June 13, 1944. M. F. ALOI 2,351,179

WELL CASING PERFORATOR

Filed Feb. 22, 1943

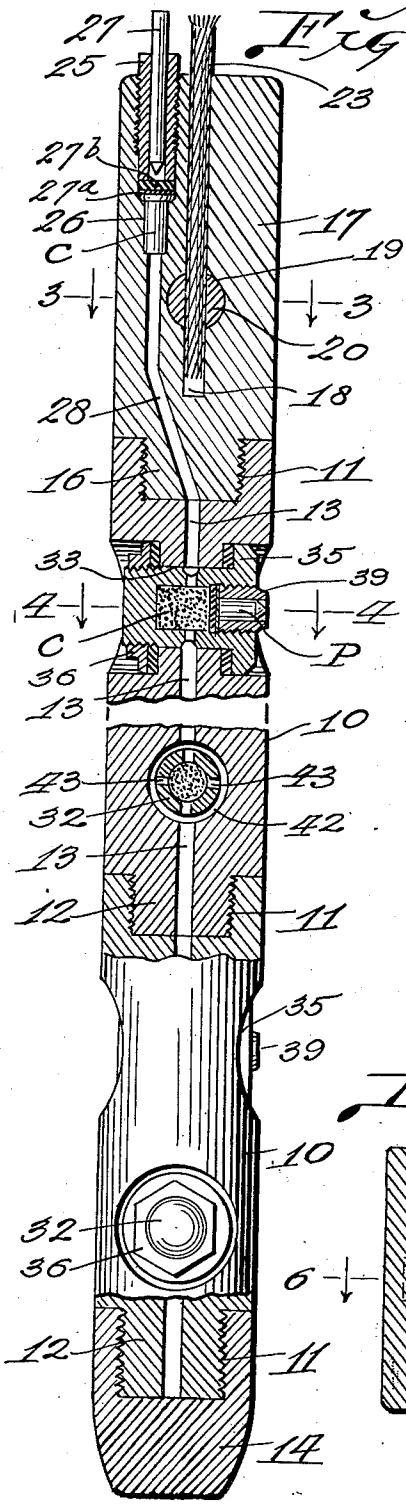


FIG. 2.

FIG. 1.

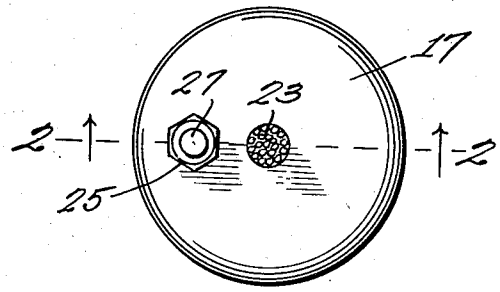


FIG. 3.

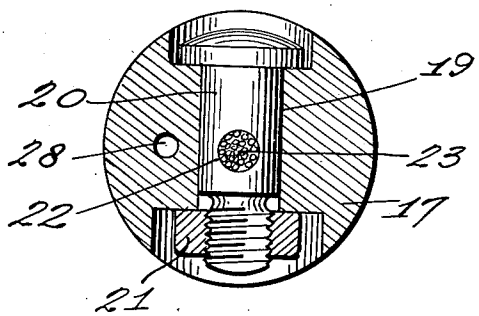


FIG. 4.

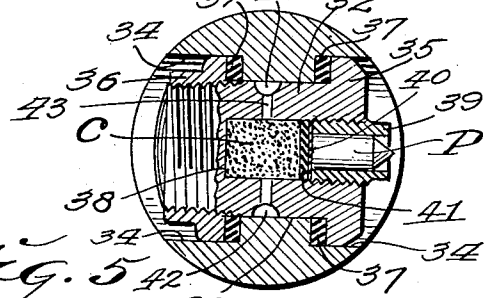


FIG. 5

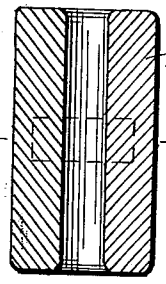
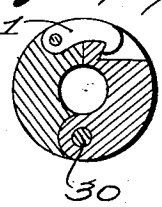


FIG. 6.



