Aug. 30, 1932. G. A. HUMASON 1,875,006

WELL TESTER

Filed March 9, 1931 2 Sheets-Sheet 1

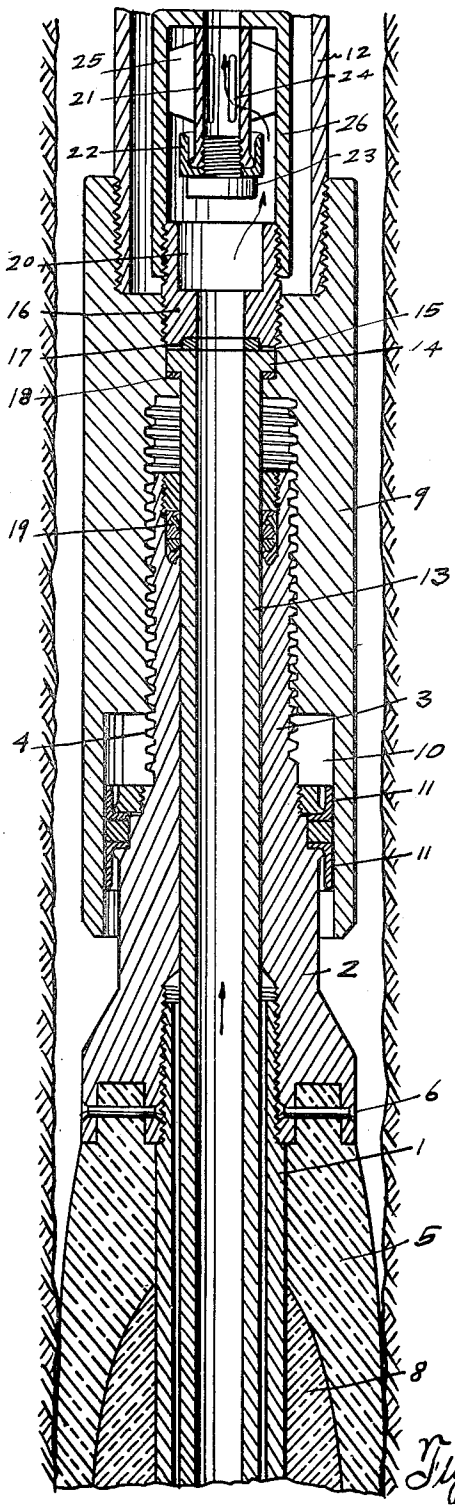


Fig. 1.

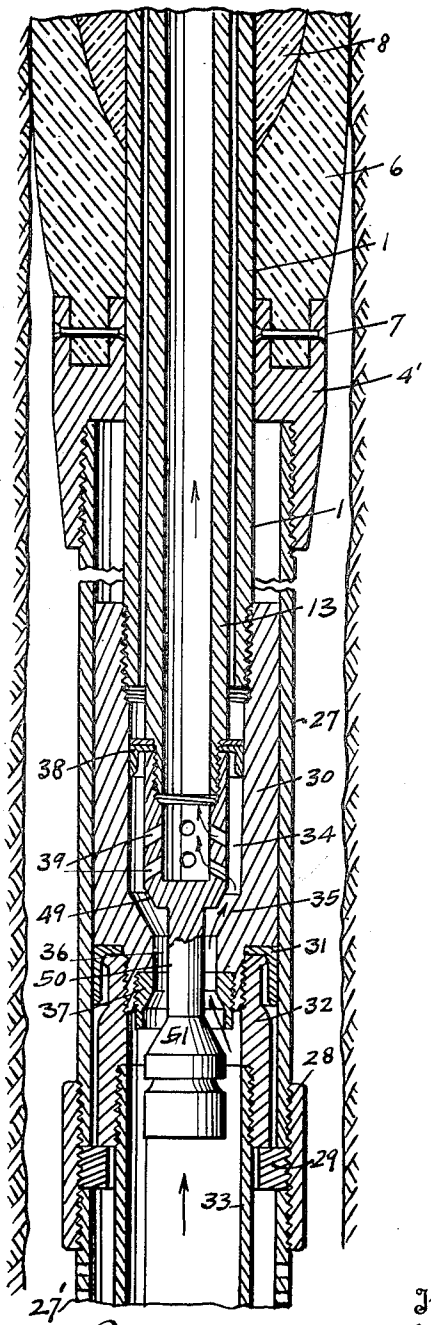


Fig. 2.

