spending nearly $7,000,000 on their exhibits, and thirty of them have beautiful State buildings erected on the grounds. The United States government has a special building and exhibits installed at an expense of $1,600,000, and about sixty foreign governments are participating at an expense of over $7,500,000. Mexico, France, England, Belgium, Brazil, Germany, Austria, Italy, Sweden, Holland, China, Cuba, Japan, Ceylon, Canada, Siam, India, and other countries have erected fine pavilions, some of which are noble replicas of famous old buildings, such as the Grand Trianon of France, the Orangery of Kensington Palace in England, Germany's Castle of Charlottenburg, Prince Pu' Lun's Peking residence, and Siamese and Japanese temples.

The site comprises 1,240 acres of lovely undulating park land, much of it covered with forest. The landscape gardener's art has heightened its scenic beauty. A commission of famous architects laid out the building scheme. About 1,000 structures are posed on the site. Many of these are exhibit buildings of enormous dimensions and grand and imposing in architectural design. Of the twelve largest exhibition palaces, that of Agriculture measures 1,600 by 500 feet; the Transportation Palace, 1,300 by 525; Manufactures, 1,200 by 525; Varied Industries, 1,200 by 525; Machinery, 1,000 by 525; Liberal Arts and Mines and Metallurgy, each 750 by 525; Electricity and Education, each 600 by 525. The exhibit palaces cover 128 acres of ground. Eight of these buildings, grouped on broad avenues and lagoons that focus on Art Hill with its cascades crowned by Festival Hall and the Terrace of States, compose what is called the "Main Picture." This picture is intended to be an exhibit of American architecture and sculpture at the beginning of the twentieth century, and over $500,000 was set apart for the artists designing the sculptural decorations herein displayed.

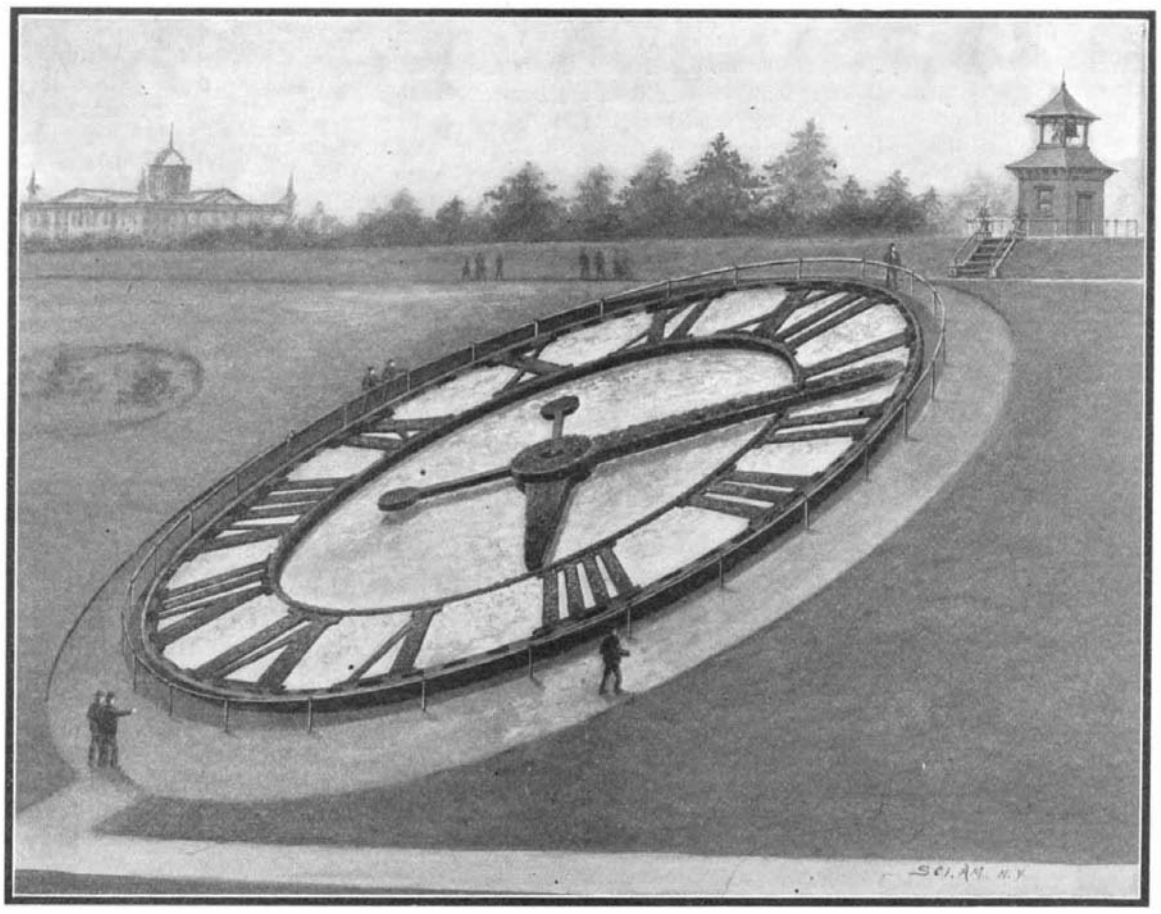
The exhibits of all nations are the results of competitive selection. All exhibits have been subjected to an admirable scientific classification and are installed in their respective buildings in 144 groups and 807 classes, so that everything can be studied in comparison with all that belongs to its own class or group. Whenever practicable the "live exhibit," the process as well as the product, is demonstrated, and this has led to a great many "outdoor exhibits." Some fifteen acres in the "Mining Gulch" are devoted to mining and metallurgical demonstrations not admissible in the Mines and Metallurgy Palace. Although the Transportation Palace covers about fifteen acres and contains four miles of railway track, Germany's elaborate display of her terminals is on outside tracks, and the airship exhibits and contests are at the Stadium, half a mile west. All the space in the Electricity Palace had been reserved for preferred exhibits, more than a year ago, and yet many interesting exhibits competing for awards in this department are "live exhibits" at work as part of the immense lighting and power plant of the Exposition in the Machinery Palace. The British, French, German, Japanese, and other foreign pavilions are treasure houses of famous old paintings, sculptures, tapestries, pottery, and other decorative art work not entered in the competitive exhibits of the Palaces of Liberal Arts, Manufactures, and Fine Arts. The school, university, manual training, and technical institutions of Germany, France, England, and America are luminously illustrated here, both in organization and method, and the teaching of defectives will be shown in actual operation.

