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May 9, 1939. W. L. CHURCH 2,157,729

APPARATUS FOR BRINGING A WELL INTO PRODUCTION

Filed May 17, 1937 2 Sheets-Sheet 1

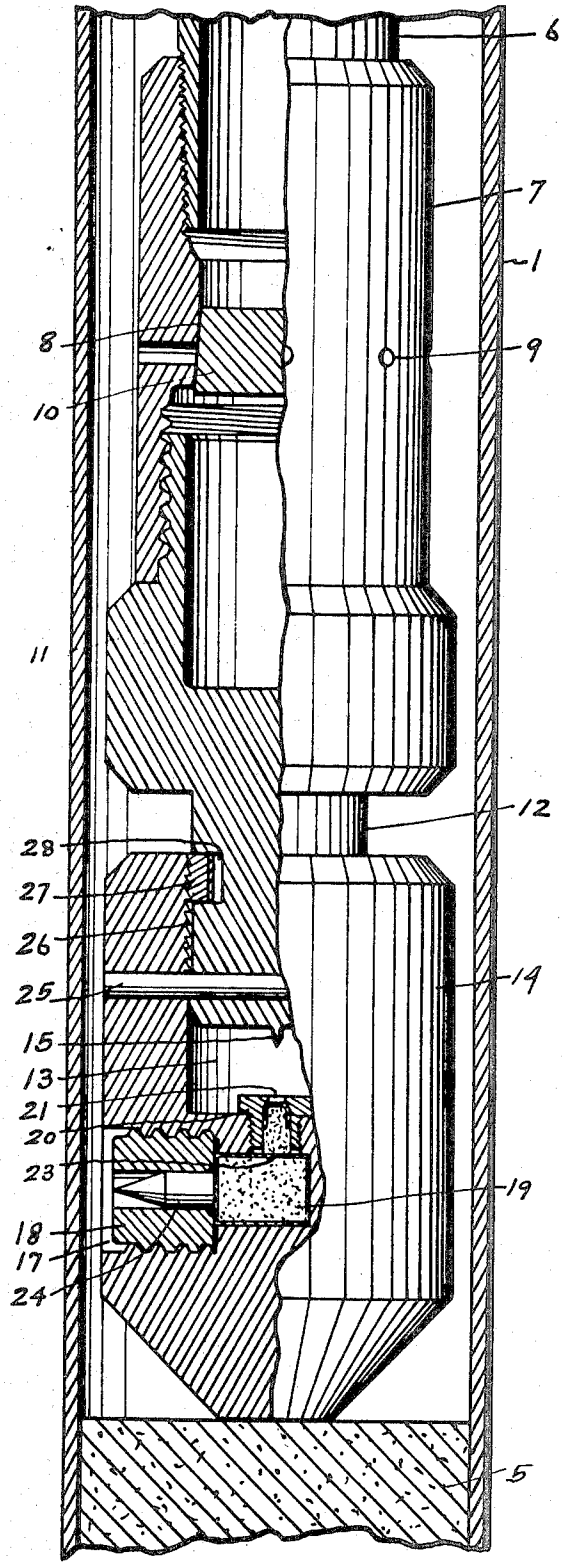


Fig. 1.

