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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.

MORE LIGHT ON TURBINE ECONOMY.

The great activity shown by the British ship and engine builders in the development of the steam turbine is giving to the world, very rapidly, important data on the question of the efficiency of the new prime mover. So long as the ships were small, and small-sized propellers and high speed of revolution were possible, the turbine shows a truly astonishing gain of economy over the reciprocating engine; but with the increase in size of ships and propellers, the margin of economy between the two types has gradually been narrowed down, until, in the latest turbine steamships, it has practically disappeared. This is due to the fact that the reduction in size, weight, space occupied, and fuel consumption of the turbines in the earlier vessels, was due largely to the high speed of revolution that was possible. But since the turbine and the propeller are on one and the same shaft, there came a time, as the ships grew larger, when the speed of revolution had to be kept down in order to maintain propeller efficiency. The efficiency of the propeller increases with the diameter and with the decrease of revolutions; whereas it is just the contrary with the turbine, whose efficiency increases with increase of revolutions and with a decrease of the diameter of the drum.

It is because of these fundamental principles that some of the recent turbine-driven ships of the larger size have not shown such favorable results in sea service as they did on trial. Of course, all ships fall off somewhat, in their regular sea service, from the figures of speed and economy obtained on trial; but the discrepancy has been very much larger in the case of turbine-driven ships of the larger size, than it has in ships driven by reciprocating engines. Observations of a large number of well-designed twin-screw reciprocating-engine vessels has shown that the effective propeller thrust at sea, compared to the results on the trials, was as about 1 to 1.25, whereas, according to an English authority, in the turbine vessel, the ratio was in one case as 1 to 2.25. It has become evident that a still further modification must be made of the ratio of diameter and speed of the propeller and its turbine; and we shall look to see the size of propellers increased in order to insure that when a ship is being driven into heavy head seas they will develop sufficient thrust to hold the vessel up to its work.

EFFECTS OF SNOW ON THE THIRD RAIL.

An important question affecting the operation of the great system of electric traction which the New York Central Railroad is now installing throughout its suburban and terminal lines, is that of the possible effects of snow upon the third rail with which the new lines will be equipped. In order to determine the action of the snow, the company recently conducted a series of elaborate tests, choosing a time when a rather heavy snowfall had completely covered the third rail to a depth above the top of the same of from four to six inches. In order to secure comparative data on the subject, the track over which the runs were made was provided with several different sections of third rail, each arranged on a different system. Among these were included an ordinary unprotected rail placed head up; a rail with protection over the top; a rail protected at the top and on one side, and also a section of the type of under-running rail, which has been adopted by the New York Central Company. The under-running rail is inverted and covered on the top and side, the contact shoe of the locomotive bearing up from below against the inverted head. In the tests, the locomotive carried a snowplow on the pilot, which failed to throw the snow clear of the third rail. This somewhat vitiated the results, because it acted unfavorably upon the over-running rails. As the result of the trials it was found that the over-running rail gave about the same results, whether it was protected or unprotected; but in both cases the operation was unsatisfactory, for the reason that the passage of the contact shoe failed to remove the snow, which tended to become packed and hard as the shoes forced their way over it. The best results were obtained with the under-running rail, the under-contact surface being kept practically free from snow, while the passage of the shoe left the rail in a cleaner condition for the next trip. As the result of these trials, the company are satisfied that they have in their present form of third rail the best type for winter service.

COMBINED FLOATING AND STATIONARY POWER STATION.

A decidedly novel method of temporarily increasing the boiler capacity of its power plant was recently adopted by a street railway company at Baltimore; and the scheme is so simple, and has such a variety of possible applications, that it is worthy of more than passing notice. It seems that on account of the great damage done to its main generating station during the great Baltimore fire, and because of the prospect of a rapid and immediate increase in its business, the United Railways and Electric Company of Baltimore found that it would have to make emergency provision for increasing its boiler plant, without waiting on the completion of the rebuilding contract which was then under way. In the emergency it was decided to charter a large passenger steamer, the "Lord Baltimore," which is laid off during the winter months, moor it alongside the dock adjacent to the power house, and make some form of flexible steam pipe connection from the steamer to the stationary engines on shore. The steamer carries four 250-horse-power boilers with an overload capacity of from 1,200 to 1,500 horse-power. The boilers were disconnected from the ship's engines, and a 10-inch pipe was run from the main 10-inch steam header in the boiler room of the power station, to the edge of the dock alongside of the steamer, where it terminated in a 10-inch manifold. Another manifold 8 inches in diameter was placed on the upper deck of the steamer, and in order to allow for the rise and fall of the vessel with the tides, the two manifolds were connected by a set of flexible copper tubes. The arrangement proved so satisfactory that, after the emergency which was created by the rush of Christmas travel had passed, the ship was maintained under charter, and the ship's boilers were drawn upon as auxiliaries during that portion of each day in which the power station was carrying its heaviest load.

COMPARISON OF HEAVY ELECTRIC AND STEAM LOCOMOTIVE PERFORMANCE.

That the development of the electric locomotive has by no means rendered the steam locomotive obsolete, was made clear in a paper recently presented before the New York Railroad Club by Mr. J. E. Muhlfeld, general superintendent of motive power of the Baltimore & Ohio Railroad. Indeed, the results of a practical comparison of the two types, as given in this paper, seem to prove that for the hauling of very heavy train loads under hard conditions of service, the biggest freight locomotives are superior to the heaviest electrical locomotives; or, to be more precise, it has been proved that this is true in the case of the particular locomotives upon which the conclusions of this paper are based. The facts will come as a surprise to electric locomotive builders and engineers, for it has been the common opinion that the electric locomotive would show to its very best advantage, especially if it were using the alternating current, in hauling heavy freight trains over the mountain divisions of our railroads.

