus.....	237
rnaces, electric.....	232	Stone age in Tasmania.....	233
urance, life.....	232	"Strip," the electrician.....	233
igation in Arizona.....	232	Tree growths, curious.....	233

TABLE OF CONTENTS OF

SCIENTIFIC AMERICAN SUPPLEMENT No. 906.

For the Week Ending May 13, 1893.

Price 10 cents. For sale by all newsdealers.

HITECTURE.—St. Theodore, Venice.—Curious results of the imitation of the statues on the Venetian monoliths.....	1448
LOGY.—The Position of Pathology among the Biological Sciences.—By Prof. RUDOLF VIRCHOW.—A most valuable and important paper by the great German biologist, recently delivered before the Royal Society.....	1448
—Fertilization and Hybridization.—The production of new species and other plants.—The results of recent experiments.....	1448
CHEMISTRY.—Elegances from the German Journals.—By Dr. X. MOORE.—A direct-acting analysis and products, principally in the line of pharmacy, of interest to druggists and medical practitioners.....	1448
CIVIL ENGINEERING.—Bridge over the Mississippi, at Memphis, Tenn.—Details of the cantilever bridge of third greatest span in the world.—3 illustrations.....	1447
Drainage of the Valley of Mexico.—The interesting problem of draining the city of Mexico.—Present aspect of the tunneling operations now in progress.—1 illustration.....	1447
ELECTRICAL ENGINEERING.—Reynolds' Instructions for Erecting and Testing Lightning Conductors.—Elaborate instructions for establishing lightning protective systems.....	1447
MECHANICAL ENGINEERING.—Blake New High Duty Pumping Engine.—A direct-acting flywheel pumping engine by the George F. Blake Manufacturing Co., of this city.—1 illustration.....	1447
Improved Quadruple Expansion Engines.—Mining pump engines of English construction and of the most advanced type.—1 illustration.....	1447
METALLURGY.—On Some of the Mechanical Properties of High Steel as Related to its Composition and Structure.—By JOHN W. LANGLEY, Ph.D.—A valuable contribution to this branch of metallurgy, involving a consideration of fusibility, hardness, toughness, tendency to water cracking, and other peculiarities of steel.—5 illustrations.....	1448
MISCELLANEOUS.—Confetti and Serpentine.—The supplies for Carnival time in the city of Paris.—The harmless weapons of the revelers.—4 illustrations.....	1448
The Bigrade.—A species of pantograph for producing two copies of a letter at once.—1 illustration.....	1447
Gun Drill in the Upper Alps.—Italian Army Corps.—1 illustration.....	1447
VAL ENGINEERING.—H. M. S. Australia.—The belted cruiser Australia, of the British navy.—1 illustration.....	1447
The Effects of a Collision.—Illustration of the effects of a recent collision in Boston Harbor.—1 illustration.....	1447
HOTOGGRAPHY.—A Photographer's Electric Pencil.—Several applications of electricity to the retouching of negatives.—1 illustration.....	1447
Photographing Interiors.—By ELLERSLIE WALLACE.—Practical essays on this interesting branch of the photographic art.....	1447
PHYSICS.—The Specific Heat of Liquid Ammonia.—By C. E. KING and J. E. STARR.—Direct determination of this fact.—A new physical constant determined.....	1448
CHEMISTRY.—Improvements in the Manufacture of Borax.—N. WARREN.—A method of producing borax from common and boracic acid.....	1448
Lapse of Fountain Linings.—By THOMAS WARWICK.—A study of deterioration of soda water fountains.—Its cause and remedy.....	1447
Painting of Wood and Iron Structures.—By EDWARD H. H.—A valuable paper on paint from the point of view of the engineer.....	1447
Painters.—By T. K. SPENCE.—The aspect of the manufacturing papers from the artistic standpoint.....	1447

OPENING OF THE WORLD'S COLUMBIAN EXPOSITION AT CHICAGO.

On the first day of the present month the Columbian World's Fair, at Chicago, was formally opened. The programme for its inauguration was simple and effective. It included music, prayer, poetry, and oratory, followed by an official reception by the President of the United States and the officials of the Fair and foreign commissioners. The music was rendered by a band of six hundred musicians; the prayer was delivered by the blind chaplain of the United States Senate, who, as he was led to his place upon the platform by his adopted daughter and faced the great audience, which he could not see, gave the requisite touch of pathos to the occasion. The principal oration was delivered by Director-General Davis, president of the Exposition. President Cleveland followed him in a very short address, warmly appreciative of the wonderful work which has been done at Jackson Park. On a table near his left hand was a gold telegraph key. As he finished his address, he pressed the key. The closing of the circuit marked the beginning of the Fair. The electric current started the machinery. The electric fountain began to play, some seven hundred flags were unfurled, and the White City, as it has been appropriately called, started into life. Its brief existence began with the pressing of the key by the President of the United States.

