J. A. HARDEL.

CHARGE TORPEDO.

APPLICATION FILED SEPT. 10, 1918.

1,298,500. Patented Mar. 25, 1919.

Fig. 1.

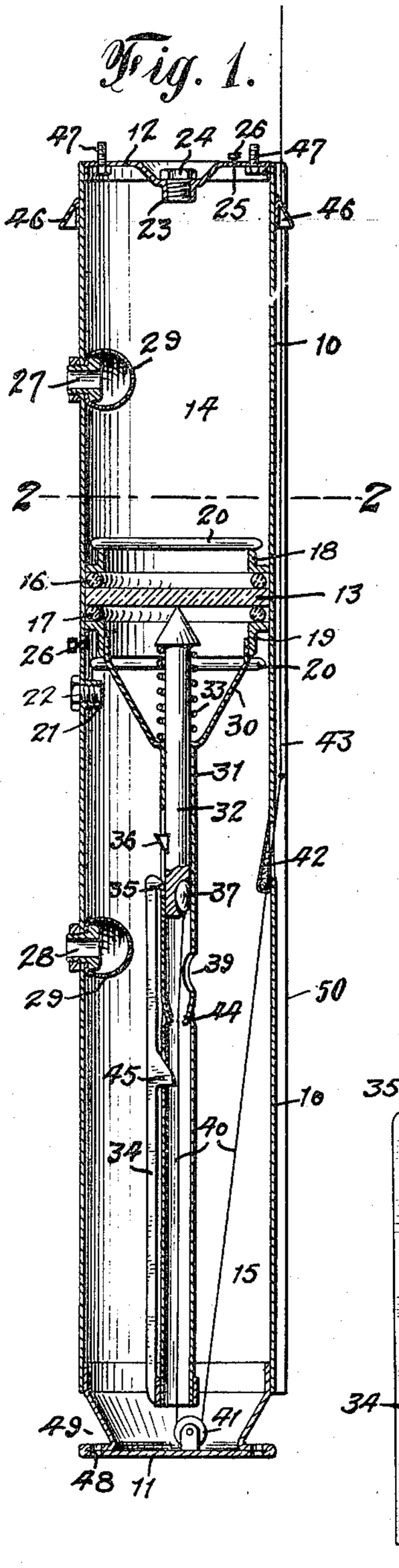


Fig. 2.

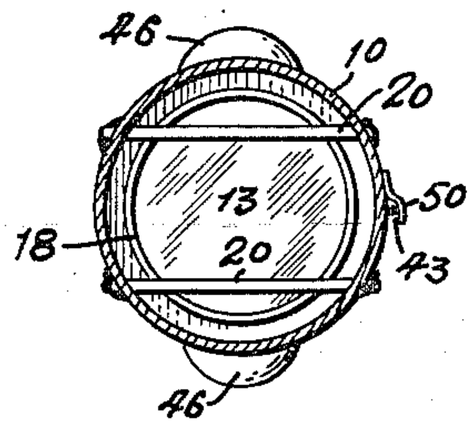


Fig. 3.

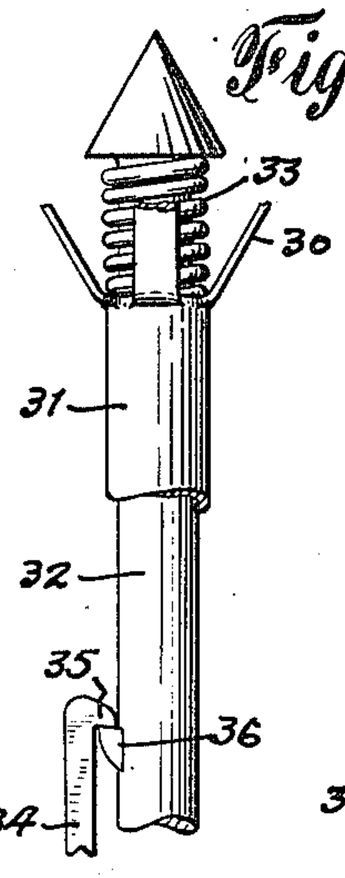


Fig. 4.

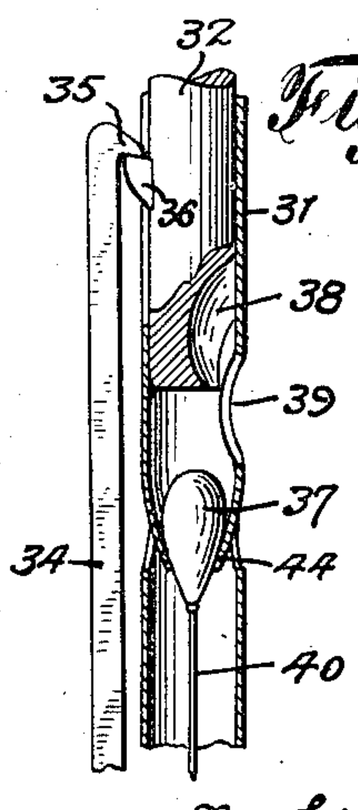


Fig. 5.

