Nov. 4, 1930. K. O. R. JOHANSSON 1,780,592

SINK MINE

Filed March 29, 1928

Fig. 2

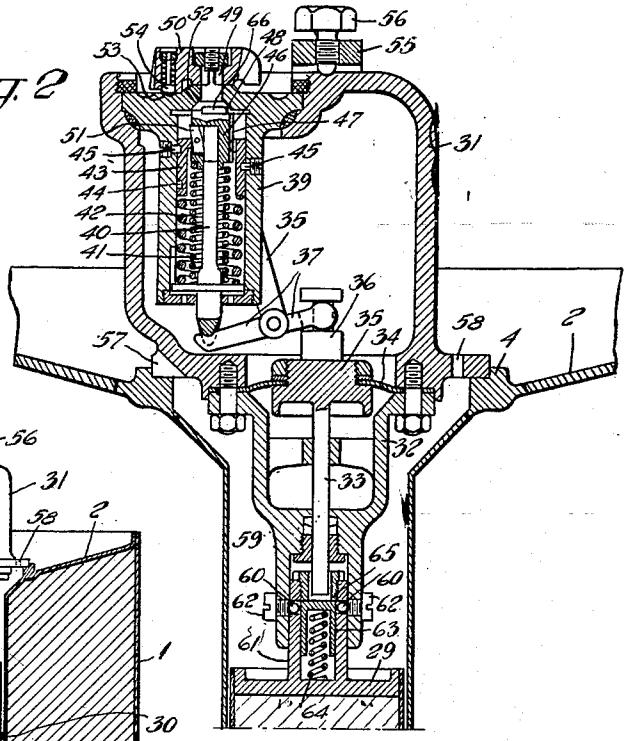


Fig. 1

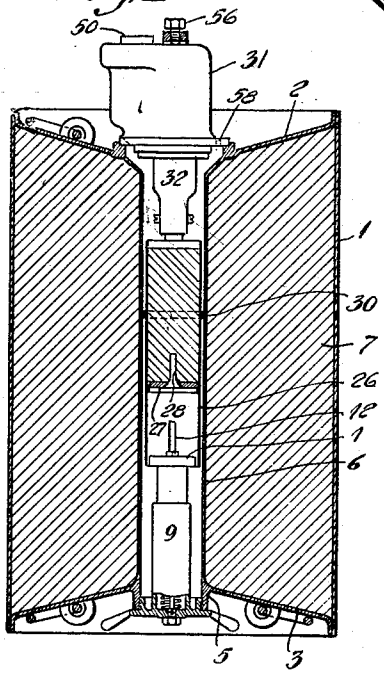


Fig. 3

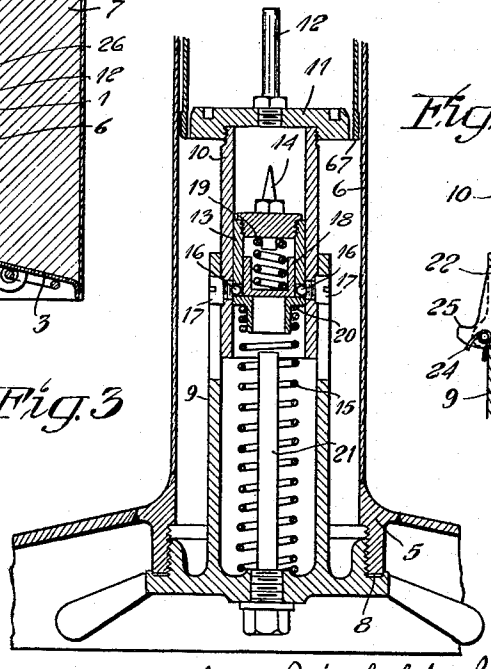
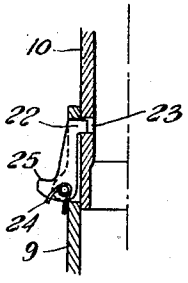


Fig. 4



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UNITED STATES PATENT OFFICE

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SINK MINE

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The present invention refers to an arrangement in sink mines or depth bombs of the type the explosion of which is controlled hydrostatically at a certain depth. Used as an anti-submarine weapon the mine can be dropped or thrown from a ship where a submarine is supposed to be located, the said mine then exploding at depths adjusted beforehand, so that the submarine is destroyed or is compelled to rise to the surface.