The Fair is designed to commemorate the discovery of America by Columbus. As it was to take place in the temperate zone, the summer was the proper season for it. The definitive site was determined at a late day that the time afforded for preparation was unavoidably very short. Such considerations as these justified the postponement of its opening from October, 1892, the true quadri-centennial, to May, 1893. Six months more were afforded for the construction work, and the only possible time for it, the summer season, became available.

Seventeen years have elapsed since the United States, by a World's Fair, celebrated the centennial of their independence. The original exhibition of the character of a World's Fair was held in England in 1851, under the auspices of the Prince Consort of Great Britain. After exhausting its superfluous energies during centuries in international war, the world made an effort to establish an international contest in the arts of peace, and succeeded. The Crystal Palace, of London, a building unique in construction, and in many processes used in its erection, fittingly marked an epoch in itself, irrespective of its contents. New York followed the example, and soon after had its own Crystal Palace in what is now known as Bryant Park.

World's Fairs have been frequent since the early days referred to. London, Paris, Vienna, Philadelphia, have successively surpassed previous efforts. But the crowning achievement in every sense is that established on the shores of the inland sea—Lake Michigan. In every respect the Chicago exposition surpasses anything which the world has seen.

The readers of our columns have learned of the new methods of construction employed. The very walls are covered and decorated in a peculiar way. The architectural features, striking and chaste, have their impressiveness increased by their gigantic size. The same element affects the superb groups of statuary employed upon the buildings. But not content with this much, the highest skill of the landscape artist has been invoked. The water front has been utilized to the fullest possible extent in introducing the beauties of lake scenery. A new city built upon the low shores of the lake made the Venetian character appropriate, and the beautiful canals of old Venice are reproduced by the side of the pre-eminently modern Chicago. The entire conception and production are unique.

A World's Fair has never been held in a country of so large a population as that of the United States. A quarter of a million of people were present at its opening. Even this number at first sight might seem disappointing, a fact which alone indicates the immensity of the enterprise. But Chicago after all is a center of population not greatly exceeding a million of souls. Philadelphia, but two hours distant from New York, represented in 1876 an available area inhabited by several times this number. As the season advances the great trunk lines will pour thousands of visitors from all parts of the world into the metropolis of the lakes, and the White City will be adequately tenanted day by day.

Every world's fair has surpassed its predecessor. Such is the rule of existence of these institutions. Yet so immense is the Chicago Exposition, so utterly unprecedented in every respect, that it is hard to believe that it will be excelled in magnitude or beauty for many years to come.

The benefits direct and indirect to Chicago and to the West cannot well be overestimated. Even to-day the most serious misinformation as to the United States obtains in Europe. The present occasion will be a true revelation of an unknown civilization to many visitors to our shores, who do not realize that a city almost as large as Berlin has within the span of a lifetime grown

up at the foot of Lake Michigan, nearly a thousand miles from the nearest sea port.

In this sense the Exposition will not be confined to the area, large as it is, of Jackson Park. The preliminary sight of New York City and the thousand mile ride through the Empire and Lake States, or over the Allegheny Mountains and across Pennsylvania and Ohio, teeming with industry of all kinds, will be the most impressive part for many. Over this ground the work of the past century is depicted. After lying almost inanimate for three hundred years' the discovery of Columbus took effect and awakened to life. It is only the last hundred years which have made the Columbian Exposition possible.

We have in preparation an extensive series of illustrations of notable objects pertaining to the Exposition, publication of which will soon be commenced. It will of course be impossible for us to illustrate all of the wonders gathered at Chicago; but we hope to place before our readers the pictorial forms of many of the most interesting things, and to present a general idea of the greatness and nature of this, the most recent and most remarkable assemblage of modern productions of science and the industrial arts.

THE WORLD'S COLUMBIAN EXPOSITION.

The World's Columbian Exposition is now a reality. It has been formally opened to the public, and although there had been more or less fear that the great claims made for it would not be realized, the results are even greater and finer than could have been anticipated. Chicago has fully demonstrated that she is competent to conceive, in all its details, the scheme of by far the greatest exposition ever undertaken; that she can carry it to consummation on a much broader scale than was first conceived. Not only has Chicago accomplished this, but she has paid out of her own coffers the chief cost of this vast undertaking. She has completed her part of the work in twenty-one months, and she has handled over 250,000 people on the opening day without difficulty. Such an achievement is stupendous; it is even beyond the conception of those who have witnessed the progress of the work.

