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2,216,144

SEALING DISK FOR GUN PERFORATORS

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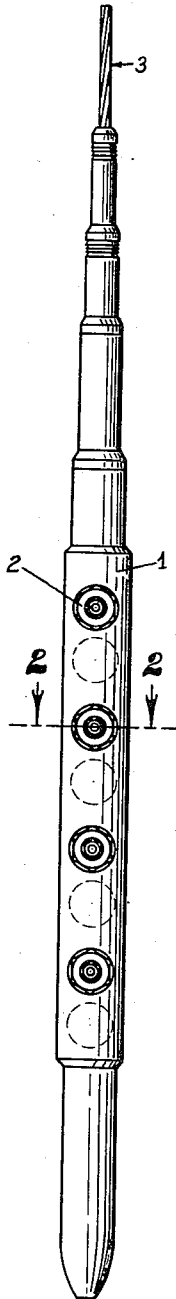


FIG. 1

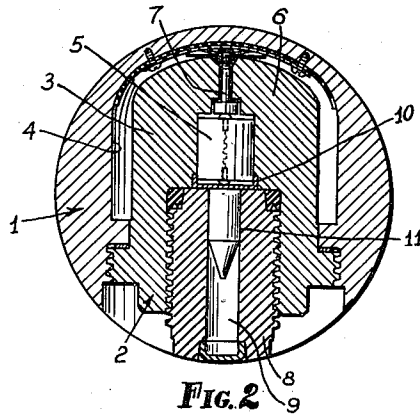


FIG. 2

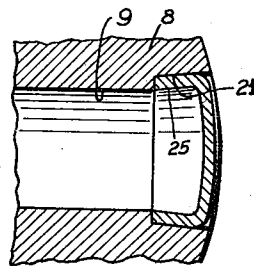


FIG. 3

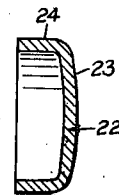


FIG. 4

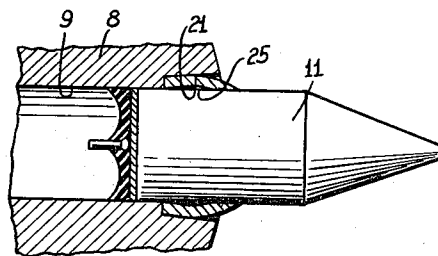


FIG. 5

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SEALING DISK FOR GUN PERFORATORS

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3 Claims. (Cl. 164—0.5)

My invention relates to sealing disks for gun perforators, and among the objects of my invention are:

First, to provide a sealing disk for the outer end of a gun barrel adapted to be submerged in liquid, for example, the gun barrel of a gun perforator intended for operation when submerged to great depths in well fluids;

Second, to provide a sealing disk of this character which tends to increase the effective length of the gun barrel with which it is associated, so that maximum velocity is imparted to the bullet;

Third, to provide a sealing disk of this character having a skirt portion which is directed inwardly along and supported by the bore of the gun perforator barrel in such a manner that the inner periphery of such skirt approximates the diameter of the bore through which the bullet passes and functions as a continuation thereof; and

Fourth, to provide a sealing disk of this character which, although capable of fabrication from relatively thin material, is able to withstand tremendous hydrostatic pressures as well as percussive pressures generated upon the firing of adjacent gun units.

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

Figure 1 is an elevational view of a gun perforator shown in position within a well;

Figure 2 is an enlarged transverse sectional view of a gun perforator, taken through one of its gun units;

Figure 3 is an enlarged fragmentary sectional view of the muzzle end of the gun barrel, showing my novel sealing disk in section;

Figure 4 is a similar view, but illustrating the manner in which the sealing disk ruptures when the bullet is discharged from the barrel; and

Figure 5 is a transverse sectional view of the sealing disk before it is inserted in the muzzle of the barrel.

The gun perforator for which my sealing disk is particularly designed consists of a body 1 in which are fitted a plurality of gun units 2. The body member is suspended from a cable 3 which preferably contains a conductor so that the various gun units may be fired electrically and in sequence.

