STEAM TURBINES.

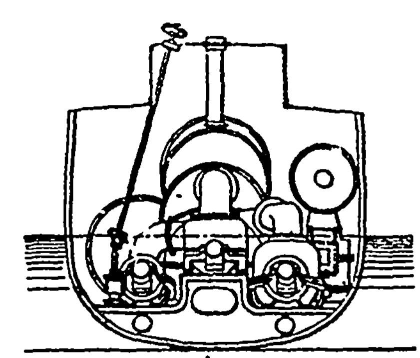
In the July issue of THE CANADIAN ENGINEER there appeared a description of the "Turbinia," the English torpedo-boat destroyer, whose great speed has attracted world-wide attention to the novel motor (the invention of the Hon. C. H. Parsons) which moves her propellers. We are now able to give drawings of the "Turbinia" and a fuller description of the turbine engines.

The Parsons' turbine consists essentially of a cylindrical case. Attached to the inner surface of the case are a number of rows of inwardly-projecting blades, which extend radially towards the axis of the engine. The function of these is to guide the steam. Through the axis of the engine there passes a shaft which is directly coupled to the screw-shaft. On the axial shaft is mounted a light drum, the external diameter of which is some inches less than the internal diameter of the case. When, therefore, the drum is placed inside the case and co-axial with it, there is left an annular space. This space is occupied by the blades, projecting inwards from the case before referred to, and by other rows of outwardly projecting blades attached to the outer surface of the light drum. The blades on the outer cylinder are called "guide blades," and the similar blades are known as "moving blades." When steam at pressure is admitted to the annular space it first comes in contact with a ring of the fixed guide blades, which are so formed as to direct the flow of steam on to the adjacent ring of moving blades at an angle to the surface of the latter, such as will cause the moving blades to rotate round the axis of the engine. As they are firmly attached to the drum, and as the latter is fixed to the shaft, motive power for a screw propeller or a dynamo is thus obtained. There are, of course, numerous alternate rings of guide blades and moving blades, there being perhaps eighty rows of both in an ordinary Parsons turbine. When the steam has been directed on one course by a ring of moving blades, it requires to have its line of motion altered so that it will strike the next ring of moving blades at the required angle. The guide blades are so shaped as to effect this purpose. In order to use steam economically it must be worked expansively, and this problem Hon. C. H. Parsons has solved in this way. As the steam does work, it necessarily increases in volume, and loses proportionately in pressure; to accommodate the increased volume additional blade area is given by gradually increasing the annular space and the size of the blades. Though its action in each individual turbine is approximately as if the fluid was inelastic, yet a small increment of volume takes place at each passage through the blades, and the expansion going on at something like geometric ratio at each of the numerous successive turbines, soon assumes large proportions. Ratios of expansion of fifty up to one hundred or even two hundred-fold are common in one single compound turbine of the condensing type—a notable feature in turbine practice being the high expansion ratios, and very large volumes can be economically dealt with without necessarily increasing the size and weight of the engine to any large extent.

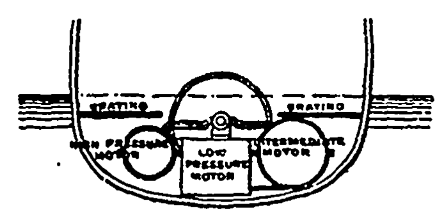
The high speed of revolutions diminished not only the weight of the engine in proportion to a given h.-p.; but also of shafting propellers and supports, as well as of the hull.

The inventor makes the following claims for the new motor: Greatly increased speed, owing to diminution of weight and smaller steam consumption; increased carrying power of vessel; increased economy in coal consumption; increased facilities for navigating shallow waters; increased stability of vessel; reduced weight of machinery; reduced cost of attendance on machinery; reduced size and weight of screw-propellers and shafting; absence of vibration; lowered centre of gravity of machinery, and reduced risk in time of war.

The "Turbinia" is 100 feet in length, 9 feet beam, 3 feet draught amidships, and 44½ tons displacement. She has three screw shafts, each directly driven by a compound steam turbine of the parallel flow type. The three turbines are in series, and the steam is expanded (at full power) from a pressure of 170 lbs. absolute, at which it reaches the motor to a pressure of 1 lb. absolute, at which it is condensed. The shafts are slightly inclined, and each carries three screws, making nine in all. The screws have a diameter of 18 inches, and when running at full speed they make 2,200 revolutions per minute. Steam is supplied from a water-tube boiler, and the draught is forced by a fan, mounted on a prolongation of the low pressure motor shaft, the advantage of this arrangement being that the draught is increased as the demand for steam increases, and also that the power to drive the fan is obtained directly from the main engines. Up to the present the maximum mean speed attained has been 32¾ knots, as the mean of two consecutive runs on the measured mile. These runs



SECTION THRO' ENGINE ROOM LOOKING AFT.



SECTION THRO' MOTORS

were made after about four hours' steaming at other speeds, and the boat on the day of the trials had been fifteen days in the water. It is anticipated that on subsequent trials, after some alterations to the steam-pipe, still higher mean speeds will be obtained. As it stands, however, the I.H.P. realized is 2,100, and the consumption of feed-water per I.H.P. hour 14½ lbs, and the speed the fastest of any vessel irrespective of size. The weight of the main engines is 3 tons 13 cwt. Total weight of machinery, including turbines and auxiliary engines, condenser and boiler, the propellers and shafts, the tanks and the water in boiler and hot well, 22 tons. Thus nearly 100 h.p. is developed per ton of machinery, and nearly 50 h.p. per ton of displacement of boat. The total weight of the "Turbinia's" engines is 3 tons 13 cwt., and they develop 2,100 indicated horse-power, as determined by Professor J. A. Ewing, F.R.S. Ordinary navy engines of the torpedo vessel class would weigh probably 15 to 20 tons.

"The advantages of a rotary-motor for the purpose of marine propulsion are manifest as regards a direct application of the force of the steam to the shaft to be driven, and a consequent saving of bulk, weight, friction and wear," says the *Marine Engineer*, London, in a recent article. 'When such a motor is shown to be economical in steam