amine. The stoppage is effected by the hand of the observer. The same electric current also causes datum points to be marked upon the paper that permit of mathematically ascertaining the instant at which an observation should be made; for example, when the passage of a wheel is occurring at a precise point.

The curves that are obtained upon the paper are much finer than would be expected, in view of the slight variations in length observed. We give herewith two specimens of the tracings, reduced to a small scale, and showing a registering that has occurred during the passage of trains and locomotives.

Fig. 4 relates to an observation made upon a Zove's iron sleeper placed under a rail over which passed, first in one direction and then in the other, a four wheeled locomotive and its tender. It will be seen that one of the wheels, which was more loaded than the other, has produced greater stresses.

In the original, as one millimeter of ordinate represented a stress of 0·12 k. (4·54 ounces) per square millimeter, we conclude therefrom that the iron has undergone during the passage a maximum stress of $0{\cdot}12 \times 75 = 9$ kilogrammes (19·85 pounds), due to the first wheel of the engine, a little less for the second, and then a stress of 4·92 k. (10·85 pounds) per millimeter,* due to the tender. After the passage, the stress has disappeared with the elongation of the metal.

Fig. 5 gives a tracing produced by the instrument fixed to one of the terminal lattice bars of a bridge girder during the passage of a freight train pushed by an engine. The

Figs. 4 and 5.—SPECIMENS OF THE CURVES OBTAINED.

train having come on slowly and then stopped, the pencil has traced a but slightly varied curve. It seems that during this time an equilibrium was established quite slowly. There will be observed two sudden projections of the curve, due to the machine being momentarily out of regulation; but when the train began to move again it will be seen that there occurred variations due to the successive passage of the wheels at the point corresponding to the diagonal. We can perceive quite clearly (and better yet in the original tracing) every car that is passing. Then finally comes the locomotive, which produces a maximum stress; and after this the bridge, being entirely unloaded, gives no further tracing of the weight that has just left it.

The apparatus is not limited in application to fixed pieces, but, in spite of its apparent delicacy, may be attached to the connecting rods of locomotives, in order to register the alternate tensions and compressions to which they are submitted.—*La Nature.*

The Proposed Saharan Sea.

With reference to the daring French project for flooding the desert of Sahara with what would be virtually a new sea, it may be well, says *Engineering*, to recall the opinion expressed by M. Elisee Reclus, that at one period in the world's history the desert was covered by a sea very similar to the Mediterranean, and that this sea exercised a very great influence upon the temperature of France, as comparatively cold —or at any rate cool—winds blew over it, while now the winds which prevail in the great expanse are of a much higher temperature, and are, in fact, sometimes suffocatingly hot. The appearance of the desert seems to support the theory of M. Elisee Reclus, that it was at one time the bed of a sea of considerable extent, of which the great inland African lakes recently discovered are possibly the remains.

The present vast extent and configuration of the African continent would also appear to support the conclusion that at one time it comprised a less area of land than it does at present. The serious question which arises, assuming that the theory of M. Elisee Reclus is substantially correct, is, What will be the effect of the creation of a second African sea in the room of that which has disappeared? Would the temperature of France, and possibly even of England, be again reduced? It is a geological theory that in the glacial period of the world's history Great Britain was covered with ice and snow very much as Greenland is at present. Some great influences must clearly have been brought to bear upon France and Great Britain, which rolled the ice over so many hundred miles northward. What was this influence? Was it the large African sea which French enterprise is endeavoring to recreate? If it were, we should say that whatever the French may gain in Africa by the realization of a Saharan Sea would be much more than counterbalanced by what they would lose in France itself.

* Approximately, 1 millimeter = $\frac{1}{25}$ of an inch.

THE NEW ORLEANS EXPOSITION.

This great enterprise, illustrated on our first page, has steadily grown in proportions from the day of its inception to the date of opening. Originally proposed by the Cotton Planters' National Association in October, 1882, to signalize our first exports of cotton one hundred years ago this fall, the plan was successively enlarged to cover also a National and International Industrial Exposition, as the importance of cotton itself, in all its relations to the commerce, the industries, and the general well being of the world, seemed to grow upon the minds of the originators of the project.

