Feb. 24, 1953 R. E. O'DONNELL 2,629,444

DEVICE FOR USE WITH OPEN HOLE TESTERS IN WELLS

Filed Nov. 10, 1950 2 SHEETS—SHEET 1

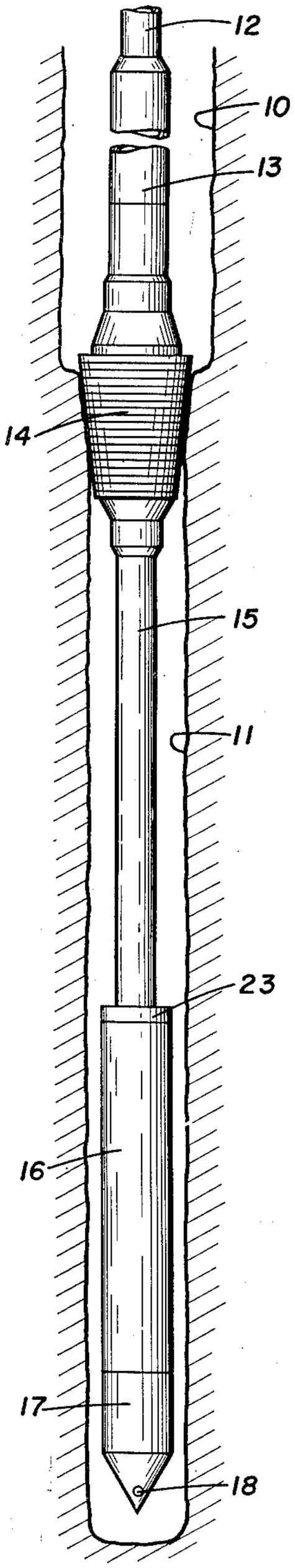

FIG. 1.

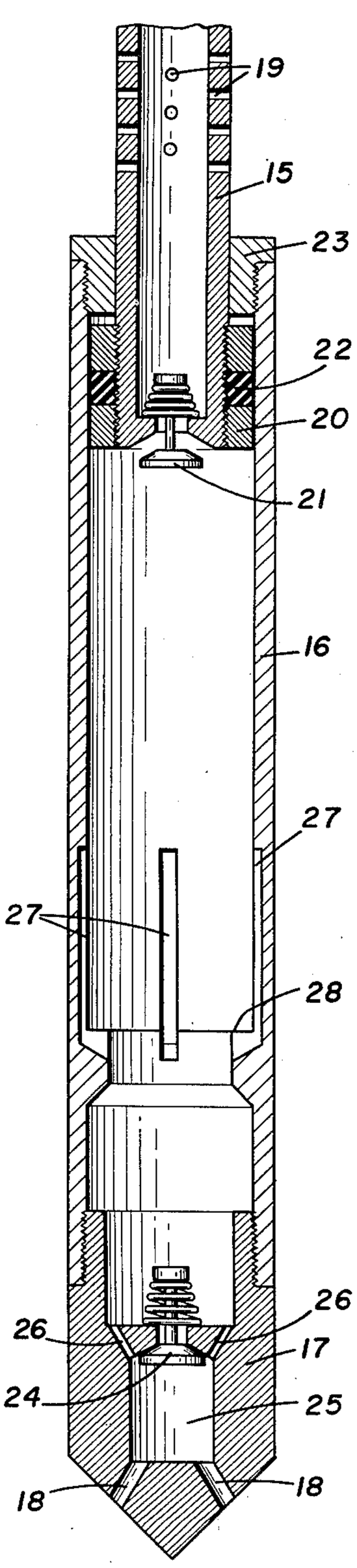

FIG. 2.

