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APPARATUS FOR DETONATING EXPLOSIVE CHARGES

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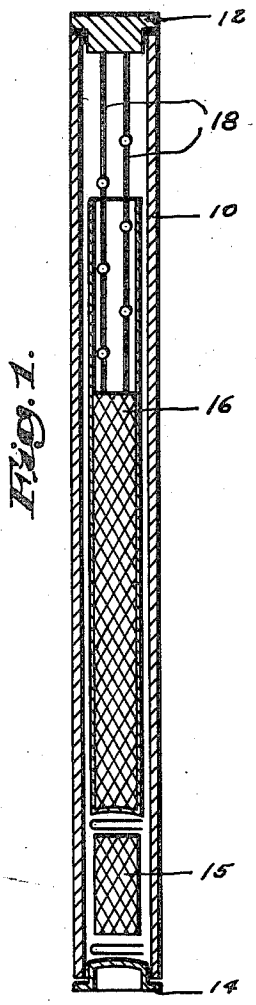


Fig. 1.

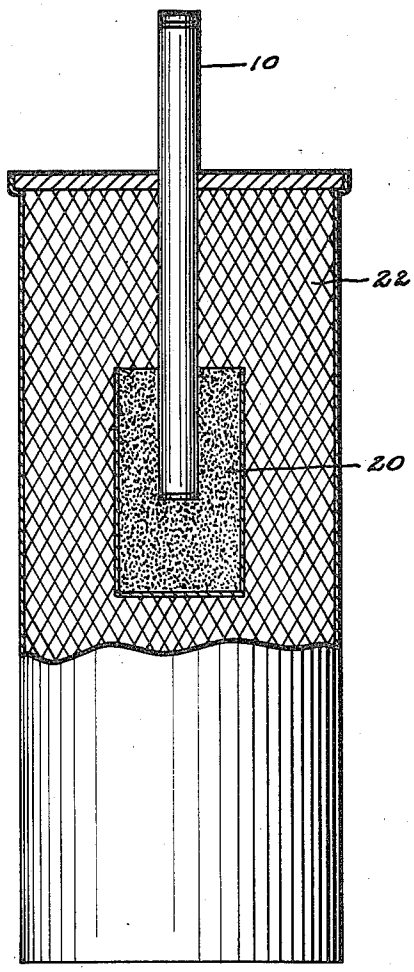


Fig. 2.

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APPARATUS FOR DETONATING EXPLOSIVE CHARGES

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1 Claim. (Cl. 102—86.5)

This invention relates to a method and apparatus for detonating an explosive charge within the body of a fluid medium. More particularly, the invention is concerned with a detonator for setting off an explosive charge at any desired depth beneath the surface of the ocean. The term "detonator" as employed in the specification is used to signify a device containing within itself a relatively small explosive charge and designed for use in initiating an explosion in a larger explosive charge surrounding the detonator element.

Devices previously used for this purpose in anti-submarine warfare and similar applications, have been of such design that the greatest depth at which they could function was about 600 feet, and they have suffered the additional disadvantage of complicated construction, involving several moving parts. Furthermore, the metallic bellows, gaskets and other elements used in these mechanisms in the past, did not lend themselves to adaptation for use in great depths by a simple change in their proportions.

An object of the invention therefore is to deal with this problem and to provide an improved detonator which is simple and positive in operation and which does not involve complicated mechanical parts. Another object of the invention is to provide a method of detonating explosive materials in fluid media in a manner dependent upon the pressure of the fluid at predetermined depths.

Other objects and many of the attendant advantages of this invention will be readily appreciated as the same becomes better understood by reference to the following detailed description when considered in connection with the accompanying drawings wherein:

Fig. 1 is a vertical cross section taken centrally of the detonator element of the invention; and

Fig. 2 is a view in elevation and partial cross section further illustrating the detonator in use.

We have discovered an improved method of initiating an explosion by utilizing hydrostatic pressure to collapse abruptly a rigid sealed container. The size of the container and its wall thickness are so chosen as to determine that hydrostatic pressure required for failure. The concussion resulting from collapse suddenly of the container serves to set off a sequence of explosive materials, the last of which delivers a sufficiently intense percussive action to fire a larger explosive charge surrounding the detonator element.

