Oct. 16, 1962 J. B. McELHENY 3,058,523

PROCESS AND APPARATUS FOR INCREASING THE FLOW OF SUBTERRANEAN FLUIDS INTO WELLS

Filed April 13, 1959 2 Sheets-Sheet 1

FIG. 1.

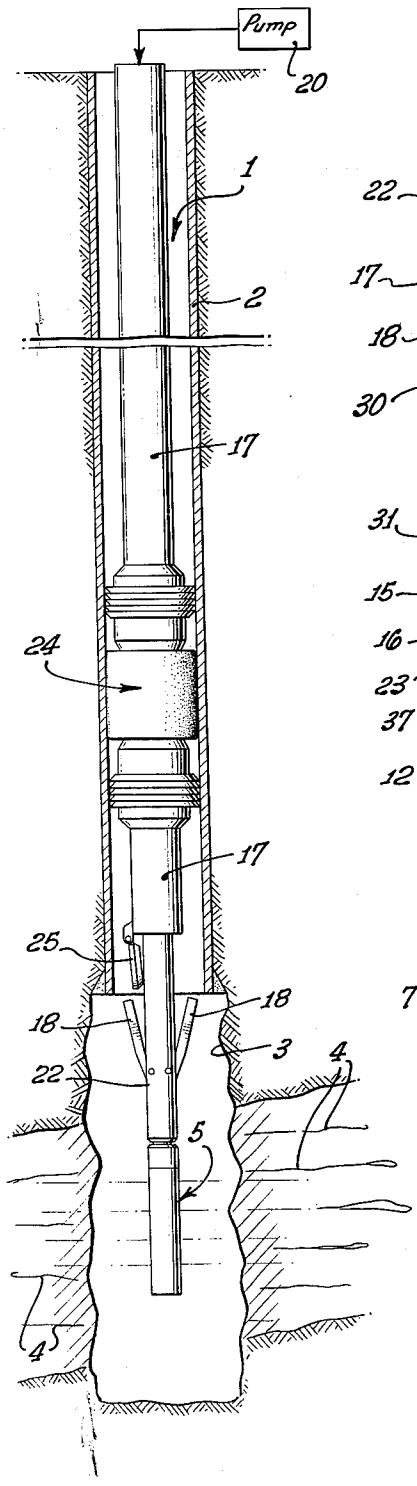


FIG. 2.

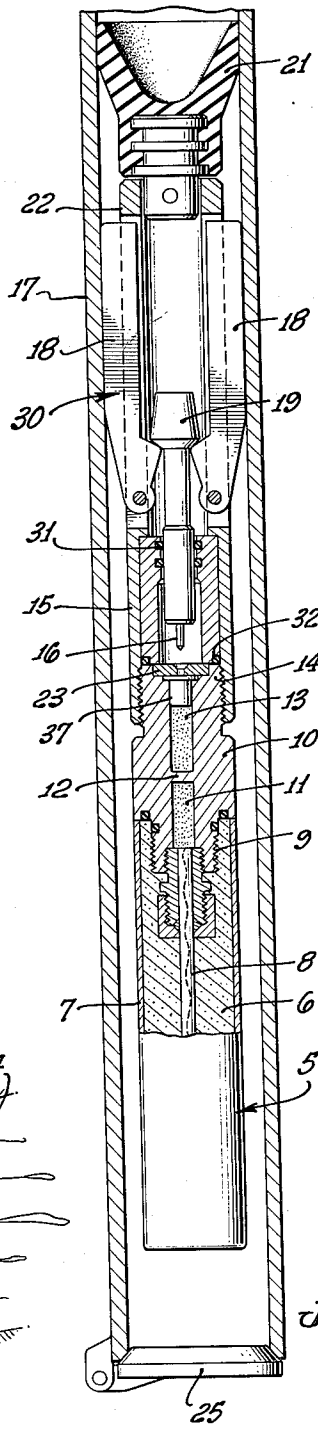
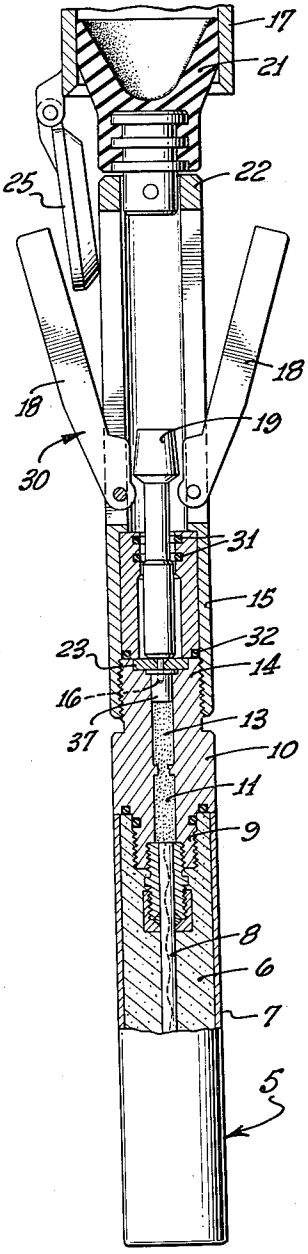


FIG. 3.



