April 5, 1932. S. G. FORNEY ET AL 1,852,512

WELL TUBING PLUG

Filed Oct. 25, 1929 2 Sheets-Sheet 1

Fig. 1.

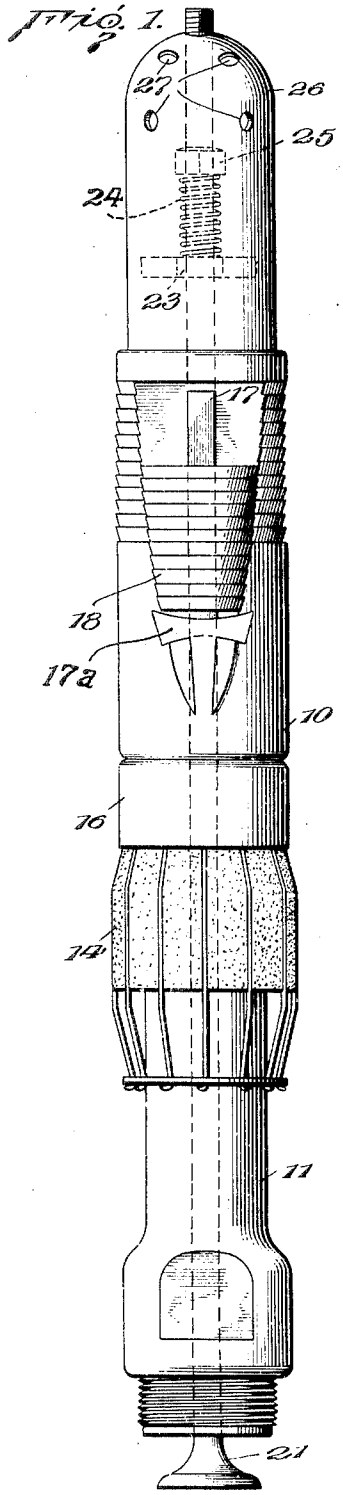
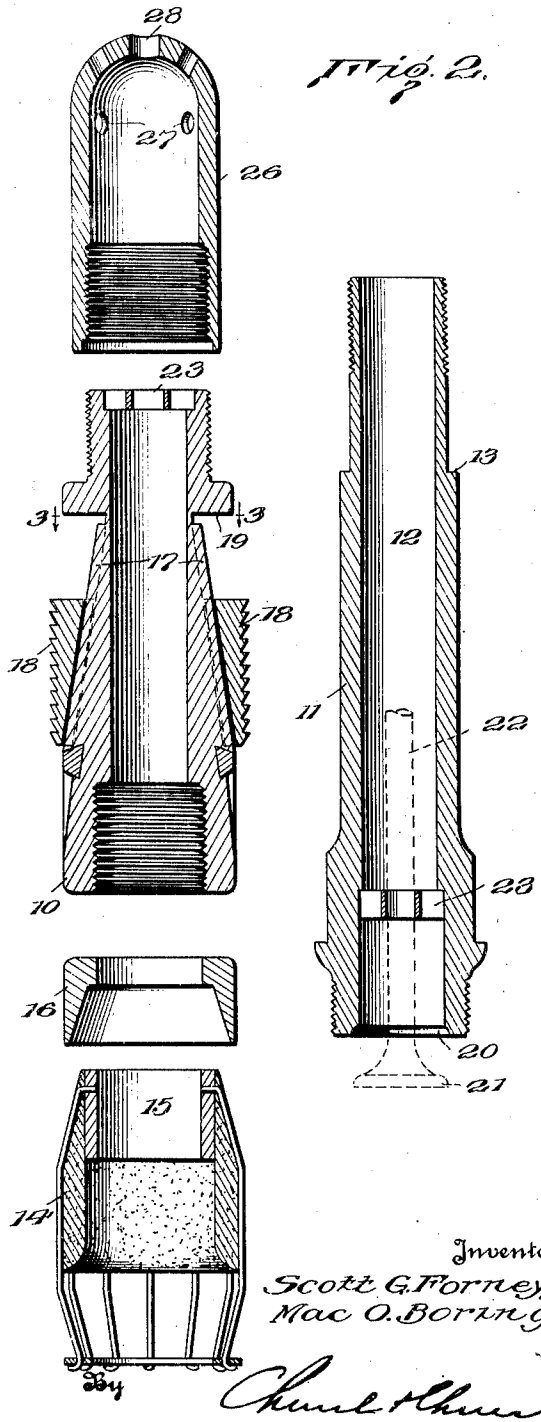


Fig. 2.