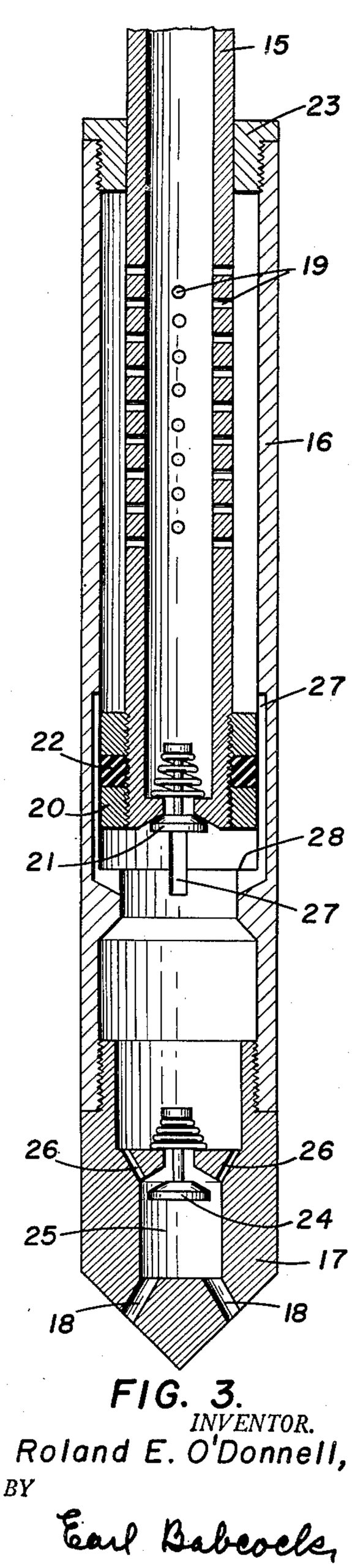

FIG. 3.

INVENTOR.
Roland E. O'Donnell,
BY
Earl Babcock,
ATTORNEY.

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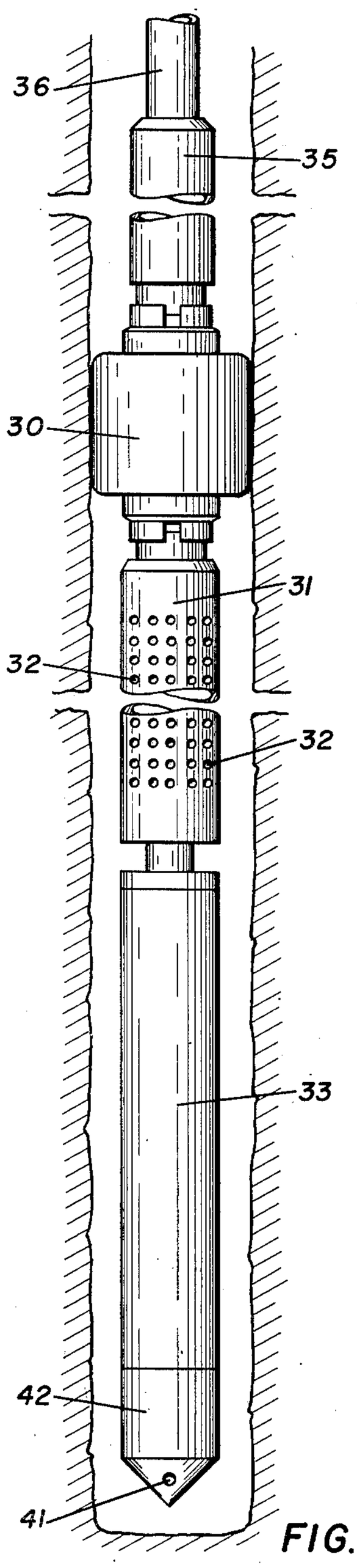

FIG. 4.

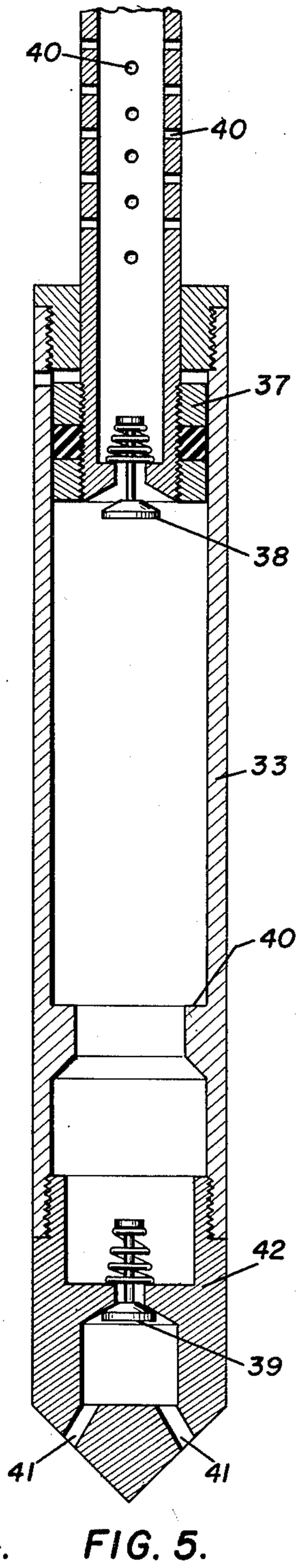

FIG. 5.

