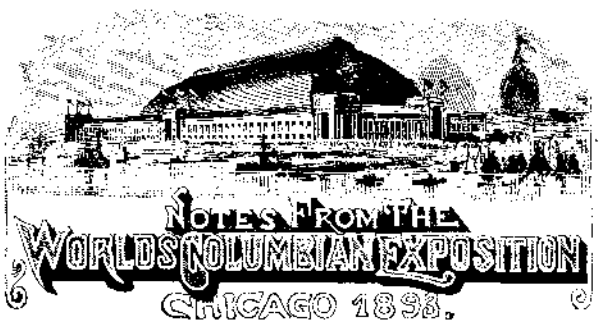

The World's Fair at Chicago is beginning to permeate the country. Its influence is steadily acquiring a momentum that is carrying to the remote limits of the States its wonderful character of beauty, and making the powerful stimulus of its invention, splendor and enterprise felt in our cities, and upon each one of us. Its pervasive loveliness, its beauty born of color and form, and around whose lineaments the radiance of light, shining with all the marvelous luxuriance of modern electrical design, has spent an aureole of surpassing joy, are moulding anew our requirements in art. As a factor of sensuous and almost ecstatic delight few fairs in the history of the world have approached it. As a revelation of the results that can be attained by the chaste and modulated combination of architecture and sculpture, at least in idea, perhaps none have equaled it; and as an example of the felicitious and almost ideal happiness of the union of structure with water surfaces it is unique. In this last particular the fair is a transfiguration. The exhilaration given by this combination of water and building are positively surprising. The picture it presents seems the evocation of genius, and hangs suspended in our minds a celestial vision. So complete is the mental satisfaction, so deep the draught of beauty, that the appreciative visitor for some hours lives simply in that sensation alone. To him the details of exhibition, the mass of material, the endless *facts* of progress, are offensive, and before he can recover his ordinary powers of inspection he allows the wonderful effect to subjugate and ravish him. The White City to him, for a while, is not a series of crowded storehouses, but an evanescent creation of poetry, that may pass with the motion of his hand or exhale with the shock of his breath. Not that it is fragile or capricious in effect; it possesses serenity and great grandeur, but it has so unusual and revealing a beauty that the spectator, feeling that he lives perhaps in commonplace surroundings, can scarcely transport himself to times of architectural wonderment without a feeling of distrust. He remains before it, quieted into a state of apprehension lest suddenly the picture will bodily rise and melt into insubstantial and trailing vapors, roseate perchance with the sun's last touch, but still only the mists of a surpassing dream.

Not the least remarkable indeed of the many aspects of the Fair is this buoyancy, lightness, and essential aerial mobility of the numerous and grandiose buildings. This impression becomes startling in some lights, as at evening. The whole marvelous creation dwells for a moment in a glory of rays as the sun sinks, and then becomes a perishing fabric, melting into the liquid sky, lost to the glistening eyes of men who watch its disappearance with a cry of despair.

As one awakes from this delicious excitement of amazement and pleasure, he begins to separate his impressions, and possibly one of his first inquiries will be, What adjustment of physical constants is it that leads to so admirable and graceful a result? In his analysis something like this must? I think, become apparent. The rudimental and dominating note in this architectural diapason is water. The buildings are tributary to that. Place these same superb creations upon a level plain, fill their interspaces with flowers, or shorn and gleaming lawns, throw around them a setting of woods, bring them under favoring conditions of light and shade, and yet no such illuminative effects would have been secured, no such transport of delicate elevation and serene majesty. The whole would have been listless and unresponsive to the craving of ideality. But this helpfulness of water, attaining a relation of ubiquitous importance to the buildings, has been wisely controlled. A large circular lake of water, around the borders of which the architectural displays would have been made, would not have brought together the reciprocal power of each upon the other. The water spaces are long and rather narrow lagoons or canals. along whose banks rise, in due proportion of height and width, provided with subtle and expressive wealth of ornamentation, the royal structures whose characters enhance each other by their perspective contiguity, while they all derive more completely from the water, so arranged, the stimulation of reflections, which lighten and idealize all alike. A great space of water, over which they might have been seen, would have diminished them, broken down the architectural interdependence and dissipated beyond perception the host of fine effects that, with the changing conditions of the day and night, now provide the atmospheric feature which makes sometimes the aspect of the Fair grounds fairy-like and almost phantasmal. These effects, finally, have been deepened by the whiteness of the buildings. It was a fortunate decision, but one doubtless of no accidental nature—so just and masterly have been all the purposes of the great minds who have directed this enterprise—that the buildings are white. We all have noticed with pleasurable pride the pictorial distinction given to our cruisers by their white hulls, the scenic interest they gather from this color. So in the White City its color contributes essentially to the manifold variety of its bewilderingly beautiful effects.