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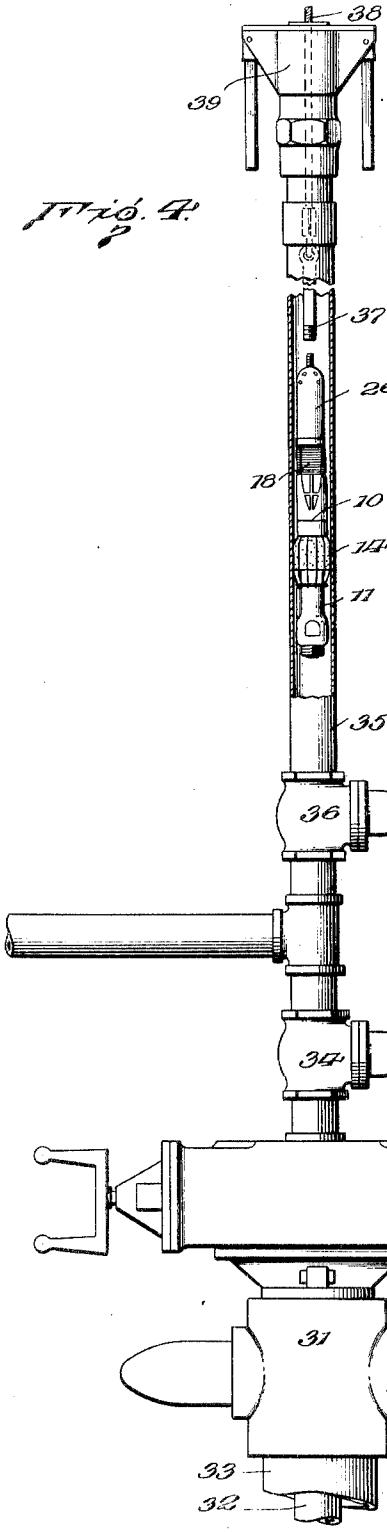

Fig. 4.

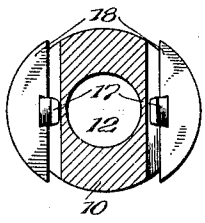

Fig. 3.

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UNITED STATES PATENT OFFICE

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WELL TUBING PLUG

Application filed October 25, 1929. Serial No. 402,488.

This invention relates to improvements in well tubing plugs.

When tubing is to be pulled out of a flowing well, it is desirable that the bottom or lower end of the string of tubing be closed so as to prevent the loss of oil, gas, or water, depending upon the type of well, which would otherwise flow through the tubing while the latter is being withdrawn.

Primarily, the present invention contemplates a tool or device of this character, and especially, a plug that may be positioned in the bottom or lower end of the tubing or at any other point in the tubing that may be desirable.

A further object is to provide a device of this character that will prevent the fluid or gas from flowing through the tubing during the removal of the latter from a flowing well, while, at the same time, the fluid or gas will be allowed to flow between the tubing and casing and into storage tanks or pipe lines, as the case may be, without loss of fluid or gas.

A still further object of the invention is to construct a device of this type that is comparatively simple of construction and which may be produced at a comparatively low cost.

With these and other objects in view, the invention consists in certain details of construction and combinations and arrangements of parts, all as will be hereinafter described and the novel features thereof particularly pointed out in the appended claims.

In the accompanying drawings:

Figure 1 is an elevational view of a tool constructed in accordance with the present invention;

Figure 2 is a longitudinal sectional view of the several parts constituting the tool, but with said parts disassembled;

Figure 3 is a transverse sectional view on the line 3—3 of Figure 2; and

Figure 4 is an elevational view illustrating the use of the present plug.

