

## DEVELOPMENT OF THE MARINE STEAM TURBINE.

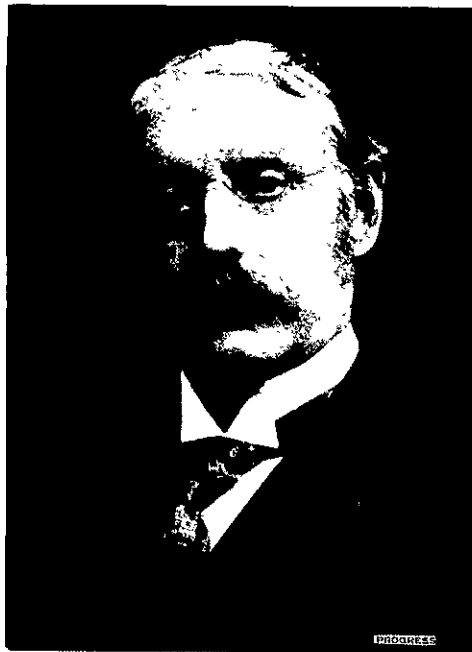
By THE HON. C. A. PARSONS AND R. J. WALKER.

It was not until 1894 that the idea of propelling a vessel by means of a steam turbine was put into practical forms. The *Turbina* was the first vessel to be fitted with turbine engines, and between 1894 and 1898 many experiments were made with her, necessitating radical changes in the design and arrangement of the machinery. The first engine which was tried was of the radial flow type, giving about 1500 h.p. to a single screw. The results, however, were far from satisfactory, a speed of only 18 knots being obtained. Several different propellers were tested with this engine, and the results compared with the power registered by a dynamometer showed in every case a very low propeller efficiency. The original turbine engine was removed, and the engines finally adopted consisted of three turbines in series—high pressure, intermediate pressure, and low pressure—each driving a separate shaft, with three propellers on each shaft. A reversing turbine was coupled with the low pressure turbine to the central shaft.

Following the success of the *Turbina*, the torpedo-boat destroyers *Viper* and *Cobra* were built and fitted with turbine machinery for the Royal Navy, and achieved remarkable speeds, the *Viper* taking the position of being the fastest vessel in the world, having attained the phenomenal speed of 36.86 knots per hour. Unfortunately, however, she ran on the rocks of the Channel Islands in a fog, and ultimately became a total wreck, and the *Cobra* foundered in a storm. Thus, after two or three years of hard work the *Turbina* was the only vessel afloat fitted with turbine engines.