A dreary sandy waste and swamp of 700 acres has been converted into a veritable city, the "White City," as it is called. The land has been transformed into a most artistic and beautiful park. It has been provided with a system of drainage designed on the latest improved scientific principles. Water, gas and electricity are supplied in almost unlimited quantities in all parts of the grounds, while compressed air is furnished in nearly all the larger buildings. The electric lighting plant, both arc and incandescent, has nearly twice the capacity of all the central lighting stations combined in the city of Boston. Practically 400 buildings have been planned and constructed, the aggregate floor area of these buildings reaching about 200 acres. These are some of the things that have been conceived and carried out in this remarkably short space of time.

There are things in connection with the Exposition that can be criticised. It is the fruit of human ability and effort. But there is so much that challenges admiration that the visitor, with any knowledge of what the Exposition is, how much has been accomplished, and under what difficulties work has been carried on, cannot fail to appreciate the great undertaking for what it really is. President Cleveland well said in his address at the opening exercises that we ask for no allowances on account of our youth. Neither the United States nor the Exposition need ask for such allowances. Every citizen should feel proud of the undertaking, and he who misses seeing it misses the crowning achievement of the century.

THE ELECTRIC SYSTEMS AT THE COLUMBIAN EXPOSITION.

One of the first exhibits ever made of an incandescent electric lighting plant in which the power to generate the electricity was furnished by steam was the one made at the Paris Exposition of 1878 by Mr. Edison. The engine and dynamo were practically one machine, the engine being probably the first one of high speed used for purposes of generating electricity. It was about this time that the incandescent lamp became a commercial success, and coincident with the accomplishment of this came the practical development and use of electricity. With the precedent of this plant it would be supposed that direct-connected plants would have become popular, especially as this particular plant was put into daily use in a light station at Milan and did excellent service.

Such high rates of speed were demanded that the matter of regulating the engine was a serious question to engine builders, and because of the greater success that attended the regulating of speed by belting down or up, the matter of direct connection was practically dropped in this country for many years. It has been carried to a point of much perfection in Europe, and is now fast coming into use in this country. Much larger units of power and of electrical energy are demanded each year, and while builders have been adding refinements to the wonderfully per-

fect mechanism of the steam engine, dynamo builders have been building machines which do not require such high rates of speed as were formerly demanded, both because of improved design and construction as well as because of the increase in size.

The electric generating plants at the World's Columbian Exposition fully demonstrate the latest practice in this country in direct connecting. Six of the Westinghouse alternating current dynamos, each with a normal capacity of ten thousand incandescent lamps, will be direct-connected to Westinghouse compound engines of one thousand horse power each. Near by, in the power plant in the Palace of Mechanic Arts, the General Electric Company exhibits a vertical triple expansion engine direct-connected to two Edison multipolar power generators of five hundred horse power each. These two plants, each of which is of unusual capacity, demonstrate the adaptability of direct connection with vertical types of engines, while in the power house of the Intramural Railway is a direct-connected plant in which the engine is of the horizontal type. The engine in this case is a two thousand horse power cross compound Allis engine of the Corliss type, and the armature of a fifteen hundred kilowatt Thomson-Houston multipolar railway generator is built up on its shaft. With the claims for economy that are made for direct-connected plants, it would be instructive if these three installations were so arranged that they could be tested under different steam pressures, so as to ascertain the point of their highest economic working efficiency.

There are other direct-connected sets at the Exposition besides these mentioned. They are exhibits and not part of any plants in actual operation, but they all go to show that the plant designed and exhibited by Mr. Edison fifteen years ago was on the correct principle.

THE POST OFFICE OF THE COLUMBIAN EXPOSITION.

The model post office established in the World's Columbian Exposition grounds by the United States Post Office Department is now in full working order, and has been used since the middle of April. This office is a branch of the Chicago post office, but is known as the World's Fair Station, and all visitors at the Exposition who have no definite knowledge in advance as to what their address will be in Chicago may have their mail sent to this station by addressing it "World's Fair Station, Chicago." This office is situated in the southwestern corner of the United States Government building, and its general arrangement is in all respects highly convenient. At the extreme left is the private office of the superintendent of the station, then in consecutive order are windows as follows: Two "Carriers' Delivery" windows, two "General Delivery" windows, one "Registered Letters" window, one "Money Orders" window, one "Stamps Wholesale" window, one "Stamps Retail" window, and at the right hand corner an "Inquiry" window. Between the carriers' windows and the general delivery windows are about one hundred lock boxes which will be rented, but there are no call boxes. Near the right hand end are four slips for mailing letters, one each marked "North," "South," "East" and "West." Besides these there are slips marked "Packages," "Papers," "City" and "Foreign."

