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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.

THE QUESTION OF TWO ENGINEERS IN THE CAB.

There have been of late so many cases of the sudden disablement of the engineer at the throttle, thereby leaving the train without control, as to lead to a renewed discussion of the question of placing two engineers in the cab, at least on the more important fast trains. Cases have occurred where a train, after the disabling of the engineer, has run for many miles before the accident was discovered. The peril of such conditions is too obvious to call for any comment. That the danger is not so infrequent as to be negligible, is suggested by the fact that our esteemed contemporary, the Railway and Engineering Review, in a recent editorial drew attention to three serious cases of this kind, which had occurred within the previous two or three weeks. The first of these was a collision on the Mobile and Ohio Railroad, caused by the engineer of a passenger train falling unconscious at his post. The train ran past a station where a stop should have been made, and the fireman did not discover what had happened in time to stop the train before it collided with a switch engine. Another case was that of the engineer of a passenger train on the Lake Shore and Michigan Southern Railway, who was overcome by heat and fell unconscious as the train was approaching Cleveland. Fortunately, in this case, the fireman observed the engineer's condition in time to prevent an accident. Mention is also made of the case of an engineer on a freight train on the Chicago, Rock Island, and Pacific Railway, who became suddenly insane and persisted in running his train at full speed in spite of the efforts of the fireman to prevent it. The above cases are only typical of many which are continually recorded in the daily press. There was a time, in the days of smaller locomotives, when the fireman had more leisure than now for general observation, both of the signals and of conditions in the cab. He was in closer touch with the engineer. To-day, however, the locomotives have increased to such large dimensions, that the attention and energy of the fireman are fully occupied in keeping the huge furnaces fully supplied with fuel, and the boiler with water. Not so very many years ago 2,000 square feet of heating surface was the maximum to be found on most of even the largest engines; but to-day the standard express passenger engine will have from 2,500 to 3,500 square feet of surface, and the most powerful freight locomotives from 4,500 to 5,500 square feet. From personal experience when riding in the cab of fast and heavy passenger trains, we know that what time the fireman is not shoveling coal, he is attending to his injector or peering ahead for the first glimpse of the signals. It is our conviction that locomotives have grown to such a size, that the railroad management should give careful consideration to the question of placing a third person in the cab of the largest engines for purposes of observation, and this is particularly necessary on those locomotives in which the engineer's cab is separate from that of the fireman.

STEAM TRIALS OF THE "LUSITANIA."

Later advices regarding the official steam trials of the "Lusitania" show that this remarkable vessel made even higher speed than she was credited with in the earlier reports. On the measured mile she steamed at 26¼ knots, and on the forty-eight-hour deep-sea trial, over a measured distance of 1,200 knots, she maintained a mean speed of 25.4 knots. As the conditions of the sea trial were practically identical with those which ordinarily obtain on a transatlantic trip, she should easily maintain an average speed, as called for by the contract with the British government, of 24.5 knots on a round voyage across the Atlantic. The 300-mile course for the deep-sea trial was laid between the Corsewall Light on the coast of Scotland and the Longship Lighthouse at Land's End. This was covered four times, the vessel making two runs to the north and two to the south. On both of the night runs there was a northwesterly wind, which freshened to considerable strength, and its effect was shown in the recorded speeds. On the first southerly course from Scotland to Land's End, the average speed was 26.4 knots. Returning, the average was 24.3 knots; on the second southerly trip it was 26.3 knots, and the final 300 miles was covered at 24.6 knots, the mean speed, therefore, working out as 25.4 knots for the whole 1,200 miles.

This was certainly an exceptional performance. Trial trips are usually associated in our minds with a short dash over a measured mile, with everything keyed up to the highest point for a supreme effort; and consequently, trial speeds have come to possess merely an academic or spectacular interest, useful as matters of record or for their effect in the advertising literature of the owning company, but giving no sure indication of the day-by-day service of the steamer. To all intents and purposes the trial of the turbine liner was a service test, both in time, distance, and in the fact that the regular routine methods of a transatlantic trip were followed by the officers, staff, and crew. Therefore, that the "Lusitania," with her engines absolutely new, and the staff necessarily unfamiliar with the ship and its motive power, should have exceeded by two knots an hour the speed made by any previous ship over the same distance, marks her as a phenomenal boat, and raises a reasonable expectation that during the present season the transatlantic record will be placed at a point which must necessarily stand for many years to come. Neither the "Lusitania" nor the "Mauretania" will prove to be the first "four-day" boat, but they are likely to bring the record down to four days and a half, and possibly a little below that.

To marine engineers the most significant fact, as stated by our esteemed contemporary Engineering, is that every unit of the machinery should have worked throughout this long trial with uninterrupted mechanical precision. The air pressure in the ash-pits at the boilers did not, at any time, reach the maximum of ¾ of an inch prescribed in the specifications by the Cunard Company. With a boiler pressure of 186 pounds, the pressure at the receiver of the high-pressure turbine varied little from 150 pounds. The mean vacuum was 28.2 inches, and the mean revolutions of the four shafts were 188 per minute. The horse-power, determined by that ingenious but we fear not very reliable device, the "torsionmeter," which determines the torque by the amount of twist of a given length of the shaft, was 64,600 horse-power. When we bear in mind that the contract horse-power was 68,000, it will be seen that the accomplishment of a greater speed with 3,400 less horse-power (if the torsionmeter was correct) is full of promise for further high-speed performance.

"CECILIE": THE FASTEST RECIPROCATING-ENGINE LINER AFLOAT.