The caressing shades seem to impart to the white figures, groups, and symbols that surmount the walls of the buildings, stand with astonishing impressive force upon the waterways, or confront you with splendid salutation upon the entrances, a half emphasized relief, and mingle over the convexities and concavities of the sculpture with an indecision of outline that makes the objects themselves unreal. Again, this whiteness permits sharp contrasts, and sometimes in the full sunlight produces a singular pallid brilliancy that defies words to define in its excessive mysterious beauty and beckoning power over the head and heart. As I stood before the Cattle Hall looking northward, with the stuccoed obelisk and its defiant lions at my side, the eye passed over water spaces, spanned by bridges bordered with white gray walls and here and there invaded by shrubby trees, and along facades, simple and effective, or elaborate and diversified, and rested at last at the end of the long avenue of forms upon the yellowed dome of the enormous Illinois building. The sky was darkened by some slowly gathering clouds behind it, but remained brilliantly blue above, and the picture was an incarnation of delicacy, poetry, and strength. Some notes of color are indeed permitted. The red green and yellow, in subdued tints, of the Transportation building and some monochromes among the State buildings perhaps heighten the white and *nivose* expression of the Fair. The one spot where a contrast in color seems the concentration of inspired design. It is where the colossus of Liberty rises in gold before the magical Peristyle. This beautiful colonnade, with the lines of speaking figures upon its parapet and the viewless spaces of the sky and Lake Michigan behind it, forms an admirable background to the august and noble statue of Daniel Chester French. Looking from the Administration building past the sculptured energy and powerful symbolism of MacMonnies' Fountain up the Basin, with this glorious statue closing the vista in serious and stately splendor, the impression is overpowering. Here the effulgence of the robed and heraldic figure in the midst of the encircling whiteness stamps the whole picture with a magnificent distinction. It would be hard to conceive of anything more deeply satisfying and illustrative. The hands of the Republic are raised, in one she holds the world, in the other a staff surmounted by the Phrygian cap of liberty. She embodies the prophecy of the future, and seems in her conscious self-reliance, in the depth of restful composition with which she is moulded, to invite the world to follow where she leads. She is titanic in size, but no one thinks of it, or even suspects it, until dimensions of her unparalleled mass are read in the guide books. She belongs so exactly where she is placed, forms so aesthetically the crown, apex, and glorification of the beautiful buildings grouped about her, that the visitor worships her beauty and feels the thrill of her potent mute eloquence for the elevation and hopes of man.

The sculpture at the Fair, in the powerful groups upon the Basin, at the bases of the bridges, upon the sky line of the buildings, or placed like medallions of stupendous magnitude at the doorways of the Administration building, are fresh tokens of the stirring genius of American art. As we watch them in the light of the sun, beneath the shades of evening, or somberly shadowy above the frieze of electric lights at night, we recognize a strange power of expression in them. They are more than vigorous, different from being merely beautiful, finer than formal correctness, more noble than ornament. They speak a mute language of serious thoughts and deepen with their glorious effigies the impending sense of new eras, new conditions, new results, which the opening hours of the new century welcome and the closing years of the old century predict. A figure, yes many figures, on the Administration building and the Agricultural Hall, itself a wonderful conception, are in the spirit of Michel Angelo, and types of the most undaunted spirit, of the most free and aspiring and genuinely earnest intention in plastic art.

Much has been said as to the fairy-like effects of the elecctric lighting at night, when the great search lights throw their intense and colored floods of light, like shafts of glory, upon the great fountain, and when the jets of water rise in iridescent beauty, changing and mingling their color in bewildering profusion, and when along the surface of the water the myriad incandescent lights are blazing. This is all very fine, but no contemplative visitor can think of comparing such meretricious effects, with their simply showy and shallow accompaniments, to the studies of high and half lights which the great complex of buildings, with their numerous features, permits under the changing skies of day and evening. These seem most entrancing. Without entering the doorway of a single building, the intelligent understanding of and dutiful reverie upon this architectural display will reward the visitor. These are a few first impressions received upon the first day of the writer's visit to the Columbian Fair.

L. P. GRATACAP.

A New Yorker's Impressions.—Entering the Mining building at the center western entrance, the exhibits that strike the eye first are the gilded pyramids of wood, intended to represent the size and value of the amount of gold taken out in Germany, Russia, Australia or New South Wales in a given number of years, a very simple and effective way, much more easily comprehended by the observation than if stated in cold figures. There are immense blocks of coal to be seen, and a country showing the finest and richest display of all kinds of ores, silver, gold and others, is New South Wales. We have been told by one of its intelligent citizens, who visited the Fair, that the general public have no idea of the variety and value of its mineral wealth, which would yield fortunes to any enterprising Americans or others, should they undertake the development and marketing of such valuable deposits, with the economy of management and transportation prevailing in the United States. The display of ores, metals, etc., in this exhibit is remarkable, and there is a silver statue of Atlas.

