June 20, 1939. J. R. HOLRAN ET AL 2,163,462

TORPEDO

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Fig. 1.

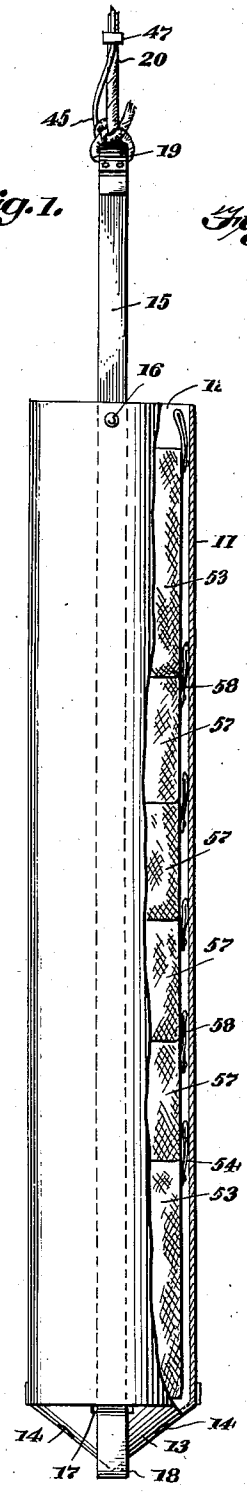


Fig. 2.

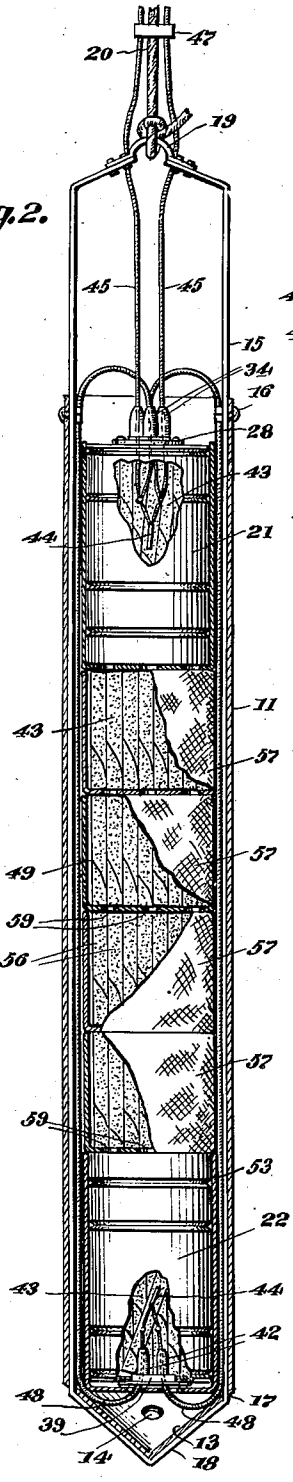


Fig. 3.

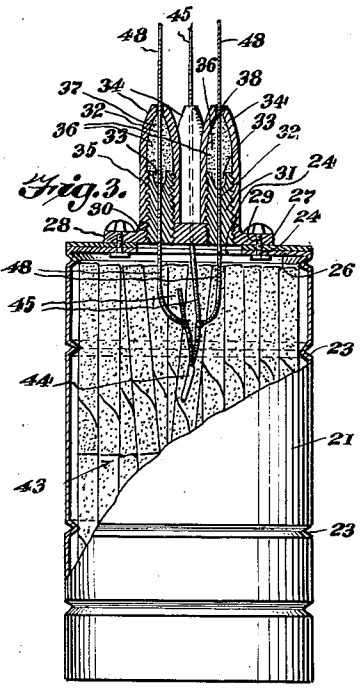
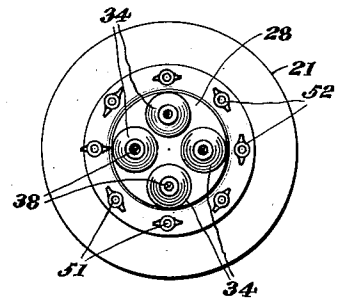


Fig. 4.