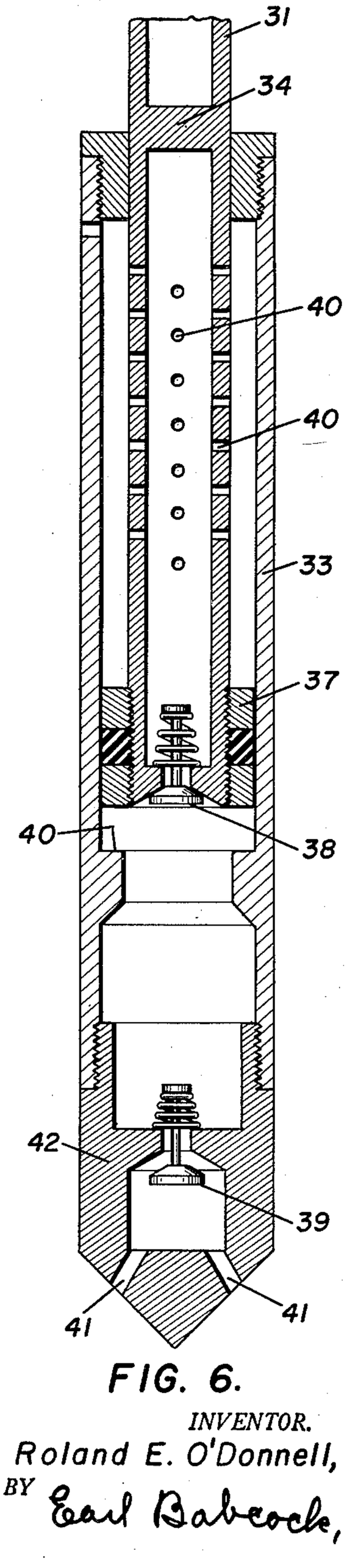

FIG. 6.

INVENTOR.
Roland E. O'Donnell,
BY Earl Babcock,
ATTORNEY.

Patented Feb. 24, 1953

2,629,444

UNITED STATES PATENT OFFICE

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DEVICE FOR USE WITH OPEN HOLE TESTERS IN WELLS

Roland Earl O'Donnell, Dallas, Tex.

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4 Claims. (Cl. 166—1)

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This invention relates to formation or drill stem testers used in oil wells or the like and more particularly to an anchor device for use with such a tester.

Drill stem testing of oil wells is now a well developed art. As shown in the U. S. patent to Simmons No. 1,930,987, granted October 17, 1933, the tester may include a valve mounted on the lower end of drill pipe and capable of being manipulated thereby, a packer such as a rat hole packer which seals off from the remainder of the well bore the particular earth formation undergoing test, and an anchor or tail pipe which usually acts as a strainer but also serves as an inlet to the valve and drill pipe while the test is being made.

It frequently happens that in attempting to make a drill stem test, the anchor pipe strikes cuttings, heavy mud or other obstructions in the lower uncased part of the well bore and it is then impossible to make the test because the assembly cannot be lowered to the depth necessary to pack off the particular formation to be tested. Perhaps this occurs most frequently when a rat-hole type of packer like that shown in the Simmons patent mentioned above is used, but it also occurs when side wall and hook wall packers are used or in any case where a test is being attempted in the open or uncased portion of the well bore.

In accordance with the present invention, a device is provided for overcoming this difficulty. A pump cylinder and piston are incorporated in the anchor or tail pipe of the tester and these can be manipulated by raising and lowering the drill pipe in such a way as to jet cuttings, debris etc. out of the open hole so that the tester can be lowered into the desired position. When the desired position has been reached, the device is so designed as to serve as a strainer and not interfere with the making of a proper test.

The objects of the invention will be apparent from the following description of the invention, when considered in connection with the accompanying drawings in which:

Fig. 1 is a view in vertical cross-section of the lower open hole portion of a well bore with a tester therein and with an anchor device constructed in accordance with the present invention located beneath the packer.

Fig. 2 is a vertical cross-sectional view of the anchor device of Fig. 1, the view showing the position of the parts on the intake stroke of the pump incorporated therein.

Fig. 3 is a vertical cross-sectional view of the anchor device of Fig. 1, the view being similar to that of Fig. 2 except that the parts are here shown in the position they occupy at the end of the delivery stroke of the pump.