Another striking exhibit is that of Montana, in which there is a silver statue of Justice (modeled after Ada Rehan, the actress), standing six feet high above the pedestal, and weighing 2½ tons. The remarkable displays of onyx, one a slab 7 feet 7 inches long and 2 feet wide, and the wonderful specimens of petrified wood from Arizona attract attention. In the foreign section is an interesting view of Carlsbad and its products; an ignot of nickel from Canada, weighing 4,500 pounds, valued at $2,250; statue of Liberty Enlightening the World, carved out of salt; a pillar of anthracite coal, 60 feet high, from Schuylkill County, Pa., representing the thickness of the great vein of coal found in that region.

The diamond exhibit in the Cape of Good Hope section is very interesting. There are photographs of the Kimberly mines, and also great blocks of the blue earth, as it is called, are shown, in which scattered among it the rough uncut diamonds run, at varying distances apart, just as they are found. Every afternoon the washing of the earth is shown and the exhibit is guarded by natives from South Africa. In connection with this exhibit is a separate room where men from Tiffany & Co. are engaged in cutting and polishing the diamonds, which is very interesting to see. The Brazilian mineral exhibit is very tastefully arranged and is filled with rare and costly stones.

Along the eastern half of the building are various kinds of mining machinery, including improved forms of stamp mills and smelting works. In this part of the building are also most of the exhibits of different States. A trip around the gallery of the building should not be overlooked. From this point a good general view of the rich exhibits displayed below is to be had. In the north end is a very complete display by the Standard Oil Company of their refineries, the extent of the oil-bearing regions, the different stages of oil refining, and the numerous large photographic transparencies hung in the north window of prominent wells and pumping stations. One of the largest transparencies ever made is shown. A raised map of the State of New York made on a proportionate scale is in the northeast gallery and is worth examining. In the west gallery are large collections of precious and rare stones, one collection by Tiffany & Co. being very complete. The attractive feature is a statue of "Silver Queen" from Aspen, Colorado, very tastefully arranged to illustrate the productiveness of that country as regards silver. Not far from this is a complete working model made to a scale showing the separation of metals from ores by means of lixiviation. In the east gallery there is a meteorite weighing 1,015 lb. which fell in Arizona. There is also an interesting exhibit of asbestos and its products. In displaying the great mineral resources of the United States the many exhibits are very instructive. Leaving the Mining building by the center eastern entrance a short walk leads one to the western center entrance of the Electricity building.

The impression one gets here is that there is considerable space for the exhibits, and after seeing the Machinery Hall exhibits there is much that is duplicated here. The numerous dynamos (many of them) are exhibited without being in operation. There are many forms of arc lights. The central pillar, composed of a thousand or more of Edison lamps in different colors, is very interesting at night. and is surmounted by a very powerful gigantic incandescent lamp. Another elaborate lighting exhibit is that of the Western Electric Company in the southeast corner of the building. By means of automatic switches and motors a series of

(*Continued on page 262.*)

Notes from the World's Columbian Exposition.

(*Continued from page 259.*)

incandescent lamps in red, white, and blue colors are arranged in zigzag radiating lines from a common center at the top of a column of lamps about 20 feet above the floor and parallel with it, their outer ends terminating in rotating globes about 3 feet in diameter, also composed of many red, white, and blue lamps. The current is first passed from the bottom of the column upward and then follows the zigzag lines to the rotating globes, illuminating them for a minute. As it passes along, the several lamps, or groups of them, are successively lighted, which produces a very curious effect. They also exhibit a row of lamps put in the form of a sign or name, and exhibit their automatic device for closing the circuit on this in such a way as to progressively illuminate each letter of the name until the whole is spelled out. Then the whole is extinguished and is rewritten again, as one might say, in electric fire. It is a very curious and novel electric device, and attracts many visitors. The north end of the building, on the ground floor, contains exhibits by foreign countries, including Germany, who sends some massive dynamos and arc lamps and exhibits a historical collection of Siemens' inventions and many forms of devices for measuring the electric current and the testing of lines.

