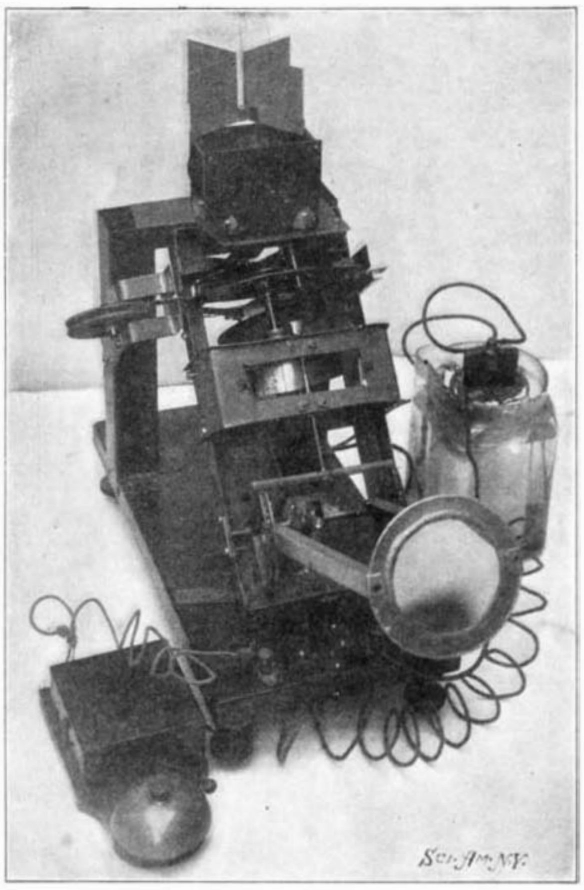
AN INSTRUMENT FOR INDICATING MEAN ASTRONOMICAL NOON.

BY EMILE GUARINI.

The time that separates two successive passages of the sun across the meridian is not always the same. Except for four days of the year there is always a



INSTRUMENT FOR INDICATING MEAN ASTRONOMICAL NOON.

difference between the time of an accurate clock (mean time) and the time indicated by a sun-dial (true time). This difference is called the time equation. On February 10, in France, the equation shows a retardation of 14.5 minutes, and on November 3 an advance of 16.5 minutes, a total difference, therefore, of 31 minutes. Since 1891, the time of Paris has been the legal time of France. It follows, therefore, that cities lying to the west or east of Paris would have to add to or subtract from the local time in order to legalize their timepieces. It is the purpose of the apparatus illustrated in the accompanying engraving to effect this correction in the equation of time automatically, and to indicate the exact moment when the sun reaches the meridian.

The apparatus consists of a substantial base plate upon which is carried a frame pivotally mounted on an axis parallel with that of the earth. At right angles to this frame a lens holder is carried, hinged at its lower end and provided with a lens, the focal point of which lies exactly on the line joining the pivots of the first mentioned frame. A clock train is disposed on the frame to the west of the meridian, in such a manner that its weight will always tend to bring the frame to this side. It will be observed from the illustration that the lens holder is operated from this clock train by chains, the movement being so timed that the lens keeps pace with the sun on its journey through the heavens. The lens has two movements, the one from east to west, the other from side to side around the pivots of the frame, both movements being automatically controlled from the clock train, and both being so timed that the rays of the sun are constantly received by the lens.