Scientists and members of all the technical professions will find that great entertainment has been prepared for them—laboratory demonstrations of all sorts; laboratory tests of locomotives, of power generators, and other machinery; elaborate models of harbor improvements and great engineering works in all parts of the world, including the great Assouan dam; tests of kites, aeroplanes, dirigible balloons, and other airship experiments. In addition there are such great attractions for them as the World Congress of Art and Science and a long series of technical and professional congresses, with distinguished participants from many foreign countries. For musicians there are great musical events extending throughout the Exposition period, with recitals by the most distinguished organists on the most powerful and wonderful organ that was ever built.

For breeders of live stock there will be a live-stock show distributing $250,000 in premiums, besides the prizes added by the breeding associations, which are all taking a profound interest in the contests.

For the physical culture advocate and the sportsman, the International Olympian Games for 1904 will be held in the noble Stadium and Athletic Field provided for them on the Exposition site, where will also be held a long series of inter-state, inter-collegiate, and inter-scholastic games and sports, for the expenses of which the Exposition has appropriated $150,000.

The dominant idea to which the projectors of this Exposition have steadily adhered, was to make it an epochal event in the progress of mankind, a great world-university course, as it were; throwing world-wide light on all the paths of progress; aiding and stimulating invention; arousing that competitive instinct in man which impels him to improve the highest achievements of others, to produce something better than the best. The influence of former Expositions on subsequent progress has been distinctly manifest, and why should not the influence of an Exposition of far greater scope and resources be still more marked and memorable, as an inspiration to inventive genius and as a guide to popular taste and to social, civil, and industrial betterment? As the completest display ever made of the resources of our own country and of the wonders wrought by our own people, it will not only be a beneficial revelation to themselves, but greatly enhance the prestige of our republic abroad. In such a representation of the races of men and of the products of nations, each is a teacher, each a learner, and must derive from it a clearer sense of the dignity of manhood and of the kinship of the human family.