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Fig. 5.

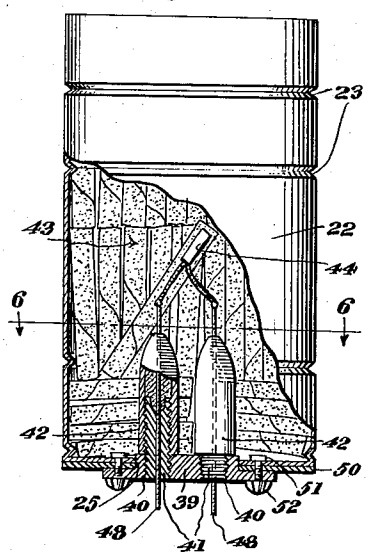


Fig. 8.

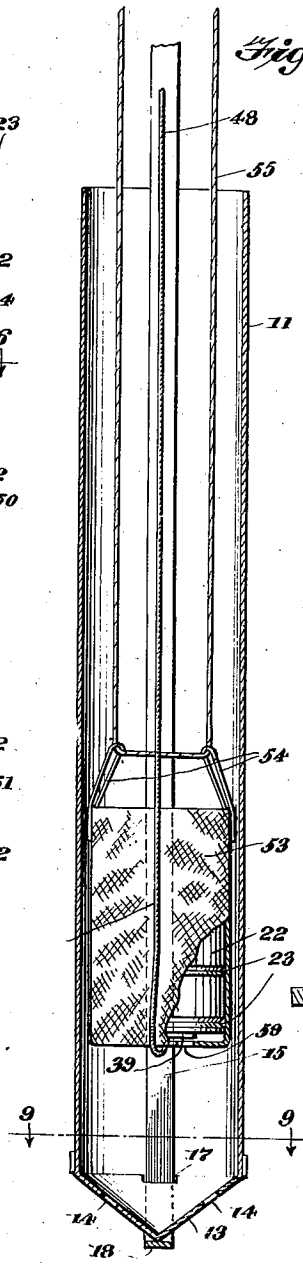


Fig. 9.

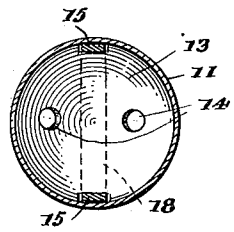


Fig. 10.

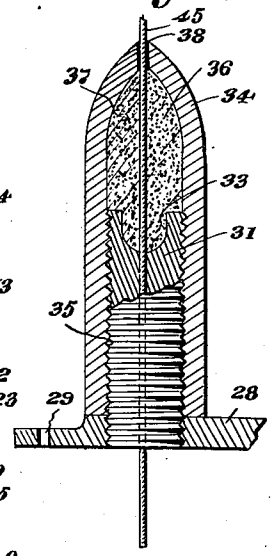


Fig. 6.

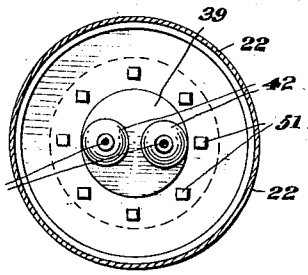
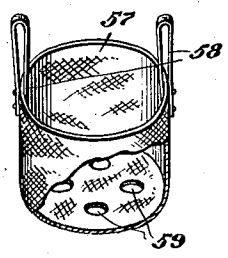


Fig. 7.



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UNITED STATES PATENT OFFICE

2,163,462

TORPEDO

John Raymond Holran, Chicago, and Edmund Townsend Lednum, Evanston, Ill.

Application March 19, 1937, Serial No. 131,928

2 Claims. (Cl. 102—4)

The present invention relates to blasting torpedoes, and more especially to torpedoes which are intended for underwater blasting, as for example, in wells, either in water wells, or oil wells, and for submarine blasting, such as is used in the removal of under-water obstructions, or for wrecking submerged foundations.

