

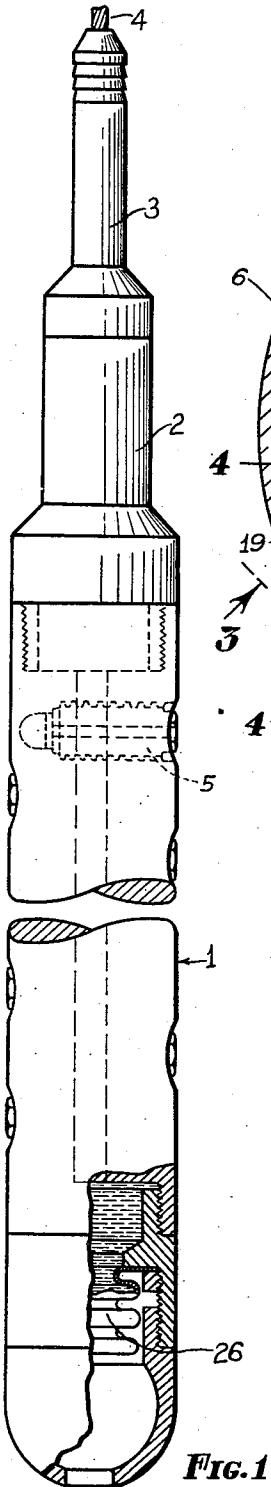
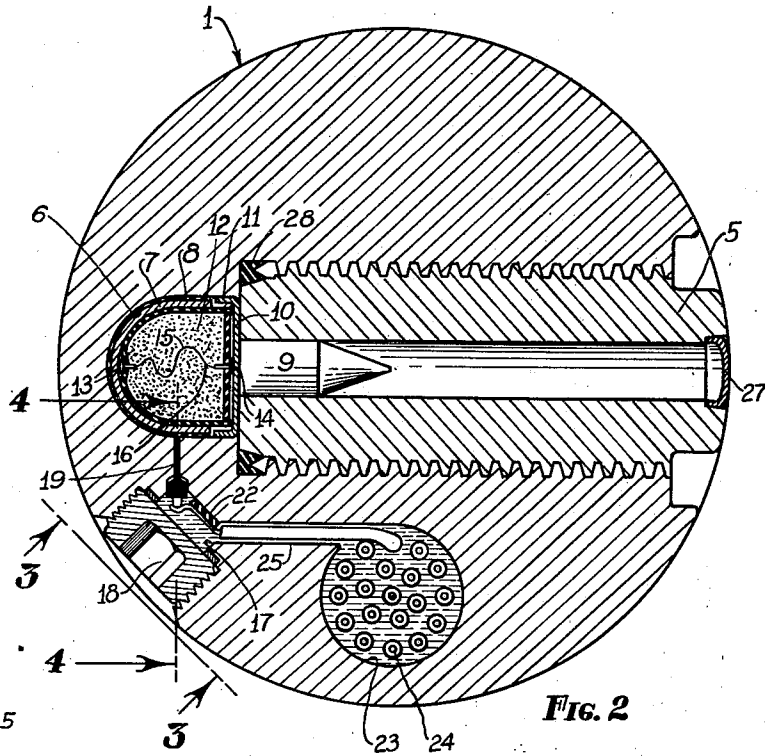
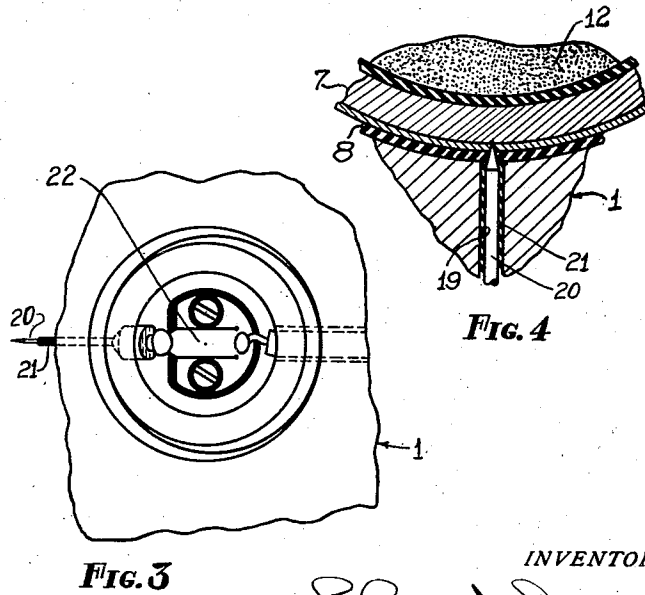
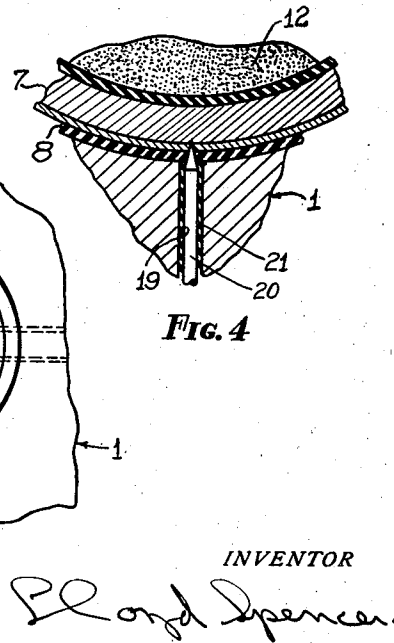
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GUN PERFORATOR FOR OIL WELLS