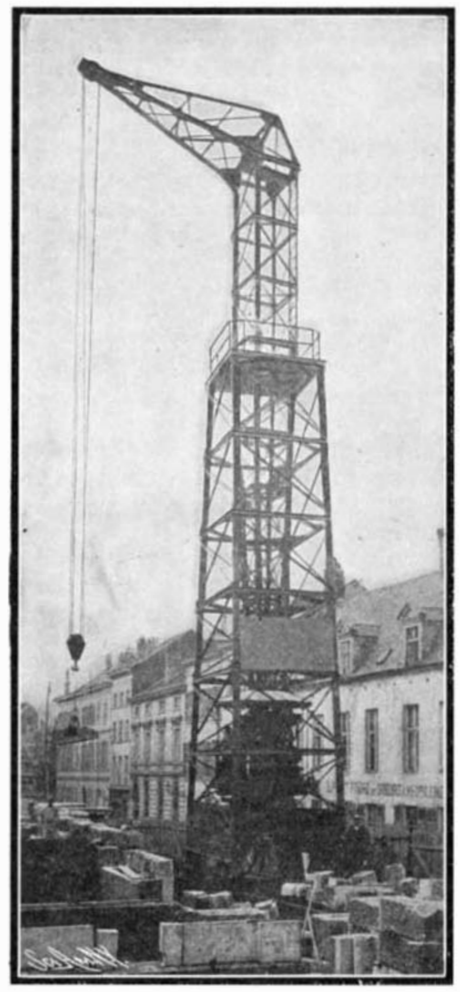
At Paris the true noon agrees with the mean noon on the 16th of April, the 15th of June, the 1st of September, and 25th of December. On these days the frame inclines neither to the right nor to the left, and the focal axis of the lens lies exactly in the plane of the meridian. When the sun crosses the meridian after mean noon, the lens, by inclining to the right, is alined with the sun before true (solar) noon; and when the sun crosses the meridian before mean noon, the lens inclines to the left and is not in line until after its passage of the meridian. The focal axis is thus displaced by a total angle of 7 deg. 42 min., corresponding to a difference of 31 minutes of time. In this double motion of right ascension and declination, the focus of the lens is always projected at the same point.

At the point where the rays are concentrated is placed a small barometric chamber of a U-shaped tube containing mercury and ether. Two insulated iron wires descend to the mercury and are connected with one or more electric bells placed at any suitable distance. When the focus falls upon the chamber the ether expands and acts upon the mercury, which, in contact with the naked extremities of the wires, completes the circuit, thus ringing a bell, and indicating mean noon.

The apparatus may be installed at any point whatever of France after regulating it once for all by means of the leveling screws. A very ordinary clockwork movement is sufficient, since a variation of one hour a day could not possibly vitiate the result.

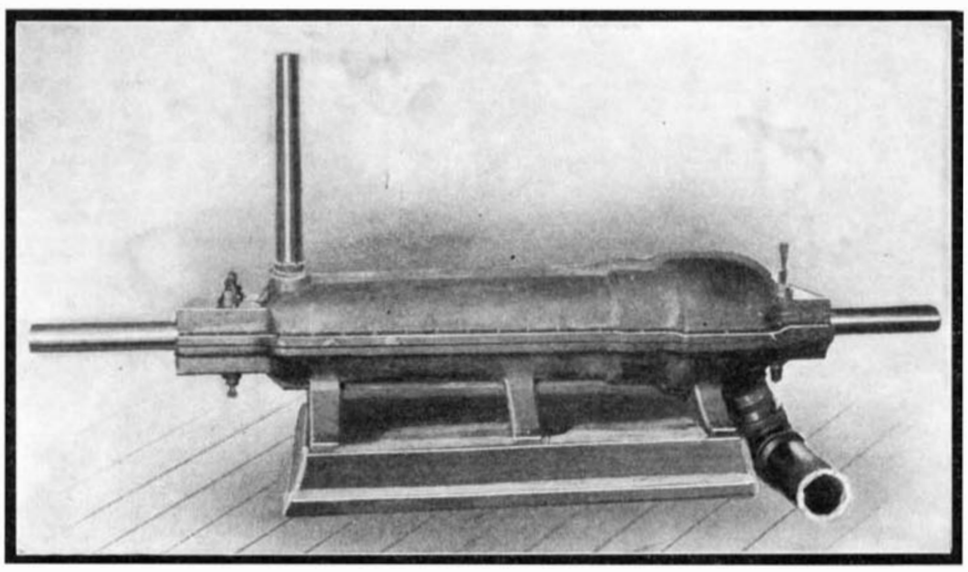
NEW STEAM TURBINE.

