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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 rates.


## ELECTRIC TRACTION TESTS AT THE WORLD'S FAIR.

One of the most valuable features of such great industrial exhibits as that now being held at St. Louis is the series of elaborate tests of machinery and general industrial appliances. These are carried out by boards consisting of some of the best-known experts in their respective departments; and the special facilities afforded, the magnitude of the plants upon which the tests are made, and the abundance of time available, render the results of the highest scientific and commercial value. Among the most elaborate of these tests are those that have been projected by the Louisiana Exposition Commission in connection with electric traction. These are to be divided into three classes. First, those which will be made in the Electricity Building; secondly, those made on special tracks laid for the purpose within the Exposition grounds; and lastly, a series of trials which will be carried out on a lengthy stretch of line outside of the grounds, to throw further light upon the question of high-speed traction. The experiments are intended to cover in a very complete way the equipment and operation of city and suburban railroads, of interurban roads, and the operation of heavy standard trains, such as run on the trunk railroads of the country. The tests that are made within the Electricity Building will be, to all intents and purposes, shop tests, the various materials and plant selected being subjected to the same inspectors and controlled by the same rules—an arrangement which will make it possible to co-ordinate and compare results in a thoroughly scientific and satisfactory manner. The tests carried on outside the building are to be made under actual operative conditions. It is expected that all the great electrical manufacturing companies will be represented, and a more complete collection of electrical plants and apparatus will be gathered together than was ever before assembled. It is hoped to supplement and carry to an even more advanced point, the valuable high-speed electrical tests made last year on the Berlin-Zossen line, when, it will be remembered, a speed of over 130 miles an hour was recorded.

## TURBINE OCEAN STEAMERS.

Although the construction of the great turbine-propelled liners for the Cunard Company overshadows in public interest every other marine turbine development just now, it is a fact that there will be some splendid specimens of turbine ocean liners in service on the high seas long before the Cunard vessels are in the water. Mention should be made incidentally of the "Turbinia," which was launched not very long ago in Great Britain, and will soon cross the Atlantic for service on Lake Ontario. Before many weeks a large ocean steamer, the "Tasmania," will be dispatched to Australia, and the Allan Line will place two turbine-driven liners in the Atlantic service of the company. Next year, moreover, a turbine-driven Cunard steamer of about half the tonnage of the 25-knot 40,000-ton turbine ships will be plying between Liverpool and the United States. Considering that the practical turbine is but a decade and a half old, this must be considered a remarkably rapid development of what is commercially considered an entirely new type of steam engine.

## NEW SYSTEM OF TUNNEL CONSTRUCTION.

Probably the most original piece of engineering work along the whole route of the Rapid Transit Subway is the tunnel which is being built beneath the Harlem River. The method adopted is, as far as we know, entirely new in a work of this character, and, like many another development in engineering, it is the outcome of local conditions of extreme difficulty which demanded some other methods of construction than those commonly adopted. These conditions arose from the comparatively shallow depth at which it was necessary to build the tunnel in order to avoid excessive grades at the approaches, and the extremely treacherous nature of the material encountered at this depth. The silt is so loose that tunneling by the Beach shield system would have been very hazardous, if not, indeed, altogether out of the question, and accordingly the contractor, Mr. D. D. McBean, hit upon the plan of driving two parallel lines of sheet piling, spaced a little wider apart than the width of the completed tunnel; bulkheading each end of the structure; and covering it with a heavy water-tight timber roof, the interior being then pumped dry of water, and the inclosed mud excavated down to grade under the pneumatic system. This was the method adopted in crossing the first half of the river on the Manhattan shore. For the second half the contractor followed the same principles of construction, but made a considerable advance in point of rapidity and cheapness of erection, by driving the two parallel walls of sheet piling, cutting them off at the level of the longitudinal axis of the tunnel, building the upper segmental half of the cast-iron lining in lengths of 70 to 80 feet upon pontoons, floating it over the sheet piling, lowering it until its flanges rested upon the piling, with which it made a water-tight joint, and letting this finished half of the tunnel serve as the roof of the temporary cofferdam. When the water is pumped out the mud is excavated to grade, the lower half of the cast-iron shell is built in place, bolted to the upper half and calked, and the tunnel is completed.

There can be no question of the economy of this method of construction over that which it supersedes; and it has the great advantage that the tunnel may be built with its upper surface practically at the highest line allowed by the War Office in navigable waterways. The vertical stability of the tunnel, a question which is causing much anxious thought on the Pennsylvania tunnel, is assured by driving along the line of the tunnel as much piling as is necessary to support the structure, this work being carried out before the lateral walls of sheet piling are put down. The question of the applicability of this system in the construction of tunnels across the East and Harlem Rivers would hinge upon the amount of interference to navigation that would be caused by the temporary staging platforms that would be necessary during the construction of the various sections of the tunnel; but it would seem that these stagings might be so widely separated as to cause but little interference with navigation.

