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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.

FUEL OIL IN THE MERCHANT MARINE.

Valuable information regarding the use of fuel oil on merchant steamships is contained in a report made by Lieut. Winchel on an investigation which he was ordered to make for the Navy Department of the efficiency of the oil-fuel plant fitted on the steamship "Mariposa" of the Oceanic Steamship Company of San Francisco, which trades between San Francisco and Tahiti. The "Mariposa" is a vessel of 3,160 tons. Her average indicated horse power, as shown on the trip under investigation, was about 2,491, and the mean speed was 13.53 knots an hour. The consumption of oil was 278 barrels per day, the average consumption of oil being 3,720 pounds per hour, which works out as 1½ pounds of oil per horse power per hour. Although in some of the most carefully designed and operated plants on shore, engines have been operated at as low a rate as 1½ pounds of coal per horse power hour, the consumption is practically 50 per cent less in weight of fuel than would be required with triple-expansion engines of the type installed on the "Mariposa" if coal were being used. In addition to the saving in dead weight carried, there was a great economy in the working force required, the engine and boiler room staff being reduced from 36 to 20 men. The boilers of the "Mariposa" contain altogether eighteen furnaces, and of these only twelve were used. There are two burners to each furnace; but it was only for short periods of time, when the engines were run at full power, that all the burners were in use.

The economy in fuel realized in these trials is not so marked as the economy in labor; for even on a vessel run under such high pressure as the "Deutschland" of the Hamburg-American Line, which has crossed the Atlantic at an average speed of 23.5 knots an hour, the consumption of ordinary steam coal is only 1½ pounds per horse power per hour, including auxiliaries; and on the vessels of the Inch Line, trading on the east coast of England, which use every refinement in the way of economizers, superheaters, etc., a consumption of a fraction under one pound of coal per hour has been realized. But it is in the economy of labor and space, and in the convenience of stowage, that oil fuel will have its greatest attraction for shipowners. Great as are these advantages for the merchant service, they are even more valuable for the navy, since the decrease in weight and bulk of fuel, and the possibility of stowing it in the double bottom, will place practically all of the space now used for bunkers at the service of the naval architect. Moreover, the diminished number of the crew will mean diminished requirements of weight and space for their accommodation. The saving thus effected can be given to an increase of armor or guns, or engine power, according as the architect wishes to develop either of these features in his vessel.

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IMPORTANT SPEED TESTS OF STEAM AND ELECTRIC TRAINS.

The most direct evidence thus far afforded that the New York Central Railroad is taking active steps toward the installation of electric traction for its suburban service in this city, is a series of tests which have recently been carried out on the experimental track of the General Electric Company at Schenectady. These tests were made with a view to determining the relative efficiency of steam and electric traction in such suburban passenger service as is carried on by the New York Central Company. The primary object of the test was to make a comparison of the rate of acceleration of the same train when hauled by a New York Central suburban engine and by a pair of electric motor cars, such as would be used were the suburban lines to be equipped with third-rail electric traction. For the purpose of the test, a train of six cars was made up, which included five standard passenger coaches of the New York Central Railroad preceded by a dynamometer car. The engine selected was one of the big tank engines especially designed for the suburban service of the New York Central Railroad, the engine being provided for this purpose with large heating surface and cylinder capacity and small-diameter six-coupled drivers. These engines have a total weight of 214,000 pounds, of which 128,000 pounds is on the drivers; a total heating surface of 24,065 square feet; cylinders 20 x 24 inches; a boiler pressure of 200 pounds to the square inch and a tractive power of 25,900 pounds. They have proved very successful, the acceleration being unusually rapid. Indeed, for this class of work, where stops are frequent, they are probably the best engines of their kind in this country to-day, and hence admirably adapted for a comparative test of capacity of acceleration with electric motor cars. For the electric test two General Electric motor cars, one weighing 73,000 pounds and the other 70,000 pounds, were used. These cars are 54 feet over all in length, and are equipped with four "G E 55" motors, all axles being provided with motors and the two cars together giving about the same weight on drivers as the steam locomotive. The test was, therefore, perfectly fair, the acceleration being directly comparable for trains of equal weight. The drawbar pull, speed and time were recorded by the same dynamometer car in all cases, the engine simply being unhitched and the two motor cars coupled up for the alternate trials. In carrying out the tests, the train of six cars with its engine or its electric motors, as the case might be, was started from rest and run over one mile of track, the acceleration being made as rapidly as possible with the power available. These runs were repeated, dropping off one car at a time, and a careful record was kept of the speed attained in 10 seconds, 20 seconds, 30 seconds, etc. The New York Central coaches weighed each from 48,200 pounds to 60,250 pounds, and the total weight of the train behind the engine or electric cars varied from 157 tons down to 23 tons.

