**SUBMARINE MINES.** A submarine mine is a weapon of war used in the attack and defence of harbours and anchorages. It may be defined as “ A charge of explosives, moored at or beneath the surface of the water, intended by its explosion to put out of action without delay a hostile vessel of the class it is intended to act against.” It differs from the torpedo (*q.v.*) in being incapable of movement (except in the special form of drifting mines, which are not moored, but move with the tide or current). But this subdivision into two distinct classes was not made till 1870. Prior to that date the term “torpedo” was used for all explosive charges fired in the water.

Submarine mines may be divided into two main classes, con­trollable and uncontrollable, or, as they are often classified, “ electrical ” or “ mechanical.” In the first class the method of firing is by electricity, the source of the electric power whether by battery or dynamo being contained in a firing station on shore and connected to the mines by insulated cables. By simply switching off the electricity in the firing station, such mines are rendered inert and entirely harmless. In the second class, the means of firing are contained in the mine itself, the source of power being a small electric battery, or being obtained from a pistol, spring or suspended weight. In all mines of this class the impulse which actuates the firing gear is given by a ship or other floating object bumping against the mine. When mechanical mines have once been set for firing they are thus dangerous to friend and foe alike. Safety arrange­ments are employed to prevent the firing apparatus working while the mine is being laid, and clockwork is sometimes added to render the mine inactive after a certain definite time or in case the mine breaks away from its mooring. Their principal advantages, as compared with the electrically controlled mines, are cheapness and rapidity of laying. “ Controllable ” mines are absolutely under the control of the operator on shore, their condition is always accurately known, and if any break adrift not only is the fact at once known but the mines themselves are harmless. Another advantage is that when fired by “ observa­tion ” as described below, they are placed at depths which will be well below the bottom of any vessels passing through the mine field. They can thus be used in channels which have to be kept open for traffic during hostilities.

Electrical mines take rather longer to prepare and lay out than the other class, as the electrical cables have to be laid and jointed, and they require rather more skill and training in the operators employed to lay and fire the mines. Such mines represent the highest development of this form of warfare, and the details given below refer mainly to this class of mine.

Electrical mines are arranged on two systems according to the method of ascertaining the proper moment to apply the firing current to the mine cables. These methods are by “ observa­tion ” or by “ circuit closer.”

The “ observation ” system depends on two careful observa­tions made by an operator on shore, one of the exact position in which the mines are laid, the other of the track of hostile ships passing over the mine field. The position of the mines when laid is marked on a special chart, on which the track of ships crossing the mine field can also be plotted. When the track is seen to be crossing the position of a mine, a switch is closed on shore and the mine is fired. To allow for errors in observation such mines are fitted with large charges of explosive and are usually arranged in lines of two, three or four mines placed across the channel, all the mines in a line being fired together. Observa­tion mines are placed either resting on the bottom or moored at depths which are well below the bottom of any friendly vessels and (except that anchoring in the mine field must be forbidden for fear of injury to cables) such mines offer no obstruc­tion to friendly traffic.

In the “ circuit closer " or “ C.C.” system, each mine contains a small piece of apparatus which is set in action by the blow of a vessel or other object against the mine. When set in action, this apparatus completes an electrical circuit in the mine, through which the mine can be fired, if the main switch on shore is closed. If it is not wished to fire, the C.C. is restored to its ordinary condition either automatically by a spring in the mine, or by an electrical device operated from the shore.

Such mines are necessarily placed near the surface, and are to this extent an interference with friendly traffic. A vessel passing by mistake through a mine field of this class would run no risk of an explosion while the mines are inactive, but might do some damage to the mines.

This class of mine is used in side channels which it is intended to close entirely, or to reduce the width of navigable channels where too wide to be defended by observation mines. Their principal advantage is that if the firing switch is closed they are effective in fog or mist, when observation mines could not be worked, and when the guns of the defence would be equally out of action. As they are fired only when close against the side of a ship, the charge can be comparatively small and the mines themselves are handy and easy to lay.

Compared with observation mines they use much less cable, as the action of the C.C. is such that only the mine which is struck can be fired. Several mines of this class can therefore share one cable from the shore, though in practice details of mooring and arrangement limit the number connected to one cable to four. A set of mines on one cable is referred to as a “ group.”

The arrangements for firing the mines are contained in a firing station on shore, in which is the battery or other source of