## OUR AVAILABLE IRON-ORE SUPPLY.

The falling off in demand for iron ore and iron-ore properties last fall, incident to the slackening of general business and the curtailments by the iron manufacturers, principally the United States Steel Corporation, has in a measure obscured the real facts as to the relation of consumption to available iron-ore supply and put a damper on the wild rush for iron properties which prevailed in 1901 and 1902. The sagging in the iron trade has not changed the facts, nor have there been made within recent years any discoveries of available iron ore that will materially postpone the day when the great iron industry of the country is to be brought face to face with the problem of supplying the vast and increasing amount of ore annually consumed. About five years ago, U. S. Geologist C. R. Van Hise predicted that inside of a decade the standard of marketable ore from the Lake Superior district would be between 50 and 60 per cent of iron content, instead of over 60 per cent, the then prevailing limit. The condition has been realized in less than half a decade, and there is a prevailing opinion that an even lower standard for merchantable ore in the Lake Superior country is even now at hand. Considerable ore between 40 and 50 per cent in iron was mined at Ishpeming (Michigan) last year, and iron men no longer look away from the "low-grade" properties as formerly. This lowering of the standard has increased the available supply considerably. It has been due partly to the advantages of cheaper mining and transportation and improvement in furnace practice, but it is a certain indication of the realization by the iron consumers that there is a limit to the amount of high-grade ore in the Lake Superior district. The chief consideration in the situation is the Lake Superior supply, since from that district in 1902, 79 per cent of the iron ore production of the United States came, and in 1903 an increasing proportion. The older eastern and southern districts do not hold any large ore reserves, and the newer districts are as yet all uncertain or unavailable.

From the standpoint of the Lake Superior supply, an interesting estimation as to the available iron ore of the whole country can therefore be drawn. Estimates made by the United States Geological Survey in 1902 of the amount of merchantable ore in sight, that is ore above 59 per cent in iron, give the ore reserve in the Mesabi district as 500,000,000 to 700,000,000 tons. The aggregate of ore in sight in all the other Lake Superior districts is placed at 350,000,000 tons. Explorations since this estimate was made have not materially increased these reserves. It is fair then in the light of the present known facts about the iron-ore supply in the Lake Superior districts to place the available reserve at 1,000,000,000 tons of 59 per cent ore. With this as a basis and the figures of annual consumption as a measure, the time of the exhaustion of these iron-ore reserves can be estimated. The production of the Lake Superior mines in 1890, 1901, 1902 averaged about 8,000,000 tons; in 1893 it fell to 6,000,000. Since that time it has increased at about 2,500,000 tons a year. The production in 1902 was 27,869,000 tons, and in 1903 24,300,000 tons, to use round figures. Take this as indicating a present yearly demand for 25,000,000 tons, and allowing for no increase, the visible ore would be exhausted in forty years. Allowing for an average annual increase of five per cent, which is a fair increase deduced from the years since 1899, and is within the estimated general increase of business for the country, not allowing for the yearly enlargement of the uses of iron in all lines, it can be arithmetically computed that the available ore estimated will be all exhausted in twenty-three years!

On the other side of the question is the possibility and probability that iron ores below 59 per cent will be utilized in the near future. This will largely increase the available supply, but how much cannot be estimated, as these "low-grade" ore bodies have not ordinarily been explored. Then there is a fair certainty that new ore bodies will be located within the districts now worked for ore. These new bodies cannot be very large, nor can they affect the supply in any such manner as the finding of the Mesabi, for instance, did; but these undiscovered ore bodies are to be considered as a factor in the problem of ore supply. There is also a chance that new iron districts will be opened in this region. The new Baraboo district in Wisconsin, though not up to predictions, has added perhaps 7,000,000 tons to the available ore. Explorations in Canada on the Anticoken range and on the western extension of the Mesabi give some promise of new sources of supply. The recent discovery of a new iron district in Aitkin and Crow Wing counties in Minnesota may be of importance. These new districts, however, have not, since the discovery of the Mesabi in 1893, come up to the expectations. Notably has the Michipicoten district in Ontario failed to realize the hopes of its discoverers. The other iron ore deposits in eastern Ontario are uncertain as to extent also.

So we have a possibility that within a quarter of a century the Lake Superior mines will be unable to meet the demands for a high-grade ore.

The western deposits are a factor in the future, but most of these are at a disadvantage as to transportation. In fact, they are all cut off from the eastern consumption by the necessarily high freight costs. The consumption of iron produced in the western furnaces may supply the local demands, and relieve the demand on eastern furnaces to this extent. It is generally believed that these western deposits are not generally so extensive as claimed, and further that with depth the ore will become valueless, by reason of the increasing sulphur content from the sulphides from which all of these ore bodies, except perhaps those in Wyoming, are derived. The iron ore in Mexico may be an important factor at no distant date. The deposits available to the Pacific Ocean are now being secured by American capital as a supply for proposed furnaces at American Pacific ports, and an iron property near Vera Cruz is preparing to ship ore to the Atlantic ports, to be consumed with the relatively small amount of Cuban ore now imported for this market.

But the fact is, that but for the bountiful supply of cheaply mined and transported ore from the Lake Superior districts, the wonderful progress of the country in industrial lines would not have been possible, and it will be necessary to figure on the day when the Lake Superior supply will be exhausted or be of a lower grade, except as to reserves held by special interests. Since the United States Steel Corporation controls more than 70 per cent of the visible ore in the Mesabi district, all of the developed mines in the Vermilion district, 60 per cent of the Penokee-Gogebic district, and 50 per cent of the Marquette and Menomonee districts, the problem for the independent consumer of ore is made more imminent than the general considerations indicate.

## ON SOME NOVEL N-RAY PHENOMENA.

Prof. Blondlot actively continues his investigations of N-rays, and in a paper recently read before the French Academy of Sciences, we note some interesting facts. The author some time ago observed that sources of light under the action of N-rays would show an increase in brilliancy. Now, Blondlot thought it interesting to ascertain whether the same phenomenon occurs in the case of a body reflecting the light from an external source or from an illuminant proper. The following experiment was accordingly made: A ribbon of white paper, 15 millimeters in length and 2 millimeters in breadth, was fixed vertically to an iron-wire support. The room being darkened, the paper ribbon was feebly illuminated by a lateral beam of light emerging from a vertical slit in a box inclosing a flame. The N-rays from an Auer burner, traversing a rectan-