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Fig. 4 is a view in vertical cross-section of the lower open hole portion of an oil well with a tester therein and with an anchor device constructed in accordance with another embodiment of the invention.

Fig. 5 is a vertical cross-sectional view of the anchor device of Fig. 4, the view showing the position of the parts on the intake stroke of the pump incorporated therein.

Fig. 6 is a vertical cross-sectional view of the anchor device of Fig. 4, the view being similar to that of Fig. 5 except that the parts are shown in the position they occupy at the end of the delivery stroke of the pump.

Referring to the drawing in detail and first to the embodiment of the invention shown in Figs. 1 to 3, it will be seen that in Fig. 1, the well bore of an oil well is shown at 10. Although the invention is not to be regarded as limited to use in a rat-hole, for purposes of illustration, a rat-hole is shown at 11. Within the well bore 10 and the rat-hole 11 is a drill stem tester assembly which includes the drill pipe 12, a tester or valve 13, which may be any one of the devices now commonly used for formation testing, a packer 14 and a tail pipe or anchor pipe 15 which is provided with perforations as shown at 19.

At the lower end of the anchor pipe 15, a tubular pump cylinder 16 is mounted for sliding movement, and this cylinder is provided with a pointed shoe 17 containing ports or openings 18 which serve to jet fluid downwardly and outwardly therefrom. The details of the pump are shown in Figs. 2 and 3. As there shown, it will be seen that a piston 20 is fixed, as by threads, to the lower end of the anchor pipe 15 and that a spring pressed traveling check valve 21 is mounted in the bottom of the anchor pipe 15. The piston 20, during most of its travel up and down in the cylinder 16 maintains a seal with the wall thereof and to this end is provided with packing or piston rings 22 of usual design. The anchor pipe 15, which also serves as the piston rod of the pump extends through a guide ring 23 but no seal is maintained between the ring 23 and the pipe 15.

Within the shoe 17 on the cylinder 16, there is a spring pressed, standing check valve 24. This valve regulates to some extent the passage of fluid upwardly through the jet ports 18 and the valve clearance chamber 25. It will be seen however that by-pass ports 26 are provided between the chamber 25 and the interior of the

cylinder 16. In other words, the valve 24, even when it is closed, does not completely seal the passageway between the cylinder 16 and the jet ports 18. Of course, the construction may be such that the by-pass ports are provided through the valve 24 and the stem thereof or the design may be such that the valve 24 does not completely close but some means should be provided for by-passing the valve 24 when it is closed although the by-pass should be small and serve, when the valve 24 is closed as a one-way choke limiting flow upwardly into the cylinder 16.

Provision is also made for by-passing the piston 20 when it is at the end, or nearly at the end of its downward or delivery stroke. This is accomplished by providing flutes or grooves on the inside of the cylinder 16 for a limited distance, as shown at 27. Just beneath these flutes 27, the cylinder 16 may be provided with an inwardly extending jar ring 28. This ring serves as an anvil which is struck by the piston 20. A special hammer may be provided on the anchor pipe 15 for striking the ring 28 but in the form shown the piston 20 serves as the hammer.

The ring 28 may be so spaced from the lower ends of the flutes 27 as to cause the liquid to cushion the blow delivered to the cylinder 16 by the piston 20 at the end of its downward stroke, as by causing "wire-drawing" of the liquid when the lower end of the piston passes the lower ends of the flutes.

In operation, the device is such that fluid may be jetted out of the bottom of the assembly to dislodge cuttings or debris in the open hole and then a jar blow delivered to the cylinder 16 to drive it into the space where the fluid has been jetted. Initially, if desired, the cylinder may be filled with jellied gasoline or any other fluid which will be useful in suspending cuttings or aiding in getting the anchor pipe down. In any event, when the shoe 17 strikes obstructions in the hole, the anchor pipe 15 and piston 20 move downwardly in the cylinder 16 and jet fluid therefrom into the portion of the well bore below the shoe 17, the valve 21 being closed and the valve 24 being open at this time so that there is no restriction to flow from the cylinder 16 to the jets 18. As the downward stroke of the pipe 15 is completed, the piston 20 passes the flutes 27. Fluid can then by-pass the piston 20 so that it delivers a jarring blow to the ring 28 and drives the cylinder 16 and shoe 17 downwardly.