This office has about twenty-five postmen in the delivery service, and there are four deliveries of mail a day, mail being delivered at all the State buildings and foreign buildings as well as at the Exposition buildings. By this arrangement visitors from any particular State can, if they so choose, have their mail delivered at their State building, provided their State has a building. The service of this office, including the mail delivery, belongs equally to Midway Plaisance as to the Exposition grounds proper.

At the right of this post office is a model postal car with all its equipment complete. A full working model of this car, one-sixth in size, is also exhibited. In this connection the Post Office Department makes a complete exhibit of the various ways of carrying mails in addition to this postal car. There is a mail carrier on horseback with his equipment, a sled to which three dogs are harnessed, showing the manner in which mail is carried in the winter in extreme cold regions. There is also the Indian mail carrier on snow shoes, a "special delivery" boy on a bicycle, a fine model of the steamship City of Paris, also a model of the side wheel steamer Southern, of New York, the first steamer that ever carried the United States mails. There are also two wax figures of postmen in full uniform, together with a full and complete display of mail bags and pouches of all kinds, etc.

FOR BROWNING BLUE PRINTS.—Dissolve piece of caustic potash as big as a soup bean in 5 ounces of water. Place print in this solution, and it will fade to orange yellow. When all blueprints have disappeared, wash print thoroughly in clear water. Then dissolve a partly heaped teaspoonful of tannic acid in 8 ounces of water. Put the yellow prints in this bath, when they will turn to a brown that can be allowed to assume a tone of any required depth. Then wash well and dry.



THE OPENING ON MAY 1.

The World's Columbian Exposition was formally opened at noon on Monday, May 1.

From the day work was begun on the Exposition, the amount of energy expended has been almost limitless, and as the opening day drew near month by month, this amount of energy increased proportionately. The greatest amount of work was accomplished during the month of April, and especially during the last week or ten days, when from 15,000 to 17,000 men were employed, and work went on unceasingly. Exhibitors were given up to late Sunday night, the 30th day of April, in which to finish their work, or, if not finished, to have it reach as near as possible the point of completion. Meantime, while exhibitors were putting the finishing touches on their exhibits, from 4,000 to 5,000 men were cleaning up the grounds and buildings. These men worked through the night and up almost to the hour that the procession escorting the guests of the day entered the Exposition grounds, and they accomplished their work so that when the Exposition was formally opened to the world, it was ready for the inspection of visitors.

The ceremonies attending the opening began on Saturday, April 29, when the Duke of Veragua reached Chicago and was escorted to his hotel. An hour later President Cleveland with his cabinet and other government officials arrived and was escorted to the hotel by State and national troops, and a little later the Liberty bell, which received such ovations all along the route from Philadelphia, was escorted through the streets of Chicago to the Exposition grounds, received almost as great an ovation as was accorded the President and the descendant of Columbus. Thousands of strangers were in the city, and the streets were crowded from the station to the Exposition grounds, eight miles away. Public and private buildings were freely decorated, and, in spite of the gloomy weather, the ovation was a royal one.

Sunday, the 30th of April, was one of the most uncomfortable days that has been experienced in Chicago this spring. The atmosphere was chilly and a driving rain continued from early in the morning until after noon. Monday morning of the opening day, May 1, was somewhat brighter, and, although it was by no means pleasant, the sun made several brief appearances. The preceding week had been one of almost continuous heavy rains, and, as a consequence, the Exposition grounds and some of the streets were in bad condition. Many of the walks and promenades in the northern half of the Exposition grounds had had the finishing touches put upon them and had been rolled and swept until they were as hard and clean as an asphalt pavement. The highways of the southern end of the grounds—and it is here that the crowds largely center—had not been fully completed. Most of them had reached the point where only the top dressing and a little more rolling was required to complete them when the rains came and, lasting so many days, prevented the completion of the work.

