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FIRING MECHANISM FOR WELL SHOOTING GUNS

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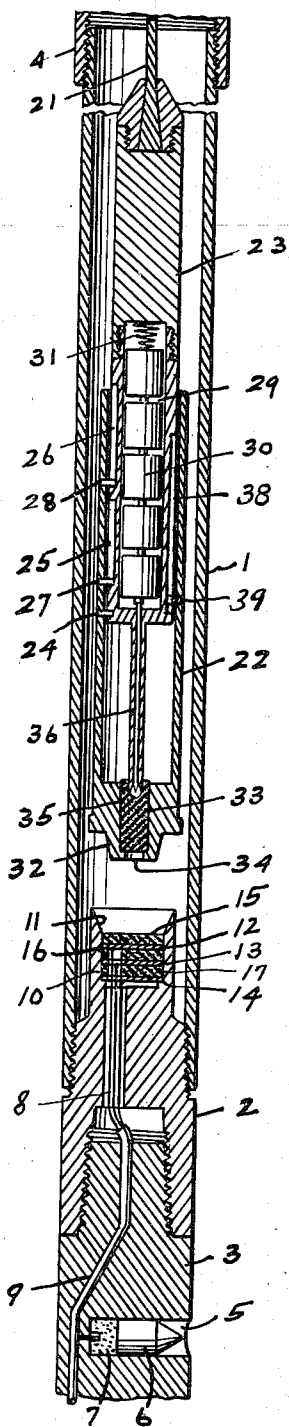


Fig. 1.

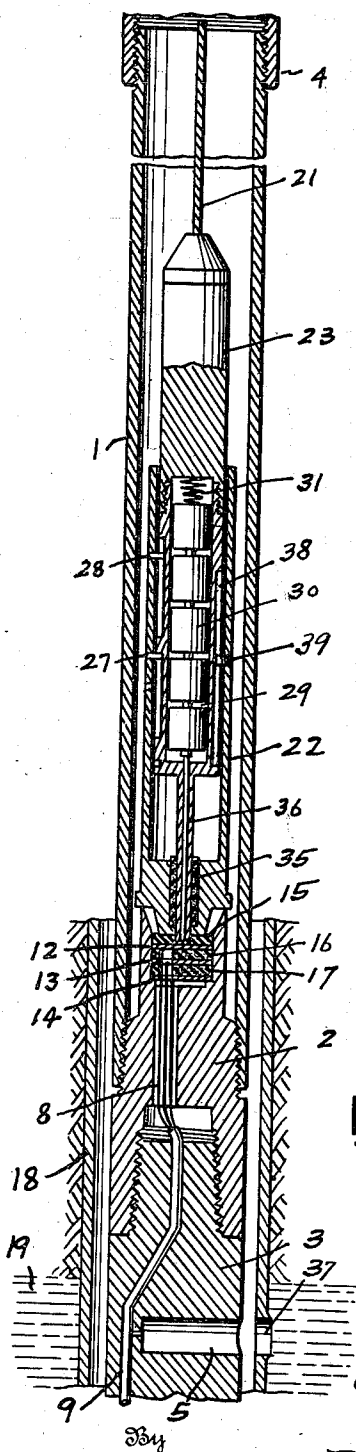


Fig. 2.

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## FIRING MECHANISM FOR WELL SHOOTING GUNS

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5 Claims. (Cl. 164—0.5)

This invention relates to a firing mechanism for well shooting guns.

An object of the invention is to provide firing mechanism of the character described which is under the control of the operator at the ground surface and whereby the charges may be successively fired so as to control the perforating operation in accordance with the will of the operator.

Another object of the invention is to provide electrical means for firing the charges, said means having the source of the electric energy embodied within the firing mechanism itself rather than located at the ground surface.

In the production of oil from wells it is common practice to drill the well to the required depth and set casing therein and to thereafter perforate the casing opposite the strata supposed to contain oil or gas. In carrying on this perforating operation it is common practice to lower a gun into the well said gun being equipped with radially directed cartridges having projectiles and firing charges with means for firing the charges. In the present disclosure a conventional type of gun body is illustrated and my improved type of firing mechanism is shown in connection therewith.

With the above and other objects in view the invention has particular relation to certain novel features of construction, arrangement of parts and use, an example of which is given in this specification and illustrated in the accompanying drawing wherein:

Figure 1 shows a vertical sectional view of the firing mechanism in inactive position; and

Figure 2 shows a vertical sectional view showing the firing mechanism in active position to cause ignition of a cartridge charge.

Referring now more particularly to the drawing wherein like numerals of reference designate similar parts in each of the figures, the numeral 1 designates a tubing, screwed into the lower end of which there is an adapter 2. This adapter is provided to connect the tubing 1 to the gun body 3.

The upper end of the tubing 1 may be connected to a string of pipe 4 which leads to the ground surface.

The gun body has a plurality of radial bores, as 5, only one being shown in the present embodiment and in these bores, or barrels, are located the projectiles 6 and firing, explosive charges 7 contained in a single cartridge unit. Electrical conductors such as 8 are arranged in a conduit 9 in the body and are suitably in-

sulated. There is one electrical conductor for each cartridge and this is formed into a filament in contact with the explosive charge.

In the present illustration the upper end of the adapter is provided with a bore 10 whose upper end is flared forming a seat 11 and in this bore are the spaced contact plates 12, 13, 14 formed of suitable conducting material and arranged alternately with respect to the separators 15, 16 and 17. These separators are formed of soft penetrable material and also insulate the plates 12, 13 and 14.