With this also there has undoubtedly been a great deal of patriotic emulation among the people of the Mississippi Valley and of the far West, as well as of the entire South, to make this exhibition as pronounced a success as possible, in order thus to promote trade relations with Mexico, the West Indies, and Central and South America, which at present seem to afford the most promising fields for enlarging our foreign commerce.

The main exhibition building, which it was at first supposed would cover all requirements, is of the enormous size of 1,378 by 905 feet, or embracing an area of 33 acres, while the area of the main building at the Philadelphia Exposition of 1876 was only 20 acres. In this New Orleans building there are no partitions, and the interior is surrounded by wide galleries, 23 feet high, supported by the piliars which also support the roof, the latter being mostly of glass. The machinery department occupies a space 300 feet wide for the whole length of the main building, but this has been found insufficient, and large extensions have been made necessary by the great number of applications for space in this section. In the center of the main building is the Music Hall, with chairs enough to accommodate 11,000 people, a platform for 600 musicians, a mammoth organ, etc.

A special building for United States and State exhibits is 885 by 565 feet in size. Congress, besides loaning the management $1,000,000 to forward the enterprise, has made liberal appropriations for a most thorough representation of the leading departments of the government. The department of State will show here samples of cotton, wool, and other fibers, and their products, from all parts of the world. The Post Office department will show all the modern improved facilities in this branch of the public service, besides having working offices on the grounds. The Treasury will exhibit the work of the coast survey, lighthouse, and customs service, engraving, printing, etc. The War Office will make an imposing display of arms, ordnance, engineering, medical, surgical, and hospital service; while the Navy, the Interior, and other departments will all be more fully represented than they ever were before at one exhibition. Collective State exhibits and a general educational display will also be located in this building.

Horticultural Hall, 600 x 194 feet, has been substantially built as a durable structure to subsequently become the property of the city of New Orleans. It has a tower 90 feet high, roofed with glass, beneath which will be a grand fountain in constant play. Around this hall will be arranged a great variety of rare tropical and semi-tropical plants, flowers, and shrubbery. Cash premiums to the amount of $32,000 are offered in this department, and the contributions thereto will be largely from Mexico, Central America, and the West Indies.

The Art Gallery, 250 by 100 feet, is an iron building, calculated for permanent use for such purpose, in its arrangements for mounting pictures, giving them the desired light, etc.

The Mexican National building, 300 by 190 feet in size, will probably afford the most prominent of all the foreign exhibits. The whole space of this building, which was specially erected by the Mexican Government for the display from that country, has been found much too small for the exhibits offered. There is to be a famous Mexican band of fifty pieces in attendanee, with a regiment of cavalry and another of infantry of the Mexican army. The Mexican Government appropriated $200,000 to further their national display here, and General Diaz, the Mexican President, announced his intention of being present at the inauguration ceremonies.

Notwithstanding that the opening of the exposition was postponed from Dec. 1 to Dec. 16, there was, as is almost always the case in such great enterprises, a good deal of dilatoriness among many of the exhibitors. This was most conspicuously the case with European participants, the principal portion of their exhibits being placed on the Great Eastern, which was not expected to leave London till Dec. 13. This great vessel, during the time of her stay here, will be not one of the least attractive features for visitors to the exhibition.

Besides the buildings above mentioned, there are several others, for individual exhibits, or as additions to those at first found too small for their original purposes, which are being and probably will continue to be erected for some weeks to come. The applications for space have, from the outset, outrun all the anticipations of the management; but the officers made every exertion to have the exposition in as complete shape as possible on the 16th of December, the day finally appointed for the opening.

The different groupings of exhibits, under which all articles wrought by man or produced by nature are classified, is as follows: 1, Agriculture. 2, Horticulture. 3, Pisciculture. 4, Ores and Minerals. 5, Raw and Manufactured Products. 6, Furniture and Accessories. 7, Textile Fabrics, Clothing and Accessories. 8, The Industrial Arts. 9, Alimentary Products. 10, Education and Instruction. 11, Works of Art.

