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NEW YORK, SATURDAY, JUNE 15, 1901.

The Editor is always glad to receive for examination illustrated articles on subjects of timely interest. If the photographs are *sharp*, the articles *short*, and the facts *authentic*, the contributions will receive special attention. Accepted articles will be paid for at regular space rate.

THE GREATEST OF POWER STATIONS.

Undoubtedly the most interesting electrical installation now being carried out is the equipment of the Manhattan Elevated roads with electricity. The great power house, two hundred feet in width by four hundred feet in length, will be the largest in existence, and its compound engines will, we believe, without exception, be the largest single steam units to be found anywhere in service on land. The normal capacity of the power station will be 65,000 horse power, and the maximum capacity about 100,000 horse power. The steam plant will be made up of eight compound engines, which will be capable of running under a continuous load of 12,000 horse power each. These engines are of an entirely new type, and they are placed in pairs on each end of a shaft which carries a Westinghouse generator with a revolving field 32 feet in diameter and weighing 185 tons. The chief novelty of the engines consists in the fact that the high and low pressure cylinders are placed at ninety degrees, the high-pressure being horizontal and the low-pressure vertical. As there are two engines to each shaft, the turning moment is perfectly even, so much so that the customary flywheel is dispensed with, its place being taken by the heavy revolving field of the generator. The high-pressure cylinders are 44 inches and the low-pressure cylinders 60 inches in diameter, the common stroke being 88 inches. To find engines that will compare with these in size, we must refer to the engine rooms of some of the largest ocean steamships. The most powerful marine engines are those of the "Deutschland;" each quadruple expansion engine on this ship has indicated in twenty-four hours as high as 18,500 horse power, or 50 per cent more than the maximum capacity of the engines above described.

A COSTLY EQUIPMENT.

Apropos of the new power station of the Manhattan Railway Company, it is of interest to note that the mere electrical equipment of the rolling stock will cost just $3,000,000. Hitherto the motive power on the elevated system has been furnished entirely by steam locomotives, and the trains on the most important lines have averaged, during the rush hours, five cars in length. Under the new system the average length of the trains will be six cars, of which the leading and trailing cars will be equipped with motors. The General Electric system of train control will be used, the motor circuits on the motor cars being opened and closed by magnets which are themselves actuated by a train circuit under the direct control of the motorman. The electrically equipped experimental train, recently described in this journal, is running steadily on the Second Avenue line in this city, and valuable data as to cost of operation, etc., are being thereby secured.

RAPID TRANSIT TUNNEL TO BROOKLYN ASSURED.

Although the temporary delay to which the Rapid Transit Tunnel from New York to Brooklyn has been subjected by obstructionist tactics on the part of certain members of the Municipal Assembly of Brooklyn has been vexatious, it has served the good purpose of drawing forth from President Orr a masterly defense of the conduct of the affairs of the road by the Commission over which he presides. There is no question that President Orr's vindication will receive the unanimous approval of the citizens of Greater New York. It will be two or three months before the final survey of the tunnel is completed and the plans drawn up, but there is no reason why work should not be under full swing during the fall of this year. Without the Brooklyn tunnel the scheme would have been incomplete; but with this connection we may look for the time when the Brooklyn half of the Rapid Transit scheme will be as extensive as that in Manhattan Island, and only second to it in the density of its traffic.

THE WAVE LINE OF THE "GEORGIA."

As the result of a slight error in the numbering of the official plans which were furnished us from the Navy Department, Washington, the titles to the photographs showing the wave line of the model of the "Georgia," which were reproduced in our recent article on the model basin at Washington, are reversed. The wave line which is credited to a speed of 27½ knots actually accompanies a speed of 19 knots, and vice versa. The height and bulk of the bow wave vary, of course, with the speed, and are greater as the speed increases. In connection with these photographs, we would draw attention to the fact that the enormous piling up of water around the bow of the model at the higher speed affords a graphic evidence of the fact that the resistance to a vessel (and therefore the horse power required to drive her) increases as something more than the cube of the speed. Although surface or skin friction accounts for some of the ship's resistance, it is chiefly the displacement of the surface water in a vertical direction—the continual lifting of so much dead weight through such a height in such a time—that calls for rapidly-increasing expenditures of power at the higher speeds.

GERMANY'S FOREIGN TRADE IN MACHINERY.

The returns of the foreign trade of Germany for the year 1900, recently published, acquire particular interest from the fact that for the first time the imports and exports of machinery have been specialized. The total imports of this kind amounted to $18,639,360, an increase of $3,109,000 over the value of machinery imports in 1899. The value of the exports of machinery was $42,776,000, an increase of $500,000 during the year. As the statistics show the proportion of the import trade in machinery that comes from this country, we commend them to the attention of our manufacturers, as indicating the lines along which their efforts might be profitably expended in increasing our imports into Germany of articles which are now supplied almost exclusively by other countries. It is not surprising to learn that out of a total importation of 28,825 tons of agricultural machinery, over 20,000 tons came from the United States. Great Britain supplied a little over 5,000 tons, and the remainder was imported in relatively small amounts from half a dozen other European countries. The second largest item in the list is that of cotton spinning machinery, the imports of which amounted to 10,863 tons. As regards this commodity the conditions are entirely reversed, Great Britain contributing 9,876 tons and the United States nothing at all. Here, surely, is an industry to which our manufacturers might well turn their attention. The demand for cotton-spinning machinery is increasing rapidly all over the world, and many countries, such as Egypt, Turkey, Bulgaria and Greece, which up to the present time have imported large quantities of cotton goods, are now making a determined effort to establish cotton industries of their own. There is also a demand for cotton-spinning machinery in South America and the far East. The manufacture of cotton machinery seems to be to-day in a somewhat similar position to the tin-plate industry fifteen years ago. That is to say, it is practically non-existent, at least so far as the export trade is concerned. There is, of course, some exporting of cotton-spinning machinery to South America, but the sum total of our export trade in this most important branch of machinery is not at all commensurate with our exports in other branches of machinery. The statistics indicate that European countries place a high value upon the possibilities of foreign trade in this line, and consider that successful competition with Great Britain is quite feasible. Germany herself exported over four and a half million marks' worth of cotton-spinning machinery in the year 1900.