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GUN PERFORATOR FOR OIL WELLS

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6 Claims. (Cl. 164—0.5)

My invention relates to gun perforators for oil wells, that is, to gun perforators designed to be lowered inside of a well casing for the purpose of firing bullets through the casing and establishing communication with the surrounding formation. Among the objects of my invention are:

First, to provide a gun perforator which is electrically operated and which incorporates novel means for supplying electrical energy to the explosive cartridge;

Second, to provide a gun perforator of this class in which the electrical contact means is substantially permanent, that is, adapted to permit repeated firing of the gun perforator without damage or requiring replacement of the electrical parts of the gun;

Third, to provide a gun perforator which is inherently so arranged that a gun bore of maximum length is obtained for a given diameter of gun body; and

Fourth, to provide a gun perforator of the multiple unit type wherein the several gun units may be placed in relatively close proximity, so that a large number of gun units may be provided in a gun structure of given length and weight.

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

Figure 1 is an elevational view of a gun perforator embodying my invention, with a portion thereof shown in section;

Figure 2 is a typical transverse sectional view thereof on an enlarged scale;

Figure 3 is a fragmentary elevational view of the contact socket substantially along the line of 3—3 of Figure 2, with the sealing plug removed; and

Figure 4 is an exaggerated fragmentary sectional view taken through 4—4 of Figure 2, illustrating particularly the manner of making electrical contact with the gun chamber shell.

The gun body comprises a body 1 which is secured to a controller casing 2, this in turn being joined to a cable head 3 suspended from a cable 4. The controller case receives a conventional controller (not shown) adapted, upon receiving successive impulses of electricity, to connect each one of the gun units, to be described hereinafter, in sequence.

The gun body is provided with a plurality of laterally directed sockets which are internally threaded to receive gun barrels 5. Inwardly of each gun barrel 5 the body member is provided

with a cartridge chamber 6 which is lined with a metallic shell 7, on the outside of which is provided a layer of insulating material 8.

The gun barrel 5 is adapted to receive a bullet 9, to the rear end of which is secured, as by spot-welding, a disc 10 having a skirt 11. The disc 10 fits over the open outer end of the chamber 6 and its skirt fits within the side walls, clear of the shell 7. The shell 7 is adapted to receive a powder cartridge 12 which is provided with terminals 13 and 14 engaging the shell 7 and disc 10, respectively. The terminals are connected by a fusible wire 16.

The rear end of the chamber 6 is preferably semi-spherical and both the shell 7 and cartridge 12 conform.

