*Submerged Discharge.—*The risk attached to having loaded torpedoes above the water-line—independently of the fact that to get the best result they should start in the element to which they belong—has given great impetus to the system of submerged discharge. From the earliest days of the weapon this has been employed to some extent. But it was principally in the direction of right-ahead fire, by having an orifice in the stem of the ship under water, to which a torpedo tube was connected. The tactical idea was thus to supplement attack with the ram, so that if the vessel endeavouring to ram saw that the object would evade this attack, she could project a torpedo ahead, which, travelling faster than the vessel, might as effectually accomplish the required service. The stem orifice had a water-tight cover, which was removed on the torpedo being placed in the tube and the inner door closed; then, sufficient impulse being imparted to eject the torpedo, and its machinery being set in motion at the same time, it darted forward towards the enemy. There is, however, some risk of the ship using a torpedo in this manner striking it before the missile has gathered the necessary impetus from its propellers to take it clear of the vessel. The system, moreover, has the disadvantage of weakening the ram, the construction of which should be of immense strength. There is the further liability of ramming with a torpedo in the bow tube, which would be as disastrous to friend as foe. This method of submerged discharge has therefore given place to ejecting the torpedo from the broadside. Considerable difficulty attached to getting the torpedo clear of the ship from this position without injury, especially when the vessel was proceeding at speed. The natural tendency of the passing water acting on the head of the torpedo as it emerged was to give a violent wrench and crush the rear end before that portion could clear the aperture. To prevent this the torpedo must be held rigid in the line of projection until the tail is clear of the ship. This is thus effected. Besides the tube with the aperture in side of the ship under water, fitted with sluice-valve, all broadside submerged discharge apparatus possess the following features: A shield is pushed out from the ship’s side. In this shield there are grooves of some form. Guides on the torpedoes fit and run in these grooves. When discharged the torpedo is thus supported against the streams of passing water, and guided so that its axis continues in the line of projection until the tail is clear of the side, the shield being of such length that this occurs at the same time that the guides on the torpedo leave the grooves in the shield. An apparatus on this principle has been fitted to a number of ships of the British navy, and gives good results at high rates of speed. It has the defect that the shield must be run out previous to the torpedo being discharged, and brought back afterwards, thus involving three separate operations, each performed by compressed air.

In the broadside submerged discharge, designed, constructed and supplied to many foreign navies by Messrs Armstrong of the Elswick works, the three operations are combined in one. There is an outer tube as before, but it contains an inner tube carrying the torpedo. Fized to this tube, and prolonging it, is the shield fitted with grooves. Both tubes have a door at the rear—made air- tight when closed—by which the torpedo is entered. A charge of cordite is used for ejection instead of compressed air, the gas from which entering the outer cylinder first forces the inner tube out, and then by means of a valve in the door of the inner tube passes in and blows out water and torpedo together, the shield supporting the latter until the tail is clear of the ship. By this time the cordite gas has expanded and cooled so as to relieve the pressure in rear; this causes the pressure of the water outside to push the shield and tube into the ship again, so that practically the whole operation is one motion.

Fig. 3 will further explain this apparatus. *A* is the outer tube; *B* the inner tube; *C* the shield; *D* torpedo; *E* explosion chamber for cordite charge placed at *K; F* pipe for gas to pass into outer tube ; *G* and *Y* doors of inner and outer tube ; *J* the valve which opens automatically when inner tube arrives at position shown in fig. 2; *T* and *P* appliance for running the tube in and out by hand when desired ; *O* arrangement for bringing whole apparatus back for repair, &c.; *M* and *N* sluice-valve and handle; R, rl, *r2, r*3*,* for draining tubes before torpedo is put in; *X* indicator showing position of inner tube.

Torpedoes have been discharged from this apparatus with successful result from a ship steaming at 17½ knots.

The advantage of cordite over compressed air for impulse is that it requires no attention: when a charge

is placed in the explosion chamber, and a torpedo is in the tube, all is in readiness for firing when desired, without further attention in the torpedo-room. The cordite is fired by electricity from the conning-tower; the officer, therefore, having ascertained that all is ready below, has only to press a button when the object is in the required position. Automatic indications are given in the conning-tower when the sluice-valve is opened and when all is in readiness for firing.

This method of discharging torpedoes from the broadside under water eliminates the principal danger of the system, which required the shield to be put into position beforehand. It was then liable to be struck and distorted by passing wreckage without the fact being apparent to those in the ship. On the discharge of a torpedo its course might thus be arrested, or possibly the charge be prematurely exploded in dangerous proximity to its own ship. There was a risk of getting the shield out too soon, and thereby exposing it unduly to injury, or leaving the operation until too late. The tendency of naval equipment being towards complication, any readjustment which makes for simplicity cannot be otherwise than beneficial, and this feature is especially desirable in all matters connected with the use of torpedoes.

The compartment containing the broadside submerged apparatus usually extends across the ship, so as to contain a tube for each side.

*Use in War.—*This has been mainly confined to attacks upon squadrons and single ships by torpedo craft of various types. At the battle of Yalu, between the Chinese and Japanese fleets, torpedoes were discharged by the former, but none took effect. The Japanese trusted solely to gun-fire. After the defeat of the Chinese at sea, their remaining ships took refuge in the harbour of Wei-hai-Wei. Here they were blockaded by the Japanese fleet, which, having a number of torpedo-boats, made several determined attacks upon the ships inside. After one or two attempts, foiled by the obstructions placed by the Chinese to bar the passage, the Japanese boats succeeded in torpedoing several ships, and thus expedited the reduction of the place. In the war between Spain and the United States the inferiority of Admiral Cervera’s squadron to that under Admiral Sampson might at the battle of Santiago have been to some extent counterbalanced by a skilful and vigorous use of torpedoes. If, instead of striving only to escape, a bold dash had been made for the American ships, the Spanish cruisers rapidly approaching end on to the foe, enveloped in the smoke of their own guns, should—some at least—have got within torpedo range without fatal injury. Closing each other at a speed of 10 knots only they would cover an interval of 6000 yds. in 9 minutes—a short time in which to disable a ship by gun-fire under such conditions. But Cervera elected to offer a passive resistance only, and while suffering destruction wrought no material injury upon his opponents. On the other hand, there have been