

perative that the invulnerability of armor should be increased without a relative increase in weight; the Harvey process was the first step in this direction, but nearly all the British ships of to-day are armored with Krupp steel, which has a tensile strength of almost 50 tons per square inch, and is hardened by small injections of nickel, chromium and manganese. The Krupp plate, in its shell resistance qualities, has a figure of merit of about 2.5 as against 1.25 for compound armor which was supplied on armored ships built previous to 1890. The compound armor consists of a wrought iron plate attached artificially to a steel face of about half its own thickness; the result being a plate with the hardness of steel and the toughness of wrought iron on the back, the combination being designed to break a shell up without cracking the armor plate. Thus it is seen that the 11-inch belt of a modern Dreadnought ship offers more resistance to hostile gun fire than the 20-inch belt of the "Trafalgar" (a ship that was considered a wonder when commissioned in 1887) and this is accomplished with a reduction of about 47 per cent. in the weight.

In a modern British battleship a second section of broad-side armor is carried above the belt mentioned above and is meant to protect the citadel or redoubt. This belt is carried upward from the midship section as high as the level of the

293 pounds of cordite is capable of penetrating 51¾ inches of wrought iron at a distance of 6,000 feet from the muzzle. It is reported that the admiralty have a still further improved 13.5-inch gun that has a muzzle velocity of 2,850 feet per second, and operates on a charge of 430 pounds of cordite without injury. This has not as yet been mounted, but according to report is an effective check against the proposed 14-inch gun mentioned in the estimates of certain foreign powers. The 12-inch gun, which we illustrate in Fig. 1, is the standard heavy British naval gun, and is mounted in nearly all the ships now in commission. This gun weighs 69 tons and throws a projectile of 850 pounds; the muzzle velocity of this weapon is 3,010 feet per second, and the extreme range is 25,000 yards, but its most dangerous range is given at 6,800 yards, at which point the velocity of the shell and its explosive properties harmonize to the best advantage.

A modern British Dreadnought carries 800 projectiles for these monsters, and the shell delivery apparatus is so arranged that one shot per minute could be flung from each gun. This rapidity of fire would not be feasible, however, owing to the eye-stinging vapors and the benumbing effect of the "back-blast" upon the crew. Guns of 10 inches, 9.2 inches, 7.5 inches and 6 inches are also disposed about the modern ship and all are considered large guns. The 4.7



H.M.S. "Invincible,"

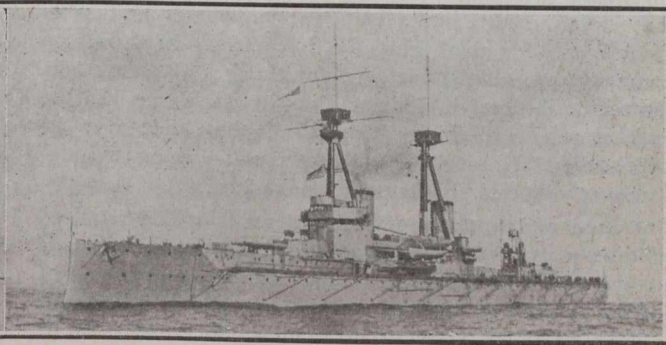
one of a powerful line of battle cruisers that would keep the lines of commerce open during a time of hostilities, while the battle-ships were blockading the enemies' ports.

main deck and is composed of 11 inches of Krupp steel in the centre tapering to 8 inches at the extremities; it encloses the turret mountings and the upper portions of the coal bunkers. All the main armor and the lower part of the upper belt is backed by a solid wall of coal nine feet thick.

The armored bulkheads subdivide the ship transversely into sections and these spaces are again subdivided by a central fore-and-aft bulkhead below the armored deck. In the Dreadnought type of British battleship the armored transverse bulkheads below the main deck—which is nine feet above the water line—are all unpierced excepting by pipes and wires and ingress and egress to these various compartments is effected by elevators.

In the protection of guns the aim is to secure the maximum of safety for the crew and the firing mechanism, coupled with the greatest possible mobility in training the weapon over the widest possible arc of fire. The barbette, which is almost exclusively used in the protection of guns, is a circular fortress of steel with a bomb-proof top, the whole revolving upon a shaft which goes right down to the bed of the ship. (Fig. 1).

H.M.S. "Orion," considered to be the most powerful all-round fighting ship in service, mounts ten of the 13.5-inch gun of the new design. This gun weighs 76 tons and throws a projectile weighing 1,250 pounds with a muzzle velocity of 2,599 feet per second, and with the usual firing charge of



H.M.S. "Temeraire,"

one of many of Britain's latest Dreadnoughts. Note the tripod construction of the masts; they are constructed thus to allow great steadiness in the fire control tower situated half way up. Two legs of these supports could be shot away and the mast still remain rigid.

and smaller weapons are regarded as "mosquito" armament, and are used only for close quarters, repelling torpedo craft, and by the marines when making land attacks.

The fire control of each and every weapon on a modern British warship, excluding the hand rifles and officers' revolvers, is under the direct control of the gunnery officer in the fire control station. A series of electric wires and a switchboard enable him to communicate by telephone and other means with every gun turret on the ship. In order to reduce the risk of the fire control station from being shot away to the smallest possible limit, the fire control station is mounted on a steel tripod, each leg of which will effectively support the platform for a time, should the other two members become damaged. These tubes are hollow and the station may be reached by ladders secured to the inner surface.

The cost of a modern super-Dreadnought may be taken as follows:—

Hull .....	\$2,386,000
Boilers and machinery .....	2,000,000
Searchlights and electrical fittings...	400,000
Boats .....	40,000
Armor plate .....	3,240,000
Five barbettes and ten guns .....	3,000,000
Secondary armament of six-inch guns	400,000
Five torpedo tubes .....	200,000
<b>Total .....</b>	<b>\$11,666,000</b>