One object of the invention is to provide in such a torpedo, a novel arrangement whereby the explosion of the charge is caused in a peculiarly efficient manner when the torpedo is submerged in liquid.

Another object is to provide in such a torpedo, a peculiarly effective form of explosion-initiating device, the operation of which will not be affected by surrounding conditions, either of moisture or of pressure.

Still another object is to provide a novel form of sealed lead-in assembly for the water-tight explosion-initiating container, by means of which wires may be led into the interior of the container in a simple and easy manner, and the assembly securely sealed against ingress of moisture.

Still another object is to provide a novel form of wiring arrangement, whereby a plurality of detonators may be exploded simultaneously.

A further object is to provide a torpedo assembly, which may be easily and quickly loaded with a minimum of danger to the operator.

It has been determined that when a detonator at the top of a column of explosives in a cylindrical opening, such as a drilled-well hole is exploded, the detonation develops a pressure, and as the propogating wave of detonation travels downwardly, the developed pressure wave precedes the same. As the pressure wave precedes the detonation wave, there is a rapid and coincident building and acceleration of the pressure wave, and this pressure retards the influence of the detonation wave within the column of explosives, and lowers the disruptive force of the explosion as detonation progresses toward the bottom of the column.

The present invention obviates this detrimental effect of the pressure wave by making use of spaced detonators with explosives located between them. With such an assembly and with the explosion of both detonators occuring simultaneously, the adverse effect of the pressure wave is nullified, the result of such an arrangement being that the pressure waves are expended in giving a greater impulse to the detonation wave at each end of the explosive column.

As a further refinement the detonators are enclosed in moisture-proof and rigid containers, insuring explosion of the detonation charge in an atmosphere of normal pressure. Normal atmospheric conditions may be taken as ideal for the creation of the detonation wave, and the sealed containers provide for maximum development of such waves by explosives in a dry condition.

In the accompanying drawings:

Figure 1 is an elevation of a preferred embodiment of the invention, a portion of the casing being cut-away to show the charge.

Figure 2 is a vertical sectional view of the device.

Figure 3 is an enlarged view of the upper of the explosion initiating devices, illustrating the manner of sealing the same.

Figure 4 is a top plan view of the upper explosion initiating device.

Figure 5 is an enlarged sectional view of the lower explosion initiating device.

Figure 6 is a sectional view on the line 6—6 of Figure 5.

Figure 7 is a perspective view of one of the containers for the explosive charge.

Figure 8 is a sectional view illustrating the manner of loading the torpedo.

Figure 9 is a sectional view on the line 9—9 of Figure 8.

Figure 10 is a detail sectional view showing one of the sealing assemblies for the lead-in wires.

Describing the drawings more particularly, the torpedo is preferably provided with an outer casing 11 that is generally tubular in form, and which may be of any desirable size, the size being determined by the use to which the device is to be put. Preferably the casing 11 has an open top or mouth 12 and a bottom wall 13 that may advantageously be conical, and which is provided with openings 14 to provide access by water or other fluid in which the torpedo is immersed to the interior of the casing.

A bail or strap 15 may be riveted to the casing 11, as at 16, at the top of the casing, and inserted through openings 17 in the bottom wall in order that the lower portion 18 of the bail may underlie and support the bottom wall. The bail 15 extends upwardly to a point sufficiently above the mouth as to not interfere with the loading of the torpedo, and is advantageously provided with a member 19, about which a lowering rope 20 may be secured.

The explosives are arranged in a column within the casing 11 with an explosion initiating device at each end of the column.

Referring to Figures 3 and 5, the explosion initiating devices comprise cylindrical containers 21 and 22, respectively. Advantageously these containers are made of sheet metal that is of sufficiently heavy gauge to resist pressure of liquid at the depth at which the torpedo is to be used in order that the container will not be deformed sufficiently to alter the atmospheric pressure existing within it, and under which it is loaded. Reenforcing channels 23 may be formed in the wall of the container to strengthen it.