The northeast corner contains full sized models of delicate instruments from Japan, used in determining the extent and duration of earth vibrations in earthquakes. At the front or south end of the building is a large structure, built in Corinthian style of architecture, containing the fine exhibits of the American Bell Telephone Company. The World's Fair telephone exchange is shown in full operation, and the modern switchboard and devices for facilitating connections, together with long distance machines, are exhibited in very complete shape. In one room visitors have the privilege of hearing a concert going on at the Midway Plaisance every afternoon, and in another music played in New York was distinctly heard, as well as conversation with that city. The evolution of the telephone is also shown by many models and drawings. It is a most instructive exhibit, and is worthy of a careful examination by visitors.

In the east gallery, up stairs, are many German and Austrian exhibts of optical instruments that could not be placed in the Liberal Arts building for lack of room. Among them were noticed the fine microscope and objectives by Zeiss and specimens of the celebrated Jena optical glass, made by Herr Schott & Co., so white and transparent that when looked through edgewise it is perfectly colorless.

Adjoining a restaurant, in the north end of the gallery, is a pavilion, from which a magnificent view looking north over the Wooded Island is to be had, and it should not be missed. Located near by are examples of electric burglar and fire alarm apparatus and a complete exhibit by the Gamewell Company, a model of an automatic electric railway switch and signaling device, and along the western gallery is a novel machine worked by electricity for cutting several thickness of cloth at once. The modern rapid automatic system of transmitting cable messages is shown to perfection by the beautiful exhibit of the Mackay-Bennett Company. A resistance cable is shown, having a similar resistance to that of the cable across the Atlantic Ocean.

The sending and receiving instruments are shown side by side. To avoid every element of danger of error, the message is first punctured out on a strip of paper by a special machine and then run through the sending instrument; the receiving instrument is what is known as the siphon recorder. It has a hair-like tube of glass which siphons the ink from the reservoir and makes a mark on a strip of paper in zigzag lines across a straight continuous center line. The motion is imparted to this siphon needle pen by the varying movement of the galvanometer receiving instrument. There is scarcely any friction, and as a consequence the message is received very accurately. The attendant told visitors that the old fashioned way of reading messages by the projection of a vertical line of light upon a graduated white screen was probably fifty times slower than the present method, while this had the merit of also recording the message in ink.

Near this exhibit is that of Gray's tele-autograph machine. It is very simple and interesting, and was illustrated in the SCIENTIFIC AMERICAN a short time ago. Two machines are shown working in unison. The operator has a pencil having elastic bands attached near the point to steady the motion, and as it moves over the tablet, the distant pencil also moves and makes the copy exact. It is an instrument which has a promising future.

In the southern end of the gallery are Edison's phonograph exhibits and his latest invention, the "kinetograph.' He photographs the face at the same time one talks into the phonograph. By this method the sound and the motion, of the lips in producing it are accurately reproduced. There is in the gallery also the wonderful German clock and a model of an electric ball and signal tower. The Edison-Lalande single solution non-polarizing battery is a noticeable exhibit, the intensity and steadiness of the current being one of its special features. Three cells will run an electric fan for a great number of hours at a very small cost.

A convenient attachment for holding the telephone to the ear combined with an adjustable writing tablet was shown and explained by an earnest exhibitor. It was more especially adapted for the old style Blake transmitter apparatus, and is adjustable for one sitting down or standing. It leaves the two hands free to write down messages. For business concerns its advantages were very manifest. Messrs. Queen & Co., of Philadelphia, have a fine display of electric apparatus for educational purposes. The Western Electric Company have a separate room fitted up to show the application of electric lamps in scenic theaters, and their underground system.

The utility of electricity as a heating medium is exhibited in the electric stoves, which are a novelty. When the cost of the supply of electricity is reduced, as it will be in the future, to a level of that of steam, it will be a very simple problem to produce heat without odor for heating purposes. The transmutation of power into the production of this useful agent on a gigantic scale will certainly be a boom to any community where it may be enjoyed.

The Electricity building has a special interest, in that it represents the latest developments of the practical usefulness of electricity in its manifold applications in the various arts and sciences. The other buildings surrounding the Court of Honor will demand further attention. F. C. B.

A glance at the list of cities and towns that are represented by exhibits in the American sections of the several buildings shows that Chicago leads all others by a long distance. In the Manufactures and Liberal Arts building the American section occupies about one-quarter of the entire space in the building, and one-seventh of the exhibitors in this space are Chicago concerns. In other words, of the 1,400 exhibitors, 200 are from Chicago. In the division of paints and varnishes nearly one-half the exhibits are made by Chicago houses, while in the stained glass division over one-half are from Chicago. Nineteen Chicago concerns are represented in the division of stoves and heating apparatus. In the Transportation building nearly one-third of the space in the American section is occupied by exhibits from Chicago, while in the Agricultural building the Chicago exhibits of food stuffs, provisions, and agricultural machinery form a large part of the display.

