second, 8 in the third and 8 in the fourth, or 34 stages in all. The low pressure turbine (fig. 63) comprises 28 more stages stepped as shown in the figure. The reversing turbine which is seen on the left hand side in fig. 63, at the place where the rotor is reduced in diameter, has 26 stages in 4 steps. These turbines have a total normal horse power of 12,500, and run at 450 revolutions per minute.

128. *Longitudinal Forces in Marine Turbines.*—In a marine steam turbine the size of the dummy is reduced so that instead of balancing the whole steam thrust it leaves a resultant force which nearly balances the propeller thrust. Consequently only a small thrust block has to be provided to take any difference there may be between these forces. This thrust block is shown on the extreme right in each figure, beyond the gland and bearing. The dummy (at D in the figures) is made up of some 22 rings of brass fixed in the case in close proximity to the faces of projecting rings on the rotor (fig. 64) with a longitudinal clearance of 0∙015 in. This form of dummy is suitable for the end near the thrust block, where exact longitudinal adjustment is possible, but the astern turbine in fig. 63 requires a different form because some longitudinal play is neces­sarily brought about there by differences in expansion of the rotor and stator. Accordingly, the astern dummy is of the “ radial ” form shown in fig. 65 where the fine clearance is round the circum­ference of the brass rings set in the rotor and stator alternately. The whole dummy includes about sixteen of these rings.

129. *Shaft Arrangement of Marine Turbines,—*Fig. 66 shows the usual three-shaft arrangement, with two low pressure turbines in parallel on the wing shafts, and one high pressure turbine, with which they are jointly in series, on the middle shaft. In very large vessels four shafts are used, and the turbines form two independent sets one on each side of the ship. The outer shaft on each side carries a high pressure turbine, and the inner shaft car­ries the corresponding low pressure turbine and also a turbine for revers­ing. This arrangement is followed in the “ Lusitania" and “ Mauretania ” where the low pressure turbines have drums 188 in. in diameter, are about 171/2 ft. in diameter over all and 50 ft. long, and weigh 300 tons. Each turbine has 8 steps with about 16 stages in each step in the high pressure turbine and 8 in the low. They run at 180 revolutions per minute.

130. *Cruising Turbines in War-Ships,—*In turbines for the pro­pulsion of war-ships it is necessary to secure a fairly high economy at speeds greatly short of those for which the turbines are designed when working at full power, for the normal cruising speed of such vessels is usually from half to two-thirds of the speed at full power. To counterbalance the reduced blade velocity, when running under these conditions, the number of rows of blades has in some cases been augmented by adding what are called cruising turbines, which are connected in series with the main turbines when the ship is to run at cruising speed. In the three-shaft arrangement the cruising turbines are fitted on the wing propeller shafts, which carry also the low pressure and astern turbines. They form a high and inter­mediate pressure pair through which the steam may pass in series