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WELL TESTER

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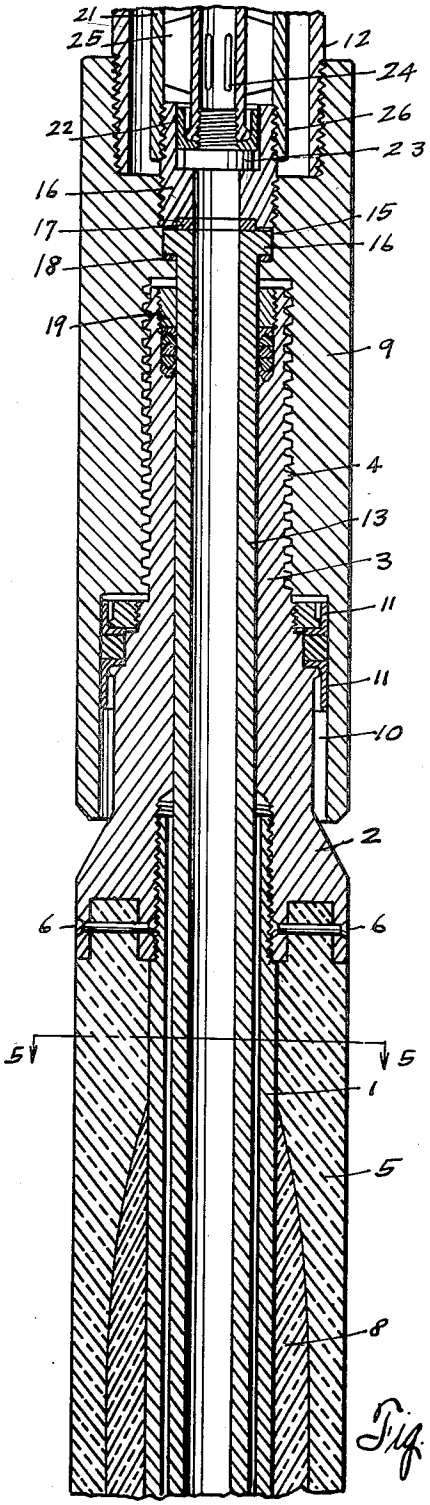


Fig. 3.

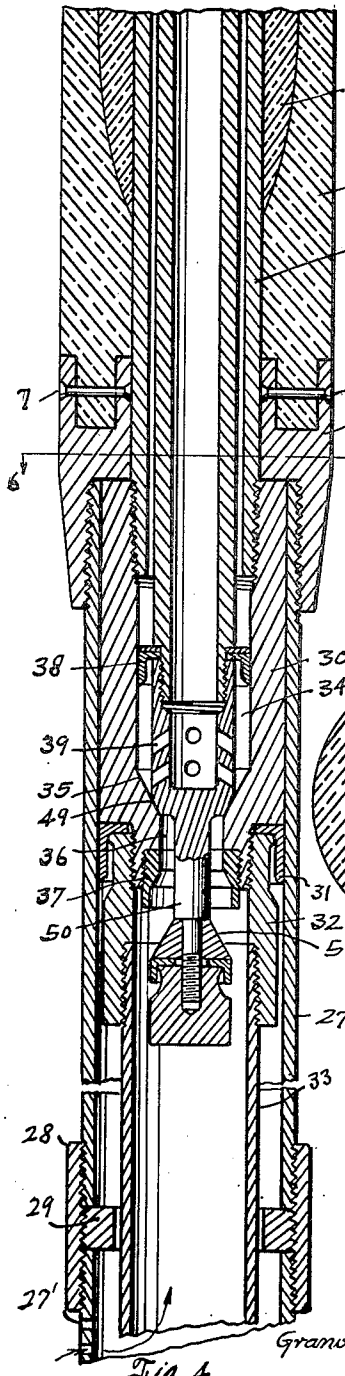


Fig. 4.