Missouri Mineral Exhibits.—The chief ore of zinc occurring in Missouri is the sulphide, ZnS, known as sphalerite or blende, but called "jack" by the miners and "black," "rosin" or "steel jack" according to its color. Almost all of this ore comes from strata of lower carboniferous age in Jasper, Newton and Lawrence Counties in the extreme southwestern part of the State, a region which is continuous with the zinc and lead region of southeastern Kansas. Less important quantities of sphalerite are produced in Greene, Morgan, Washington, and other counties. The exhibit contains beautiful cabinet specimens as well as massive commercial ore, and the variety of color and crystalline form is very interesting. One of the exhibits is a huge mass of almost pure "rosin jack" weighing 1,650 pounds from N. Perry's land at Carterville. Resting on a pedestal of Missouri spelter is a 790 pound mass, consisting for the most part of huge crystals of "black jack" dotted over with very small crystals of dog tooth spar and octahedral crystals of galenite, which comes from the Empire Zinc Company, Joplin.

An instructive feature of the exhibit of sphalerite is the display of the mill work of the Empire Zinc Company on the ore from its Kohinoor mine. Twenty-one jars show the ore as it comes from the crusher, as it is fed to each size jig and the slime tables, and the "heads" or concentrates and the "tails" or refuse from each. The average amount of zinc in the concentrates of this company is about 64 per cent, that in the tailings is about 2 per cent, while that in the rock crushed is about 18½ per cent.

Almost the sole leadore is the sulphide, PbS, or galenite, which the miners name "lead."

The lead ore of the southwestern district is readily cleaned by hand picking or jigging, but that of the southeastern region is so intimately mixed with the rock that an elaborate plant is needed for its proper concentration. Such a plant is illustrated in the exhibit by a beautiful model ($\frac{1}{48}$ actual size) of the ore-dressing works at Bonne Terre, owned and operated by the St. Joseph Lead Company. The mill handles from 900 to 1,000 tons of rock every twenty-four hours, and each crusher feeds its own set of roughing jigs, sand jigs and percussion slime tables, so that in case of a breakdown it is not necessary to stop the whole mill, but only that series in which the accident occurs. All the crushers, jigs and slime tables are on the main floor of the mill, while the rolls, screens, pumps for the elevation of material, classifiers and settling vats are on the floor beneath, and everything is arranged to work as automatically and with as little manual labor as possible. In addition to this model, the exhibit of this company consists of a series of specimens and samples, showing very fully the country rock and the occurrence of the ore in it, the milling products and the various stages of furnace work to commercial lead. In addition to these is a set of large photographs of the mills, furnaces, etc., belonging to the company. The St. Joseph Lead Company's mines at Bonne Terre are the largest in the two Americas and the third largest in the world.

The finest specimens of crystallized galenite in the exhibit come from the land of the Oswego Mining Company, of Joplin. This is a very large group of almost perfect crystals, some of which are fully three inches on the edge.

The Picher Lead Company, of Joplin, makes a unique display of a comparatively new industry, viz., the manufacture of strictly amorphous lead sulphate for paint. This is made directly from galenite by the Lewis-Bartlett process as a by-product in the making of pig lead. The process consists in catching in tow bags the volatilized lead sulphide given off by the open Scottish hearth furnaces; burning the sublimed sulphide in the open air; completing the oxidation to sulphate in a furnace, and purifying the sublimed product. The display consists of crude ore and slag and grades "A" and "AA" of "sublimed white lead," which contain small percentages of PbO, and "sublimed lead sulphate," which is more than 99 per cent pure $PbSO_4$. The firm marketed more than 5,000 tons of these products in 1892.

Nearly in the center of the exhibit stands a pyramid ten feet high made up of huge masses of lead and zinc ores aggregating 28,000 pounds, which represents the output of the whole State for fourteen minutes of working time in 1892. The most striking specimens in the pile are a mass of pure galenite from Belleville, Jasper County, weighing 6,500 pounds, and one of rich disseminated galenite weighing more than 5,000 pounds from Bonne Terre. A pile of pig zinc ("spelter") containing 200 slabs and weighing 9,600 pounds, represents the amount of metal in the zinc ore mined in the State every fifteen minutes of working time in 1892; and a pile of 70 pigs, or 5,600 pounds of lead, represents the same for that metal. The product of the State for the fiscal year ending June 30, 1892, was 131,500 tons of zinc ore and 32,000 tons pig lead.

The chief mineral associate of the lead and zinc in Missouri is calcite, and this is shown in the exhibit in wonderful variety, beauty, and complexity of form. The largest single crystal is a doubly-terminated acute scalenohedron, measuring more than two feet from tip to tip. It is from Joplin. Other important associates are dolomite, marcasite, or "white iron pyrites," and barite, all of which are well represented in the exhibit.