Stated generally, the plug may be said to consist of a body portion formed of upper and lower sections between which there are held means for effecting a seal between the plug and the inner surface of the tube in which the plug is inserted. Said body sections and the sealing means are of tubular formation, and formed in the bore of one of the sections is a valve seat for a valve capable of closing the passage through the plug proper. This valve is provided with a comparatively long stem, extending through suitable guides in the interior of the plug, and is normally spring pressed against its side, so as to close the passage through the tube. On the upper section of the plug body, there is a housing with a spring which actuates said valve, and the upper end of the valve stem projects through said housing, whereby its protruding end portion may be engaged by suitable means for the purpose of unseating the valve while the plug is being lowered in the well. Means are also carried by the plug for gripping against the interior wall of the tube for holding the plug in the desired position in the tubing, these gripping means being of a character which would permit the plug to be lowered in the tubing but which, at all times, will prevent an upward movement of the plug.

Referring to the drawings, the upper section of the plug is indicated at 10, and the lower section at 11, and the two sections being formed with threaded portions for connecting the same together. The two sections are formed with a central bore 12, and held between the lower end of upper section 10 and a shoulder 13 on lower section 11, there are means for effecting a seal or packing the space between the plug and the wall of the tubing. These sealing means may take various forms, their specific construction constituting no part of the present invention, so that it will suffice to say that it will consist of an elastic extensible member 14 capable of being distended against the wall of the tubing. It might be added that the sealing means comprising the extensible elastic member 14, reinforced on its interior by a metal band 15 and what will be termed the cap portion 16, is a well known make of "swab" that may be purchased on the open market.

For the purpose of retaining the plug in the desired position in the tubing, the intermediate portion of section 10 is tapered up-

wardly on its exterior surface and formed at this point with slide ways or guides 17 for gripping members 18, whose inner surfaces conform to the cylindrical shape of section 10. The exterior surfaces of these gripping members are serrated in such fashion that the plug will readily slip downwardly in a tubing, but any effort to withdraw the plug from the tube upwardly will cause the teeth of the gripping members to bite into the surface of the tubing. Upward movement of these gripping members relatively of section 10 when the plug is being lowered into the tubing, is limited by shoulders 19 on said body section. Excessive downward movement and dissociation of the gripping members is prevented by strips 17*a* which are anchored to the section 10 and extend transversely across the lower portions of the tapered surfaces and the guide 17.

While the plug is being lowered in the tubing in a well, it is necessary that oil or gas be permitted to flow through the plug, but, after the plug has been positioned in the tubing, ready for the tubing to be pulled, it is necessary that not only the space between the plug and tubing be sealed, but the passage through the plug itself must also be closed. For this reason, the central bore 12 of the plug is formed with a valve seat 20 for a valve 21, the valve being provided with means extending above the upper end of the plug and capable of being engaged by means of instruments from the surface of the ground for opening the valve. Preferably, valve 21 is formed with a valve stem 22 that extends entirely through the plug, so that its upper end can be engaged by tools from the surface of the ground. The stem is guided longitudinally of the plug by ring-like guides 23, formed in the bore of each of the body sections 10, 11 and for yieldingly retaining the valve against its seat 20, a spring 24 is interposed between guide 23 in upper section 10, and a collar 25 on said stem. In order to protect spring 24, it is enclosed within a housing 26 screwed on upper section 10. This housing is formed with openings 27 for the passage of fluid or gas, and with a centrally located passage 28 through which the upper end of the valve stem 22 projects. With this arrangement, pressure on a protruding end of stem 22 sufficient to overcome spring 24 will unseat valve 21 and, of course, when this pressure is relieved, spring 24 will return the valve to its seat.