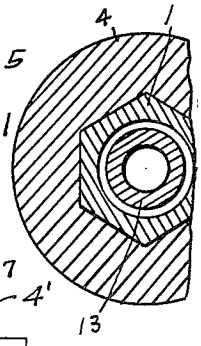


Fig. 6.

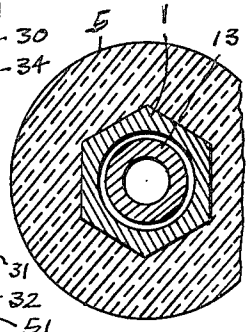


Fig. 5

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UNITED STATES PATENT OFFICE

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WELL TESTER

Application filed March 9, 1931. Serial No. 521,161.

This invention relates to a well tester.

One object of the invention is to provide a device of the character described specially designed for use for the purpose of testing the strata in a well bore for determining the presence or absence of gas, oil or other fluid in the well.

Another object of the invention is to provide a well tester which may be lowered into the well, through the drilling fluid therein, while in closed position to prevent the entrance of the drilling fluid into the tester and whereby the drilling fluid in the well may be sealed off from the strata to be tested and the lower end of the tester then opened to permit the inflow of fluid from the strata to be tested and then closed to trap the sample in the chamber of the tester.

A further feature of the invention resides in the provision of a tester of the character described having means at the lower end thereof for opening said sample chamber and then closing the same, after the packer has been set, by a one-way rotation of the tester stem.

A still further feature of the invention resides in the provision of a well tester having a packer thereon with means for expanding the packer to seal off the drilling fluid from the strata to be tested and with means for protecting the packer against tortional strain incident to the opening and closing of the tester to the end that said packer will not become disrupted and left in the bore upon the withdrawal of the tester therefrom.

It is another object of the invention to provide in a testing device of the character described, novelly arranged packing means to exclude gritty fluid from the movable parts of the device and means are also provided for securely trapping a sample taken in the sample chamber to prevent the escape thereof.

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

Figure 1 shows a vertical sectional view of the upper end of the tester set in a well bore.

Figure 2 shows a vertical sectional view of the lower end thereof in open position.

Figure 3 shows a vertical sectional view of the upper end of the tester showing the packer in collapsed position.

Figure 4 shows a vertical sectional view of the lower end thereof shown closed to trap the sample in the chamber.

Figure 5 shows a fragmentary cross sectional view taken on the line 5—5 of Figure 3, and

Figure 6 shows a fragmentary cross sectional view taken on the line 6—6 of Figure 4.

Referring now more particularly to the drawings wherein like numerals of reference designate similar parts in each of the figures, the numeral 1 designates a tubular packer support whose outer surface is preferably polygonal in shape and attached to the upper end thereof there is a tubular coupling 2 whose upper end 3 is reduced and provided with external coarse threads 4. Slidable, but non-rotatable, on the lower end of said support there is a coupling 4′ having a bearing which conforms to the shape of and which snugly receives the support 1. Around said support there is a sleeve like expansible packer 5 whose upper and lower ends, respectively, are dovetailed into the adjacent couplings 2, 4′ and pinned therein by suitable pins as 6, 7, or otherwise attached thereto. This packer 5 may be made of rubber or other suitable expansible material and said packer has a core, as 8, at its mid-portion around the support which is formed of more yieldable material than that of the outside of the packer, so that when end pressure is applied to the packer sleeve, as hereinafter explained, said sleeve will more readily expand outwardly or bulge so as to form a more perfect contact with the walls of the well bore as shown in Figures 1 and 2.