The Iron Mountain Company, which owns and operates the mines at the world famous Iron Mountain, in St. Francois County, makes a complete exhibit of all the grades of bessemer and non bessemer specular iron ore which it produces, and specimens of the associated rocks and minerals, together with charts and photographs of the mines, mills, and surrounding country, and an interesting and instructive dissected model of the mountain. More than 3,500,000 tons of specular ore and low grade hematites and limonites show the wide distribution of iron ores throughout the State.

The building stones of the State are numerous and beautiful, and are represented in the exhibit by dressed cubes. Red and gray granite from St. Francois and Iron Counties; light gray crystalline magnesian limestone from Greenfield and Carthage; white non-magnesian limestone from Hannibal; gray, red, cream-colored and mottled marbles from near Fredericktown, Madison County; drab sandstone from Warrensburg; and yellow sandstone from Ste. Genevieve, indicate the extent and variety of Missouri building stones. "Mexican onyx" occurs in many parts of the State, and some fair samples are on exhibition.

Fine kaolin or china clay, ball clays, potters' clays, fire clays, terra cotta clays, and brick clays occur in many localities in the State, and a fully representative collection is displayed in the exhibit.

A fine lump of cannel coal 5½ feet high from a bed 68 feet thick in a "pocket" in Morgan County is the chief feature of Missouri's coal display. More than $6,000,000 worth (mine value), almost all of which was bituminous, was mined in 1892.

One of the main features of the exhibit is a relief map of the State, which was constructed especially for it, and is about six feet square. E. O. HOVEY.

No words can describe the enthusiasm with which Chicago people celebrated Chicago day, October 9, at the Exposition. Business was never more universally suspended throughout the city than on that day, and nearly every merchant and manufacturer bought souvenir Chicago day tickets, many by the hundreds, according to the number of employes, to distribute among them. The weather was perfect, and the number of strangers in the city was much in excess of anything yet experienced since the Exposition was an as-

sured fact in this city. Trains that ordinarily came into the city in perhaps two sections came in divisions with several sections in each division. Saturday 100,000 extra visitors must have come to the city, and on Sunday at least as many more arrived. Meantime the citizens had prepared a welcome by decorating the leading buildings in the business center. On Sunday there was the largest attendance within the grounds of any Sunday by nearly double, the number of paid admissions being 88,000, but there were no indications in the grounds of the great day to come. The only thing unusual about the park was the crowds. Crowds were everywhere, and many people were not fortunate enough to even secure a cot or a table to sleep on. In places down town many people are reported to have paid a dollar for the privilege of having a chair to sit in all night.

Monday the gates at the Exposition grounds were thrown open at six o'clock, although heretofore eight o'clock has been the hour of opening. Even this hour was not too early for many of the new comers who were seeing the Exposition for the first time. An important feature of the attendance was the number of Chicago citizens who purchased tickets, went to the grounds and entered the gates so their presence should be recorded, then immediately turned about and returned home. Chicago pride was the main incentive for this, so that the day should be the high tide mark in attendance, but another consideration was that this day, the twenty-second anniversary of the great fire which laid almost the entire city in ashes, should be a memorable one, so far as its observance was concerned.

Then, again, a large attendance guaranteed a sufficient sum in the treasury to pay off all obligations and leave the Exposition free from debt.

The formal exercises of the day began at ten o'clock, and some of the important features of the programme were: a fanfare of universal peace by eight buglers from the regular army, who were stationed at different points about the basin, and sounded the notes of peace; a chorus of eight hundred voices, that sang the national hymns of the countries of Europe and the most popular of standard American tunes; the ringing of the Liberty bell; and representation of the different States of the nation by school children. The great event was the parade of floats, which took place at sundown. This was followed by a grand display of fireworks, the leading figure being a representation of the burning of Chicago, covering 14,000 feet of space, and representing four scenes, the O'Leary cow, the cow kicking over the lamp, the fire starting and sweeping everything before it, and the city in ruins.

The Liberty bell was rung by a rope composed of contributions of fiber of all kinds from all corners of the earth, and comprising all kinds of vegetable and animal fibers, from hemp and manila to silk and scalp locks and braids of hair from Indians. Two old fire engines, survivors of the great conflagration, were conspicuous reminders of the event the celebration commemorated. Pokagon, a son of the Indian who sold the site of Chicago to the whites for three cents an acre, was conspicuous among the special guests of the day and made an address, and John Young, a son of the Pottawatomie Indian from whom Chicago was named, was also present. The original treaty granting the land to the whites, which has been carefully preserved to this day, was one of the precious relics of the day that was exhibited.