The gun body 1 is provided opposite each chamber 6 with a recess 17 adapted to be sealed by a plug 18. The recess 17 communicates with the corresponding chamber 6 by means of a small hole 19; for example, this hole may be as small as .026 of an inch in diameter. The hole 19 receives a needle contactor 20 covered with insulation 21, except at its inner end. The needle contactor 20 is pointed at its inner end and is adapted to be forced into electrical engagement with the shell 7. The shell 7 is formed of high grade steel to withstand the explosive pressures generated upon ignition of the cartridge 12. In order to provide adequate contact between the shell 7 and needle contactor 20 the outer surface of the shell may be plated with a softer material such as copper.

The end of the needle contactor 20 which protrudes into the recess 17 may be enlarged and engaged by a contact clip 22. The gun body 1 is provided with a conductor passage 23 which extends longitudinally therewith and communicates with the controller housing 2. The passage 23 contains a plurality of conductors 24, one conductor for each gun unit. A lateral passage 25 communicates between each recess 17 and the passage 23.

In order that there be no leakage of well fluid into the electrical parts of the gun through the gun bore after the gun unit is fired, the passage 23 and communicating recesses 17 may be filled with a non-conductive liquid such as oil, glycerin or the like. The lower end of the gun body may be provided with a suitable flexible diaphragm 26, one side of which communicates with the passage 23 and the other side of which is exposed to the well pressures, so that such well pressures are transmitted at all times to the fluid contained within the passage 23 and

recesses 17, and liquid cannot leak through the holes 19 which receive the needle pin 20.

Before discharge, each gun unit is provided with a sealing disc 27 covering the bore of the gun and with a gasket 28 at the inner end of the gun barrel, sealing the threaded connection between the gun barrel and gun body.

If desired, the gun units may be arranged in sets and the members of each set directed diametrically opposite, in which case two passages 23 are provided.

By reason of the extremely small diameter of the hole 19, a comparatively thin shell 7 is able to bridge the hole even though subjected to extreme pressures, it being known that the explosive pressures within a gun perforator of this type may exceed 150,000 pounds per square inch. The insulation 8, being entirely confined and fully supported by the chamber 6, is not disturbed by such high pressure.

The sealing disc 10 attached to the bullet 9 introduces a slight delay in the discharge of the bullet, with the result that the peak pressure generated in the cartridge is increased, with attendant increase in the velocity of the bullet.

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. A gun perforator comprising: a gun body having a cartridge chamber and a conductor port intersecting said chamber; a shell lining in said chamber; insulation interposed between said shell and gun body; a conductor fitting said port and electrically associated with said shell; the relationship of shell thickness to the diameter of said port being so proportioned that said shell withstands the explosive force of a cartridge discharged in said chamber.

2. A gun perforator comprising: a gun body having a cartridge chamber and a conductor port intersecting said chamber; a metallic shell lining said chamber; insulation interposed between said shell and gun body; a conductor fitting said port and electrically associated with said shell;

and an explosive cartridge fitting within said shell and including an electrically responsive firing means in electrical association with said shell.

3. A gun perforator comprising: a gun body having a laterally directed socket forming at its inner end a cartridge chamber, and a conductor intersecting said chamber; a gun barrel fitting said socket outwardly from said chamber; a metallic liner for said chamber; insulation electrically separating the liner from the walls of the chamber; a conductor fitting said port and electrically connected with said liner; and an explosive cartridge adapted to fit within said liner and including an electrically responsive element electrically associated with said liner.

4. A gun perforator, as specified in claim 3, wherein the relationship between the diameter of said port and the thickness of said liner is such that the portion of said shell bridging said port withstands the force of said cartridge without extrusion into said port.

5. A gun perforator comprising: a gun body having a cartridge chamber intersected by a conductor port; a cover for said port; insulation electrically separating said cover from the walls of said chamber; a conductor fitting said port and electrically connected with said cover; the relationship between the diameter of said port and the thickness and area of said cover being such that said cover withstands explosive forces generated in said chamber without extrusion into said port.

6. A gun perforator comprising: a gun body having a laterally directed socket forming at its inner end a cartridge chamber, and a conductor intersecting said chamber; a gun barrel fitting said socket outwardly from said chamber; a cover for said port; insulation electrically separating said cover from the walls of said chamber; a conductor fitting said port and electrically connected with said cover; the relationship between the diameter of said port and the thickness and area of said cover being such that said cover withstands explosive forces generated in said chamber without extrusion into said port.

LLOYD SPENCER.