The hour for opening the gates of the Exposition to the visitor is eight o'clock, but long before that hour on the opening day visitors poured in at all of the gates, and the stream increased in volume up to the time of the arrival of the procession. This procession consisted of a platoon of mounted park policemen, a detachment of city policemen, mounted, Company B Seventh United States Cavalry, the Chicago Hussars, mounted, Troop A Illinois National Guard, and a large number of carriages containing the officials of the Exposition, with the presidential and ducal parties, foreign representatives, city and State officials, ladies of the several parties, etc. This procession proceeded up Michigan Avenue, out the Boulevard, and entered the Exposition grounds by passing through Midway Plaisance. People crowded the streets along the entire route of the procession. In the Midway Plaisance the people in the several foreign villages turned out *en masse* to extend their welcome to the President. Turks, Moors, Egyptians, Singalese, Algerians, Japanese, Javanese, and the other foreigners extended their greetings to the President each in their own peculiar manner. Passing through the Plaisance into the Exposition grounds proper, the procession wended its way through throngs of people to the Administration building. Here the military companies formed an open passageway, through which the carriages passed as they drove up to the building, and the invited guests alighted.

The ceremonies attending the formal opening of the Exposition began promptly at half past eleven. The special platform constructed for the occasion on the east front of the Administration building provided sufficient seating capacity for the two thousand or more invited guests, the orchestra, the large chorus, and others. Exposition officials estimated that at least 150,000 people could be comfortably crowded into the Grand Plaza in front of the platform. Long before President Cleveland made his appearance on the stand all available space, not only in front but on each side of the Administration building and the great open areas in front of the Manufactures and Liberal Arts building and the Agricultural building, was crowded to the utmost, and thousands of people filled the grounds even as far east as in front of the Peristyle. The sight from the platform was magnificent. A large sounding board had been constructed directly back of the orchestra and chorus, and its efficiency was complete, thus adding much to the perfectness of the ceremonies.

After the President and other guests were seated, the ceremonies opened by the orchestra rendering the "Columbian March and Hymn." Dr. Milburn, chaplain of Congress, offered prayer, Miss Jessie Couthouli recited the "Prophecy," a poem written for the occasion by W. D. Croffut. Following the rendering of the overture, "Rienzi," by the orchestra, Director-General Davis of the Exposition delivered a short address, reviewing concisely the work and purpose of the Exposition. Concluding this address, the Director-General turned to President Cleveland, who returned the salute of the Director-General. As the President rose to his feet he was greeted by an outburst of cheering from the immense crowds in front of him, aggregating perhaps 300,000 people. Cheer after cheer arose, echoing from the Administration building across the basin to the Peristyle and back again. The President presented the purposes of the Exposition, asking for no allowance on the score of the youth of the nation, then declared the Exposition opened, and, touching the electric key, turned on the steam to the great 2,000 horse power engine of the power plant in the Palace of Mechanic Arts.

As President Cleveland touched the key and declared the Exposition opened, the sight and the sound following was most memorable. On every building throughout the grounds, and especially on those adjoining the basin and canals, the hundreds of flagstaves had been arranged with their flags tightly furled but ready to be flung to the breeze at an instant's notice. Immediately in front of the grand stand were three poles, each eighty feet high, and on top of each was a golden model of the Santa Maria. At the signal, flags were unfurled from these poles and the halliards controlling the flags on every one of the other flag poles were loosened as if by one movement, and the flags of every country exhibiting at the Exposition, the Exposition colors, and an immense amount of bunting of bright and harmonious colors were flung to the breeze. At the same instant two electric fountains situated on either side of the McMonnies fountain, and immediately in front of the grand stand, sent great streams of water fifty to seventy-five feet in the air, and the great golden Statue of the Republic mounted immediately in front of the Columbus entrance to the Peristyle was unveiled. The man-of-war Michigan which lay immediately off the Exposition pier fired twenty-one guns as a Presidential salute. The steam launches in the basin blew their whistles, and at the same time whistles from steamers lying at the pier and the great steam whistles and gongs on the power plant of the Exposition joined in the din. The orchestra and the chorus closed the formal exercises with the tune "America," and at the second verse the whole concourse of people, guests and visitors joined in the singing.

President Cleveland and the other invited guests retired to the Administration building, where a lunch was served. While they were preparing for the lunch a band of several American Indians that had been stoically watching the exercises was led into the rotunda under the vast dome of the building, and at a given signal they sounded the Indian war whoop which startled the foreign guests. After a short rest following the lunch, the President, the Duke and a few more of the more prominent guests were escorted about the grounds and through the several buildings, riding part of the way in carriages and the rest of the way in electric launches on the waterways. Quite a little reception was held in the Manufactures and Liberal Arts building, where the President and the official representatives of all the exhibiting nations and colonies who were present were formally introduced. President Cleveland and party left the grounds at half past five for Washington.

It is hardly to be expected that such an enormous undertaking as this Exposition has been could be wholly complete in every respect on the opening day. Nevertheless visitors have no reason to be disappointed or critical, for on the opening day there were more exhibits to be seen and studied than any human being

(Continued on page 294.)