The invention has primarily for its object to render the mine entirely safe, also with a certain amount of rough treatment, both before the mine is to be dropped or thrown and also in the act of dropping or throwing the same. The mine should thus be capable of withstanding shocks or blows of a mechanical nature, without being burst or damaged thereby.

The mine consists of the following principal parts, namely:

The shell consisting substantially of a mantle provided with a cover and a bottom,

The charge which is enclosed within the mantle,

The pistol with the detonator causing the explosion of the charge,

The detonating plunger which is filled with an explosive substance, the same as the shell, and

The depth regulator, that is to say, a mechanism which when adjusted in a certain manner causes the mine to burst at a desired depth.

The arrangement according to the invention is principally characterized by the fact that the detonating plunger is locked to the depth regulator, prior to the mine being dropped or thrown, in such a manner as to be separated from the detonator and also in such a manner that the locking will be released at a certain depth by the pressure of the water, so that the detonating plunger will not only be brought into connection with the detonator but will also fire the pistol so as to cause the mine to burst.

The accompanying drawing illustrates an embodiment of the invention.

Fig. 1 is a partly sectional view of the mine in its entirety.

Fig. 2 is a longitudinal section of the releasing device of the mine shown to an enlarged scale.

Fig. 3 shows the firing device of the mine, likewise to an enlarged scale, this device being called the pistol in the following.

Fig. 4 shows a detail of the device according to Fig. 3.

The shell consists of a cylindrical mantle 1 of steel plate, said mantle being provided with a cover 2 and a bottom 3, both of these members being conical to some extent. Welded to the center of the cover is a flange 4, and a flange 5 is likewise welded to the center of the bottom, said flange 5 being threaded for the purpose of permitting the pistol to be screwed in. The two flanges 4 and 5 are united by means of a central tube 6 surrounding the pistol and the detonating plunger.

The charge 7 generally consists of trotyl cast into the frame 1 and filling the major portion thereof. The charge is caused to explode by detonation of the detonating plunger.

The pistol is threaded into the bottom flange 5 and tightens against the latter by means of a packing 8, said pistol consisting of a sleeve-shaped frame 9 having a supporting sleeve 10 slidably mounted therein. Screwed onto the one end of the sleeve 10 is an impact bottom 11 forming the attachment for the detonating tube 12. Adapted to be displaced within the supporting sleeve 10 is the percussion sleeve 13 with the percussion pin 14 and the percussion spring 15. Prior to firing, the supporting sleeve 10 and the percussion sleeve 13 are locked onto each other by means of a ball lock. The latter consists of balls 16 entering openings in the percussion sleeve 13 and retained in their places by means of screws 17 provided with concave end surfaces and by means of a sliding sleeve 18 which is kept pressed against an abutment 20 by means of a spring 19. Secured centrally with respect to the device above described is a spindle 21 extending through the percussion spring 15. The supporting sleeve 10 is locked to the sleeve 9 forming the shell, by means of the means

shown in Fig. 2. The latter consists of two pawls 22 disposed diametrically in a plane at right angles to the plane in which the balls 16 are situated. The pawls engage openings 23 in the supporting sleeve 10 under the action of torsion springs 24. Projecting from the pawls are arms 25 which may be brought into cooperation with the detonating plunger to release the pawls 22 in the manner described more fully hereinbelow.

The detonating plunger consists of a sleeve 26 with a bottom 27 attached therein, said bottom having a sleeve 28 secured therein, the sleeve 28 being adapted to receive the detonating tube 12. A second bottom 29 secured in the sleeve 26 is locked to the depth regulator by means of a ball lock. Enclosed between the bottoms 27 and 29 is the detonating charge which may consist of trotyl, tetryl or novite. Provided between the sleeve 26 forming the detonating plunger and the central tube 6 is a rubber ring 30 rolling between the central tube and the sleeve 26 when the detonating plunger is introduced into the central tube, the rubber ring thus forming an effective tightening means against water.