The arrival at the port of New York of the transatlantic liner "Kronprinzessin Cecilie," of the North German Lloyd Steamship Company, marks the advent of the last and finest of that great quartette of high-speed ocean steamers of this company, which has helped so greatly to advance the speed and comfort of transatlantic travel. Commencing with the "Kaiser Wilhelm," which was the first ship to maintain an average of over 23 knots an hour across the Atlantic, the company have placed in service at intervals of a year or two the "Kronprinz Wilhelm," with a record of 23.47 knots; and the "Kaiser Wilhelm II.," which raised the speed to 23.58 knots, the present record of the Atlantic. The last-named ship, which was brought out in 1904, proved to be so eminently satisfactory that, when the company decided to build the "Cecilie," they considered that they could not do better than duplicate the "Kaiser Wilhelm II." in every particular. This was done; and that the ship will equal, and probably exceed, the performance of the sister vessel is shown by the fact that on the trial trip, over a measured course of 60 miles, the "Cecilie" averaged a speed of 24.02 knots.

In view of the fact that the "Lusitania" has shown such good results on her trial trip, and is likely to capture the Atlantic record, and that the German Lloyd Company are certain, in the future, to make an effort to win back the record, it is probable that the "Cecilie" is the last high-speed transatlantic steamer of very great power that will be built with reciprocating engines. In fact, it may be taken that in this ship the German shipbuilders have carried the development of the reciprocating marine engine up to the high-water mark of its possibilities. Further advance will be either along the lines of the steam turbine, or of turbo-motors with the electric motors direct-connected to the propeller shafts; or it may be that the next advance will be marked by the introduction on a large scale of the marine producer-gas engine. That the limits of the reciprocating engine have been reached, is shown by the great magnitude attained by many of the engine parts, and notably by the propeller shafts. These last in the "Cecilie" are 25¼ inches in diameter, and upon each devolves the heavy duty of transmitting at times as much as 24,000 horse-power. This is an enormous load to be imposed, day and night for nearly a week, upon a single member, and the question of further increase of power is halted by the serious difficulties that would be encountered in the forging of shafting of the necessary size, elasticity, and durability. For this reason alone, naval designers are being driven to the use of three and even four shafts; and to such an arrangement the steam turbine lends itself perhaps more readily than the reciprocating engine. In the new record-breaking ship which the North German Lloyd Company are pretty certain to undertake, it will be a question of great interest as to which of the four leading types of turbine will be adopted—whether the English Parsons, the American Curtis, the German Zoelly, or the French Rateau.

If we are right in our conjecture that the "Cecilie" will mark the highest point to which the development of the reciprocating engine will be carried in high-powered steamers, the "Cecilie" and the sister ship will always be notable landmarks in the future annals of the marine engine. They have set the figures for fuel economy at a point which must ever tax the skill of the steam turbine builders to surpass, if indeed they ever attain it. Before giving any details of the motive power, we may mention that the "Cecilie" is 706 feet long, with a beam of 72 feet, a depth of 44 feet 2 inches, and a displacement of 26,000 tons. She has the usual double bottom, and the hull is divided into twenty water-tight compartments. All the bulkhead doors may be closed directly from the bridge; and like all modern liners of the first class, she may be considered unsinkable by any of the ordinary agencies of disaster. Of the interior accommodations of the ship it is sufficient to say that they are superior, even to those of the later ships of this line; while the decorative features are marked by the simplicity and refinement of the latest school of marine decorative work.

The engines of the "Cecilie" are four in number, each carried in its own separate water-tight compartment. Each engine has indicated about 12,000 horse-power in actual service. They are placed in pairs in tandem, two on each shaft. In the four engines there are altogether sixteen cylinders—four high-pressure, four first intermediate, four second intermediate, and four low-pressure cylinders. The high-pressure cylinders, which are carried in tandem over the first intermediates, are 37⅜ inches in diameter; the first intermediates are 49¼ inches; the second intermediates, 74⅞ inches in diameter; and the low-pressure cylinders reach the truly enormous size of 112¼ inches diameter, these being the largest marine cylinders, we believe, ever built. The common stroke is 6 feet. Steam is supplied from nineteen cylindrical boilers, at a pressure of 230 pounds to the square inch, through four main steam pipes, each of which is 17 inches in diameter. To produce this steam 764 tons of coal are burnt every twenty-four hours in 124 furnaces; and, as we have above stated, the resulting 48,000 horse-power of the main engines has proved sufficient to drive the vessel at slightly over 24 knots an hour.

It is an interesting coincidence that the finest, and what will probably be the last, of the reciprocating-engine liners, should be placed in service at about the same time as the first of the new high-speed turbine liners. The performance of these two ships will naturally be watched with the keenest interest; for in spite of the fact that the turbine-driven ship greatly exceeds the other in size and power, the "Cecilie" herself, with her displacement of nearly 30,000 tons, and her horse-power of nearly 50,000, is sufficiently large and powerful to eliminate, when driving into a head sea, much of the advantage due to the higher momentum of the larger ship. It is to be hoped that the facts as to relative coal consumption will be made available for the technical world. Just now, the steam turbine is being saddled with a reputation for extreme costliness in fuel; and predictions along these lines are being made so freely regarding the new Cunarders, as to suggest that perhaps the wish, in some quarters, may be father to the thought. For ourselves, we think it is likely that, because of the size of the plant and the high speed at which the turbines are being run, the new Cunarders will show about the same economy as the latest reciprocating-engine ships. This has been brought down in the "Cecilie" to 1.4 pounds of coal per horse-power per hour, including the auxiliaries.