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GUN PERFORATOR

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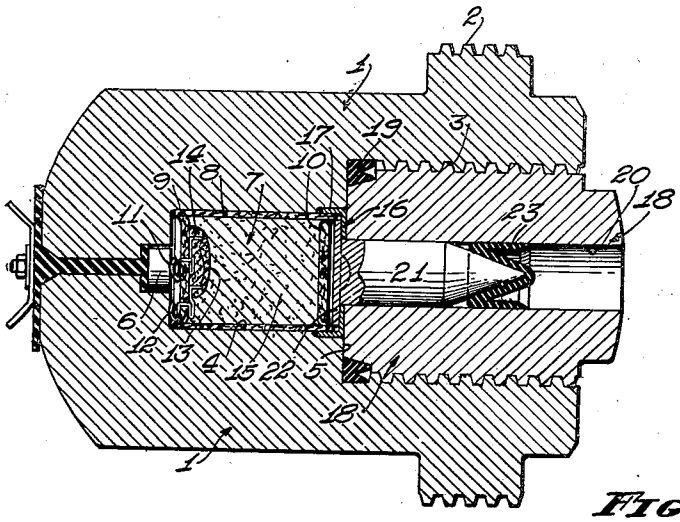


FIG. 1

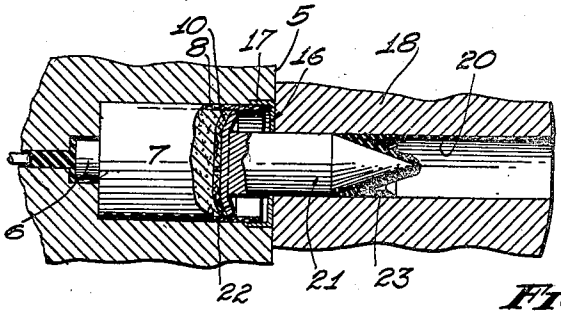


FIG. 2

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GUN PERFORATOR

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7 Claims. (Cl. 164—0.5)

My invention relates to gun perforators; that is, to devices adapted to be lowered in a well casing for the purpose of firing bullets through the casing and thereby form passages for the entrance of oil into the casing. Among the objects of my invention are:

First, to provide a cartridge assembly which is particularly adapted for the gun perforator unit disclosed in my earlier patent, No. 2,092,294, issued September 7, 1937, and which retains the benefits inherent in my former invention, particularly in that the pressure area against the gun barrel is restricted to an area substantially equal to that of the cartridge chamber;

Second, to provide a gun perforator wherein the powder density of its cartridge and the effective barrel length of the gun perforator is increased as the submergence of the gun perforator in well liquid is increased;

Third, to provide a gun perforator which is so arranged that hydrostatic pressure is applied directly against the bullet and the bullet is free to function as a plunger which engages and compresses the powder charge; and

Fourth, to provide a gun perforator wherein the penetrating ability of the gun perforator is increased as its depth of submergence is increased, to compensate at least partially for any hindrance to penetration due to the hydrostatic pressure of the liquid in which the gun is submerged.

With the above and other objects in view, as may appear hereinafter, reference is directed to the accompanying drawing, in which:

Figure 1 is a longitudinal sectional view of a gun perforator showing the parts as they appear upon assembly, but before the gun is submerged in well liquids with portions of the bullet and, in addition, the back contact member, together with associated parts, including the insulated lead wire, shown in elevation; and

Figure 2 is a similar but fragmentary longitudinal sectional view of the gun unit showing the parts as they appear when the gun unit is submerged to substantial depth within the liquid contained in a well bore, with a portion of the bullet, a portion of the cartridge case, the back contact pin and the insulated conductor leading thereto shown in elevation.

My gun perforator includes a gun block 1 having external threads 2 for supporting the gun block in a gun perforator body such as shown in my previous Patent No. 2,092,294. The gun block is provided with an internally threaded barrel socket 3 and a cartridge chamber 4 at the inner end thereof. The cartridge chamber 4 is centered with respect to the socket 3 and is smaller in diameter, so as to form a shoulder 5.

An explosive resistant contact pin 6 extends through the rear end of the gun block into the cartridge chamber 4. The cartridge chamber 4 receives a cartridge 7 which comprises a cylindrical shell 8, and end disks 9 and 10, all formed preferably of insulating material. The rear or inner end disk 9 supports a pair of terminal members 11 and 12, one of which engages the contact pin 6 and the other of which engages a wall of the cartridge chamber. The terminals 11 and 12 extend into the cartridge and are connected therein by a fuse wire 13. A suitable ignition compound 14, commonly known as "match head" compound, covers the fuse wire. The remainder of the cartridge is filled with an explosive material 15.