The grounds on which the exposition is to be held consist of 247 acres, known as the City Park, about four miles from the business center of the city, and with a frontage of about half a mile on the Mississippi River, affording ready landing for steamers, besides excellent rail facilities. The temperature of New Orleans from the 1st of December to the last of May averages about 65° F., the thermometer seldom falling below freezing point, while the fields and forests retain their foliage, and nature presents a most attractive appearance to one visiting the city from the harsher clime of a northern latitude.

For the photographs from which our views are made we are indebted to Mr. E. L. Wilson, who has been appointed Superintendent of the Photography Section of the exposition, and Mr. F. C. Beach, who has charge of the Amateur Photographers' portion of the display.

Steel or Tin Plates.

A correspondent of the *Ironmonger* who has paid a visit to nearly ever tin plate works in South Wales, the principal seat of this industry, says that the trade has nearly passed through a very complete revolution, caused by the introduction of steel bars. It has been found that steel bars made by the Siemens-Martin process are fully equal to, or rather better than, the best charcoal bars made by the old process of refining iron scrap with charcoal refineries, while the price is altogether out of all proportion in favor of the steel. There are makers still using both charcoal and coke iron, but they are anxiously watching the progress of their formidable rival, and will undoubtedly find themselves obliged to abandon the manufacture of iron bars. A considerably greater number of plates can be made from a ton of steel bars than from a ton of coke iron bars, and in consequence of the greater closeness of grain and beautiful surface of the black steel plates before tinning, considerably less tin is required to make a steel plate look equal to one of iron.

Beyond strengthening some of the rolling mills, no alteration of plant is required to work steel. At present, the Siemens-Martin steel is used for bars known as charcoal bars, and the Bessemer for bars known as coke bars. The only difference seems to be a want of reliability and uniformity in the Bessemer bars, which will probably be remedied, as they sometimes come in too hard for working in the mills, and the plates will not always stand the bending test both ways. On this point there is scarcely full knowledge, and it is the opinion of some that it will take years to fully appreciate all that can be done with steel.

With reference to the alleged poisonous nature of some plates, there does not appear to be the slightest ground for supposing that the tin can be adulterated in any way without detection; and the minute black specks sometimes complained of are due to a variety of causes, which may be traced back to a few microscopical portions of manganese being left in the steel ingot. The presence of lead would be at once detected, in however small a quantity. It has been suggested that possibly terne plates may have been accidentally used for canning meat. These, being coated with a mixture of lead and tin, can be safely used for packing dry goods; but if used for wet goods or acids, would be highly dangerous. It has been pointed out that the air acting on the contents of a tin of fish might cause the formation of oxide of tin, and it appears safer to remove the contents as soon as opened to a china jar, rather than use them from the opened tin itself. Palm oil is universally used as a flux in the tinning houses. Some patent oils and a few compositions having resin as a basis have been tried, but have not made any great progress, and palm oil still holds its own. The introduction of the "Morewood" rolls in the tinning pots has quite revolutionized the system, as the coating is much more equal, while much less tin is wasted than by the old listing pot, so that all plates may be said to be coated by this process now. By regulating the speed of the rolls, the maker can arrange the amount of tin to be deposited on each plate to an almost exact nicety.

Hard into Soft Castings.

In a communication to the Academie des Sciences, M. Forquignon states that when white iron castings are heated to a point a little under that of fusion, they become transformed into gray iron. The change is due to the separation of carbon from its previous combination with the metal, and its deposition in the bulk of the casting. By careful experiments recently conducted, M. Forquignon has found the following results: He heated a number of white iron pigs for 172 hours in a stove from which the gas was carefully exhausted, and afterward analyzed the product. The iron originally contained 3 per cent of combined carbon; while the material as taken out of the experimental furnace was found to contain only 0·895 per cent of carbon in combination, and 2·061 per cent of carbon in the graphitic state. This change must have been due wholly to the slow and continued heating of the metal. It is not stated whether there was any perceptible difference between the outside and inside of the metal under treatment, which might be expected under such conditions. The process has a certain resemblance to the usual method of softening steel, in which the effect of continued heating is to decompose the mixture of pure metal and carbon.