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R. TEMPLE

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DEEP WATER CARTRIDGE

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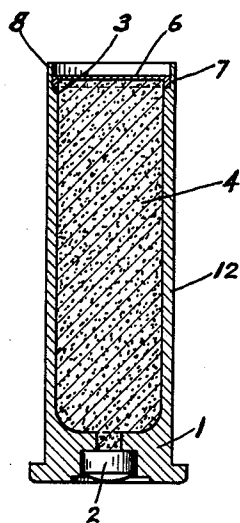


Fig. 1

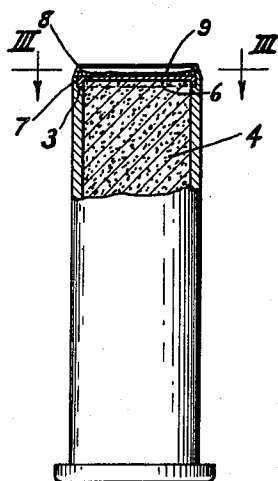


Fig. 2

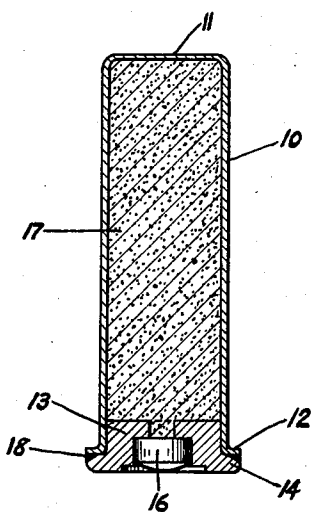


Fig. 4

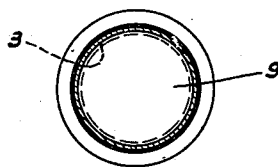


Fig. 3

INVENTOR.
Robert Temple

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DEEP WATER CARTRIDGE

Robert Temple, Swissvale, Pa., assignor, by mesne assignments, to Mine Safety Appliances Company, Pittsburgh, Pa., a corporation of Pennsylvania

Continuation of application Serial No. 156,815, April 19, 1950. This application April 29, 1957, Serial No. 655,803

3 Claims. (Cl. 102—43)

This invention relates to explosive blank cartridges especially suitable for use for long periods of time in deep water where the hydrostatic pressure is very great, and more particularly to the sealing of such cartridges to prevent water from leaking into them.

The invention disclosed herein is a continuation of co-pending application Serial No. 156,815, now abandoned, filed April 19, 1950 for Deep Water Cartridge and Method of Sealing It.

Most tools now used for cutting the anchoring cables or chains of floating mines are actuated by explosive blank cartridges. When such mine cutters are used at considerable depths in the ocean and other bodies of water, such as from 500 to 1000 or more feet, they are not always dependable because the hydrostatic pressure is so great that water may be forced into the cartridges. The cartridges may not always leak immediately but such cartridges are often submerged for hours and even days. Therefore, they should be water tight permanently. Crimping of the cartridge case over the closure in its open end is not sufficient to prevent leakage, and neither is the use of plastic sealing material between the closure and the encircling wall of the case.

It is among the objects of this invention to provide a deep water cartridge which is sealed against great hydrostatic pressure indefinitely, in which the seal itself is metal securely united to the adjoining metal parts, and in which great pressure is built up before the cartridge is ruptured.

In accordance with this invention, the tubular metal case of the cartridge has an integral closed end, and an open end in which a metal closure member is inserted. The closure is soldered to the case by a solder whose melting point is low enough to prevent the soldering heat from igniting the powder in the case. Preferably, the cartridge case has an annular shoulder formed inside of it close to its open end. A metal closure is seated on this shoulder and is pressed against it by a short portion of the case projecting beyond the closure and bent inward against the latter. This crimped end of the cartridge then is dipped in molten solder which is at a temperature between about 225° and 350° F. This temperature will not heat the cartridge sufficiently to explode the double base powder, with which these cartridges generally are filled. The soft or low melting point solder unites with the closure and the surrounding case and forms a permanent seal between them. The pressure seal prevents water from leaking into the cartridge. If desired, a separate primer head may be formed and used as the closure for the open end of the case, the opposite end of which has a thin end wall closing it and which is ruptured when sufficient pressure builds up in the case. The primer head and case are soldered together.

The invention is illustrated in the accompanying drawings, in which Fig. 1 is a longitudinal section through a cartridge just before the open end of the case has been crimped over the closure; Fig. 2 is a side view of the cartridge, partly in section, after the solder seal has been

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formed; Fig. 3 is a cross section taken on the line III—III of Fig. 2; and Fig. 4 is a longitudinal section through a modified embodiment of the invention.

Referring to Figs. 1 to 3 of the drawings, the main part of the cartridge is the usual tubular metal case which is closed at one end by an integral end wall 1 and a separate priming cap 2. The end wall forms a primer head, and the cap is disposed in a socket in the head and is forced tightly against a seat therein by ring staking the outer end of the socket against the cap. This holds the cap in the head and forms a seal that will prevent water from entering the case past the cap. The opposite end of the case itself is open and is provided around its inside with an annular recess that extends a short distance toward the closed end of the case. This recess forms a radial shoulder 3 inside of the case and also reduces the thickness of the side wall of the case projecting beyond the shoulder. The case is filled with suitable powder 4, preferably the well-known double base powder, and then its open end is closed by a metal closure member. This member is in the form of a disc 6 of a size that will fit snugly within the thin walled end of the case. Integral with the inner face of the disc is an annular flange 7 which engages the case shoulder 3. The closure is held firmly against the shoulder while the projecting end 8 of the case is crimped over the edge of the disc. This crimping or bending can be done in any well-known manner while the side wall of the case is prevented from bulging away from closure flange 7. Projecting end 8 extends beyond closure 6 to provide an annular wall to which solder is applied.