The outer end of the cartridge chamber receives a sealing disk 16 having a skirt 17 directed into the cartridge chamber and fitting into a rudimentary counterbore. The skirt 17 prevents the explosive force from entering between the barrel and shoulder 5, thereby restricting the pressure area to that of the cartridge chamber.

The barrel socket 3 receives a gun barrel 18, the inner end of which seats against the shoulder 5. A sealing gasket 19 is provided between the gun barrel and barrel socket. The gun barrel is provided with a gun bore 20 centered with respect to the cartridge chamber and of smaller diameter. A bullet 21 fits in the gun bore 20 and projects rearwardly through an opening in the sealing disk. The rear or base end of the bullet is provided with a flange 22 having approximately the diameter of the interior of the cartridge shell 8. The flange may be in the form of a flat plate welded to the bullet. The outer or pointed end of the bullet 21 is covered by a sealing plug 23 which may be shaped to conform to the pointed end of the bullet, but is provided with an outwardly directed pressure flange so as to readily seal the gun bore against the passage of fluid inwardly around the bullet.

Operation of my gun perforator is as follows: When the parts are assembled they are in the positions shown in Figure 1; that is, the explosive is partially compressed in the cartridge, the bullet is in its forward position in the gun barrel with the flange 22 bearing against the sealing disk 16. When the gun perforator is lowered into the well bore and submerged in liquid several thousand feet the hydrostatic pressure of the liquid forces the bullet back-

wardly into the cartridge chamber, as shown in Figure 2. In doing so, the explosive material is further compressed and the effective length of the barrel is increased by the amount that the bullet projects into the cartridge chamber.

It is of course essential that the cylindrical portion of the bullet be long enough that a substantial proportion thereof remain in the bore of the gun barrel, so that it will be properly guided. The increase in powder density increases the powder pressure within the chamber and the increase in effective barrel length tends to increase the muzzle velocity of the bullet. These two factors combine to increase the penetrating power of the bullet, particularly when firing into liquid under material hydrostatic pressure, and thereby tend to compensate for any loss of penetrating power due to the hydrostatic head of the liquid against which the bullet must move.

Various changes and alternate arrangements may be made within the scope of the appended claims, in which it is my intention to claim all novelty inherent in the invention.

I claim:

1. A gun perforator comprising: means defining a cartridge chamber and gun bore; a bullet for said gun bore exposed to the hydrostatic pressure of liquids in which the gun perforator is immersed, and adapted to be urged by said hydrostatic pressure backwardly into said cartridge chamber; an explosive cartridge in said cartridge chamber adapted to be compressed by rearward movement of said bullet; said cartridge chamber being larger than said gun bore; and a flange on the inner end of said bullet within said cartridge chamber.

2. A gun perforator comprising: means defining a cartridge chamber and an open ended gun bore leading therefrom; a bullet and sealing cap therefor slidable in said gun bore and adapted under urge of hydrostatic pressure of a liquid in which the gun perforator is immersed to form a ram; an explosive cartridge in said chamber adapted to be compressed by said bullet; said cartridge chamber being larger than said gun bore; and a flange on the inner end of said bullet within said cartridge chamber.

3. The combination with a gun perforator having a cartridge chamber and a gun bore smaller in diameter than said chamber and extending therefrom, of a cartridge comprising: a shell fitting said chamber and containing an explosive charge, said shell constituting a cylinder; a bullet including a flanged end forming a piston for said cylinder whereby, when said bullet is subjected to the hydrostatic pressure of liquids in which the gun is immersed, the piston is urged into said cylinder to compress said explosive charge.

4. The combination with a gun perforator having a cartridge chamber and a gun bore leading therefrom, of a cartridge comprising: a cartridge case and a bullet extending therefrom adapted to fit said cartridge chamber and gun bore, respectively, said bullet movable into said case to compress the explosive contained therein.

5. The combination with a gun perforator having a cartridge chamber and a gun bore leading therefrom, of a cartridge comprising: a cartridge case, a bullet extending therefrom and a sealing element carried by the extended end of said bullet, the case and bullet fitting in said chamber and gun bore, respectively, said bullet movable under urge of hydraulic pressure against said sealing means to compress the explosive contained in said cartridge.

6. A gun perforator, as set forth in claim 1, wherein said flange is shearable under the explosive pressures generated in said chamber.

7. A gun perforator, as set forth in claim 2, wherein said flange tends to delay release of said bullet until the explosive pressure exceeds a predetermined value, whereupon said flange shears.

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