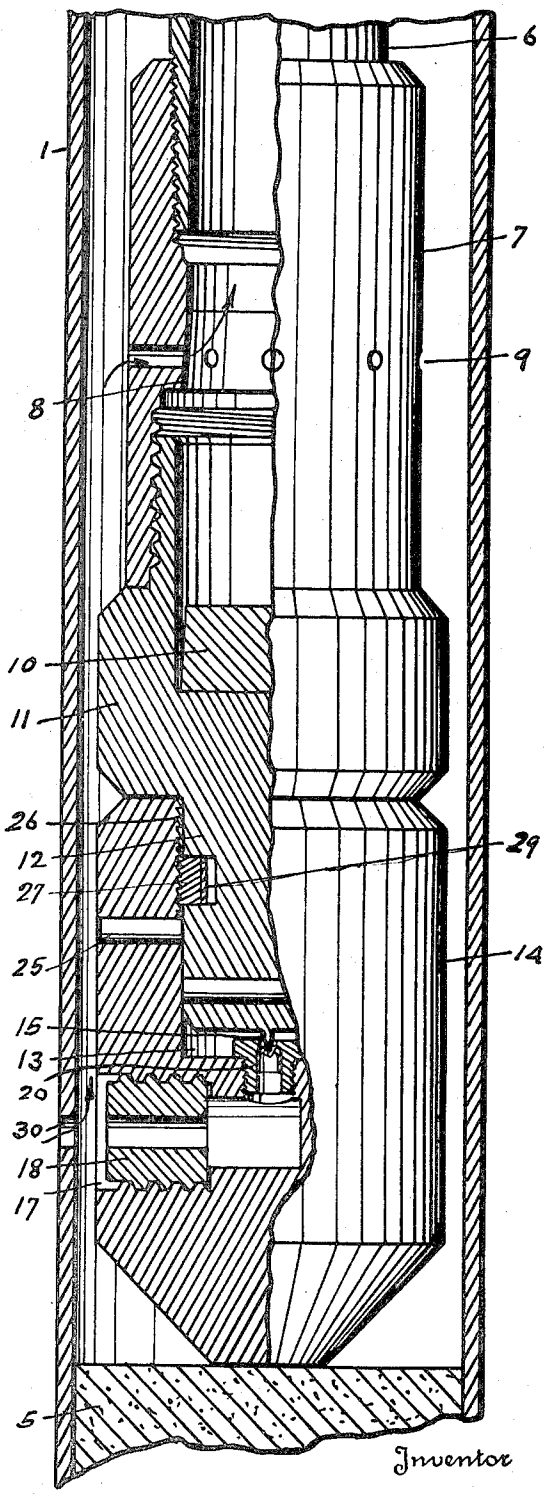


Fig. 2.

Inventor
Walter L. Church

By
Edward V. Hardway
Attorney

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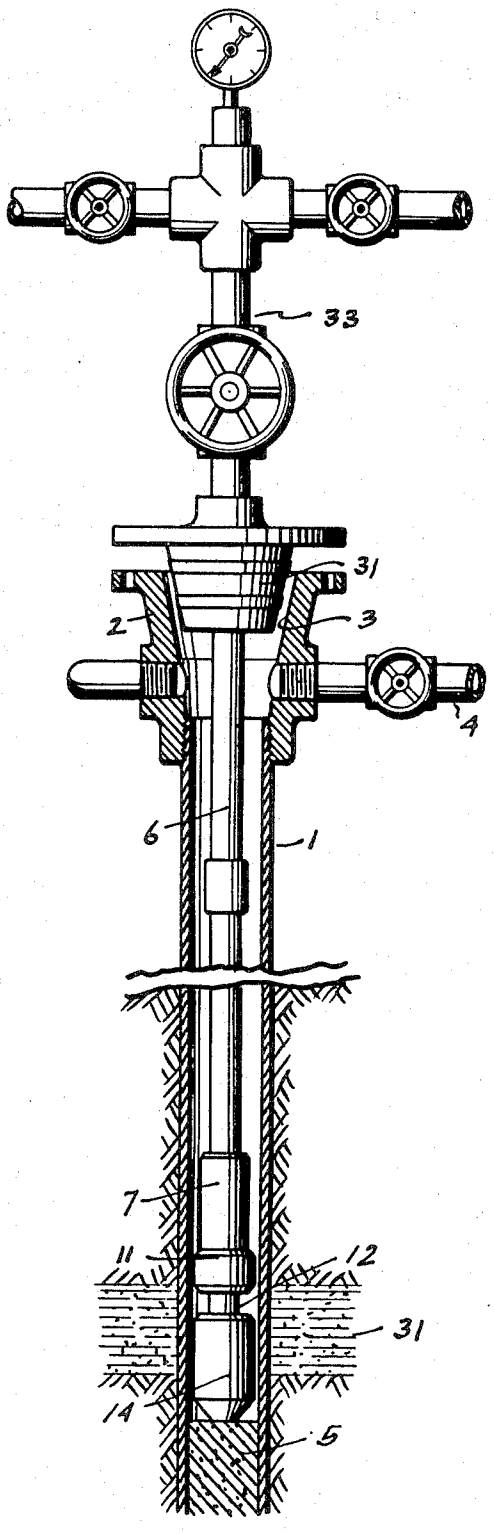


Fig. 3.