A patent has just been granted to Mr. Morgan D. Kalbach, of Lebanon, Pa. (Box 381), on a steam turbine of novel construction. The turbine is so designed as to secure the greatest expansion of steam and the utmost velocity possible in an apparatus of this class. One of our illustrations shows a portion of the turbine broken away to show detail. From this it will be observed that the turbine casing is made up of two sections bolted together and formed to provide a series of connecting cylinders of gradually-increasing diameter. Shoulders are formed at the end of each cylinder between which a series of partitions are held. At the inlet end of each cylinder a partition, *A*, is placed and the remainder of the space is taken up with a series of stationary disks or partitions, *C*. The partitions *A* and *C* are keyed to the casing so as to prevent them from turning. They are formed with annular flanges which overlie a series of rotating disks, *B*, interposed between them and keyed to the turbine shaft. The partition, *A*, is formed with a

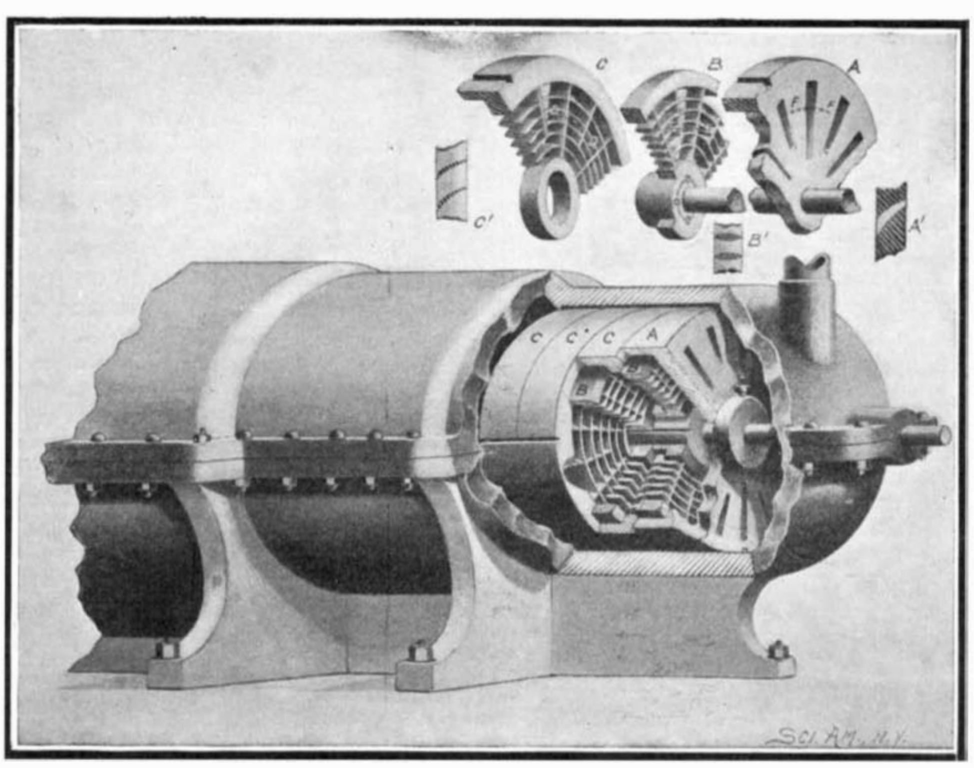


NEW GERMAN TOWER ELECTRIC CRANE.

series of radial steam ports whose cross section is curved as shown at *A'*, which is a section on the line, *F F*, of Fig. A. These ports, it will be observed, gradually widen inwardly or toward the left, so that the velocity of the steam jet will be increased by reason of its expansion therein. The curved ports direct the jets at an angle against the blades of the disk, *B*, causing it to rotate. The shape of the disk *B* is indicated at Fig. B and section *B'*, which is taken on the line *E E*. The steam next encounters a partition, *C*, similar to disk *B*, but formed with curved radial vanes, at shown at *C'*, which is a section on line *D D*. These blades direct the steam at an angle against the blades of the next rotating disk, *B*. It will be observed that the segments inclosed by the radial vanes of the disks *B* and *C* are subdivided near the circumference by shorter radial arms. After traversing one cylinder, the steam passes to the next, which is shorter, but of larger diameter to allow for expansion, and so on until the discharge pipe is reached. By constructing each partition and each rotating disk in a single piece, the inventor is enabled to make the vanes very light, without reducing their strength, and much more so than in constructions where separate vanes are employed, and by subdividing the disks as the diameter increases, he is enabled to increase the surface area on which the steam can impinge.



GENERAL VIEW OF THE NEW TURBINE.