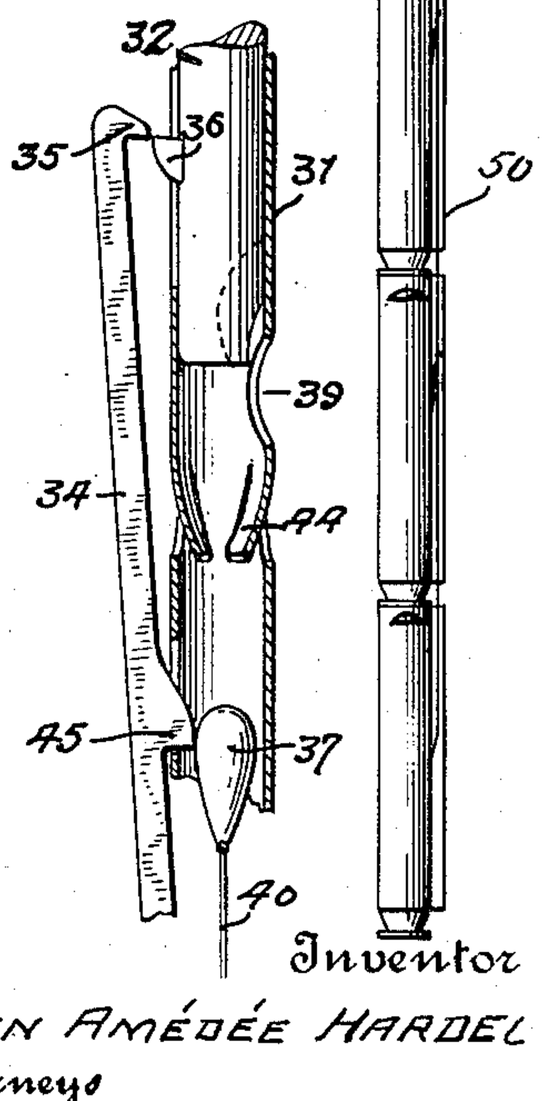
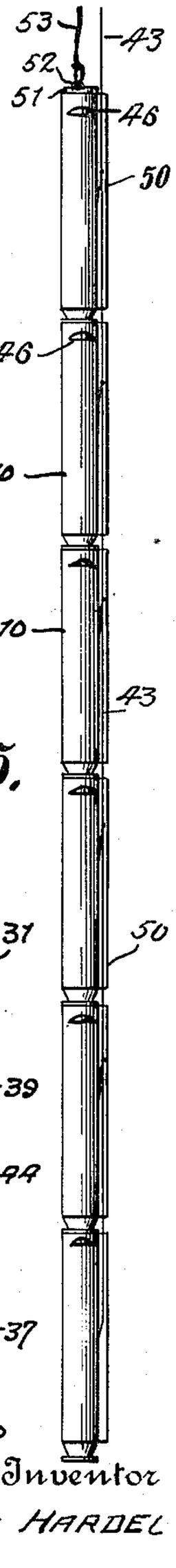


Fig. 6.



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CHARGE-TORPEDO.

1,298,500. Specification of Letters Patent. Patented Mar. 25, 1919.

Application filed September 10, 1918. Serial No. 253,407.

To all whom it may concern:

Be it known that I, JEAN AMÉDÉE HARDEL, a citizen of the Republic of France, residing at Paris, France, have invented a certain new and useful Improvement in Charge-Torpedoes, of which the following is a specification.

My invention relates to charge torpedoes and particularly to a charge torpedo for use in the "shooting" of oil wells, or for mining or quarry work where an explosive charge is fired below the surface of the ground.

The object of my invention is to provide a charge torpedo which may be conveniently charged just before it is inserted and in which the explosive charge comprises two or more elements, each in itself safe to handle, maintained separate in the torpedo until the latter has reached firing position and then mingled to afford an explosive mixture which may be fired in any desired manner.

In the accompanying drawings,

Figure 1 is a vertical section of a torpedo in which my invention is embodied in one form;

Fig. 2 is a section on the line 2—2, Fig. 1;

Fig. 3 is a partial broken elevation of the percussor and trigger of the torpedo;

Figs. 4 and 5 are similar views showing the percussor respectively set and released; and

Fig. 6 is a side elevation of a battery of torpedoes assembled.