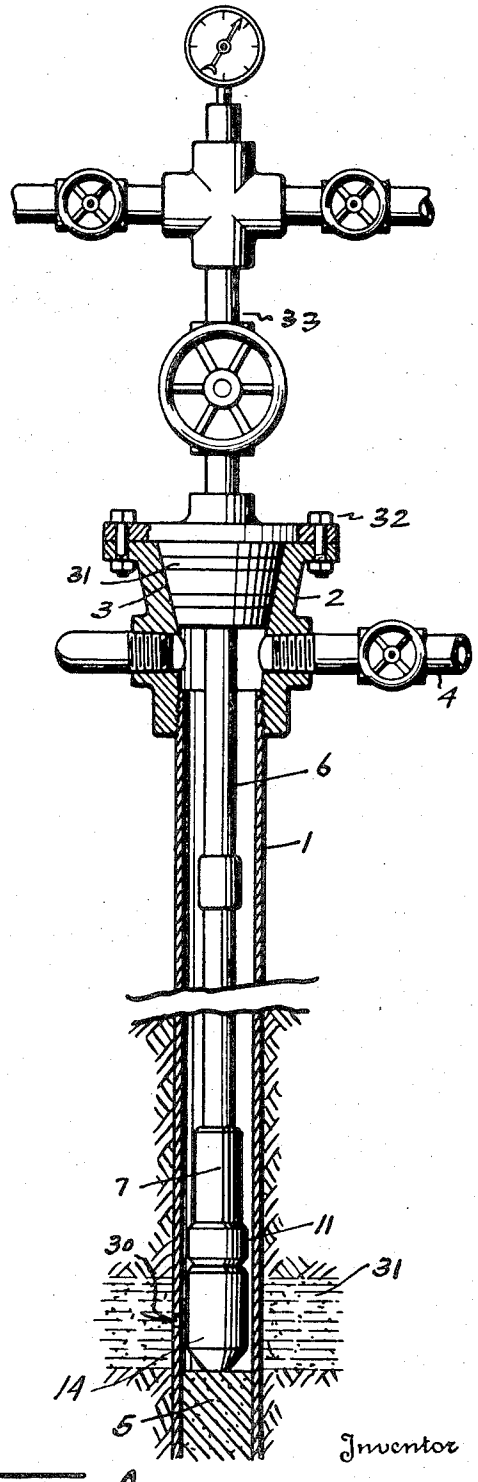


Fig. 4.

Inventor
Walter L. Church

By
Edward V. Hardway
Attorney.

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APPARATUS FOR BRINGING A WELL INTO PRODUCTION

Walter L. Church, Houston, Tex., assignor of one-half to James G. Gratehouse, Harris County, Tex.

Application May 17, 1937, Serial No. 143,040

3 Claims. (Cl. 166—1)

This invention relates to an apparatus for bringing a well into production and comprehends also a novel method for accomplishing that result.

It is an object of the invention to provide apparatus for perforating a well casing, closed at the bottom, to admit oil or gas into the casing from which it may be delivered to the ground surface.

Another object of the invention is to provide novel means for shooting a well, that is, for perforating a well casing to admit the produced liquid. The apparatus embodies a tubing having displaceable means for closing the lower end of the tubing and having a gun perforator on the lower end of the tubing equipped with means for firing a projectile, at the will of the operator, whereby the well casing will be perforated, said apparatus also embodying means for simultaneously closing the upper end of the casing and for controlling the flow of fluid from the well.

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

Figure 1 shows a side view, partly in section, of a casing perforating gun as attached to the lower end of a closed tubing and shown in position to be fired.

Figure 2 shows a side view, partly in section, of the gun after firing.

Figure 3 shows a side view of the complete equipment located in a well in position for firing the gun, and

Figure 4 shows a side view of the apparatus after the gun has been fired and the apparatus is hooked up for production.

Referring now more particularly to the drawings wherein like numerals of reference designate the same parts in each of the figures, the numeral 1 designates a well casing having the casing head 2 secured to the upper end thereof and which is provided with a downwardly tapering seat 3. The casing head has a valve controlled outflow line 4 leading out from beneath said seat.

In the present illustration the casing 1 has been closed as by cement 5 preferably the method of cementing the casing will be the method disclosed in Patent No. 2,016,919 issued to applicant on the 8th day of October, 1935, although the lower end of the casing may be closed in any selected manner. The numeral 6 designates a tubing to be run into the well. On the lower end of the tubing there is a coupling 7 which has an inside downwardly flared seat 8 and the coupling has perforations 9 therethrough leading out from said seat. These perforations are normally closed by a disc 10 which conforms to the shape of and fits closely in said seat 8 while the string is being lowered.