The conductors 8 have their upper ends connected to the respective plates 12, 13 and 14, each conductor being in electrical contact with only one of said plates.

The well shooting gun as hereinabove described, is first lowered into the well which is cased with the casing 18, until the projectiles are brought opposite what is thought to be a producing stratum as 19.

A go-devil is then lowered into the string of pipe 4 by means of a cable 21. This go-devil includes a tubular outer body 22 and an inner body 23. The inner body is initially pinned to the outer body by means of a frangible pin 24 and the inner body has the external vertical grooves 25, 26 into which the inner ends of the frangible pins 27, 28 project. The pins 27 and 28 are anchored to the outer body.

The lower end of the inner body contains a cylindrical chamber 29 which contains one or more electrical batteries 30 which are held against substantial movement therein by a coil spring 31 which is interposed between the series of batteries and the upper end of the chamber 29.

The lower end of the outer body 22 is formed with a guide 32 adapted to enter the seat 11 when the go-devil is lowered.

The lower end of the outer body 22 is provided with a socket 33 and an opening 34 beneath said socket. The socket is filled with a soft rubber plug 35 of insulating material.

Electrically connected to the series of batteries 30 there is an insulated stem 36 which extends downwardly into the plug 35 and whose lower end is pointed.

When the go-devil is lowered into the tubing 1 it may be dropped onto the upper end of the adapter 2 as shown in Figure 2, with sufficient force to shear the pin 24 and the stem 36 will penetrate the plug 35 as well as the disc 15 and will contact with the metal disc 12 thus completing circuit through the charge 7 which will be ignited and thereupon the projectile 6 will

be fired and will penetrate the pipe 18 forming the perforation 37 which will allow the inflow of fluid from the stratum 19. If upon a test the stratum 19 proves productive the go-devil may be elevated and again dropped and the upper end of the groove 25 will strike and shear the pin 27 allowing the stem 26 to move further downwardly into contact with the metal disc 13 so that another charge will be fired. Upon another elevation and dropping of the go-devil the upper end of the groove 26 will shear the pin 28 allowing the stem 36 to penetrate further into contact with the metal disc 14 to fire another charge.

If upon making the first perforation the stratum should not prove productive the gun may be elevated or lowered to another stratum and a test made as before and the outer pipe 18 may be fully perforated at the producing stratum when found.

It is obvious that more discs such as 12, 13, 14 may be provided, that is one for each of the cartridges with which the gun body is equipped.

In order to prevent the complete separation of the outer member 22 from the inner member 23, when the latter is elevated the said inner member is provided with an external longitudinal keyway 38 into which the inner end of the key 39, carried by the outer member 22, projects.

By the use of the type of firing mechanism above described an ordinary cable may be used for lowering the go-devil and there will be no danger of premature firing of the gun while it is being lowered into the well for the reason that the electrical firing equipment will not be lowered until after the gun, containing the cartridges, has been lowered into the well to the desired location.

The drawing and description are illustrative merely while the broad principle of the invention will be defined by the appended claims.

What I claim is:

1. In a perforating gun of the character described having a gun body provided with a bore and a chamber for an explosive charge, an adapter connected to said body providing for the connection of a tubular string thereto, a contact member within said adapter, an electrical conductor connected to said contact member and having ignition means in the chamber, a unit adapted to be lowered through the string and including a guide for positioning the unit relative to the adapter, said unit also including a source of electrical energy and means for contacting said contact member to electrically connect said source with the contact member to complete an electrical circuit through said conductor.

2. In a perforating gun for wells having a gun body provided with a plurality of bores for projectiles and explosive charge chambers behind the projectiles, electrical conductors having ignition means in the respective chambers, a

series of contact members carried by the gun with which the respective conductors are connected, a unit adapted to be lowered into the well and including a guide for positioning the lower end of the unit relative to the contact members, said unit also including a source of electrical energy with means for successively contacting said contact members to successively electrically connect said source with said members whereby electrical circuits may be successively completed through said conductors and ignition means to fire the charges in said chambers and means for operating said unit from the ground surface.

3. In a perforating gun for wells having a gun body provided with a plurality of bores for projectiles and explosive charge chambers behind the projectiles, electrical conductors having ignition means in the respective chambers, a series of contact members carried by the gun with which the respective conductors are connected, a unit adapted to be lowered into the well and including a source of electrical energy, said unit also including a contact element supported by frangible pins for successively contacting said contact members to successively electrically connect said source with said members whereby electrical circuits may be successively completed through said conductors and ignition means to fire the charges in said chambers.

4. In a perforating gun of the character described having a gun body provided with a bore and a chamber for an explosive charge, a tubular string from which the body is suspended, a contact member associated with said body, an electrical conductor connected to said contact member and having ignition means in the chamber, a unit adapted to be lowered through the string and including a guide for positioning the unit relative to the contact member, said unit also including a source of electrical energy and means for contacting said contact member to electrically connect said source with the contact member to complete an electrical circuit through said conductor.

5. In a perforating gun for wells having a gun body provided with a plurality of bores for projectiles and explosive charge chambers behind the projectiles, electrical conductors having ignition means in the respective chambers, a series of contact members carried by the gun with which the respective conductors are connected, a unit adapted to be lowered into the well and including a guide for positioning the lower end of the unit relative to the contact members, said unit also including a source of electrical energy with means for successively contacting said contact members to successively electrically connect said source with said members whereby electrical circuits may be successively completed through said conductors and ignition means to fire the charges in said chambers.

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