SCIENTIFIC AMERICAN

ESTABLISHED 1845

MUNN & CO., - - Editors and Proprietors

Published Weekly at

No. 361 Broadway, New York

TERMS TO SUBSCRIBERS

One copy, one year for the United States, Canada, or Mexico $3.00
One copy, one year, to any foreign country, postage prepaid. £0 16s. 5d. 4.00

THE SCIENTIFIC AMERICAN PUBLICATIONS.

Scientific American (Established 1845) ....$3.00 a year
Scientific American Supplement (Established 1876) .... 5.00 "
Scientific American Building Monthly (Established 1885)........ 2.50 "
Scientific American Export Edition (Established 1878).. .... 3.00 "
The combined subscription rates and rates to foreign countries will be furnished upon application.

Remit by postal or express money order, or by bank draft or check.

MUNN & CO., 361 Broadway, New York.

NEW YORK, SATURDAY, APRIL 16, 1904.

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.

TURBINE ENGINES FOR THE NEW CUNARDERS.

Great interest attaches to the announcement that the Cunard Steamship Company, guided by the expert commission which was appointed to investigate the subject, have decided to install turbine engines on the two large passenger steamers which they are about to build with the assistance of the British government. The readers of the Scientific American were prepared for this announcement by the article which we published a few months ago in which, by the courtesy of the local representative of the company, we were enabled to give the leading dimensions of these great ships, and state that in all probability the decision of the committee would be in favor of the turbine.

The announcement is a most momentous one, and by many engineers and steamship men it is considered that the company has shown great daring in applying the turbine to engines which will probably indicate when pushed to their maximum capacity, about 75,000 horse-power. It is argued that the success of the turbine on small river and cross-channel steamers of not over 1,500 to 2,000 tons displacement does not guarantee its success when applied to vessels of such an unprecedented size as these new Cunarders. The Scientific American has never shared any of these doubts. Indeed, we have always urged that there were no complications, no novel conditions, to limit the usefulness of the turbine if it should be installed in the engine room of a large modern steamship; that, on the contrary, the duty required of the engines of fast Atlantic liners is of the very kind in which the steam turbine has shown to best advantage, namely, when it is running continuously, at high speed, and under full load.

The committee which was appointed last September was probably one of the strongest and most representative that could have been gathered together. It included, among others, the superintendent engineer of the Cunard Company, the late director of naval construction, and the deputy engineer-in-chief of the British navy, and the engineering managers of three of the largest shipbuilding companies in Great Britain, including a member of Messrs. Denny & Co., who have built most of the turbine-propelled passenger ships that are now in service. When the committee was formed, there was only a small amount of information available as to the relative economy of turbine and reciprocating engines when they were doing similar work and developing the same amount of power. The work of the committee was directed to making careful comparative tests under such conditions. One of these was carried on at Newcastle-on-Tyne, where reciprocating and turbine engines were run at various proportions of their power and also at full speed, the output of electricity being recorded in each case and the condensed steam from the engines being accurately measured. In addition to these tests ashore, others were carried out on the sister passenger steamships "Arundel" and "Brighton," which are identical in everything but motive power, the "Brighton" being driven by turbine engines and the "Arundel" by reciprocating engines. The two vessels were run side by side from New Haven to Dieppe and back, all possibilities of error due to variations of weather and tide being thus eliminated. Subsequently the "Brighton" made several trials in the Solent, running at different rates of speed.

Throughout the whole investigation the committee have been fully alive to the fact that it was a great step from the successful propulsion of ships of the size of the "Arundel" by turbines to the fitting of this type of engine in vessels of the great dimensions of the new Cunard ships. Consequently great attention has been paid to the design of the tubines, with a view to rendering their manufacture as simple as possible, and to securing the well-known advantages in efficiency due to increased size.