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WELL CASING PERFORATOR

Millio F. Aloi, Maywood, Calif.

Application February 22, 1943, Serial No. 476,666

12 Claims. (Cl. 164—0.5)

My invention relates to well casing perforators of the particular type forming the subject matter of U. S. Letters Patent #2,202,887 issued to me June 4, 1940, and the principal objects of my invention are, to generally improve upon and simplify the construction of the casing perforator covered by my aforesaid patent, to provide simple and efficient means whereby the explosive charges in the firing chambers of the device are positively ignited in sequence, one from another, and further, to construct the body of the perforator in sections, capable of being readily assembled or taken apart in order that a perforator of any desired length may be easily and quickly provided.

A further object of my invention is, to equip a casing perforator of the character referred to, with simple and efficient means for preventing the explosive charges within the body of the device from being ignited by hydraulic pressures encountered at great depths, for instance, five thousand or more feet.

With the foregoing and other objects in view, my invention consists in certain novel features of construction and arrangement of parts which will be hereinafter more fully described and claimed and illustrated in the accompanying drawing in which:

Fig. 1 is a top plan view of a casing perforator constructed in accordance with my invention.

Fig. 2 is a longitudinal section, reduced in size, and taken on the line 2—2 of Fig. 1.

Fig. 3 is a horizontal section taken on the line 3—3 of Fig. 2.

Fig. 4 is a horizontal section taken on the line 4—4 of Fig. 2.

Fig. 5 is a vertical section taken lengthwise through the center of the weight used in firing the explosive charge igniting cartridge at the upper end of the tool.

Fig. 6 is a horizontal section taken on the line 6—6 of Fig. 5.

Referring by numerals to the accompanying drawing which illustrates a preferred embodiment of my invention, 10, 10 designate the cylindrical sections which compose the main body of the tool, said sections being formed of metal, preferably steel, with each section provided in its upper end with an axially arranged threaded recess 11, and projecting from the lower end, is a threaded pin 12, adapted to enter the threaded recess in the next lower section.

Formed through each section 10 is an axial bore 13 and when the sections are assembled to form the tool, these bores provide a flame duct which extends the entire length of the body composed of said sections.

Screwed onto the pin 12 on the lowermost one of the sections 10, is a short cylindrical pilot block 14, generally known as a "bull nose" which serves to guide the tool as it is lowered into the well hole.

Screwed into the threaded recess in the upper end of the uppermost one of the sections 10 is a threaded pin 16, that depends from the lower end of a short cylindrical member 17, the same forming the upper section of the tool and formed in the upper portion of this member is an axial bore 18.

Intersecting bore 18, a short distance above its closed lower end, is a diametrically disposed bore 19 for the reception of a bolt 20, the head of which is countersunk at one end of said bore 19 and the threaded end of this bolt receives a nut 21, which occupies a recess, formed in member 17 around the bore 19.

Formed through the intermediate portion of bolt 20 is an aperture 22 through which passes the lower portion of the cable 23 used for lowering and raising the perforator in the well hole and the casing therein.

The distance from the bottom of the countersink which receives the bolt head, to the center of the bore 18, is slightly less than the distance from the underface of the bolt head to the center of the aperture 22 and thus, after the cable has been passed through said aperture 22 and nut 21 is tightened on said bolt aperture 22 will be driven slightly out of registration with bore 18, thereby pinching and very securely clamping the cable to the tool.

Removably seated in the upper portion of upper section 17 is a tubular member 25 and the lower end of this chamber is reduced in diameter to form a blank cartridge-receiving chamber 26.