The drawings illustrate a preferred embodiment of the invention and comprise a cylindrical tube closed at either end, and having a relatively small percussion charge received therein, and also relatively larger explosive charges arranged in sequence.

As already noted, the principle of operation of the detonator depends upon hydrostatic pressure effects. It is well known to those who study the behavior of elastic bodies under the action of stress that a cylindrical tube, constructed for instance of metal and having both ends closed, will withstand external hydrostatic pressure up

to a certain limiting pressure without any distortion other than a slight shrinkage in all its dimensions. However, when the external hydrostatic pressure exceeds the limiting value, the tube becomes very unstable and collapses violently. The pressure at which the collapse occurs depends in a known way on the dimensions of the tube and the physical properties of the material of which it is constructed.

Considering in greater detail the structure shown in the drawings, numeral **10** denotes a rigid tube which may be of any suitable metal such as brass, closed at either end by metal caps **12** and **14**, secured in water-tight relation to the tube as by soldering. Good results have been obtained with a tube having a wall thickness of .011 of an inch, 2 inches long, ¼ inch inside diameter. Other suitable dimensions may be employed, depending upon the depth at which the charge may be desired to be detonated.

In the tube is located a pellet **15** of percussive material such as pentolite and adjacent to the pellet is provided an explosive charge **16**, similar to that for example which is comprised by a nonelectric blasting cap. Connecting with this body of explosive, is a third percussive means **18**, consisting of strips of paper which include percussive detonating mixtures. It will be noted that the strips **18** are in spaced relation to the walls of the tube **10**, in a position in which they may receive the impact of portions of the wall collapsing suddenly. The strips **18**, when detonated by collapse of the wall portions of the tube, initiate progressive explosive effects in the larger explosive charges **16** and **15**. The end of the detonator is in turn received in a booster charge **20** (Fig. 2) and surrounded by a main charge **22** of explosive such as TNT or other similar high explosive.

A feature of the invention is that the metal tube may be made of approximately the same diameter as the standard blasting caps and electric detonators, and of such a length and wall thickness that it will collapse at a desired pressure. This tube may then be placed in the detonator cavity of any standard explosive charge, thus converting this standard charge into a depth bomb suitable for detonation at the desired depth, however great this may be.

A further exceedingly desirable feature of our invention is its extreme simplicity in contrast with the devices previously used as pressure operated fuses. These devices commonly comprise several sliding or rotating parts, and require the fitting together of these parts into guides and bearings. For this reason they require manufacture of parts to much closer tolerances, very thorough inspection during assembly, precautions to avoid congealing of lubricants due to aging or to low temperatures, and many other precautions which are not necessary with our invention because it contains no bearings or guides or moving parts in the strict sense of the word.

Our improved detonator has still another virtue in that it is always protected from immersion in water up until the point of collapse and its rapid percussive action is capable of firing the main charge **22** even though the latter body may be wet. Because of this the container for the main charge may be of simple and cheap construction, paper or cardboard being quite satisfactory for example. It is further to be noted that no holding lines are necessary in relying upon the action of hydrostatic pressure for starting percussive action. This too is of considerable advantage.

From the above description it will be apparent that we have provided a simple, positive and efficient detonating means especially desirable for use in fluid bodies and useful in setting off explosive bodies at relatively great depths in the ocean.

Obviously many modifications and variations of the present invention are possible in the light of the above

teachings. It is therefore to be understood that within the scope of the appended claim the invention may be practiced otherwise than as specifically described.

What is claimed is:

A detonator device comprising in combination an elongated, rigid, thin-walled, cylindrical tube sealed at its ends, the cylindrical wall of said tube being impactively collapsible under an ambient pressure exceeding a predetermined intensity, an explosive charge positioned at one end of said tube, a plurality of longitudinally extending supporting strips retained in substantially parallel alignment within said tube between the other end of said tube and said explosive charge, a multiplicity of percussive pellets spacedly mounted along each supporting strip whereby upon collapse of said cylindrical wall at least one of said percussive pellets is exploded by the force applied thereto by opposite wall portions of said cylindrical tube to initiate detonation of said explosive charge.

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