The containers 21 and 22 have open mouths 24 and 25, respectively, located at their upper and lower end, respectively when they are in proper position in the torpedo assembly. The side walls are turned inwardly about the mouths to form flat flanges 26, these flanges being provided with a series of bolt-receiving openings 27, in which bolts are positioned to secure the closure structure.

Inasmuch as it is desired to completely exclude moisture and to prevent a change of pressure within the containers, and since it is necessary that wires to transmit electrical current for exploding the detonator of the explosives charge within the container be led into its interior, a special form of closure is applied to close the mouths of the containers.

Referring to Figure 3, which illustrates the closure for the upper explosion initiating device, the closure consists of a circular base plate 28 having bolt-openings 29 spaced to register with the openings 24 of the flange.

The plate 28 is provided with four threaded openings 30 for the reception of threaded nipples 31 that have wire-receiving passages 32 running through them longitudinally, and which are preferably provided with hollowed out cavities 33 in their upper ends. A hollow thimble 34, having the lower part of its bore threaded at 35, is threaded upon each of the nipples. The bore of these thimbles extends to a point above the end of the nipple, when the thimble is screwed down tight against the surface of the plate 28, to form a chamber 36 for the reception of a body of sealing compound 37. The chamber 36 cooperates with the cavity 33 in the end of the nipple, so that as the thimble is screwed down, the sealing compound is forced into the cavity 32 and is compressed tightly therein.

Each of the thimbles is provided with a wire-receiving opening 38 through its end, and preferably the walls of the thimble are curved inwardly towards this opening 38, and the sides of the cavity 33 curve in toward the wire-receiving passages 32, so that as the thimbles are threaded downwardly and compress the sealing compound, it is pressed inwardly toward a wire running through the assembly.

Referring to Figure 5, the lower explosion initiating device is closed by a plate 39 having two threaded openings 40 that correspond generally to the openings 30 of the upper closure, and in which the nipples 41 are threaded to extend upwardly within the container 22. Thimbles 42 are threaded upon the nipples in a manner similar to the thimbles 34, with the exception that such thimbles are within the container in order to avoid projections beneath the initiating device when it is positioned adjacent the bottom of the casing 11.

Charges of explosive material, as indicated at 43, are packed within the containers 21 and 22 and suitable electrically fired detonators 44 are associated with the charges. Referring again to Figure 3, electrical wires 45 are connected with the detonator 44, and are led through two of the nipples 31 and their associated thimbles 32. The wires 45 extend upwards past the bail 15, and advantageously are secured to the cable 20 at intervals by clips 47 in order to restrain the wires, to avoid damage against objects as the torpedo is lowered. Connected to the wires 45 within the container 21 is a pair of wires 48 that lead from the detonator 44 of the lower initiator through the nipple and thimble assemblies 41, 42, and upwardly along the inner side of the casing 11 to the nipple and thimble assemblies of the upper initiators, through which they pass into the container 21. It will be apparent that when the wires 45 are connected to a suitable electrical firing device, and such device is operated, the two detonators 44 will explode simultaneously and the initiating charges 43 will set up simultaneous detonation waves that will travel towards each other through a column of explosives 49 loaded into the casing 11 between the containers 21 and 22.

The manner of loading the initiating devices is as follows. The container 21 or 22 is arranged with its closed end down, and the explosives 43, which are illustrated as being in usual stick form, are loaded through the mouth. The lead wires 45 are thereafter led through the opening 37 in respective thimbles, and sealing compound is introduced into the bores of the thimbles. Now the wires 45 are inserted through the passages 32 in the nipples, which have been inserted in the openings in the cover plate 28 and the thimbles threaded on the nipples and screwed down tightly against the top of the plate, thereby compressing the sealing compound as heretofore described. The electrical detonator 44 is then attached to the ends of the wires 45 and the wires 48 are inserted through their respective thimble and nipple assemblies, and attached to the wires 45.