Fitting snugly within tubular member 25 and slidable therein under an impact of considerable force, is a firing pin 27. After a blank cartridge such as C has been placed in chamber 26, a thin disc 27^a, preferably of steel and overlaid with a packing disc 27^b of rubber or the like, is positioned on top of said cartridge and clamped thereagainst by screwing tubular member 25 downwardly. The construction just described protects the cartridge against moisture and prevents said cartridge from being fired as a result of the high hydrostatic pressure prevailing in deep wells.

Leading from the lower end of cartridge chamber 26 downwardly through the lower portion of section 17 and threaded pin 16, is a flame duct

28 which communicates with the upper end of duct 13 in the uppermost one of sections 10.

The sliding weight or go-devil used for firing the cartridge, comprises a tubular member 29, formed in two parts, divided lengthwise and hinged to each other on one side by a hinge pin 30 and the parts being held in closed position upon the cable by a pivoted hook 31 (see Figs. 5 and 6).

This weight is adapted to slide freely upon cable 23 and at the lower end of its travel, to strike and drive pin 27 downwardly to fire cartridge C.

Mounted in each section 10, are one or more explosive charges and projectile carrying assemblies as illustrated in detail in Fig. 4, each assembly including a cylindrical plug 32 which occupies a diametrically arranged aperture 33 and intersects duct 13.

The ends of aperture 33 are enlarged or countersunk as designated by 34 for the accommodation of a head 35 on one end of plug 32 and for a nut 36 that is screw-seated on the other end of said plug.

Packing rings 37 are positioned on plug 32 between head 35, nut 36 and the body 10 to exclude moisture and hydraulic pressures from aperture 33.

Extending into plug 32 from the head end thereof, is a chamber 38 adapted to receive an explosive charge C and screw-seated in the outer portion of this chamber is a short barrel 39 which receive a projectile P.

A disc 40 of thin metal such as steel and a packing disc 41 of rubber or the like are positioned between the inner end of barrel 39 and the explosive charge in chamber 38.

Formed in the periphery of plug 32 is a circumferential groove 42 which communicates with duct 13 and formed in the plug and connecting said groove with chamber 38, is a series of radially disposed ducts 43. When the parts of the tool are properly assembled, the lower end of flame duct communicates with the upper end of the duct 13 in upper body member 10 and each duct 13 communicates with the corresponding groove 42 from which ducts 43 lead to the explosive charge chambers 38.

To prepare the tool for use, explosive charges are placed in the chambers 38 and the barrels 39, each carrying a projectile, and screwed into the plugs with a disc 40 and packing disc 41, between each barrel and explosive charge.

A blank cartridge C is now placed in chamber 26 with metal disc 27^a and packing disc 27^b on top of said cartridge, and tubular plug 25 is now screwed into upper section 17 to seal and retain the cartridge therein.

Just before the tool is lowered into the casing, a firing pin 27 is inserted in plug 25.

When the tool has been lowered to the point where the casing is to be perforated, the go-devil is positioned on the cable 23 and at the termination of its downward sliding movement thereupon, pin 25 is struck and driven downward to puncture the discs 27^a and 27^b and fire the blank cartridge C.

Flame from the ignited charge in the cartridge passes downward through duct 28 and through the upper portion of the duct 13 in the uppermost section 10 and said flame passes through groove 42, ducts 43 into chamber 38 to ignite the explosive charge therein.

The force developed by the ignited explosive charge breaks the discs 40 and 41 and forcibly expels the projectile so that same is driven outwardly from the barrel to pass through and perforate the casing wall.

A portion of the flame from the ignited explosive charge passes downward through duct 13, thereby igniting the charge in the next lower one of the plugs 32 and expelling the projectile carried thereby and such action is repeated downwardly throughout the tool, so as to successively expel the projectiles and perforate the casing throughout a length substantially equal to the length of the tool.

Thus it will be seen that I have provided a well casing perforator that is simple in construction, inexpensive of manufacture and very effective in performing the functions for which it is intended.