The full data of this most valuable experiment were given in a paper by E. J. Arnold and W. B. Potter, at the last annual convention of the American Institute of Electrical Engineers, the complete text of which will be found in the current issue of the SUPPLEMENT. The electric runs were made upon the General Electric Company's experimental track against a head wind of 15 miles an hour. In the middle of the run there was a 6½ degree curve, the frictional effect of which was assumed as equivalent to the 1-10 per cent upgrade of the steam runs, which were made on the New York Central main line adjoining the electric works. In the case of the steam runs there was also a head wind of 15 miles per hour. Although the locomotive was especially built for rapid acceleration, having a large firebox and heating surface, the pressure dropped from 200 pounds at the commencement of the mile to less than 185 pounds during the early part of the acceleration. In starting, the throttle was opened wide and steam was used for the full stroke, the engine being hocked up as acceleration proceeded. In neither case was there any slipping of the driving wheels. Although the steam locomotive was able to exert a tractive effort at starting equal to that obtained by the electric motor cars, this high tractive effort was not maintained, but fell immediately with the increase of speed, in spite of the most expert handling of the throttle and reversing lever. The accelerations attained in each case at the end of each 10 seconds were as follows: With a train of six cars, the acceleration at the end of ten seconds was, for the locomotive, 19.5 miles per hour; for the motor cars, 11.2 miles an hour; at the end of twenty seconds, the speed had risen to 16.3 miles per hour for the locomotive and 21.2 miles per hour for the motor cars, the respective figures at the end of thirty seconds being 20.8 miles an hour for the locomotive and 28.1 miles per hour for the motor cars. With four cars only in the train the accelerations were in ten seconds for the locomotive, 12 miles per hour; for the motor cars, 14.4 miles per hour; in twenty seconds, for the locomotive, 19.5 miles per hour; for the motor cars, 27.4 miles per hour; while in thirty seconds the acceleration was, for the locomotive, 24.7 miles per hour, and for the motor cars, 32.4 miles per hour. With only one car attached, the accelerations were in ten seconds for the locomotive, 14 miles per hour; for the motor cars, 22.5 miles per hour; in twenty seconds, for the locomotive, 25 miles per hour, and for the motor cars, 34 miles per hour. In thirty seconds the acceleration for the locomotive was 31.7 miles per hour, and for the motor cars, 38.2 mlies per hour.

The comparison of results proves that the electric motors can better utilize the weight upon their drivers during acceleration than a steam locomotive, the motor covering the same distance in the same time with less energy expended and at less maximum speed than a steam locomotive, owing to its being able to maintain its maximum accelerating rate for a longer period. In making the tests the power was kept on until the three-quarter-mile post was reached, when it was shut off and the brakes were applied so as to bring the train to rest as near the mile post as practicable. The steam train ran from 5 to 15 per cent over a mile before the train was brought to rest, and the electric train from 2 to 4 per cent; but, in spite of the longer distance covered, the average speed of the steam runs only approached that attained in the electrical runs over a shorter distance. Since the electrical runs all show a lower maximum speed and a higher average speed than those made with the steam locomotive, the energy consumption of the electric runs should, therefore, be less for the same work done than with the steam locomotive. Since the motors of electric trains may be placed upon the trucks of ordinary passenger coaches, there is a saving of weight due to the elimination of the locomotive and tender, and the authors of the paper point out that, hence, the true basis of comparison between steam and electrically propelled trains should be the energy per seat mile rather than per ton mile. As an illustration of the advantages, in point of economy of power, of electrical traction over steam, a table based upon these tests is given in the paper, showing the energy required per passenger for both steam and electric runs; and from this we find that for a train of six cars the watt hours per passenger required in a steam train are 43.9, as against 29.7 in an electric train. In a three-car train the watt hours for steam would be 77.4, as against 37.5 for electricity. In a comparison of coal consumption, based upon the actual service of a steam locomotive for twenty-four hours covering four trips between North White Plains and the Grand Central Station on the New York Central road, it was found that the coal consumed per effective horse power hour was 15.6 pounds. In comparing this with electrical traction, it is assumed that the ratio of effective horse power output of motors to the indicated horse power of the central station engine is about 50 per cent. The average coal consumption per horse power hour at the electric power stations is assumed at 2½ pounds, and at this figure the coal per effective horse power output at the electric motors would be 5 pounds. Assuming the head air resistance as 10 per cent and the increased weight of the cars due to their electrical equipment as 20 per cent, the actual comparison of coal consumption works out in the ratio of 6.6 pounds per horse power hour for electric traction and 15.6 pounds for steam traction. Assuming the cost of coal for electrical power is about a third the total cost of that power if maintenance and interest on investment be included, it is concluded that the actual gross cost of electrical power would closely approximate the coal consumption cost of the steam locomotive in this class of service, the maintenance and attendance cost of the electrical equipment being, however, considerably in favor of electrical power.

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THE COLLAPSE OF THE CAMPANILE—THE CAUSE.

In the October issue of the Building Monthly of the SCIENTIFIC AMERICAN will be found an article from the pen of an American, resident in Venice, on the fall of the famous Campanile. Accounts of official neglect have found a place in the daily papers; but it is doubtful if many suspected how culpable the authorities of Venice have been. Commendatore Giacomo Boni, known the world over for his work in the Roman Forum, furnished the writer of the article in question with a mass of information which shows how keenly alive certain architects were to the critical condition of the tower, and how willfully indifferent Italian officials apparently were to the fate of one of their grandest architectural structures.

As far back as 1878 the Italian architect Luigi Vendrasco foresaw the collapse of the old bell-tower and persistently tried to prevent it. His endeavors to save the Campanile ruined his career. It was while directing some work in the palace of the Doges that Vendrasco discovered how great the danger was. Although the fate of the Campanile was no official concern of his, yet he felt it his duty to warn the Syndic, the Prefect, and the various commissions charged with the preservation of architectural relics. Vendrasco's reports were never opened. He appealed to Queen Margherita and even to Queen Victoria. For that last bit of pertinacity he was officially requested to remember that he was an Italian and not an Englishman. Although repeatedly snubbed, Vendrasco still persisted in calling to the attention of the authorities the imminent ruin of the tower. In order to put an end to his letters, the troublesome architect was transferred to Cagliari. His advanced years prevented him from reporting in time to resume his new duties, for which failure he was dismissed.

Day by day Vendrasco saw the disaster approaching. When a cut was made in the east wall of the Campanile in repairing the roof of the Loggetta, Vendrasco saw that a fatal injury had been done. The cut reopened the old fissure of 1745, caused by lightning. Even some of the official engineers and architects now began to show concern; yet so general was the indifference of the Venetians that no steps were