The depth regulator, the object of which is to facilitate adjustment of the depth at which the mine shall explode, is arranged in the following manner. In consists of a frame in two parts, i. e. an upper part 31 and a lower part 32, said parts being united by means of bolts and nuts. The upper part 31 is separated from the lower part 32 with a watertight fit by means of a diaphragm 34 secured between both, said diaphragm being connected with a spindle 33 by means of a plunger like member 35, the spindle 33 being displaceable in the lower part 32. The parts 31 and 32 thus form two separated pressure chambers. The detonating plunger is kept locked onto the depth regulator by means of a ball lock consisting of balls 60 adapted to enter openings in a sleeve 61 connected with the cover 29. The balls are retained in their places, first, by means of screws 62 with concave end surfaces and, second, by a sliding sleeve 63 adapted to be displaced in the sleeve 61, said sleeve 63 being pressed against an abutment 65 by means of a spring 64. The member 35 is fitted with a pin 36 having a neck provided with a turned portion engaged by the one arm of a two-armed lever 37. The lever is mounted in lugs 38 projecting from a spring casing 39. Guided in this spring casing is a spindle 40 abutting against the one arm of the lever 37. Abutting against the spindle 40 are two springs, i. e. an internal weaker spring 41 adapted for the smallest firing depth, and an outer coarser regulating spring 42 acting together with the spring 41 at the greater depths. At the top, the regulating spring 42 abuts against a tension sleeve 43 having a flat thread 44 with a great pitch on its outer cylindrical surface, said thread being engaged by two guide screws 45. The tension sleeve 43 is rotated by means of a valve 46 engaging into corresponding slots in the tension sleeve by means of two wedges 47. The valve 46 tightens against a conical seat 48 in the upper portion of the spring casing 39 and is formed at the top into a square pin 49 having a handle 50 threaded thereon. Two pawls 51 (only one of which is visible) in the valve 46 prevent the spindle 40 in secured position from moving upwards, and in this position, the channel 52 through which the water flows into the pressure chamber 31 is covered by the valve 46. Figures for the indication of the depth are provided on the upper plane of the spring casing 39 in the places where the pointer of the handle 50 points at corresponding depths, in addition to which recesses 53 for the pawl 54 of the handle are provided to fix the position of the handle. In addition to the figures indicating the depth there is also a position marked "Secured". The whole depth regulator is kept in its place by a strap 55 which is movably attached to the cover 2 and adapted to be tightened up by means of a tension screw 56. The regulator casing does not tighten against the flange 4, but is provided with openings 57 and 58 through which the water may enter the chamber 59.

The mode of operation of the apparatus is as follows:

Prior to clearing the device, the depth regulator is adjusted on "Secured." No water can then enter the pressure chamber 31, the spindle 40 cannot move, and the detonating plunger is locked. The detonating tube 12 and the detonating plunger are thus separated, and even if the former would be brought to detonation by firing, this does not cause explosion of the main charge.

The desired depth is adjusted by turning the handle 50 so that its upper pointer points at the corresponding figure of depth. The tension sleeve 43 is then displaced upwardly and compels the pawls 51 inwardly, so that the spindle 40 may be freely displaced, the water channel 52 being uncovered at the same time, the same being brought into communication with a recess 66 in the tightening surface of the valve 46.

The mine is dropped or launched into the sea. When it commences to sink, water flows in through the channel 52 into the pressure chamber 31 and through the openings 57 and 58 into the chamber 59. On having entered the pressure chamber 31 the water actuates the member 35 and the diaphragm 34. This action is counteracted by the spring 41 and, at the greater depths, also by the spring 42. At the pressure of the water on the diaphragm 34 and the member 35 the spindle 33 is displaced toward the sliding sleeve 63 and moves the same inwardly against the action of the spring 64. When the sleeve 63 has thus