The crimped end of the case then is dipped in a suitable acid to clean it for soldering, and then is dipped in molten solder. As soon as the cartridge is removed from the molten solder the excess solder is wiped from the outer surface of the case. The end of the cartridge is completely tinned. The solder 9 covering and united to the closure and the encircling thin annular wall of the case solders the two together and forms a metal seal between them that will prevent water, even at high pressure, from entering the case, no matter how long the cartridge is submerged. The solder that is used preferably is formed from 52½ percent bismuth, 32 percent lead and 15½ percent tin. This is a soft or low melting point solder, the melting point of which is low enough to prevent the soldering heat from igniting the powder in the cartridge. For the usual double base powder, the temperature of the molten solder, into which the cartridge is dipped, should be between 225° and 350° F. The higher temperature is not great enough to ignite such a powder in the cartridge case.

Since the bonding qualities of low melting point solder are relatively poor, it is necessary to provide adequate cartridge surface area to which the solder may be applied. The surface provided by the annular wall formed by extending projecting end 8 beyond closure 6 a short distance, together with the closure surface provide the necessary bonding surface area.

The disc 6 is thin enough to be ruptured by the pressure built up in the cartridge. It must rupture before sufficient pressure would be built up to blow the primer cap back out of the primer head. The thickness of the disc will depend on the amount of work the cartridge is expected to do.

In the modification shown in Fig. 4 the case and the primer head are made as separate elements and then are soldered together. Thus, the tubular case 10 has an integral wall 11 closing one end, while the other end of the case is open. The open end of the case is encircled by an integral flange 12 that extends radially outward a short distance. The primer head is in the form of a plug 13 which is inserted part way into the open end of the case.

The projecting portion of the plug is encircled by an integral radial flange 14 that seats against the case flange. The plug fits snugly inside the case and is provided with the usual primer cap 16. After the case has been filled with powder 17 and the primer head has been inserted, the adjacent edges of the two flanges 12 and 14 are soldered together entirely around the cartridge to hold them together and to form a circular seal 18 that will prevent water from seeping into the case. The edge of the primer head flange adjacent the case may be chamfered to form an annular groove for receiving the solder. Here again, a soft or low melting point solder is used so that the heat of the soldering operation will not ignite the powder in the case. When the cartridge is fired, the pressure in it builds up until it is sufficient to rupture the front wall 11 of the case. The thickness of this wall depends upon the work that it is desired to do with the cartridge, but of course it must be thin enough to rupture before the primer cap is blown back out of the primer head.

The rate of burning of powder in a cartridge is directly proportional to the square of the pressure on the powder. Powder loosely disposed in a cartridge with no wadding or other obstruction in front of it will be shot out by the primer with little or no burning. On the other hand, if resistance is offered, the rate of burning will increase in proportion to the square of the resistance. The faster the rate of burning, the more complete it is and the higher the pressure produced. Therefore, it is highly desirable that the powder in the cartridges shown in the drawings should be retained therein as long as possible after detonation of the primer, thereby giving the powder time to burn and build up high pressures in the cartridge which speed up the combustion and produce even greater pressure to do work at a rapid rate. The cartridges disclosed herein are admirably suited to this purpose, because in each embodiment of the invention the front end wall of the cartridge has to be ruptured by the pressure behind it before any work can be done. This insures satisfactory combustion of the powder and great efficiency from it. Such cartridges make it unnecessary to use external means, such as shear pins and the like, for temporarily holding back the members that are driven forward by the force of the explosion so that the desired pressure can be built up behind them, because these cartridges are self-retarding as well as leak proof.

According to the provisions of the patent statutes, I have explained the principle of my invention and have illustrated and described what I now consider to represent its best embodiment. However, I desire to have it understood that, within the scope of the appended claims, the invention may be practiced otherwise than as specifically illustrated and described.

I claim:

1. A deep water cartridge comprising a tubular metal case having a closed end and an open end, explosive powder in the case, the inside of the case at said open end being provided with an annular shoulder, a metal closure seated on said shoulder, the case projecting beyond the closure to form an annular wall and being crimped over said closure to press it against the shoulder, solder of a melting point below the ignition point of said powder covering and bonded to the outer surface of the closure and inner surface of the annular wall, and said solder forming an annular pressure seal substantially filling the annular space between the closure and surrounding case which withstands hydrostatic pressures above atmospheric to protect the powder from moisture.

2. A deep water cartridge comprising a tubular metal case having a closed end and an open end, explosive powder in the case, the inside of the case at said open end being provided with an annular shoulder, a metal closure seated on said shoulder, said metal closure consisting of a metal disc encircled at one side by an integral flange, the case projecting beyond the closure to form an annular wall and being crimped over said closure to press it against the shoulder, solder of a melting point below the ignition point of said powder covering and bonded to the outer surface of the closure and inner surface of the annular wall, and said solder forming an annular pressure seal substantially filling the annular space between the closure and surrounding case which withstands hydrostatic pressures above atmospheric to protect the powder from moisture.

3. A deep water cartridge comprising a tubular metal case having a closed end and an open end, explosive powder in the case, the inside of the case at said open end being provided with an annular shoulder, a metal closure seated on said shoulder, the case projecting beyond the closure to form an annular wall and being crimped over said closure to press it against the shoulder, solder of a melting point below the ignition point of said powder covering and bonded to the outer surface of the closure and inner surface of the annular wall, and said solder forming an annular pressure seal substantially filling the annular space between the closure and surrounding case which withstands pressures at water depths of at least 500 feet to protect the powder from moisture.

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