The dimensions of the ships, as already announced, are: Length on deck 800 feet, beam 85 feet, minimum draft between 33 and 34 feet, on which dimensions the vessels will have a displacement of about 40,000 tons. These figures may be compared with those of the "Kaiser Wilhelm II.," which is the largest of the high-speed transatlantic liners. This vessel on a length of 706 feet has a beam of 72 feet and a draft of 29 feet, the draft being limited by the depth of the water in the German ports. The contract will probably require that the new Cunarders develop a speed of 25 knots on trial and a sustained sea speed of 24½ knots an hour.

The 75,000 horse-power will be developed upon four shafts. On the outer pair will be the high-pressure turbines; on the inner pair the low-pressure, and also the go-astern turbines. The coal consumption will be over 1,000 tons a day.

THE GROWTH OF OUR STREET RAILWAY SYSTEMS.

Our readers are familiar with the annual statistics of the steam railroads of the United States which we publish regularly in the Scientific American. Hitherto we have not been in the habit of giving similar statistics of the street railways; but the latter have grown in mileage, passenger traffic and capitalization to such great proportions that for the future we hope to give the annual statistics of street railway and traction lines as well as the great steam railroads. For the figures that follow, we are indebted to Poor's Manual for 1904, from which we learn that the total mileage of city, suburban and interurban track in the United States is 24,561 miles. Of this, 281.4 miles are operated by horse cars, 142.2 miles by dummy engines, 267.8 miles by the cable, while 23,869.6 miles are operated electrically. For the operation of the horse-car lines 7,923 horses and mules are employed; for the dummy lines there are 475 dummies and locomotives; for the electric lines 52,119 motor cars are required; while for all lines there are needed for operation 13,301 passenger and freight cars. The immense value of these properties may be judged from the fact that the capital stock amounts to the sum of $1,685,840,296; while the bonded debt is $1,180,313,809. The electrically operated roads have increased from 10,239 miles in 1894 to 23,869.6 in 1903. At the same time the lines operated by dummies and locomotives have decreased from 409 to 142.2; those operated by cable from 578 to 267.8, and those operated by horses from 1,950 to 281.4 miles. While the total mileage has not quite doubled in this period, the capital stock has increased over 150 per cent, while the bonded indebtedness has increased by even a larger ratio.

A BARRAGE ON THE RIVER THAMES.

For some time past considerable dissatisfaction has existed in those shipping circles whose traffic is concerned with the Port of London, because of the insufficient depth of water in the river. Owing to the increasing size and tonnage of steamships, it is often necessary to await a favorable tide at Gravesend, which delays are detrimental to the commercial interests of the port of London. Then again the navigation channel up the river is so narrow and so crowded that traffic is seriously impeded. Many plans have been advocated for the surmounting of these obstacles. One of the most ambitious of these is to emulate the engineering achievements on the River Nile in the Aswan and Asyut barrages, by the construction of a great dam across the river between Tilbury and Gravesend, and convert the forty-six miles of the river between Teddington Lock and Gravesend into one huge basin or dock.

The projectors of this scheme, of which complete plans and specifications have been prepared, contend that as the river level can be regulated by the erection of such a barrage as this, it will be possible to obtain a navigable depth of water varying from 65 feet at Gravesend to 32 feet at London Bridge, without dredging, together with a fairway to allow ships drawing 30 feet of water to proceed to London Bridge at any time, irrespective of the tide.

The barrage would be constructed on the same lines as those at Aswan and Asyut on the River Nile. It would be built of mass concrete, faced with granite on all exposed faces. The foundations of the barrage would be in the underlying chalk, and they would be built by means of large coffer dams, inclosing an area sufficient for the walls and locks. The latter, when completed, would be opened for the up and down traffic of the river while the construction of the wiers and sluices was proceeded with. The sluices would be left open for the free passage of the tides until the closing of the barrage, which would take place at high water of a spring tide. The locks would be worked electrically from a power house built upon the central pier of the locks, the necessary electric energy for which would be generated by dynamos operated by the fall of part of the water flowing over the dam. The river traffic would be signaled and regulated from a pilot house, from which also the locks, movable bridges, etc., would be controlled. Four locks are proposed, each provided with internal gates in addition to the outer ones, in order that they may be worked in long or short lengths to suit the traffic. The lengths provided in this way would be 300 feet, 500 feet, 700 feet, and 1,000 feet, and the widths 80 feet and 100 feet. It is not likely that these dimensions will ever be exceeded by steamships. There would be a roadway across the barrage, for pedestrian and vehicular traffic.