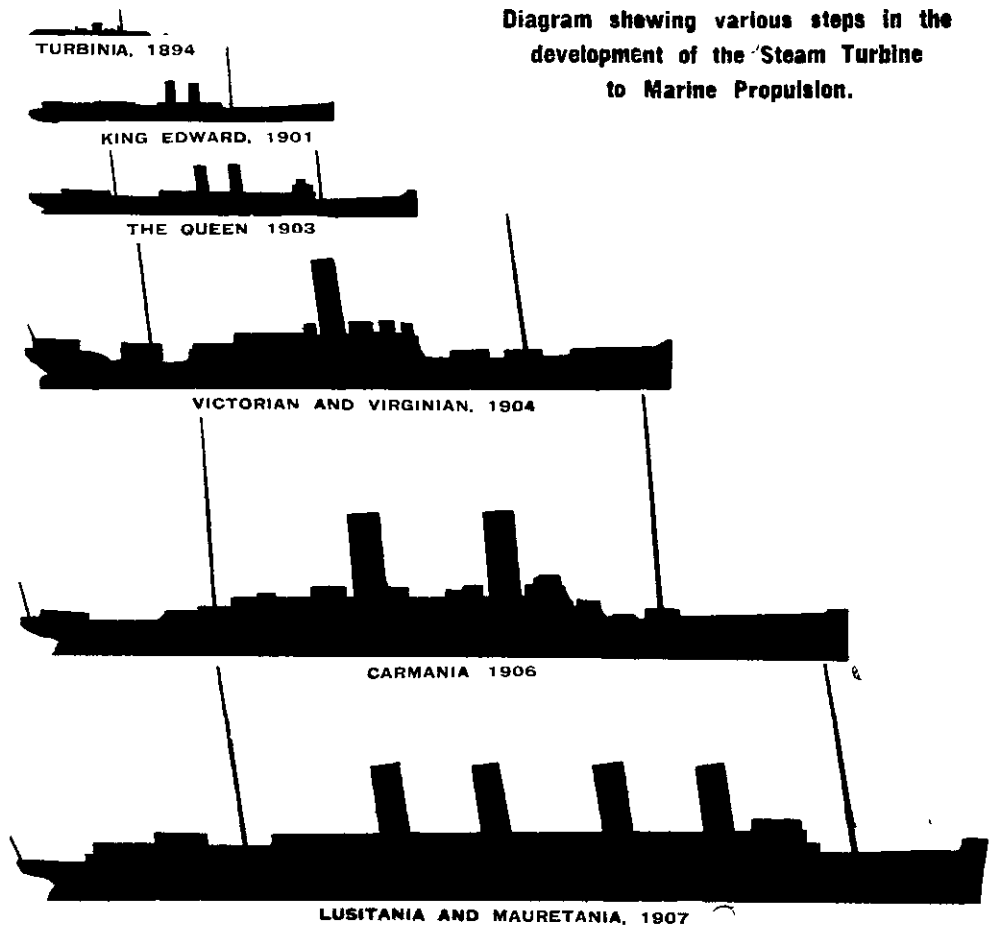
The marine turbine was first adopted for commercial purposes in the Clyde steamer *King Edward* to the order of Captain Williamson, in the summer of 1901. So successful was this vessel during the first season's running on the Clyde that an order was placed for a second vessel, *Queen Alexandra*, and the performance of these two vessels running on the Firth of Clyde demonstrated the commercial advantages accruing from the adoption of the turbine system. Other vessels quickly followed the *King Edward* and *Queen Alexandra*, until there are at the present time thirty-one turbine vessels in service for commercial purposes, representing a total of about 105,000 gross tonnage and 235,000 i.h.p. Our illustration shows in diagrammatic form, the comparative sizes of the various steps in marine propulsion. The profile of the vessels shown are to the same scale, beginning with the *Turbina*, of 100 ft. in length, 44 tons displacement and 2,000 i.h.p., to the express Cunarders *Lusitania* and *Mauretania*, of 785 ft. length, 45,000 tons displacement, and 70,000 i.h.p. each.

Comparisons of the earning powers of turbine vessels have been made from time to time with similar vessels on the same respective routes, which have been found to be favourable to the turbine, and in some cases the saving in coal is very considerable. By the courtesy of Mr. Pierrard, of the Belgian Government, particulars are just to hand of the first season's running of the turbine steamer *Princesse Elisabeth* on the Ostend and Dover service,



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Diagram showing various steps in the development of the Steam Turbine to Marine Propulsion.



[From *The Mariner*.]

and are given in the accompanying table,\* along with the particulars of similar vessels on the same service, but fitted with paddle engines.—

In the year 1905 the mean consumption of coal per single trip and the mean time per trip from Ostend to Dover, and *vice versa*, of the four preceding vessels were as follows:—

	P. E.	P. C.	M. H.	L. II.
Total number of trips	82	278	278	232
Mean duration of trip (minutes) . . . . .	187	217	212	227
Mean consumption per trip (tons) . . . . .	23.01	24.05	23.82	24.30

For the six months of the year 1906 the corresponding results were the following:—

	P. E.	P. C.	M. H.	L. II.
Total number of trips	134	132	106	44
Mean duration of trip (minutes) . . . . .	185.2	210.5	206.4	202.4
Mean consumption per trip (tons) . . . . .	22.71	23.22	24.27	24.87

Mean Results.  
Turbine. Paddle.