NEW TURBINE WITH CASING BROKEN AWAY TO SHOW DETAIL.

A NEW GERMAN TOWER ELECTRIC CRANE.

BY FRANK C. PERKINS.

The accompanying illustrations show the details of construction, as well as a general view of a most interesting electrically operated tower crane constructed at Karlsruhe, by the Gesellschaft für Elektrische Industrie. The extreme height of the crane is 24.75 meters. The total height to which the hook may be raised is 23.5 meters, and the length of the arm or jib is 6 meters. This crane is designed to carry a load of 15,000 kilogrammes and the speed of lifting with a load of 10 tons is 5 meters per minute, and with 3 tons 17.5 meters per minute. The crane is shown in operation in the city of Belgium, where a large armory is being constructed. The crane operates upon a track several hundred feet in length, the gage of the track being about 12 feet, or 3.25 meters. It is utilized for handling the large blocks of stone, carrying them from the cars on which they are transported to the building, and located where desired at the place of construction. The crane is operated by three electric motors, one of which is utilized for moving the tower crane on the rails, the second for turning the crane, and the third for raising or lowering the load. This type of tower crane is most economical in its operation, and entirely does away with the expensive scaffolding required in the construction of buildings within the capacity of the crane. It is stated that a new crane of this type is being built which will be about 120 feet in height, and will be of great service in the construction of high buildings. The crane of the tower type, it will be noted, not only takes the place of the scaffolding usually required, but also takes the place of the hoisting apparatus, doing its work vastly quicker and cheaper than it can possibly be done by old methods. It is of great importance in use on docks, and is designed to withstand great pressures and to resist the greatest wind velocities with ease. It may be operated on grades varying from 1 to 4 per cent, and is very stable in spite of the small gage of the track.

It is well known that the employment of electricity as a motive power has caused quite a revolution in the arrangement and working of cranes, hoists, and other apparatus used at various factories and works, as well as at docks and harbors. The application of electricity as a motive power has been of great advantage in connection with the operation of traveling cranes, as well as other forms of hoisting apparatus. The starting of cranes has been greatly facilitated by the use of electric current, and the relatively small weight and small space of the electric motors required for the different movements of the crane, has been of course of great advantage.

While it is true that hydraulic cranes are also driven from one central station, the power conductors consist of rigid inflexible piping, in many cases, which makes the crane almost, if not quite, stationary. The hydraulic crane has by no means the economical working of the electric crane, the consumption of water, and therefore of the power, being in proportion to the height to which the weight is raised, or to the length of way, and not in proportion to the work done. It will thus be seen that with the hydraulic crane, the expenditure of power remains at about the same high rate, whether heavy loads or light loads are handled. There is also the great danger with hydraulic cranes in case of very cold weather, where the pipes and other apparatus are exposed to hard frost. For traveling cranes, the hydraulic method is almost useless on account of the great difficulty met with in supplying the necessary power.

When steam cranes are employed, it is necessary to supply not only a steam engine and a boiler, but a fireman as well, and although long intervals may intervene between the operations of the crane, nevertheless its steam must be kept up all the time, thus wasting considerable fuel, and reducing the economy of operation. It is also necessary to employ the same steam engine for the several movements of the crane, as the use of three engines for the three principal movements of the crane would be excessively costly, to say nothing of the large amount of space which would be necessary. Even with a single engine, the amount of space required is excessive on account of the mass of complicated driving gear required in order to obtain the different movements. It is these reasons that render it more desirable under many conditions to operate cranes by electricity than by the compressed-air hydraulic, or steam methods.

PUMPING MACHINERY AT THE ST. LOUIS FAIR.

BY THE ST. LOUIS CORRESPONDENT OF THE SCIENTIFIC AMERICAN.