A tunnel 28 feet wide by 25 feet in height is also proposed in the base of the barrage to afford a means of communication between the trunk railroads on either side of the river. The cost of this project is estimated at $18,290,000, and it is proposed to meet this expenditure by levying a toll of 1½ cents per ton upon all vessels passing up and down the river.

ACTION OF LIGHT UPON THE FORMATION OF ACCUMULATORS.

Dr. Tommasi, of Paris, long ago observed that, in an accumulator, a negative plate exposed to the light is more rapidly formed than one placed in darkness. This reducing action of the light always manifests itself whatever be the composition of the active material contained in the accumulator plates, the density of the sulphuric acid that serves as an electrolyte, and the temperature at which the operation is effected.

In order to more perfectly establish the part played by luminous energy in the formation, or, more exactly, in the reduction of the active material of the negative plates to spongy lead, Dr. Tommasi made the following experiments: Two of his own type of accumulators, each composed of a glass vessel filled with acidulated water and containing three negative and two positive plates, were placed, one of them, *A*, in a place submitted to the action of the solar rays, and the other in a bitumen-coated cardboard box entirely closed on every side so as to completely protect the accumulator, *B*, from the action of the light. The two accumulators, *A* and *B*, were connected in series and submitted to a charge of from two to three amperes.

For thirty hours there was no perceptible difference; but, starting from this period, the negatives exposed to the light soon assumed a grayer tint—a certain proof of a greater advance in the formation. Such difference of tint, due to the reduction of a greater or less amount of oxide of lead, in the first place continues to increase, and then diminishes and finally disappears when the negatives are almost completely formed, i. e., reduced to spongy lead.

These experiments, several times repeated, show that the negatives of an accumulator are, all else being equal, formed more rapidly in light than in darkness.

This fact, as ascertained, is because of intent to find out how much influence was exerted by the light upon the speed of formation of the positive plates of accumulators. For this purpose, Dr. Tommasi mounted two of his own accumulators, each containing three positives, and two negatives, in such a way that the two end plates consisted of positives. One of the accumulators was exposed to the light and the other was kept in darkness. These accumulators, connected in series, were submitted to a rate of charging of from two to three amperes.

After twenty hours, the positives placed in darkness assumed a darker color, that is to say, were more peroxidized than were the positives exposed to the light.

Such difference in color increased at the outset, then diminished, and finally became inappreciable when the positives of the accumulators, *A'* and *B'*, were almost entirely formed, i. e., converted into peroxide of lead.

The positives of an accumulator, all things being equal, are therefore formed more rapidly in darkness than in light.

Besides, the positives formed in darkness have a dark brown hue, while those formed in the light are of a reddish brown. Such difference in color persists even after some few charges. In the long run, it at last disappears completely. The reddish color of the positives formed in the light becomes darker and darker until it finally assumes the brown hue of those formed in darkness.

Dr. Tommasi has likewise observed that negatives formed in the light have a lighter tint than those formed in darkness. Such difference is, however, not very marked.

As for the capacity, that remains sensibly the same whether the accumulators be formed in darkness or in light. We should be tempted to explain the phenomenon by an analogous one noted some time ago in connection with wireless telegraphy, viz., the charge that a condenser takes under the influence of solar light. Such charge would seem to oppose the formation of the positive plate and add its action to that which forms the negative one. This is a hypothesis of our own, which we submit with all reserve.

According to reports, arrangements are practically completed for the construction by the Chicago, Rock Island & Pacific Railroad of a line across Iowa between Davenport and Council Bluffs. The distance will be shortened considerably.