Deep oil well torpedoes are usually charged with nitroglycerin which is expensive and difficult to obtain at present, as well as dangerous to handle and transport at any time. In quarry and mining work, dynamite is used and this is also dangerous and difficult to obtain under present conditions. Many fatalities occur in the oil well regions each year as a result of the premature firing of nitroglycerin torpedoes or of accidents in the handling of the explosives, and similar accidents are frequent in handling dynamite.

According to the present invention a torpedo is provided in which the charge comprises two or more separate elements, each in itself harmless and handled without danger, but forming when mingled, an explosive mixture of high power and efficiency which may be fired at will. The torpedo is appropriately divided into a plurality of compartments in which these elements are separately contained, while means are provided for breaking down the partition or partitions between compartments to permit the elements of the explosive to mingle after the torpedo has been inserted to firing position. While various explosives may be used in connection with an apparatus such as the present I may refer by way of example to the well known panclastites invented by Turpin and the ingredients of which are peroxid of nitrogen on the one hand and an organic substance on the other hand.

For the purpose of illustration, I have shown a two-compartment torpedo suitable for oil well shooting, but it will be understood that the invention is applicable to various utilities and that the construction employed must be adapted to various conditions.

The torpedo shell 10 is tubular and sealed at its opposite ends by heads 11 and 12. Its exterior is divided by a frangible partition or diaphragm 13 into two chambers 14 and 15 each of which contains a separate element of the explosive. The particular nature of these elements need not be herein defined, inasmuch as the particular explosive forms no portion of the present invention, but it may be stated that both elements are preferably in liquid form and consequently leakage between the chambers must be prevented. To this end the diaphragm 13 is faced on each side by packing rings 16 and 17 pressed against the diaphragm by crown rings 18 and 19, retained by transverse pins 20, which pierce the torpedo casing and are externally riveted down in position. It will be noted that the margins of the crown rings 18 and 19, against which the pins 20 bear, are beveled to insure a wedging action against the same by the holding pins on their insertion. A fill aperture 21 opens to the chamber 15, and is normally closed by a plug 22, while the fill aperture 23 opens to chamber 14 and is closed by its plug 24. Vent holes 25 open into the chambers 14 and 15 adjacent the fill apertures and are closed by plugs 26.

Inasmuch as the torpedo frequently passes through considerable depth of water before it reaches the position in which it is to be fired, it is subjected to more or less exterior pressure which might have a damaging effect unless compensated. To this end

I open into each chamber 14 and 15 a pressure equalizing port 27 and 28 respectively, and seal the contents of the chamber from escape by a collapsible and expansible member 29 of rubber or other suitable material. It is obvious that the pressure exerted by the liquid in the well is equalized within the torpedo through these compensating ports 27 and 28 and their flexible diaphragms 29, while the liquids within the latter are sealed against escape or contamination.

In order to break down the frangible partition 12, after the torpedo has reached firing position, I provide any suitable rupturing means. This might be caused by suitable chemical action or by any suitable electrical appliance. For the sake of illustrating the invention, however, I have here shown a mechanical device of simple and efficient construction. To the lower crown ring 19 I have secured a frame 30 by which the tubular guide 31 is held in rigid position. Within the guide works a percussion pin 32 adapted to be driven by the spring 33 against the diaphragm 13 to rupture the latter. The percussor is held in inoperative position by a trigger 34, the nose 35 of which engages over the shoulder 36 and holds the pin against the action of the spring 33.

The percussor is retracted against the action of its spring 33, by a plummet 37 which engages a recess 38 in the lower end of the pin 32 and is held therein by contact with the wall of the guide tube 31. The latter is apertured however, at 39 to permit the escape of the plummet from its seat after the pin has been drawn down to a point at which its shoulder 36 engages beneath the nose of the trigger 34. To one end of the plummet is attached a pull wire or lanyard 39 which passes down through the guide tube 31 and around a pulley 41 secured to the head 11 of the torpedo and thence up through the gland 42 to a cable 43. After the escape of the plummet 37 from the pin it is halted in its downward travel by a pair of spring detent arms 44 struck inward from the walls of the guide tube 31. In order to pass this detent an appreciable pull must be exerted upon the lanyard 40. Below the detent a bevel boss 45, on the trigger 34, projects into the guide tube 31 and lies in the path of the plummet 37 as it travels downward after its escape from the detent 44. The plummet strikes the boss 45 and throws the trigger 34 outward, thus disengaging the nose 35 of the trigger from the shoulder 36 on the pin and releasing the latter. The spring 33 thereupon drives the pin against the diaphragm 13 and ruptures the latter, whereupon the liquid in chamber 14 falls into the chamber 15 and mingles with the liquid therein to form the explosive mixture.

In actual practice it is advantageous to use a battery of torpedoes which are successively filled and joined together as they are lowered into the well. I have illustrated such a battery, in Fig. 5, the several lanyards 40 being secured to the common cable 43 which is paid out from the surface as the torpedo is lowered into the well and by which the several lanyards are operated when it is desired to prepare the charge.