The wide variety and great total capacity of service rendered by the Worthington pumps at the St. Louis Exposition call for special mention. Three large rotary pumps, each designed for a capacity of 35,000 gallons per hour against a head of 159 feet serve to supply the Cascades in front of Festival Hall with water; each of these is driven by a 2,000-horse-power Westinghouse motor. In the boiler room there is installed a double row of fourteen 1,000-gallon Underwriter fire pumps which serve the mains for the entire fire protection of the Exposition grounds. Then follow the three 24-inch turbine pumps for circulating water in the power house. Here also are four boiler feed pumps, two of the vertical and two of the horizontal type, which serve the whole of the boiler installation in this building. There are also four 24-inch centrifugal pumps for handling the entire sewage of the Exposition grounds. Ranged along one side of the power house are the three centrifugal pumps with their engines direct-connected, which are shown in one of our front-page illustrations. Two of these pumps are constantly in service, with the third in reserve. One of the two in service delivers water to the cooling towers outside the building, and the other is the circulating pump for the surface condensers of the four large Westinghouse engines in the Machinery Building. Each of these three units consists of a Westinghouse high-speed compound engine, high-pressure cylinder 18 inches, low-pressure cylinder 30 inches in diameter, and a common stroke of 16 inches, steam pressure 150 pounds, and revolutions per minute 240, direct-connected to a centrifugal pump of 20,000 gallons capacity. The wheel of these pumps is 6 feet in diameter and both suction and delivery pipes are 2 feet in diameter. Another illustration shows two horizontal air pumps manufactured by the Laidlaw-Dunn-Gordon Company of Cincinnati. The larger pump shown to the left of the illustration has steam cylinders 13 inches and 24 inches diameter, air cylinders 22 inches and 14 inches diameter and a common stroke of 24 inches, both steam and air working compound. The capacity is 1,300 cubic feet of free air per minute against 100 pounds pressure. The smaller pump has steam cylinders 13 and 20 inches, and air cylinders 20 and 12 inches diameter and 12-inch stroke. Its capacity is 520 cubic feet of air per minute against 100 pounds pressure.

Correspondence.

The Catalpa Tree Again.

To the Editor of the Scientific American:

I have read a few articles in your paper in regard to the catalpa tree. While some, no doubt exaggerate its merits, I am disposed to believe that Mr. S. E. Worrell has as much underestimated it as others have overestimated it.

I have on my place a lot fenced with catalpa posts in the spring of 1886. In the spring of 1903 I rebuilt the fence, using the same posts but reversing the ends. Only about 10 per cent of these posts had rotted off. Catalpa contains an oil which prevents it from rotting internally. Above ground it wears away from the weather, and in the ground it takes a slow surface rot.

As to the growth: In the fence spoken of there was a small, round post from which a small bud put out at the ground and grew. This is a tree now, measuring fifty-four inches around or eighteen inches through, in eighteen years. This tree is on medium upland. It has a large top, but no larger than an oak or other trees under the same circumstances. Catalpa grows best on rich, moist bottom land. It should be planted about 10 x 10, or 400 to the acre, so that they will be slender. West Tennessee contains thousands of acres of bottom land which overflows so badly that it cannot be relied on for cultivation and can be bought cheap.

While speaking of timber and its lasting qualities, I wish to mention red mulberry and black locust. In the year 1867 my father planted a red mulberry gate post. In 1897 the post was taken up and moved and was rotted about one inch on the surface in the ground.

In the year 1877 three black locust trees were cut in my grandfather's yard. Twenty-seven years have passed and the stumps are so sound that one cannot shake them with a sledge hammer. Black locust is of slow growth but sprouts profusely and grows very thick and slender and roots deep in the clay.

In another article Mr. Dennis appears to be mystified as to the influence of power. In grinding corn it is generally admitted that the old-fashioned water mills make better meal than the modern steam mills. These water mills as a rule were of small power and used large rock (or burr) at a slow speed and ground from three to ten bushels per hour. The modern steam mill uses a small burr at a high speed—often a cast burr at almost the speed of a buzz-saw—and putting through it about twenty bushels per hour, the burr, meal and all around gets hot and the meal is ruined. W. R. Crawford.

McKenzie, Tenn.

Effect of the Sun Upon the Black Race.