moved past the balls 60, the latter are free, that is to say, the locking between the depth regulator and the detonating plunger is released, and the latter may move toward the pistol under the influence of the water pressure in the chamber 59. The detonating tube 12 then enters the sleeve 28, and the edge of the sleeve 26 of the detonating plunger hits the arms 25 of the pawls 22, so that the pawls are turned out of engagement with the supporting sleeve 10. The latter will thus be free to enter the sleeve 9, this taking place when the bottom 27 of the detonating plunger hits the impact bottom 11 of the pistol. The sliding sleeve 18 is thus approached to the spindle 21 which moves the sliding sleeve 18 past the balls 16 against the action of the spring 19, whereby the percussion sleeve 13 is released from the supporting sleeve 10. The percussion spring 15 is strained at the same time, and when the percussion sleeve 13 has been released in the manner just described, it is moved, together with the percussion pin 14, against the detonating tube 12 by the percussion spring, the detonating tube being thus fired so as to cause the charge to explode.

When the mine is dropped or launched into the sea and is brought into contact with the water, this frequently takes place at a great speed and in any direction. In order that the mine shall not then explode, there are two securities provided through the above described arrangement according to the invention. In the first place, the supporting sleeve 10 of the detonator is retained by the pawls 22 which are balanced in such a manner that they will not have a tendency to strike out at the same time, and, secondly, the masses of the parts 33, 34 and 35 of the depth regulator on the one hand and those of the spindle 40 with the springs 41 and 42 on the other hand are so adapted, while the lever 37 also provides such an arrangement, that the turning moments of both of the said groups about the pivot of the lever will be the same. The impact against the water, or an impact caused in some other manner from the one or the other direction on the longitudinal axis of the mine, or approximately so, will thus be neutralized through the arrangement of the lever 37, in such a manner that the detonating plunger cannot be released from the depth regulator through the impact. It is entirely out of question that the guiding sleeve 63 could leave its locking position through the impact alone, this being due to the small mass of the sleeve and to the presence of the spring 64, the rigidness of which is such that it will safely counteract every impulse of movement of the sleeve by impact only.

The inlet channel 52 is made so small as it may possibly be without preventing introduction of so great a quantity of water into the pressure chamber 31 as is required to cause explosion of the mine at the smallest firing depth. The opening is made so small with regard to the fact that, should an additional pressure be produced, for instance by firing or shell explosion on board the ship where the mine is kept, such additional pressure would, if the opening 52 were larger, be apt to be transferred through the opening into the pressure chamber 31 so as to prematurely release the detonating plunger from the depth regulator, which might cause premature explosion of the mine.

I claim:

1. A sink mine or depth bomb with hydrostatic control of the explosion depth and provided with a depth regulator, a detonating plunger and a pistol, characterized by the fact that the detonating plunger is locked to the depth regulator, prior to the mine being dropped or launched, in such a manner that the detonating plunger will thus be separated from the detonator, and in such a manner that the locking will be released at a certain depth on account of the water pressure, so that the detonating plunger will not only be brought into connection with the detonator, but will also release the latter so that it will cause explosion of the mine.

2. A sink mine or depth bomb according to claim 1, characterized by the provision of a chamber (59) on that side of the detonating plunger which is opposite to that of the detonator, said chamber (59) communicating through one or more openings (52) with the water surrounding the mine after the same has been launched, so that the water may penetrate into the chamber (59) and move the detonating plunger into connection with the detonator after the detonating plunger has been released from the depth regulator.

3. A sink mine or depth bomb according to claim 1, characterized by the depth regulator consisting, first, of a spring casing (39) with a control device (60) accessible from the outside and adapted for the tension of a spring or springs (41, 42), said spring casing (39) being preferably enclosed within a pressure chamber (31) provided in the depth regulator, said pressure chamber communicating through one or more openings (52) with the water surrounding the launched mine, and said pressure chamber being separated through a diaphragm or a plunger, or both, from a chamber also provided within the depth regulator, said latter chamber having enclosed therein a displaceable spindle (33) or the like connected with the diaphragm (34) or with the plunger, or with both, said spindle being so disposed in relation to a locking means provided between the depth regulator and the detonating plunger that the said locking means will be released when the diaphragm (34) or the plunger, or both,

is/are actuated by water entered into the pressure chamber (31).