Total number of trips . . . . .	216	1,070
Mean duration of trip (minutes) . . . . .	185.9	215.4
Mean consumption per trip (tons) . . . . .	24.06	24

From the above table it will be seen that the turbine boat does the passage in about 15 per cent less time than the paddle steamer, on the same coal consumption. To reduce the turbine boat to the displacement and speed of the paddle boats, and assuming that the i.h.p. varies as the cube of the speed, the mean consumption of the *Princesse Elisabeth* would be about 17 tons, as against 24 tons in the paddle boats thereby showing a saving of over 25 per cent.

The following mercantile vessels have been completed and placed on service this year:—The pleasure and mail steamer *Rewa*, for the British India Steam Navigation Co., Ltd., of 455 ft. by 56 ft. and 16½ knots speed; the new Clyde passenger steamer *Duchess of Argyll*, for the Caledonian Steam Packet Co., of 250 ft. by 30 ft. beam and 20 knots speed; the Thames passenger steamer *Kingfisher*, for the General Steam Navigation Company, of

275 ft. by 32 ft. and 20 knots speed; the three cross-Channel steamers for the Great Western Railway Company's new route, Fishguard to Rosslare, viz., *St. David*, *St. Patrick*, and *St. George*, of 350 ft. by 41 ft. by 13 ft. 6 in. and 22½ knots speed; the cross-Channel steamer *Viper*, for Messrs. G. & J. Burns, of 315 ft. by 39 ft. 6 in. by 12 ft. and 21½ knots speed; and another Clyde passenger steamer, the *Atalanta*, for the Glasgow and South-Western Railway Company, of 210 ft. by 27 ft. by 10 ft. 6 in. and 17½ knots speed. In addition to these the two Great Central Railway steamers are nearing completion, and will, it is anticipated, be put on service this year; and the yacht *Mahroussa*, which has been re-engined by Messrs. A. & J. Inglis, on her recent trials attained a speed of 17½ knots.

In addition to the two express Cunarders, the following mercantile orders are in hand—Two large ocean-going liners by the Fairfield Shipbuilding and Engineering Company, two cross-Channel steamers for the South-Eastern and Chatham Railway, similar to the *Onward* and *Invicta*, and a further steamer for the Union Steamship Company of New Zealand, by Messrs. Denny, two large sets of turbine engines for shipment to Japan, by the Turbine Company, of Wallsend; and the Royal yacht, building by Messrs. Inglis, the turbine engines for which are being manufactured at the Turbina Works, Wallsend; representing a total i.h.p. of work in hand of about 590,000.

The development of the marine turbine has taken place almost entirely in Great Britain. A few war vessels have been built in France and Germany. The reason that the Parsons marine turbine has made so little progress on the Continent in the past is probably due to the fact that in France and Germany rival turbine systems of local origin have been energetically exploited, inducing those responsible for the ordering of new vessels to defer the adoption of a new system until the claimants had results to show. Turbine vessels which have been engined in England with Parsons turbines up to the present date represent a total h.p. actually completed of about 280,000 i.h.p. The total h.p. of marine turbines completed and on order with the Parsons Company and their licensees is over 870,000 i.h.p.

\* COMPARATIVE TABLE.

	Princesse Elisabeth	Princesse Clementine.	Marie Henriette.	Leopold II.
Length b p. . . . .	104.85 m.	103.70 m.	103.70 m.	103.70 m.
Breadth . . . . .	12.192 m.	11.58 m.	11.58 m.	11.58 m.
Mean draught . . . . .	2.92 m.	2.85 m.	2.82 m.	2.82 m.
Displacement in metric tons . . . . .	2,005	1,853	1,847	1,829
Registered tons . . . . .	1,747	1,474	1,450	1,375
Type of engines . . . . .	Turbines.	Compound.	Compound.	Compound.
Speed on trial (knots) . . . . .	24	22.187	22.2	22
Date of construction . . . . .	1905	1896	1893	1893