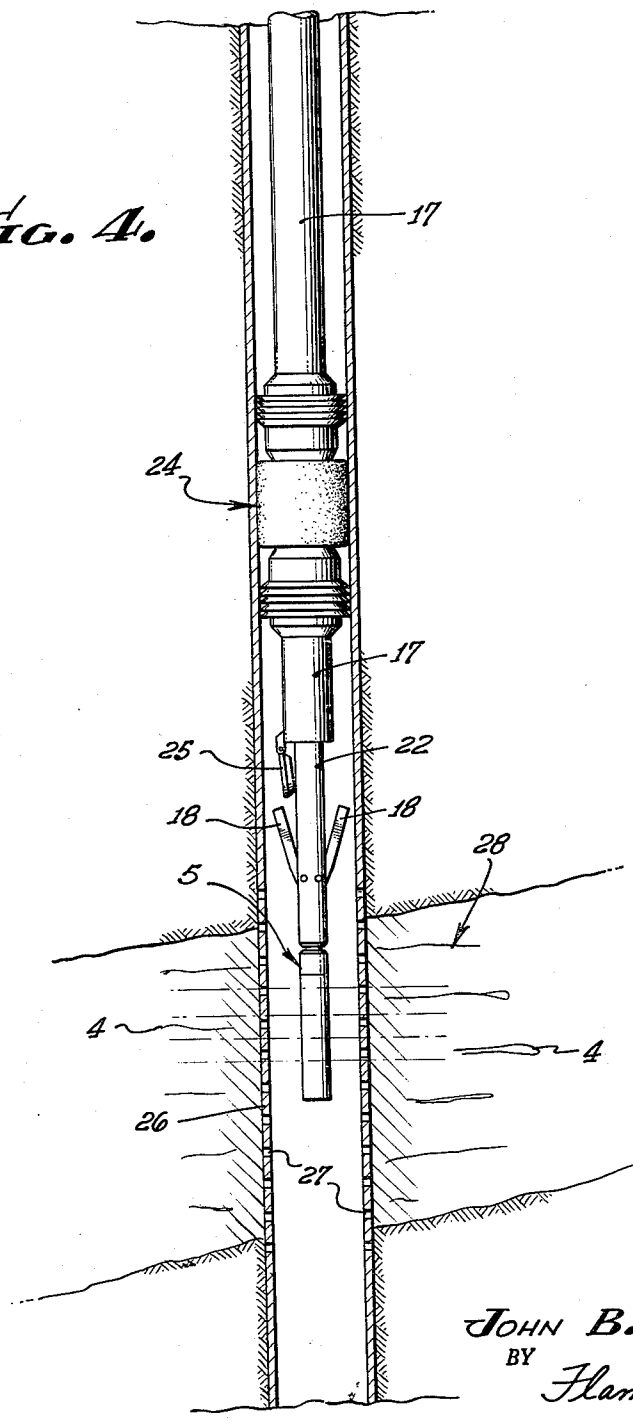
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FIG. 4.



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PROCESS AND APPARATUS FOR INCREASING THE FLOW OF SUBTERRANEAN FLUIDS INTO WELLS

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1 Claim. (Cl. 166—55.4)

This invention relates to the productivity of wells, and particularly to oil wells.

Wells of this character may be of very considerable depth, and cased by well casing except at the bottom. Oil or other fluid material may flow from the earth formation into the well bottom through fissures, cracks and crevices in the layers exposed in the bottom.

In order to increase the flow of oil or gas, it is necessary to enlarge these fissures or crevices, or to create new fractures or fissures. In the past, this has been done by the creation of high fluid pressures usually produced by detonating explosives by the aid of a firing circuit controlled from above the ground. For example, solid or liquid explosives, deposited in the bottom of the well, have been detonated to produce explosive blasts.

It is one of the objects of this invention to make it possible to create or enlarge such fissures or crevices or cracks in a simple and safe manner.

This invention possesses many other advantages, and has other objects which may be made more clearly apparent from a consideration of several embodiments of the invention. For this purpose, there are shown a few forms in the drawings accompanying and forming part of the present specification. These forms will now be described in detail, illustrating the general principles of the invention; but it is to be understood that this detailed description is not to be taken in a limiting sense, since the scope of the invention is best defined by the appended claims.

Referring to the drawings:

FIGURE 1 is an elevation of apparatus utilized to practice the invention, shown as disposed within a well, the depth of the well being shortened in order to reduce the size of the figure;

FIG. 2 is a view, mainly in longitudinal section, of a portion of the apparatus illustrated in FIG. 1;

FIG. 3 is a view similar to FIG. 2, but illustrating the igniting position of the apparatus; and

FIG. 4 is a view similar to FIG. 1, but showing the use of the apparatus in a casing, instead of in an exposed formation.