On the following morning the official announcement of the previous day's attendance was 713,646 in paid admissions, 682,587 full admissions and 31,059 children, while the 37,380 passes swelled the total attendance to 751,026. The crowds were handled with remarkable success, but the numbers were too great, and premiums were paid even for a foothold on street cars, and many men clambered to the roofs of the cars, a sight that has not been seen in Chicago for many years.

The number of paid admissions from May 1 to October 12 amounted to 16,803,955. The attendance on Chicago day (October 10) being 703,021. The attendance at the greatest day in Paris, 1889, was only 397,150.

The New York Pasteur Institute.

The new building of the New York Pasteur Institute, West Central Park and Ninety-seventh Street, was formally opened October 9, the inaugural address being delivered by Dr. Paul Gibier, the director of the institute, who is one of the most distinguished pupils of Pasteur. For several years the Pasteur Institute was maintained at almost the sole charge of Dr. Gibier, who has an extensive practice among the Franco-American population of New York. At length a subscription was raised and the present fine building erected. The institute is five stories high and is built of brick and stone. The building is constructed on scientific principles and all the latest improvements introduced in the laboratories of Pasteur, Charcot and Brown-Sequard have been adopted here. Bedrooms for patients who pay and for those who are treated gratuitously are provided in sufficient number to accommodate the maximum number of patients who have already been treated at one time. On the roof are rooms built of asphalt, to contain the rabbits and other animals used in experiments. Various medicinal baths are also provided. Dr. Gibier came to the United States in 1888 to study yellow fever. In New York the following year it was proposed to him to establish an anti-rabie and bacteriologic institute, and the present fine building is a just recognition of the value of his labors.

A NEW STEAM TURBINE.

Steam has been found to be the medium best adapted for converting heat into mechanical work; its low price, simple means of production, good chemical qualities, the ease with which it is reduced to a liquid state and the comparatively small dimensions of the appliances needed, have caused its decided preference to other gases. During several generations work has been progressing in all civilized countries for the development of the steam engine; and yet invention in this field is far from having reached perfection. Each year the consumption of steam per horse power is reduced by a fraction; each new number of the technical journals brings information of new and improved constructions of steam engines. Every constructor of engines knows that here is a vast field for the persevering work of man. To this the results of the last decade bear testimony.

Concerning the theoretical conditions for a favorable conversion of heat into mechanical work, viz., high initial temperature and high pressure, the possibilities of their being accomplished in the steam engine are very limited. The strength of the boilers is even now put to severe tests by the high pressure, and the sensitive parts of the engine cannot endure the high temperatures which might be desirable. The sides of the cylinder, being alternately heated and cooled, communicate to the steam an average temperature which is lower than that of the live steam, and the consequence is a rapid condensation and consequent loss of energy during the period of admission of steam. Efforts have been made to overcome this difficulty by surrounding the cylinder with a steam jacket, or by dividing the expansion into several cylinders, in order to reduce the variations of temperature and the consequent total condensation to a minimum. Thus compound triple and quadruple expansions have been evolved, necessitating more movable parts of machinery and increasing the passive resistance. It has long been the aim of inventors to effect the expansion of steam necessary for economy of fuel by means of less complicated machinery and to avoid the oscillating movement. For the results attained through the investigations of one of them we will give an account below.

De Laval's steam turbine, which forms the subject of our first page illustration, is in principle exactly similar to the well-known axial jet turbine for water, being so arranged that the steam has acquired the same pressure as the surrounding atmosphere before reaching the turbine wheel, thus converting its entire capacity for work into momentum.

The steam passes between the blades of the turbine at a constant relative velocity and in a clear jet, without any disposition to further change its pressure or specific gravity. The consequence is that the movement of the steam in the turbine is according to the same laws as for water, and the blades of the turbine can, therefore, be constructed in the same manner as if designed for water.

Some idea of the size of the steam turbine may be obtained by reference to the lower figure of our first page engraving, which represents, actual size, the wheel of a twenty horse power steam engine now running at the World's Columbian Exposition, at Chicago, driving a duplex dynamo. This wheel is journaled in a steam-tight casing, in which are located the nozzles supplying steam to the turbine. The blades against which the steam strikes are made thin at the edge to reduce the resistance to the flow of steam. In this turbine steam is expanded to the pressure of the surrounding medium before arriving at the blades. This expansion takes place in the nozzle, and is caused by making the sides of the nozzle divergent. As the steam passes through the nozzle its volume is increased in greater proportion than the cross section of the jet, thus causing an increase in velocity. With an initial pressure of seventy-five pounds, and an expansion to the pressure of one atmosphere, the final velocity of the steam is about two thousand six hundred and twenty-five feet per second. If the expansion is continued to the pressure of one-tenth of an atmosphere, the resulting velocity will be about four thousand six hundred feet per second. It will thus be seen that expansion is carried much farther in this steam turbine than in ordinary steam engines.