Where a battery of torpedoes is used, I prefer to fill the lower compartments 15 of each torpedo with its explosive element before lowering the torpedo into the well, and then support the torpedo at the mouth of the well by wing pieces 46, while the other explosive element is filled into the chamber 14 through the hole 23 in the upper head. Bolts 47, carried by this head, pass through holes 48 in the base flange of the succeeding torpedo and are secured by nuts located in the annular recess 49 afforded by the conical shape of the head 11 of the torpedo. In order to guide the lanyard 40 and cable 43 and hold them closely adjacent the torpedo, I may provide a flange 50 between which and the shell of the torpedo they are confined. A cap 51 with eye 52 may be secured by the bolts 47 on the top torpedo of the series to afford an attachment for the cable 53 by which the charge is lowered to firing position in the well.

It is to be understood of course that after the elements in the chambers of the torpedo have mingled and the charge is ready for firing, the explosion thereof is caused by a detonator, electrically or otherwise operated. In deep oil wells it would be sufficient to drop or lower into the well a fused detonator, or a contact charge. This feature of the firing operation is outside the scope of my present invention, which relates to the charge torpedo and the maintenance of the elements of the explosive mixture separated until the torpedo has reached firing position in the hole,—whether it be in a deep oil well, or the drilled hole of a quarry or mine.

Various modified constructions by which the same ends may be obtained will readily occur to those dealing with the problem without departing from what I claim as my invention.

I claim:—

1. A charge torpedo comprising a container, a diaphragm dividing said container into separate compartments to receive separate elements of an explosive mixture, and mechanical means, operative after the torpedo has been inserted to firing position, to rupture said diaphragm and thereby permit the said elements to mingle.

2. A charge torpedo comprising a container, a diaphragm dividing said container into separate compartments to receive separate elements of an explosive mixture, and mechanical means, operative from the sur-

face after the torpedo has been inserted to firing position, to rupture said diaphragm and thereby permit the said elements to mingle.

3. A battery of charge torpedoes comprising a series of independent containers, each having a diaphragm dividing the container into separate compartments to receive separate elements of an explosive mixture, means at the opposite ends of each container for uniting the same to the adjacent containers alined therewith end to end, and means operative from the surface after said battery has been inserted to firing position, to substantially simultaneously rupture said diaphragms and thereby permit the elements of the several explosive mixtures to mingle.

4. A charge torpedo comprising a container having an explosive charge and means for equalizing within the container the exterior pressure to which the container is subjected when inserted to firing position.

5. A charge torpedo comprising a container, a frangible diaphragm dividing the same into separate compartments, a spring-pressed percussor and means operative after the torpedo has been lowered to firing position, for releasing said percussor to rupture the diaphragm.

6. A charge torpedo comprising a container, a frangible diaphragm dividing the same into separate compartments, a spring-pressed percussor, a trigger for holding said percussor against the action of its spring, and a releasing device operative from the surface after the torpedo has been lowered to firing position, for operating the trigger to free the percussor.

7. A charge torpedo comprising a container, a frangible diaphragm dividing the same into separate compartments, a spring-pressed percussor, a trigger for holding said percussor against the action of its spring, and a releasing device operative from the surface after the torpedo has been inserted to firing position, for operating the trigger to free the percussor, together with a detent engaging said releasing device while the torpedo is being inserted to firing position.

8. In a charge torpedo, a spring-pressed percussor recessed at one end, a guide tube in which said percussor works, a plummet adapted to lie in said recess and be held therein by the guide tube, a trigger adapted to engage said percussor and hold the same against the action of its spring, a pull cord secured to said plummet for shifting said percussor in the guide tube against the action of its spring, into position to be engaged by said trigger, said guide tube being apertured to permit the escape of the plummet from the recess in the guide tube after the percussor has reached position for engagement by the trigger, a frictional detent within the tube to halt the plummet, and a releasing cam on the trigger engaged by the plummet to shift the trigger into position to free the percussor after the plummet has passed the detent, substantially as described.

9. A series of independent charge casings each comprising a casing containing separated elements of an explosive charge, means for securing said torpedoes together end to end as they are inserted into firing position, and means for mingling the explosive charge elements in each of said torpedoes simultaneously.

10. A series of charge torpedoes each containing separated elements of an explosive charge, means for securing said torpedoes together end to end, a trigger mechanism within each torpedo to control the mingling of the explosive mixture elements therein, a series of lanyards attached to said several trigger mechanisms and a common pull cord to which said lanyards are attached for operating the same simultaneously.

11. In a construction such as specified in claim 10, an exterior guide on the torpedoes in which said pull cord is confined adjacent the shell of the torpedo.

In testimony whereof I have signed my name to this specification.

JEAN AMÉDÉE HARDEL.