The imports of machine tools into Germany amounted to 6,270 tons, of which 4,757 tons came from the United States; but out of a total importation of 4,308 tons of locomotives and locomobiles our share amounted to only 189 tons, as against 3,196 tons (chiefly portable engines for agricultural work) imported from Great Britain. There is no doubt that the latter country excels in the manufacture of these engines; but there is nothing in the nature of the case to prevent the United States from supplying an agricultural portable engine which will be just as serviceable in its way as the agricultural machinery, in the manufacture and export of which this country is preeminent. Another item to which we would direct the attention of our manufacturers is that of electrical machinery, the imports of which into Germany amounted in 1900 to 4,350 tons, of which we contributed only 343 tons, as against an importation from Austria-Hungary of 2,080 tons and from Switzerland of 977 tons. We have already in these columns directed attention to the valuable work which the Budapest engineers are doing in the electrical field. Although our electrical exports to Great Britain and elsewhere are valuable and growing, it behooves our electrical manufacturers to study the possibilities of the Ganz high-pressure alternating system, which, it will be remembered, was at first adopted on its merits by the London underground roads in preference to the direct system, and was only finally rejected after a vote of a majority had been secured by those interested in the installation of the latter type.

Another export to which we might profitably turn our attention is that of weaving machinery. Out of a total of 8,184 tons, 6,138 tons were imported into Germany from Great Britain, 1,420 tons from Switzerland and nothing from this country. Summarizing the imports of lesser accounts: out of a total importation of 4,365 tons of steam engines, 1,738 tons came from Switzerland, 1,061 from Great Britain and 200 tons from the United States. Of 1,666 tons of lifting machinery, 574 tons were contributed by this country; of 1,055 tons of flour-milling machinery, 182 tons were contributed by the United States; while of 473 tons of rolling mill machinery, 77 tons came from this country.

An examination of the list of exports from Germany of machinery shows that Russia is by far the largest buyer of German goods. Thus of nineteen and a half million marks' worth of sewing machines, Russia was by far the largest buyer, as she was also of locomotives and portable engines, taking 4,024 tons out of a total export of 12,293 tons. Of 21,555 tons of steam engines, Russia purchased 5,586 tons and France 4,247 tons. The total export of electric machinery was about 13,000 tons, of which Russia again was the largest buyer, taking a total of 3,077 tons. Russia was also the largest buyer of agricultural machinery from Germany, taking about half of a total export of 13,000 tons. The exports of machine tools from Germany amounted to 9,267 tons, of which Russia purchased 2,370 tons and Austria Hungary 1,236 tons. The full figures of Germany's machinery trade are given in an article in the current issue of the SUPPLEMENT, which we commend to the careful reading of our manufacturers in the special lines to which reference has been made above.

LAWS OF ABSORPTION OF X-RAYS FOR DIFFERENT BODIES.

M. Louis Benoist has lately made a series of experiments at the physical laboratory of the Sorbonne concerning the transparence of different bodies for X-rays. In a former series of experiments he showed that these rays are not homogenous and undergo a selective absorption by the different bodies traversed. In studying a certain number of bodies it appeared that the transparence to X-rays is not entirely a function of the mass, but that the absorbent power, or *specific opacity*, increases in general with the density. He showed also that different bodies possess a property which may be called radiochroism, as it is comparable with the coloration of substances which are transparent to light, and in virtue of which the relative opacity of two bodies changes with the mass traversed and with the nature of the X-rays used, the most rapid change taking place with the denser bodies. In continuing these researches he has studied about 120 different bodies, simple and compound, and has obtained results which enable him to deduce the principal laws of transparence of matter for X-rays. A prism of paraffin, 2-5 inch square at the base, and 3 inches long, is taken as a standard; its absorption for X-rays of a determined character is measured, and the absorption of other bodies compared with it by finding the length of a prism of the same base which will give the same absorption as the standard; the mass of this prism thus determines the *equivalent of transparence* of the body. This equivalence permits of calculating the mean specific opacity of the body for the thickness corresponding to that of the standard. The measurement of these equivalents brings out some interesting results, of which the principal are as follows: First, the specific opacity of a body appears to be independent of its physical state; for instance, it is the same for water and ice, it is independent of temperature, etc. Second, the specific opacity seems to be independent of the mode of atomic grouping of the body, that is, of crystalline forms, allotropic states, etc. (allowing for differences of purity); it is the same, for instance, for anhydrous alumina and corundum, for the different forms of carbon, crystalline and amorphous, for yellow and red phosphorus, etc., also for isomeric organic compounds. Third, it appears to be independent of the state of freedom of the atoms, and the equivalent of transparence of a mixture or combination may be calculated from those of the elements which compose it (taking account of possible difference of radiochroism); thus for silicon the equivalent measures 15.7, and for oxygen 44.5, from which that of quartz is calculated at 24, corresponding to the measured value, 24.1. In another case, caustic lithia measures 57 and oxygen 44.5, giving for lithia a calculated value of 113.8, the measured value being 115. The specific opacity for X-rays, measured under determined conditions, may be considered as a prop-