THE GREAT FLORAL CLOCK AT THE ST. LOUIS EXPOSITION.

THE LARGEST CLOCK IN THE WORLD.

BY CLAUDE H. WETMORE.

Sixteen times larger than any timepice in the world will be the floral clock on the Exposition grounds at St. Louis, which is located in front of the north entrance to the Palace of Agriculture, and separated from that building by a driveway. Although it is what is known as a floral clock, it will keep accurate time, for beneath the vines and other plants, skilled artisans have constructed machinery similar to the works of a watch, but which in size bears the same comparison as does the dinotherium, which once inhabited the Miocene beds of Europe and Asia, to the titmouse of today.

The disk consists of a circle of flower beds one hundred and twelve feet in diameter; and the hands are long, green pointers, the largest of which moves five feet a minute. At the place where these hands join in the center, a tall man could lie down and the surface beneath would extend four feet beyond his head.

Between the dial and the Palace of Agriculture are three small ornate buildings. The central one, which is fourteen feet square at the base and fourteen feet to the cornice line, is of Grecian architecture, except the roof, which is a hemisphere twelve feet in diameter. The ground color of this roof is azure; it is dotted with stars and marked with meridians, to represent the heavens. In this building is the mechanism that connects with the underground machinery and moves the hands, also the mechanism that strikes the great bell. The south wall is of plate glass, and the glass in turn is hidden from view by a swinging door, except for a few minutes during every hour, when the door is thrown back automatically, revealing the works within. Above the dome is a figure of Time.

On the right of this central building is a similar structure, though smaller; the roof, also a hemisphere, represents half the earth, showing the western continents. Within hangs the 7,000-pound bell, which sounds the hours in deep tones that can be heard all over the Exposition grounds. And it is at the first stroke of the bell that the door swings open, revealing the clockwork.

A companion structure stands on the left of the central building, and within is an immense hour-glass that turns automatically every hour.

At night these three buildings will be brilliantly illuminated, and so will be the dial, to do which electric bulbs will nestle under the plants that form the numerals and cover the hands. To cause the necessary effect, two thousand lights will be used.

This clock, in so far as the machinery goes, is an exhibit of a western manufactory; the floral arrangement has been planned by the Chief of Agriculture of the Exposition and his assistants. Following the latest plans, the inner surface of the dial—the smaller circle, which is bordered by a wide rim containing the numerals—will be of white, low-growing flowers bordered by a thin hedge of foliage plants. Within the rim the numerals of the hours will be dark tall foliage plants, thrown into relief by intervening white blossoms, the same as those growing in the inner circle. The border of the rim will be a circle of low-growing flowers, and beyond this again will be spears of foliage plants, red alternating with yellow, which will indicate the seconds, 1,800 of the one color and the same number of the other, making 3,600 in all.

Surrounding the complete circumference of the dial on the outside will be six feet of lawn, and surrounding this again will be a broad path of red-colored earth.

The minute and the hour hands are long steel troughs, in which fertilized earth has been placed to supply nourishment to the vines that will cover the metal and completely hide it from view. The minute hand weighs 2,500 pounds, and the vines that will cover it would hide from view the front of a large house.

The effect in the daytime will be that of a mass of green moving slowly over a field of white, and pointing at brilliant-colored hours and minutes; at night, a glowing indicator will move above glowing numerals.

PARTICULARS OF THE GREAT CLOCK.

Diameter of dial	112 feet.
Length of minute hand	70 feet.
Diameter of the hands across the center.	10 feet.
Minute hand moves each minute	5 feet.
Weight of minute hand	2,500 pounds.
Weight of bell	7,000 pounds.
Diameter of bell at mouth	70 inches.
Height of bell	60 inches.

The total cost of the eleven Washington University buildings, used by the Louisiana Purchase Exposition, is $1,480,000. These buildings are all permanent structures.

Idaho was one of the first States at the World's Fair to complete its agricultural exhibit. The showing is a revelation as to that State's resources, and the taste displayed in the arrangement is much admired by all who see it.

President Roosevelt, from his desk in the White House at Washington, pressed the electric button which set in motion the wheels of the World's Fair machinery. This was done at exactly 1 o'clock, eastern time, or 12 o'clock, noon, St. Louis time.

The National Academy of Sciences.