The wheel is made of steel, the blades being cut out of the solid material by means of a milling machine. A steel ring is shrunk on the periphery of the wheel to prevent the steam from passing over the ends of the blades. It also serves to oppose the tendency of the turbine to act as a fan.

With the greatest possible care, it has been found difficult to perfectly balance the wheel. To meet this difficulty the inventor has placed the wheel upon a flexible shaft, so that the turbine when running at a high rate of speed adjusts itself and revolves on its true center of gravity, the center line of the shaft meanwhile describing a surface of revolution. If the shaft were rigid, the vibrations of the turbine wheel would be communicated to its bearings, which would heat and be liable to cutting.

The turbine wheel shaft extends into the gearing box and carries a pinion, 3, as shown in the detached view of the wheel and shaft. This pinion, which is double, engages a double cog wheel in the box, the pinion on the turbine shaft being one-tenth the diameter of the driven wheel, so that the speed of the latter is one-tenth of that of the turbine wheel, or two thousand revolutions per minute.

In the gearing box of a larger turbine the speed is reduced from 30,000 revolutions to 3,000 by means of a driver on the turbine shafts which set in motion a cog wheel of ten times its own diameter. These gearings are provided with spiral cogs carefully cut and placed at an angle of about 45°. On account of the high velocity, all tensions caused by the transmission of power are very slight; consequently, the cogs can be quite small, which is one of the conditions for even running of the gearing. The shaft of the larger cog wheel, running at a speed of 3,000 revolutions, is provided at its outer end with a pulley for the further transmission of power.

The turbine box of the large machine contains eight nozzles, of which four can be opened or closed by means of independent valves, according to the power required. The more exact regulation is effected by the governor. The turbine, therefore, can be made to work at the same pressure and degree of expansion even if the effect is varied as 2 : 1. The nozzles are easily accessible for removal and exchange, if required. The journals and gearing are lubricated from the oil cups on top of the gearing box. This machine is intended to work with condensation. A vacuum is obtained by means of any ordinary condenser. The nozzles are strongly divergent toward the opening, and the entire turbine box made perfectly tight.

The speed of the turbine is controlled by a very sensitive governor on the shaft of the larger gear wheels.

The segment weights or wings are movable on knife edges with the least possible friction. When the governor revolves, the weights diverge their inner ends, push a pin forward, this pin in turn causing the cut-off of the steam through the movement of a balanced valve in the steam supply pipe at the top of the turbine. A spiral spring inclosed in the governor keeps the weight in a state of equilibrium at a speed of 3,000 revolutions. It consequently corresponds to the weight of the collar on pendulum governors. The exhaust steam is taken from the center of the turbine box.

This turbine is applied to all uses to which ordinary reciprocating engines are applied, but in the running of dynamos, and in other uses requiring uniform speed, it has proved itself superior to reciprocating engines.

This engine is on exhibition at the Swedish Section, K 22, Machinery Hall, World's Columbian Exposition, Chicago, where the inventor, Dr. Gustaf de Laval, is represented by Mr. Reinh. Hornell.

Working Harveyized Armor Plate.

The naval authorities are experiencing difficulty in preparing the Harveyized armor plates for use. Although the Harvey plate has beaten all others, as is generally conceded, it is a question whether the plates can be successfully fastened to the vessels without impairing their high efficiency. The Harveyized plates are so much superior in hardness to plain and nickel steel plates that the tools used heretofore are useless. The armor for the Maine has recently been supplied by the Bethlehem Company, but the constructors have not as yet discovered any feasible method of fastening on the armor without cutting out spaces and drilling to fasten the plates to the side. With the Harveyized plate the tools will do the cutting after the steel has been softened. It is believed that this local softening of the steel will weaken the steel so that its qualities will be reduced to those of nickel plate. Another point is also brought forward: the late Mr. Harvey received $96,000 for the right to use his process, and the department is also paying a royalty of one cent a pound for all Harveyized plate, so that the new armor plate is already very expensive and will be doubly so if certain parts require to be re-treated. The matter is being investigated, and it is hoped that some method will be devised for putting on the armor plate without the necessity of an expensive operation which doubtless injures the value of the plate.

A WATERPROOF preparation for coating walls, paper, and other fabrics, and water supply pipes. The composition is manufactured by dissolving shellac or resin in methylated spirit with application of heat. To the partially cooled solution lead carbonate and carbolic acid are added.