It will be understood that minor changes in the size, form construction of the various parts of my improved casing perforator may be made and substituted for those herein shown and described, without departing from the spirit of the invention, the scope of which is set forth in the appended claims.

I claim as my invention:

1. In a well casing perforator, an elongated body composed of a plurality of detachably connected sections, the upper section being provided with a cartridge-receiving chamber, a firing pin disposed above said chamber, a duct leading downwardly from said chamber through the sections of said body a plug removably seated in each section below said upper section, which plug is provided with an explosive charge chamber and with ducts between said chamber and said first mentioned duct, a projectile carrying barrel removably seated in each plug and means positioned between said barrel and the explosive charge in said chamber for protecting said explosive charge against moisture and hydraulic pressure.

2. A well casing perforator as set forth in claim 1 with a cable connected with the upper portion of said body and a go-devil adapted to slide upon said cable and to strike said firing pin.

3. A well casing perforator as set forth in claim 1 and with a protective closure positioned between said cartridge and firing pin.

4. In a well casing perforator, an elongated body provided with a longitudinally disposed duct, a plug removably seated in said body and provided with an explosive charge-receiving chamber which communicates with said duct, means removably seated in said plug in front of said explosive charge receiving chamber for holding a projectile and an air and moistureproof packing between said projectile holding means and the explosive charge in said chamber.

5. In a well casing perforator, an elongated body provided with a longitudinally disposed duct, a plug removably seated in said body and provided with an explosive charge receiving chamber, said plug having an external groove which communicates with said duct and with short ducts leading from said groove to said chamber and a projectile carrying barrel removably seated in said plug.

6. A well casing perforator as set forth in claim 5 and with an air and moistureproof packing between said barrel and explosive charge chamber.

7. In a well casing perforator, an elongated body composed of a plurality of detachably connected sections, the upper section being provided with a cartridge receiving chamber, a firing pin disposed above said chamber, a duct leading downwardly from said chamber through the sections of said body, a plug removably seated in each section below said upper section, which plug is provided with an explosive charge chamber and

with ducts between said chamber and the first mentioned duct, a projectile carrying barrel removably seated in each plug and means positioned between said barrel and the explosive charge in said chamber for protecting the explosive charge against hydraulic pressure.

8. In a well casing perforator, the combination with a body having a longitudinally disposed flame carrying duct and a transverse opening intersecting said duct and extending entirely through said body, of a removable plug seated in said opening and having an explosive charge-receiving chamber and ducts establishing communication between said flame carrying duct and chamber said plug capable of being inserted in and removed from said transverse opening by axial movement and a projectile-receiving barrel removably seated in said plug in front of the chamber therein.

9. The combination as set forth in claim 8 and with packing means between said barrel and charge-receiving chamber.

10. The combination as set forth in claim 8 and with packing means between both ends of said plug and said body.

11. In a well casing perforator, a body provided with a longitudinally disposed duct and with an open ended transverse opening which intersects said duct, both ends of which opening are counterbored, of a plug removably seated in said opening, said plug having an explosive charge receiving chamber, a projectile receiving barrel seated in said plug in front of said charge-receiving chamber and means for establishing communication between said chamber and duct, a flange on one end of said plug and positioned in one of said counterbored ends of said opening and means removably seated on the other end of said plug within the corresponding counterbored end of said opening for removably securing said plug in said opening.

12. A cartridge unit for well casing perforators having a body provided with a longitudinally disposed flame carrying duct and a transverse socket which passes entirely through said body and intersects said duct, comprising a readily removable plug adapted to be positioned in or removed from the socket in said body by axial movement, means for securing said plug in said body, said plug having an explosive charge-receiving chamber, a projectile-receiving barrel seated in said plug in front of the chamber therein and said plug being provided with a duct for establishing communication between the flame carrying duct through the body and the explosive charge chamber within said plug.

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