4. A sink mine or depth bomb according to claim 1, characterized by the locking device between the depth regulator and the detonating plunger consisting of a sleeve (61) projecting from the latter, said sleeve being displaceable in a sleeve (32) provided in the depth regulator, a ball lock being provided between both sleeves, the balls (60) of said ball lock engaging in locking position into both sleeves (61, 32) and being retained in the said position by a sleeve (63) displaceable in the first mentioned sleeve (61) and actuated to be brought into locking position, said sleeve (63) being disposed in the path of the spindle (33) connected with the diaphragm (34) or the plunger of the depth regulator, in such a manner that when the diaphragm (34) or the plunger is actuated by the water pressure, the spindle (33) will be displaced to release the balls (60) of the ball lock, so that the locking between the depth regulator and the detonating plunger is released.

5. A sink mine or depth bomb according to claim 1 characterized by the pistol consisting of two sleeves (9, 10) displaceable within each other, said sleeves being locked onto each other by means of pawls (22) when the detonating plunger is separated from the pistol in locked position, the said pawls (22) being so disposed as to project into the path of the edge of a sleeve (26) forming the casing of the detonating plunger, so that the said edge will, when the detonating plunger is released from the depth regulator and moved by the pressure of the water toward the pistol, actuate the pawls (22) so that they will be tripped to release the pistol sleeves (9, 10) from each other.

6. In a sink mine, the combination with a pistol having safety means for normally preventing actuation thereof, a depth regulator, a detonating plunger and means normally locking the same to said regulator, of means carried by said plunger, and operable upon movement of said plunger subsequent to the release of said locking means by said depth regulator, for releasing said safety means to permit actuation of said pistol.

7. In a sink mine, a casing housing the explosive charge and having walls defining a substantially vertical passage, a depth regulator at the upper portion of said passage, a detonating plunger slidable within said passage and normally positioned at the top thereof, a pistol at the bottom of said passage; said pistol comprising a percussion pin, a detonator and safety means locking said pin and detonator against relative movement; and means actuated by said depth regulator for releasing said detonator plunger to permit the latter to fall by gravity, said safety means including a portion lying in the path of movement of said detonator plunger.

8. In a sink mine, a depth regulator comprising a diaphragm subject to hydrostatic pressure, a regulating spring, and a lever having the opposite ends thereof associated respectively with said diaphragm and spring, and means providing a fixed pivot at an intermediate point of said lever, the lengths of the respective lever arms being so related to the movable masses of said diaphragm and spring that the turning movements of said masses substantially neutralize each other.

9. In a depth regulator for a sink mine, the combination with a diaphragm and means activated thereby for controlling the operation of said mine, a hydrostatic chamber, an adjustable spring for exerting pressure to said diaphragm, and a valve controlling the inlet to said chamber and the stress in said spring, of means operable automatically when said valve is positioned to close said inlet to prevent movement of said spring and said diaphragm.

10. In a depth regulator for a sink mine, the combination with a hydrostatic chamber and diaphragm for controlling the release of firing mechanism, of a valve operable in one position thereof to close the inlet to said chamber, a spring seated between a sleeve and a spring plunger, means cooperating with said sleeve to move the same axially of said spring when said valve is rotated, a lever for transmitting the pressure on said plunger to said diaphragm, and pawls carried by said valve for locking said plunger against movement when said valve is positioned to close said inlet.

11. In a sink mine, a pistol comprising a pair of telescoping sleeves, a detonator and a percussion pin, means attaching said detonator to one of said sleeves, a ball lock normally retaining said pin in spaced relation to said detonator, means actuated by displacement of said sleeves for releasing said ball lock, a detonating plunger movable with respect to said piston, a depth regulator and means locking said plunger to said regulator, and safety means locking said sleeves against displacement, said safety means including releasing elements lying in the path of movement of said plunger, whereby upon release of said plunger by said depth regulator, the plunger may move towards said pistol to release said safety means.

In testimony whereof I affix my signature.

KARL OSKAR REINHOLD JOHANSSON