The annual or stated meeting of the National Academy of Sciences was held in Washington, D. C., from April 19 to 21, 1904, in the United States National Museum, under the presidency of Dr. Alexander Agassiz. Public sessions were held in the lecture room of the Museum during the afternoons, and were devoted to the reading of papers, of which some nineteen were presented.

Prof. John Trowbridge, of the Lawrence Scientific School of Harvard University, opened these public sessions with a series of three papers, all of which consisted of lantern-slide illustrations devoted to the exposition of the topics which they served to elucidate. The first of these was on "Spectra of Gas at High Temperatures," and was followed by one by Theodore Lyman on "Short Wave-Lengths of Light," while a third was by H. W. Morse on "Spectra Produced by the Wehnelt Interrupter." Messrs. Lyman and Morse have carried on their investigations under the direction of Prof. Trowbridge, who, as they were not members of the Academy, presented their papers.

"On Fluorescence Spectra" was the title of a short joint paper by Profs. E. L. Nichols and Ernest Merritt of the Physical Department of Cornell University, after which Prof. Robert S. Woodward of Columbia University described "A Double Suspension Apparatus for Determining the Acceleration of Gravity" and "The Compressibility of the Earth's Mass Required by the Laplacean Law of Density Distribution," both highly technical expositions of the subjects treated.

Of more popular interest was Prof. George F. Barker's "Note on Radio-activity and Autoluminescence." This able physicist discussed the phenomena which have been discovered in connection with uranium, radium, and other elements, presenting a full series of minerals showing radio-activity. Baskerville's recent announcement of his discovery of carolinium and berzelium was referred to and the work of the brilliant young chemist from the University of North Carolina favorably commented on. Prof. Barker showed a number of photographs which had been developed by the autoluminescence of the minerals which he exhibited before the Academy.

Of considerable interest was the paper entitled "Physiological Economy in Nutrition, with Special Reference to the Minimal Proteid Requirement of Healthy Man," presented by Prof. Russell H. Chittenden, director of the Sheffield Scientific School of Yale University. He described in detail the experiments carried on by him on a number of students and a squad of United States soldiers and found at the end of six to twelve months—varying with the different subjects—that he had been able to effect a gradual reduction of meat and other proteid foods with little if any increase in starch and other foods and that the weight of the subjects was almost exactly the same as when the experiments began. Their bodily vigor was greater and their strength much greater, the latter due, however, to the regular physical exercises which they practised. His conclusions were therefore that the average healthy man eats from two to three times as much as he needs to keep him in perfect physical and mental health and vigor. Prof. Chittenden said that so far as he himself was concerned he found his health greatly improved by eating only two meals a day, eliminating entirely his breakfast. Considerable discussion followed the reading of this paper, which was participated in by Prof. Horatio C. Wood, of Philadelphia, Pa.; Dr. John S. Billings, of New York, and Prof. E. S. Morse, of Salem; and while the value of Prof. Chittenden's experiments was conceded, it was contended that a series of experiments with persons eating the normal amount of food would be highly desirable in order to show what ill effects if any follow the ordinary practice. In other words, no evidence was presented to show that the satisfying of a man's appetite in the usual method was deleterious to health. The paper was illustrated by a number of lantern slides, showing the physical development of the subjects.

"A Brief Preliminary Report upon Apocynum cannabinum," showing the properties of this plant, was presented by Prof. Horatio C. Wood, of Philadelphia, Pa.; and Prof. Henry F. Osborn, on behalf of Prof. W. D. Matthew, of New York, described briefly the "Position of the Limbs in the Sauropoda."

The public session on Thursday began with Gen. Henry L. Abbot's paper on "The Disposition of Rainfall in the Basin of the Chagres," and was followed by Prof. Henry F. Osborn, who, under the title of "Recent Paleontological Discoveries by the American Museum Exploring Parties," referred to the explorations which have been carried on during the past three years with a fund of $15,000 given by the late William C. Whitney for the purpose of learning more perfectly the history of the prehistoric horse on the American continent. A number of discoveries of great interest and value to zoologists and paleontologists was reported. One of the finds made was of the skeletons of a small herd, consisting of a mare and colts, of the Neohipparion. The type was named Neohipparion Whitneyi, in honor of the donor of the gift which made the expedition possible. The Neohipparion is especially interesting as being a perfect American type of the old European Hipparion, or forest-living horse. The find was made in 1902 in the upper Miocene period formation of Nebraska. Other finds were a specimen of the *Equus Scotti*, or true Lower Pleistocene period horse, discovered in 1900 in Texas.