On the upward or intake stroke of the piston 20, some fluid can enter the cylinder 16 through the choke ports 26, but these are so small that the valve 21 opens letting fluid into the cylinder mainly through the perforations 19 of the anchor pipe 15. Thus as the anchor pipe 15 is moved up and down in the cylinder 16, fluid is pumped from a point in the open hole 11 above the cylinder 16 to a point beneath the cylinder 16. This fluid may be circulated in this part of the open hole over and over, as the drill pipe is raised and lowered, until the anchor pipe is down to the desired location.

The number and location of the perforations 19 in the anchor pipe 15 may be such that when a test is made, the fluid from the formation enters the anchor pipe above the cylinder 16 without flowing through it. On the other hand, especially if the cylinder 16 is quite long, it may be desirable to have the fluid from the formation flow mainly up through the cylinder 16 and the arrangement illustrated is capable of carrying out such flow.

The packer 14 will normally be seated when the anchor pipe 15 and piston 20 are in the cylinder at the end of the delivery stroke, as shown in Fig. 3. Fluid can then flow through the jet ports 18, the choke ports 26, around the piston 20 through the flutes 27 and then through the perforations 19 up through the anchor pipe 15 into the tester 13 and drill pipe 12.

After the test has been completed, the anchor pipe 15 may be raised and lowered to cause the piston 20 or other hammer on the anchor pipe 15 to deliver upwardly jarring blows to the guide ring 23 and thus assist in removing the cylinder 16 from the open hole.

In the embodiment of the invention shown in Figs. 4, 5 and 6 a wall packer is used instead of a rat-hole packer and the construction of the anchor and pump assembly is different than that shown in Figs. 1, 2 and 3.

To set a wall packer, like that shown at 30 in Fig. 4, it is ordinarily necessary to have its lower shoe supported on an anchor pipe 31. As shown this anchor pipe is provided with ports 32 in its upper portion and these are located above any portion of the anchor pipe which extends into the pump cylinder 33 and above a cross partition or plug 34 (Fig. 6) in the anchor pipe. Any fluid which flows up through the anchor pipe 31, tester valve 35 and drill pipe 36 will flow along the outside of the lower portion of the anchor pipe 31 and enter it through the ports 32.

As in Figs. 1, 2 and 3, there is a piston 37 and a travelling valve 38 on the lower end of the anchor pipe 31 and the cylinder 33 is provided with a standing valve 39 and a jar ring 40. It will be observed, however, that there are no choke ports around the standing valve and no by-passes around the piston at any point in its path of travel.

Above the piston 37 but below the plug 34, the anchor pipe is provided with a number of holes 40 which serve as inlet ports for the pump cylinder 33. When the piston 37 is moved upwardly within the cylinder 33, fluid enters the cylinder through the ports 40 and the traveling valve 38 and when the piston 37 is moved downwardly within the cylinder, this fluid is forced out through the standing valve 39 and the jet ports 41 in the shoe 42 to force cuttings or the like up around the cylinder 33 and anchor pipe 31 so that the tester 35 and packer 30 can be lowered until it is in the desired position to test a particular formation.

While only two embodiments of the invention have been shown and described herein, it is obvious that various changes may be made without departing from the spirit of the invention or the scope of the claims.

I claim:

1. An anchor device for use with a drill stem tester in oil wells or the like, comprising, in combination, an anchor pipe having perforations therein, a tubular cylinder mounted for sliding movement on the lower end of said anchor pipe, a piston within the cylinder and connected to the anchor pipe, a travelling valve mounted on said anchor pipe, a standing valve mounted in said cylinder beneath said travelling valve and a shoe on said cylinder having jet ports therein, whereby when the anchor pipe is moved up and down with respect to the cylinder fluid is circulated, from a point above the cylinder through the perforations in the anchor pipe, down through the cylinder and jetted through said shoe to remove cuttings or the like from the portion of the well beneath the cylinder.

2. The arrangement defined in claim 1 in combination with a jar ring secured inside said cylinder and a hammer on said anchor pipe, the arrangement being such that the jar ring is struck by said hammer at the end of the downward stroke of said piston to deliver a downwardly driving blow to the cylinder.

3. The arrangement defined in claim 1 in combination with ports in said anchor pipe for by-passing said standing valve and flutes in said cylinder for by-passing said piston when it is at the end of its downward stroke in the cylinder.

4. The arrangement defined in claim 1 in combination with a guide ring secured in the top of said cylinder and a hammer on said anchor pipe,

the arrangement being such that the guide ring is struck by said hammer at the end of the upward stroke of said piston to deliver an upwardly driving blow to the cylinder.

ROLAND EARL O'DONNELL.

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