Screwed on to the reduced upper end of the coupling 2 there is a long collar 9 whose lower end is formed with a cylindrical recess 10 and on said reduced upper end of the coupling 2 there is secured packing means, preferably composed of reversely arranged

cup rings 11, 11 which fit closely within the cylindrical recess 10.

An operating string of pipe 12 is attached to the upper end of the collar 9.

There is a tube 13 having a sample chamber and whose upper end has an enlarged head 14 which works in the inwardly thickened upper end of the collar 9 and has a swivelling connection therewith and is retained therein by means of a tubular nipple 16 which is screwed into said collar. The head has the upper and lower packing rings 17, and 18, which form fluid tight joints therewith. The reduced upper end of the coupling 2 has a suitable stuffing box 19 around the tube 13.

The upper end of the nipple 16 is formed with a cylindrical valve seat 20 in which the tubular valve 21 works. This valve is provided with a suitable packing 22, as for example, an upwardly opening cup ring which is secured to the lower end of the valve by means of a screw plug 23 which closes the lower end of the valve, and retains said cup ring in place. The upper end of this valve is open and the valve has the side slots 24 and the lateral guide wings 25. This valve is confined to a vertical movement by means of a cage 26 which surrounds the same, and is attached to the upper end of the nipple 16.

Attached to the lower end of the coupling 4 there is a pipe 27 preferably formed of sections connected by a collar as 28 and the lower section thereof being preferably in the form of a perforated pipe or screen 27′. There is a ring 29 connected into the joint between the sections 27, 27′ which forms an inside annular abutment for the purpose hereinafter stated. Fitted in the pipe section 27 there is a plunger 30 whose lower end has a downwardly opening cup ring 31, or other suitable packing which is clamped in place by the tubular nipple 32 screwed on to the lower end of the plunger 30 and a guide tube 33 is attached to the nipple 32 and works through the ring 29.

The plunger 30 is hollow forming a cylinder 34 therein whose lower end converges forming a valve seat 35 with the fluid passageway 36 leading on down through the lower end of the plunger 30. Screwed into the lower end of the plunger 30 there is a detachable valve seat 37 which is flared downwardly.

The lower end of the tube 13 has a downwardly opening cup ring 38 or other suitable packing fixed thereon, which works in the chamber 34 and beneath said cup ring said sample chamber has the inlet openings 39. The lower end of the tube containing the sample chamber is formed into a tapering valve 49 conforming in shape to the contour of the seat 35 and said tube 13, beneath said seat has a depending stem 50 which works through the passageway 36 and attached to the lower end of said stem there is a tapering valve 51 shaped to conform to the contour of and to fit within the valve seat 37 to form a fluid tight joint therewith when seated.

When the testing device is assembled to be let down into the bore, the collar 9 is turned on the reduced coupling end 3 so as to adjust the sample tube 13 upwardly to close the valve 51 and the assembled apparatus is then lowered through the drilling fluid in the well until the lower end of the section 29 rests on bottom. While being thus lowered this valve 51 will exclude the drilling fluid from the sample chamber in the tube 13 and the packing 11, 31 will prevent said fluid from entering between the movable or working parts of the device. When the section 27′ lands on bottom the downward movement of the coupling 4′ will be stopped, but the operating stem will move on down together with the collar 9 and its appendants, including the coupling 2, the packer support 1 and the plunger 30 until the lower end of the nipple 32 rests on the ring 29. The packer 5 will thereby be expanded out against the walls of the bore to form a fluid tight joint and thus exclude the drilling fluid above from the strata to be tested beneath. The operating stem 12 may be now appropriately turned to screw the collar 9 downwardly on the coupling 2 and this will move the sample tube 13 downwardly and open the valve 51 to permit the inflow of fluid from the strata to be tested in through the screen and up through the passageway 36 and the ports 39 into the sample chamber of the tube 13 and if there is a sufficient inflow the fluid may pass on up through the tube 13 past the valve 21 up into the stem 12. A continued rotation of the stem 12 in the same direction will operate to seat the valve 49 against the seat 35 and the sample will thereby be trapped in the chamber of the tube 13 and such fluid as may have passed above the valve 21 into the stem 12 will be trapped in said stem by said valve 21.