Prof. Osborn also read a paper advocating a reclassification of the reptilia, chiefly interesting because of the positive announcement that man as a mammal, with a single arch on the side of his skull, is unmistakably descended from that class of reptiles known as lynapida, which has only one arch. The descendants of the lynapida are all mammals, including man.

Dr. Alexander Graham Bell then introduced Prof. A. F. Zahm, of the Catholic University of America, who read an important paper on "Surface Friction of the Air at Speeds Below Forty Feet a Second," after which Prof. Bell himself presented a brief paper on "The Multi-nippled Sheep of Beinn Bhreagh," in the course of which he announced that in the continuation of his efforts to produce a variety of sheep that would yield twins, he obtained sheep that showed evidence of as many as eight nipples, thus leading to the inference that a variety of sheep could be developed that would yield larger families than at present.

Biographical Memoirs of James Hadley by Arthur T. Hadley and of Henry Barker Hill by Charles L. Jackson were read by the Home Secretary. The meeting was brought to a close by a "Note on the Simplest Possible Branch of Mathematics," by Charles S. Pierce.

In addition to the papers presented, the business of the Academy included the presentation of the Henry Draper medal to George E. Hale, director of the Yerkes Observatory, for his brilliant astrophysical researches. The constitution limits the membership of the Academy to one hundred persons, and not more than five new members can be elected each year. At this meeting only four men were found worthy of admission into this select body. They were William Morris Dean, who fills the chair of geology in Harvard University; William Fogg Osgood, assistant professor of mathematics in Harvard University; John Ulric Nef, head professor of chemistry in the University of Chicago; and William Thomas Councilman, professor of pathology in the Harvard Medical School. By the election of these members the active list has been increased to nearly ninety-three.

Also the following eight foreign associates were chosen: Dr. Paul Ehrlich, of Frankfort on the Main; Dr. H. Rosenbusch, of Heidelberg; Prof. Emil Fischer, of Berlin; Sir William Ramsay, of London; Sir William Huggins, of London; Prof. George H. Darwin, of Cambridge; Prof. Hugo de Vries, of Amsterdam; and Prof. Ludwig Boltzmann, of Vienna.

The Melancholy Cypress

In a recent issue of the St. Louis Globe-Democrat Ferdinand Tonney declares that the axman is fast destroying the melancholy cypress, and that the enormous consumption of the imperishable wood will soon clear the Southern swamps of their noblest product. Mr. Tonney says the best specimens are found in Arkansas and Louisiana. The lumbermen class the timber as red, yellow and white, according to the tint of the wood. In Southern Illinois, some years ago, there were brakes of a white variety, but the trees were pygmies when compared with the yellow cypress giants of the Cache River country in Arkansas, and the mammoth red cypress tree along the Ouachita River. The slow growth and the uncertain method of reproduction lead to the belief, says Mr. Tonney, that before many years the tree will become extinct. The great brakes are rapidly disappearing before the modern methods of lumbering, and regions which heretofore were regarded as inaccessible because of the swamp conditions are being cut over, and the lumber going into the markets at a rate surprising even to those who are intimately acquainted with the industry. The antiquated methods of logging, so slow and cumbersome, have been replaced by the up-to-date ideas, and the new facilities and improvements have worked wonders in the business. Mr. Tonney says, further, that just now cypress is the one kind of timber which has obtained a prominent place on the lumberman's list, and the increasing demand and the advancing price are attracting the attention of every one who has in any way to deal with building materials. The commercial value of a good cypress brake is almost beyond the belief of those who are not familiar with the lumbering industry. The merits of the timber as adapted to a multiplicity of uses are without question, and it has taken rank along with white pine and poplar. A house may be built, these days, wholly of cypress. The framework, siding, flooring, lath, shingles, and even the interior, when finished in this remarkable product of the Southern swamps, give satisfaction, which is shared alike by the builder and owner. Strength, durability and beauty of finish combine to make it popular with the woodworker. An instance may be cited where cypress was substituted for yellow pine in the construction of the World's Fair buildings. While it is true that the cypress brakes in Arkansas are being drawn upon heavily, there is no danger of immediate depletion. And every cypress tree felled means that in return additional wealth comes to swell the means whereby in other ways Arkansas is undergoing splendid development.