Each gun unit 2 comprises a gun chamber 3 which screw-threads into a laterally directed socket 4 provided in the body member, which is provided with a cartridge chamber in which fits a cartridge 5 containing an explosive and re-

sistance wire 6 adapted to be heated by means of a suitable electrical circuit provided through a contact pin 7 located at the rear end of the chamber 3. The outer end of the chamber 3 is internally threaded to receive a gun barrel 8. The cartridge 5 and bore 9 of the gun barrel are separated by an expansion-delay disk 10 to which is attached initially a bullet 11.

The structure so far described is conventional, insofar as this invention is concerned, and is set forth more fully in my earlier patent, No. 2,092,294.

This invention deals particularly with the muzzle end of the barrel 8. The muzzle end of the barrel 8 is counterbored, as indicated by 21, on a slight taper, and is adapted to receive a cup-shaped sealing disk 22 comprising a dome-shaped head portion 23 and a skirt portion 24 which is initially cylindrical in form, but adapted to be deformed so as to fit the counterbore 21 when forced into the muzzle end of the gun barrel, as shown best in Figure 4.

The internal diameter of the sealing disk 22 is approximately equal to the diameter of the bore 9 of the gun barrel, so as to form a continuation thereof, the counterbore 21 being just sufficiently larger than the normal bore 9 of the gun barrel to accommodate the disk.

By reason of the dome-shaped head 23, external pressure tends to spread the skirt 24 against the counterbore 21 and prevent leakage into the bore 9.

Tests have shown that a sealing disk of this character covering a bore having a diameter of approximately one-half an inch has been able to withstand the hydrostatic pressures present under 10,000 feet of liquid in addition to the percussive pressures set up when adjacent gun units are fired, such percussive pressures exceeding the hydrostatic pressures by several times.

When the gun unit is discharged the expansion-delay disk 10 and wadding, designated 12, forming an end of the cartridge 5, follow the projectile, as shown in Figure 4, and form a piston seal against the escape of pressure. Due to the expansion-delay disk, the velocity of the bullet is extremely high compared with the short length of its travel; consequently, the sealing disk 22 instead of being forced from its seat is punctured and its inner surface deformed to fit along the surface of the bullet, and minimizes the escape of gases from behind the bullet when the bullet has left the bore 9 and is within the counterbore 21. This has the effect of increasing the

length of the gun bore equal to the axial depth of the counterbore 21.

It has been found by experimentation, as well as by calculations, that the length of the bore plays an important part in the initial velocity given to the bullet, and consequently its penetrating power. Therefore, by increasing the effective length of the gun bore, as accomplished with the sealing disk 22, greater penetration is obtained from the same powder charge than would be otherwise possible.

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 as broadly as the prior art permits.

I claim:

1. In a gun perforator adapted to be submerged to great depths in a liquid-filled well-bore, the combination of: a barrel having a bore which receives a projectile; a rudimentary counterbore at the muzzle end of said barrel, said counterbore having a slight inward taper; and a dome-shaped sealing disk having an initially cylindrical skirt portion adapted to be forced into sealing contact

with said counterbore, with the dome end of said disk at the muzzle end of the counterbore, whereby external pressure against the dome tends to spread said skirt and increase its sealing contact with said counterbore.

2. A combination as set forth in claim 1 wherein the differential diameters of the normal bore and counterbore are complemented by the thickness of the skirt whereby the inner surface of said skirt forms a continuation of said normal bore.

3. In a gun perforator adapted to be submerged to great depths in a liquid-filled well bore, the combination of: a gun unit having a gun bore adapted to receive a projectile; a counterbore of rudimentary depth and length at the outer end of said bore; and a liquid-excluding cap for said counterbore, said cap having a dome-shaped head closing the end of said bore and a skirt portion press-fitted into said counterbore, said cap head tending, when subjected to external pressure, to expand said skirt thereby to increase the pressure of said skirt against the walls of said counterbore and maintain a sealing connection therewith.

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