In Figure 4, there are shown more or less conventionally the connections at the surface of the ground for the purpose of illustrating the manner in which the present plug is used. As shown in this figure, when it is desired to pull the tubing, the valve 29 in the flow line 30 leading from casing head 31 is opened, whereby fluid or gas flowing upwardly between the tubing 32 and well casing 33 may be carried off to a suitable point, the gate valve 34 above the casing head being closed at this time. A tubing plug is then placed in a joint of tubing 35, which is screwed into tubing gate valve 36. Two or three polish rods 37 made up together, or a sinker, is run on a sand line 38 to force the plug to a point near the bottom of the tubing, the gate valves 34, 36 being opened at this time to permit the plug to be lowered. Preferably, there is a wire line stuffing box 39 connected to the top joint of tubing to prevent loss of liquid or gas through the upper end of the pipe. The weight of the polish rods pressing down on the protruding end of valve stem 22 forces the valve 21 open at the bottom of the tool, permitting the oil or gas to flow through the tubing while the tool is being lowered to the required depth. After the plug has been lowered to the desired point, the polish rods are removed with the sand line, but the plug remains at the bottom of the tubing by reason of the fact that the grips 18 will prevent upward movement of the plug itself. Upon the rods being raised, spring 24 closes valve 21 immediately, and the space between the plug and tubing being sealed by member 14, the tubing can be pulled without the loss of any oil or gas, as all production on the part of the well will then be flowing between the tubing and the casing, to and through flow line 30.

What is claimed is:

1. A self anchoring plug for well casings comprising a cylindrical body portion having a beveled cut-away portion formed axially thereon, a central dovetail guide member projecting outwardly from said beveled portion and extending axially thereon, a dog member having its inner surface axially slidable on said beveled portion and having a central dovetail slot interengaged with said guide member, and a stop member extending transversely across the outermost portion of said beveled portion and anchored to said body portion for limiting the movement of said dog and preventing its dissociation from said body portion.

2. A full-automatic fluid pressure anchored flow restricting plug for insertion through the outlet end of tubing through which fluid is flowing and is to be checked, comprising a tubular body member, a cup shaped packer element carried by said body member and having a sealing lip of such diameter as to initially snugly engage the inner surface of the tubing, locking means carried by said body member permitting free movement of said body member in the direction opposite that of fluid flow, but engageable with the inner surface of said tubing to lock said body member against movement in the direction of fluid flow, and a valve element normally urged to close the bore through said tubular body member; said valve having a portion so located and exposed with respect to the other

portions of the plug as to be capable of being held open by means inserted from the outlet end of the tubing in order to permit fluid flow through the body member while the plug is being advanced to the desired location in the tubing.

3. A full-automatic fluid pressure anchored flow restricting plug for insertion through the outlet end of tubing through which fluid is flowing and is to be checked, comprising a tubular body member, a packer element carried by said body member and having, when unexpanded, a normal diameter such as to initially snugly engage the inner surface of the tubing, locking means carried by said body member permitting free movement of said body member in the direction opposite that of fluid flow, but engageable with the inner surface of said tubing to lock said body member against movement in the direction of fluid flow, and a valve element normally urged to close the bore through said tubular body member, said valve having a portion so located and exposed with respect to the other portions of the plug as to be capable of being held open by means inserted from the outlet end of the tubing in order to permit fluid flow through the body member while the plug is being advanced to the desired location in the tubing.

4. A full-automatic fluid pressure anchored flow restricting plug for insertion through the outlet end of tubing through which fluid is flowing and is to be checked, comprising a tubular body member, a packer element carried by said body member and having, when unexpanded, a normal diameter such as to initially snugly engage the inner surface of the tubing, locking means carried by said body member permitting free movement of said body member in the direction opposite that of fluid flow, but engageable with the inner surface of said tubing to lock said body member against movement in the direction of fluid flow, a head portion on said body member having therethrough an axial central aperture disposed at the extreme top of the plug as a unit, and a valve element normally urged to close the bore through said tubular body member, said valve having an operating member normally projecting through the central aperture of the head portion of the body member, but operative, when depressed flush with the top of said head portion, to open said valve and permit fluid flow through the body member while the plug is being advanced to the desired location in the tubing.

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