The lower end of the coupling 7 is closed by the plug 11 which is screwed therein and this plug has a depending mandrel 12 which is fitted downwardly into a correspondingly shaped socket 13 in the upper end of the gun body 14. The lower end of the mandrel has a depending, pointed firing pin 15.

Beneath the socket 13 the body has the radially extended recess 17 which is internally threaded to receive the tubular plug 18 and the recess 17 is reduced and inwardly extended at its inner end to receive the cartridge 19 containing an explosive. A container 20, carrying a primer charge is screwed downwardly into the body at the bottom of the socket 13 and is provided with a percussion cap 12 aligned underneath the firing pin 15. The primer charge in the container 20 is in communication with the main charge in the cartridge 19 through a small opening 23 in the cartridge.

In the plug 18 there is a projectile 24, formed of suitable hard material, whose outer end is pointed and whose inner end is welded, or otherwise fastened to the plug 18.

When the apparatus is assembled the firing pin 15 will be held above and spaced from the percussion cap 21 by means of a shearable pin 25 which passes through the body and the mandrel as shown in Figure 1.

The inner wall of the socket 13 has the downwardly pitched ratchet teeth 26 with which a correspondingly toothed dog 27 engages. This dog is mounted in a socket 28 in the side of the mandrel and is held yieldably outwardly by means of a suitable pressure spring 29 which maintains said teeth in interengaging relation.

When it is desired to bring in the well the inside of the casing is first washed to displace the heavy drilling fluid containing mud and this washing process is continued until substantially clean water is contained within the casing. The apparatus is then assembled as shown in Figure 2 and lowered until the lower end of the gun body lands on bottom. The weight of the tubing 6 is then released causing the pin 25 to shear and causing the firing pin to strike and discharge the percussion cap 21 whereby the charge will be ignited and sufficient pressure built up to disrupt

the welding or other anchoring means of the projectile **24** thus forcing said projectile outwardly at high velocity through the casing forming the perforation **30**. It is, of course, to be understood that more than one projectile may be employed if desired. Usually a number of perforations will be formed, in a manner however, similar to that above stated. The perforation **30** will, of course, be made opposite oil bearing strata **31**.

As the tubing **6** is lowered the tapered pressure head **31** at the upper end thereof will seat in the seat **3** and the flanges of the casing head and pressure head may be bolted together by the bolts **32**. The flow connections as **33** may be then hooked up and a weight dropped through the tubing to displace the disc **10** to permit the inflowing oil to flow into the tubing through the perforations **9** and pass thence to the ground surface in the usual way.

Should it become necessary to remove the gun from the well, the dog **27** will engage the teeth **26** of the body **14** so as not to leave said body in the well.

The drawings and description disclose what is now considered to be a preferred form of the invention by way of illustration only, while the broad principle of the invention will be defined by the appended claims.

What I claim is:—

1. Apparatus of the character described comprising a gun body shaped to be lowered into a well, a projectile, explosive means effective, upon ignition, to eject the projectile, a tubular string for lowering the body into the well, means for connecting the body to the string permitting movement of the string relative to the body but preventing disconnection of the body from the string, means for igniting the charge upon such relative movement, said string having an inlet at its lower end and displaceable means normally closing the inlet against inflow of liquid whereby the string will be lowered empty into the well.

2. In combination a casing in a well closed at its lower end, a tubular string having a lower end opening and displaceable means normally closing said opening, means at the upper end of the casing and string, respectively, for closing the upper end of the casing upon lowering the string to final position, a gun having a radially directed projectile therein, on the string and means for causing the ejection of the projectile solely by the final lowering movement of the string.

3. Apparatus of the character described comprising a gun body shaped to be lowered into a well, a projectile, explosive means effective, upon ignition, to eject the projectile, a tubular string for lowering the body into the well, means for connecting the body to the string permitting movement of the string relative to the body, but preventing disconnection of the body from the string, means for igniting the charge upon such relative movement, said string having an inlet through the wall thereof at its lower end and above said body for permitting entrance of well liquid into the string.

WALTER L. CHURCH.