It is to be observed that during the turning movement of the stem 12 the tortional strain is sustained by the packer support 1 and the packer 5 will not be twisted or distorted or liable to be torn loose from its anchorage.

When the sample is taken and trapped as above stated the testing device may then be withdrawn from the well for an inspection of the sample and while being withdrawn the upper end of the plunger 30 will engage the coupling 4′ so that the packer support 1 will sustain the main weight of the load and will carry the packer safely out of the bore so there will not be any liability of the packer becoming detached from the tool and is left in the bore.

The drawings and description now disclose what is now considered to be a pre-

ferred 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. A well tester including a tubular operating stem, a collar attached to the lower end thereof, a packing device having an expansible packing sleeve and upper and lower couplings connected thereto, the upper coupling having a threaded connection with said collar, a tubular packer support attached to the upper coupling and extending through said sleeve and lower coupling, a pipe connected to and extended beneath said lower coupling, a tubular plunger attached to the lower end of said support and working in said pipe beneath the lower coupling and having fluid passageway therethrough, a tube connected to said collar and extending down through said support and having a lower end opening, valves on the lower end of said tube adjustable into position to alternately close and open said passageway by a one way rotation of the stem.

2. A well tester including a tubular operating stem having a sample chamber therein, said chamber having an inlet passageway into the lower end thereof, a packing device including an expansible packer and relatively movable parts whereby said packer may be expanded and contracted, valve means for opening and closing said passageway, means operatively connecting said valve means with the stem whereby said valve means may be operated to open and close said passageway by a rotation of the stem, and means extending through the packer for relieving the packer from torsional strain during the rotation of the stem.

3. A well tester comprising a single, tubular, string of pipe adapted to be lowered into a well containing a drilling fluid, said string having an upper section forming an operating stem, formed of relatively rotatable parts, and a lower section, said sections being longitudinally movable relative to each other, a sleeve like packer on the string arranged to be expanded against the wall of the well, by the relative longitudinal movement of said sections, to seal off the drilling fluid from the strata beneath the packer, a valve mechanism in the string including seats, a tube connected to the upper section and having a sample chamber therein open at its lower end, said tube having valves thereon to cooperate with said seats, operative connections whereby the tube may be operated to actuate the valves to open and close the lower end of the sample chamber by the relative rotation of said parts in a one way direction.

4. A well tester comprising a single, tubular, string of pipe adapted to be lowered into a well containing a drilling fluid, said string having a sample chamber therein open at its lower end, said string having an upper section forming an operating stem, formed of relatively rotatable parts, and a lower section, said sections being longitudinally movable relative to each other, a sleeve like packer on the string arranged to be expanded against the wall of the well, by the relative longitudinal movement of said sections, to seal off the drilling fluid from the strata beneath the packer, said packer having upper and lower end couplings attached thereto, a valve mechanism in the string beneath the sample chamber, operative connections whereby the valve mechanism may be operated to open and close the lower end of the sample chamber by the relative rotation of said parts in a one way direction, and a rigid, tubular, packer support extending through the packer and connected rigidly to one coupling and upon which the other coupling is slidable and non-rotatable, said support being arranged to relieve the packer of torsional strain upon rotation of the stem.

In testimony whereof I have signed my name to this specification.

GRANVILLE A. HUMASON.

CERTIFICATE OF CORRECTION.

Patent No. 1,875,006. August 30, 1932.

GRANVILLE A. HUMASON.

It is hereby certified that the residence of the assignee in the above numbered patent was erroneously described and specified as "Brooklyn, New York", whereas said residence should have been described and specified as Houston, Texas, as shown by the records of assignments in this office; and that the said Letters Patent should be read with this correction therein that the same may conform to the record of the case in the Patent Office.

Signed and sealed this 29th day of November, A. D. 1932.

(Seal)

M. J. Moore,
Acting Commissioner of Patents.