A gasket 50, having been applied to the flange 26 and bolts 51 positioned within the openings 27, the cover plate 28 or 39 is arranged with the bolts passing through openings, and nuts 52 are applied to the bolts and screwed down tightly. The lower initiator is then prepared in a similar manner, the wires 48 being led through the nipple and thimble assemblies, and attached to the detonator 44, after which the plate 39 is secured to the flange 26. It may be found as a matter of convenience, that it is more advisable to assemble the lower initiator and place it within the casing 11 before attaching the wires 48 to the wires 45.

After having assembled the initiating devices, the lower container 22 with the wires 48 attached, is placed within an open topped fabric sack 53 that is provided with loops 54 at its upper end. A cord, as 55, in Figure 8, is threaded through the loops, and by means of this cord, the initiator is lowered to the bottom of the casing 11, after which the cord may be withdrawn by pulling on one end. After the lower initiator is in position, the main explosive charge of the torpedo is loaded into the casing. The explosive charge 49, which may advantageously be in the form of cartridges 56, is loaded into a plurality of fabric sacks 57 which, as illustrated in Figure 7, are open mouthed with loops 58 attached to the side walls, and openings 59 in their bottom walls. Advantageously the sacks 57 are of the same height as the length of the explosive cartridges. The sacks 57 are loaded, and lowered into the casing 11 by

means of the loops 58 in the same manner as the lower initiating device, it being understood that they are loaded into the casing one at a time. When a sufficient quantity of explosives has been loaded into the casing, the upper initiating device, also contained in a fabric sack, is positioned on top of the explosive charge. Thereafter the wires 45 are led upward, passing the bail and attached to the lowering cable 20.

From the foregoing description, it will be readily appreciated that an extremely efficient torpedo is provided by this structure. The initiating charges that are within the containers 21 and 22 are maintained at normal atmospheric pressure by means of the closure assembly and are also protected against moisture. The wiring arrangement enables both initiators to be fired simultaneously, with the result that detonating waves are created simultaneously at each end of the column of explosives, the waves travelling at equal rates toward each other through the explosives and efficiently causing the charge to explode. The structure in spite of its advantages does not require a great amount of time to assemble. The method of handling the charge and the initiators results in a minimum hazard from accidental explosion. The method of loading the explosives in fabric sacks permits rapid and safe handling of high charges and the method of loading the charge as a series of units, insures a uniform and maximum density of explosives within the casing. The openings 59 in the bottom walls of the sacks, together with the openings in the bottom of the casing and the open mouth of the casing insure that the entire column is under equal pressure conditions, inasmuch as free entry of fluids is provided for. The method of enclosing electrical detonators in a container of high explosives, the entire charge within the container serving as an initiating device, insures a complete explosion of the main charge, and since the initiating charge is under normal conditions of pressure, it is insured that the initiating charge will itself explode with the greatest efficiency.

From the foregoing, it is thought that the construction, operation and many advantages of the herein described invention will be apparent to those skilled in the art without further description, and it will be understood that various changes in the size, shape, proportion and minor details of construction may be resorted to without departing from the spirit or sacrificing any of the advantages of the invention.

What we claim is:

1. In a torpedo having a tubular casing, a column of flexible fabric receptacles in superposed relation in the casing, a plurality of vertically disposed cartridges of explosive in each of the receptacles, a fluid-proof and pressure-resistant metal container of substantially the same cross sectional dimensions as the receptacles positioned at each end of the column of receptacles and enclosing the said column between them, a plurality of explosive cartridges within each of the metal containers, a detonating device within each of the containers, and means for simultaneously discharging the detonating device.

2. An explosion initiating system for a torpedo having a vertical tubular casing and a column of explosive material within the casing, the said system comprising an electrical firing device, a fluid-tight container positioned within the casing and overlying the top of the explosive column, a charge of explosive and an electrical detonator enclosed by the container, a pair of wires connecting the detonator with the firing device, a second fluid-tight container positioned within the casing and underlying the bottom of the column of explosive, a charge of explosive and an electric detonator enclosed by the second container, and a second pair of wires connected to the detonator within the second container and the wires of the said second pair being, within the first container, respectively connected to the wires of the first pair.

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