The New Warships for Japan.

BY THE ENGLISH CORRESPONDENT OF THE SCIENTIFIC AMERICAN.

A further advance in warship design and construction is to be exemplified in the two new powerful armorclads to be built in England, for the Japanese navy, by Vickers Sons & Maxim, Ltd., of Barrow-in-Furness, and Sir W. G. Armstrong Whitworth & Co., of Elswick, respectively.

In general design these ships will somewhat resemble the "King Edward VII." class, now in course of erection for the British navy, with some important modifications and improvements. They will each measure 455 feet in length. This is 30 feet in excess of the recent battleships for the British navy, but although an increase is made in the length there is no corresponding augmentation of the beam and draft, which are 78 feet 2 inches and 26 feet 7½ inches respectively. This increase of the length with the preservation of the other two dimensions marks a new feature in battleship design. That there are limitations to these dimensions is incontestable, for the progress and development of large battleships has outpaced the corresponding provisions of docks sufficiently large to accommodate them. There are few docks in existence capable of accommodating battleships exceeding 78 feet beam. Yet it is imperative in the case of hostilities when a vessel is injured that it should be able to be docked at the nearest port, and the repairs effected with all possible celerity.

This fact has been borne forcibly in mind in the design of these two new vessels for the Japanese navy. There are no graving docks in that country at present which could accommodate a vessel exceeding 78 feet beam. Consequently the beam measurement has been minimized to the most advantageous extent.

The displacement of these vessels is approximately the same as the "King Edward" class—16,400 tons. The contracted speed is to be 18½ knots generated by twin-screw four-cylinder triple-expansion engines.

Steam is to be supplied from a battery of twenty Niclausse water-tube boilers. The coal capacity of each vessel is to be 2,000 tons.

The armament will be particularly formidable, comprising four 12-inch guns mounted in pairs within barbettes. The latter are to be built of 9-inch hardened steel, and provided with armored hoods. In addition there will be one 10-inch gun placed in each of the four quarters in 6-inch armor, and also covered with protective hoods. In the "King Edward VII." class 9.2-inch guns are employed, but the substitution of the 10-inch guns instead of the 9.2-inch weapons accentuates the formidable character of the armament to a very considerable degree. The 9.2-inch gun fires a 380-pound shot with an energy of 20,000 foot-tons, while the 10-inch weapon discharges a 500-pound projectile with an energy of 28,000 foot-tons. A total of 2,000 pounds of shot with an aggregate energy of 112,000 foot-tons will thus be obtained, from the four 10-inch weapons, as compared with 1,520 pounds of shot, and 80,000 foot-tons energy from the four 9.2-inch guns, an increase of 480 pounds and 32,000 foot-tons in shot and energy respectively.

This main armament will be supplemented by twelve 6-inch guns placed as follows: Five weapons on each broadside within the main battery and one on either side of the upper deck centrally situated.

For the repulsion of torpedo and submarine attack there will be twelve 12-pounder, three 3-pounder, and six Maxim guns conveniently placed. Six submerged torpedo tubes are to be provided.

The guns placed behind the broadside armor will be separated by armor bulkheads. The 12-inch guns will be arranged 26 feet, the 10-inch guns 22 feet, and the main deck guns 14 feet above the load waterline.

The scheme of protective belting first introduced upon the battleship "Mikasa" will be followed, but with some extension. For instance, the water-line belt will be 9 inches in thickness and 6 inches thick up to the level of the upper deck. In addition to this, however, a 4-inch continuous belting above the lower or berth deck will be introduced for the first time. This addition will be continued to within 80 feet of the bow, and 88 feet of the stern. By this arrangement, with the exception of right fore and aft, no part of the upper works of the ship will be left unprotected.

Both offensively and defensively these two vessels when completed will be the most powerful warships afloat. The gun power is the most formidable yet designed for a battleship, the guns being both heavier, and in the case of the 6-inch weapons more numerous than those decided upon for the vessels of other navies, and records a decisive advance in battleship construction and armament.