To the Editor of the Scientific American:

It has always been a matter of much satisfaction to the scientist and the strongest corroboration of the truth of his conclusions, that his discoveries are immediately appropriated by co-workers in other fields and used in explanation of hypotheses or of demonstrated facts, independently discovered and frequently very remote in their general bearing. In this way, the chemist and the physicist have been the strongest supporters of the physiologist: the paleontologist and the biologist are mutually sustaining each other's theses; and the phychologist is both giving to, and accepting from, each of the other fields of organic science. All this is, of course, precisely what any believer in universal truths might expect and of itself is hardly worthy of comment. Yet such an expectation only serves to increase the rudeness of the shock which comes from what seems to be a direct contradiction between an existing fact in nature and a natural law so fully demonstrated as to be beyond question as regards its validity. This seeming contradiction expresses itself in the fact of the existence of the dark-skinned races in the tropics, and the physical law which asserts that black is a poor reflector, and consequently a good absorber of heat. Of both the fact and the law in its general bearing there is little need here of demonstration; for no black race is, I believe, indigenous to regions outside the tropics, and none of the whitest races to regions within them; on the other hand experiments with blackened thermometer bulbs and with different colored cloths upon the snow under the influence of direct sunlight as well as our experiences with black and with white clothing and shoes need only be alluded to in support of the law of absorption of heat. Why, then, is my query, are the black races placed in such relation to the sun's rays as to be most affected by them? And why did not nature compensate for the effects of color by placing them near the poles? It would, of course, be but begging the question to answer that the black races have in other ways been made more immune to the effects of heat by modifications in metabolic processes of life. It still remains to be shown why nature should have put herself to the trouble of accentuating an evil which must be corrected at some expense of energy. Seemingly the law of the survival of the fittest might have been just as potent in the racial elimination of pigment from the skin as in the elimination of any other unfortunate variation. Yet in accordance with what we know of the laws of the reflection of heat, the sensible effect of direct sunlight upon the negro should be more intense, by several degrees, than upon the white man. Why is it?

Edwin Grant Dexter,
Professor University of Illinois.

Urbana, Ill., August 1.

The Current Supplement.

The current Supplement, No. 1494, opens with a very full description of the Westinghouse exhibits at the St. Louis fair. Excellent pictures, especially taken for the Scientific American, accompany the text. Still other articles relating to the fair, which will doubtless be of interest, are those describing the State of Washington's building; the exhibit of war material, Mines and Metallurgy Building. All these articles are fully illustrated. W. N. Best, in an article entitled "The Science of Burning Liquid Fuel," gives much instructive information. "A Home-Made Water Motor of One-quarter Horse-Power" is the title of an illustrated article that will surely appeal to amateur mechanics. Walter W. Curtis outlines the history of timber treatment. An interesting paper on steel axles, read by J. L. Replogle before the Western Railway Club of Chicago, is abstracted. The English correspondent of the Scientific American describes a new process of manufacturing silicate-of-lime stone from sand. Lord Rayleigh recently delivered at the Royal Institution of Great Britain an admirable lecture on shadows. This lecture, revised by the author, is published in the Supplement, together with all the illustrations of which Lord Rayleigh made use.

Dr. H. R. Mill, of London, in a paper read before the British Association, dealt with some difficulties experienced in the preparation of the rainfall charts for the United Kingdom which he exhibited. Many observers were wanted. The organization installed by the late Mr. Symons had splendidly developed, and they had now over four thousand, mostly voluntary, observers, of whom three hundred might change every year. The records extended over thirty and more years, but in some parts, especially in the north, they had very few gages. To arrive at average mean rainfalls over large areas, they had to allow for the different distribution of the stations, for the different lengths of the records, and the configuration of the country. It was very difficult to determine the average fall for any particular day; in that case the hours of readings and the methods of entering had to be considered, in addition to other points. When averages for the whole year were computed, some of those difficulties became less serious; but the unequal lengths of the periods of observation, and the absence of raingages in certain districts, made the results uncertain. There were such gaps in Wales, and, though he understood the prejudices against piling up data, we wanted more information. Collective continuity helped us over inaccuracies. Dr. Mill suggested several methods, including composite photography, for compiling his new maps, and it was the methods which he hoped to have discussed. The discussion by Messrs. W. Marriott, Assistant Secretary of the Royal Meteorological Society, W. G. Black, of Edinburgh, J. Hopkinson, of Watford, Prof. Turner and others, turned more upon details and the reliability of observers, however. In replying, Dr. Mill remarked that he wished that all the stations were as splendidly equipped as the Southport station.