In FIG. 1 there is illustrated a well 1 having tubular casing 2 extending downwardly to an uncased lower portion or end 3. Into this end 3 leads a number of fine fissures, crevices or cracks indicated by reference character 4. Through these fissures, crevices or cracks flows petroleum or gas, or both, into the well bottom 3.

In order to increase the flow into the end 3, a slow burning propellant is ignited in the well. Such propellants, in liquid or solid form, are now well-known, and are often used for propelling rockets. The propellant in this instance is indicated as a package 5 (see also FIGS. 2 and 3). This package 5 is intended to be ignited by the aid of apparatus described in detail in a prior application filed in the name of the present applicant on April 7, 1958, under Serial No. 726,709, and entitled "Oil Well Casing Perforator."

The slow burning propellant material 6 produces constantly increasing pressures in the space in which it is confined. It may be covered by a thin plastic shell 7.

To increase the ultimate pressure, a succession of such packages may be ignited at spaced intervals.

The package 5 includes a booster igniter cord 8 which

extends into the interior of the solid propellant 6. If solid propellant is utilized, it may conveniently be carried on the lower threaded end 9 of a carrier 10. The booster 8 may be placed in communication with an explosive charge 11 normally separated by a rupturable wall 12 from a dry charge 13. Both the charge 11 and the dry charge 13 can be carried in appropriate recesses in the carrier 10.

The upper end 14 of the carrier 10 is threadedly engaged by the lower sleeve-like end 15 of a firing mechanism 30. The firing mechanism includes a firing pin 16 adapted to fire a cartridge 37 at the upper end of the recess accommodating the dry charge 13, and thereby to cause ignition of charges 13 and 11, and rupturing of wall 12. By the aid of appropriate sealing rings 31, 32, the space accommodating charge 13 is sealed against entry of well liquid until firing is accomplished. Then the explosive force of the dry charge is sufficient to detonate the charge 11, even if it be wet, after wall 12 is punctured.

As explained in said prior application Serial No. 726,709, the firing pin 16 is held against firing by the aid of a tubular guide 17 cooperating with one or more lever arms 18 which hold the enlarged head 19 of the pin 16 in inactive position.

The tubular guide 17 extends upwardly to the surface of the well. A pump 20 serves to provide fluid pressure to urge the firing device downwardly as by operating on a flexible-type piston 21 appropriately joined to the firing device body 22. The fluid from the well bottom 3 is urged by this pumping action into the formation.

Just as soon as the firing mechanism passes downwardly beyond the guiding tube 17, the lever arms 18 are freed of restraint and release the head 19 of the firing pin 16. This condition is illustrated in FIG. 3. In this position, the firing pin is projected by hydraulic pressure existing in the well 1 through an appropriate guiding aperture in a collar 23, to fire the cartridge 37. At the same time, the wall 12 is ruptured and the charge 11 is ignited to ignite the booster 8 and thereby the propellant 6.

In order to maintain the space adjacent the end 3 in sealed position, a packer 24 is provided surrounding the tubular member 17 and in engagement with the well casing 2. Furthermore, when the firing mechanism moves out of the bottom of the tubular guide 17, a check valve closure 25 is urged by spring pressure to closed position, as indicated in FIG. 1. This check valve may be of any conventional form urged to closed position by a light spring, such as shown in U.S. Patent No. 2,507,262 to McGivern, that would not appreciably retard the passage of the igniting device and the propellant passage through the bottom of the tube 17.

The gradually increasing pressure due to the igniting of the slow burning propellant fuel package 5 serves to enlarge or to increase the number of the passageways through which fluid or liquid can flow into the bottom of the well. This is accomplished without violent explosive forces. The process may be repeated several times in order to accumulate and constantly increase the fluid pressures existing in the bottom of the well.

FIG. 1 illustrates the use of the invention in an open hole. However, as shown in FIG. 4, the invention may be practiced in connection with a perforated casing section 26. This section is in communication by the aid of the perforations 27 with a producing layer 28. The same beneficial effects are obtained as in the form of FIG. 1.

The inventor claims:

In a system for increasing flow of fluids into a well extending through a formation having a producing portion: a tubular guide extending from the top of the well

to a place adjacent the producing portion; a package of propellant material guided in said guide, and adapted to emerge from the guide into said portion; means carried by the package for igniting the propellant when it leaves the guide, including a latch released by movement of the package beyond the guide; a sealing device between the guide and the well to seal off the producing portion; a closure for the bottom of the guide, movable exteriorly of the guide; and means for urging the closure to closed position, upon exit of the package from the guide, whereby fluid pressures may be built up in the producing portion for forming or enlarging crevices, cracks and fissures in the formation around said portion.

References Cited in the file of this patent

UNITED STATES PATENTS

2,676,662	Ritzmann	Apr. 27, 1954
2,705,920	Kanady	Apr. 12, 1955
2,766,828	Rachford	Oct. 16, 1956
2,859,697	Long	Nov. 11, 1958
2,876,843	Huber	Mar. 10, 1959