The author of the paper has been in possession, during the past few years, of unrivaled facilities for making comparative tests of the two types of locomotive, for the Baltimore & Ohio system has in operation six electric locomotives of the most powerful kind, four of which have been in operation for ten years past, while during the past year they have been operating the most powerful steam locomotive in existence, namely, the Mallet duplex, compound, articulated locomotive, which attracted so much attention at the World's Fair. The electric locomotives, it will be remembered, were built for the purpose of hauling passenger and freight trains through the two-mile tunnel leading to the new terminal station of the Baltimore & Ohio Railroad in the city of Baltimore. The older locomotives operate as single units and weigh about 98 tons each, while the later electric locomotives are designed in two 80-ton sections; from which it will be seen that these engines are comparable with the heaviest steam locomotives. The compound steam locomotive is carried on two six-wheeled trucks, with the high-pressure engines on one truck, the low-pressure engines on the other. All wheels are coupled and the total weight is available for adhesion. The engine weighs 334,500 pounds, and the draw-bar pull, when it is working compound, is 74,000 pounds, and 84,000 pounds when it is working simple. The total elevation from Connellsville to Rockwood, on the division where the compound has been employed, is 931 feet, the ruling grade being 1 per cent, and the total distance 43.4 miles. Over this road the engine has hauled thirty-six loaded cars, representing a total weight of 2,370 tons, at an average speed of 10 miles per hour.

The results of service show that the total cost of operation and maintenance of the electric locomotive, including in this the generation of the electric current and miscellaneous expenses, has been $34.50 for each hundred miles run by each locomotive. Of this total the cost of the running and shop repairs average $6.10 for each hundred miles. On the other hand, the cost of maintenance of the steam locomotive averaged only $24.50 per each hundred miles, which is about 30 per cent less than the cost of the electric engines for the same distance doing fairly similar work. The cost of shop repairs and general materials amounted to $3.16 per one hundred miles, which is about 50 per cent less than the cost for the same item of the electric locomotive. It was pointed out in the paper that the advantages do not stop here, since the first cost of the electric locomotive alone is, at the present time, about 50 per cent greater, measured on the basis of pounds of tractive power, than the cost of the steam locomotive. Furthermore, there is to be added the disadvantage, in the electric locomotives, that the great concentration of weight on a comparatively short and rigid base is extraordinarily severe on the rails, bridges, and other track structures. The author of the paper draws the conclusion from these comparative data, that, except in the special cases where the use of steam locomotives is undesirable, the greater first cost and cost of operation of electric locomotives would prevent their competing with the steam locomotive for heavy railroad work.

In accepting the facts given in Mr. Muhlfeld's valuable paper, we must be careful not to be led into the error of drawing too broad conclusions from his facts, as gathered on the Baltimore & Ohio Railroad. In the first place, it should be borne in mind that the big freight locomotive has the advantage of having been designed especially for heavy mountain work, and that it so far exceeds the average big freight locomotive in dimensions and power as to be quite in a class by itself. The electric locomotives, on the other hand, can hardly be considered as representing the latest developments of heavy electric traction, either here or abroad. We have no doubt that if electric locomotive builders the world over were invited to design a locomotive for doing exactly the duty which the big steam compound is now doing on the Connellsville division, they would be prepared to build an alternating-current locomotive which would do the work for about the same cost per pound of tractive effort and per hundred miles run as the compound. This, however, would only be possible if the whole line were operated under electric traction, and the particular locomotive was debited merely with its share of the cost of the line and power stations.

THE ORGANIZATION OF THE SUBMARINE FLOTILLA OF THE BRITISH FLEET.

It is anticipated in the forthcoming programme of the British navy for the ensuing year, that the appropriations in regard to the construction and disposition of the fleet of submarines now constituting an important branch of the navy will be a prominent feature. The various and continuous experiments that have been conducted by the Admiralty with the Vickers-Maxim-Holland type of boat of varying displacements have resulted in the evolution of an efficient craft, replete with all the improvements and modifications resulting from the prolonged investigations. Authentic information regarding these latter vessels is somewhat difficult to obtain, but that the majority of the defects inherent in the earlier types of boats have been surmounted is apparent from the important arrangements concerning the organization of these vessels that is now being carried out. The displacement of the submarine has been continuously increased until the most modern craft are upward of 300 tons, and this increase in size has been attended with various important improvements in speed, radius of action both afloat and submerged, and the electric and gasoline engines for propulsion under these respective conditions of traveling. The dimensions of the accumulators and the gasoline tanks have been considerably augmented, thereby effectively rendering the boat more independent of frequent replenishment, the latest type of vessel carrying sufficient liquid fuel for traveling 1,300 miles on the surface.

More important, however, is the prominent part which the submarine is to fulfill in the future defense of the country. The military system of fixed submarine mines at the entrance of rivers and harbors has been taken over in its entirety by the naval department, and in the greater number of cases has been completely abandoned in favor of a more elaborate defensive scheme by submarine boats. Furthermore, the submarine vessel is to constitute a separate department of the Admiralty, which, although acting in complete conjunction with the navy, will, however, be conducted on quite a separate footing, the submarines having their own bases and docking equipment for repairs, overhauling, refitting, and so forth.

It is intended by the Admiralty to organize six submarine-boat bases round the English coasts. Three of these are disposed upon the south coast at Ports-