April 25, 1933. J. L. BADGETT 1,905,208

SAND TESTER

Filed Aug. 18, 1930

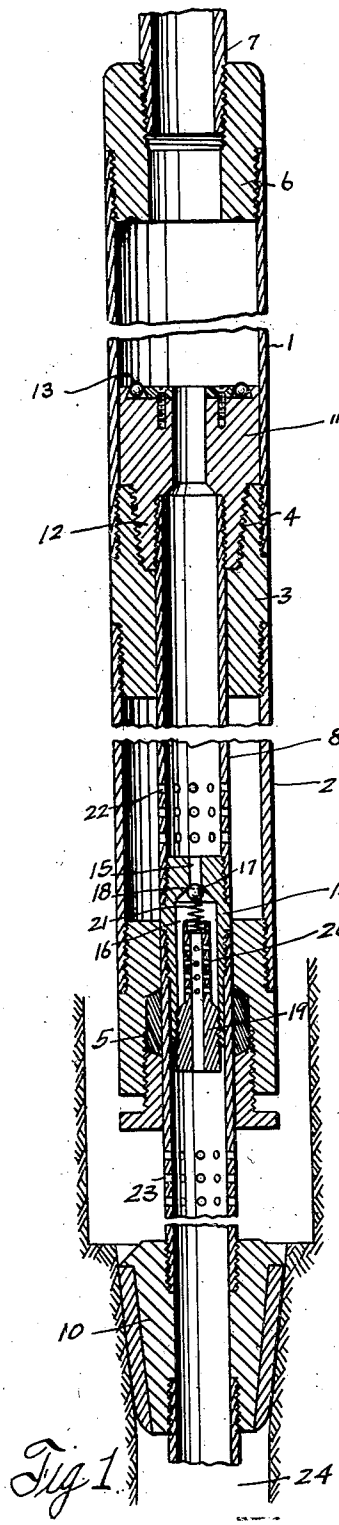


Fig. 1.

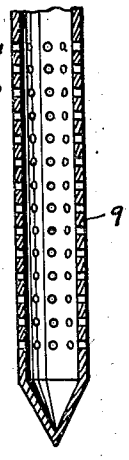


Fig. 2.

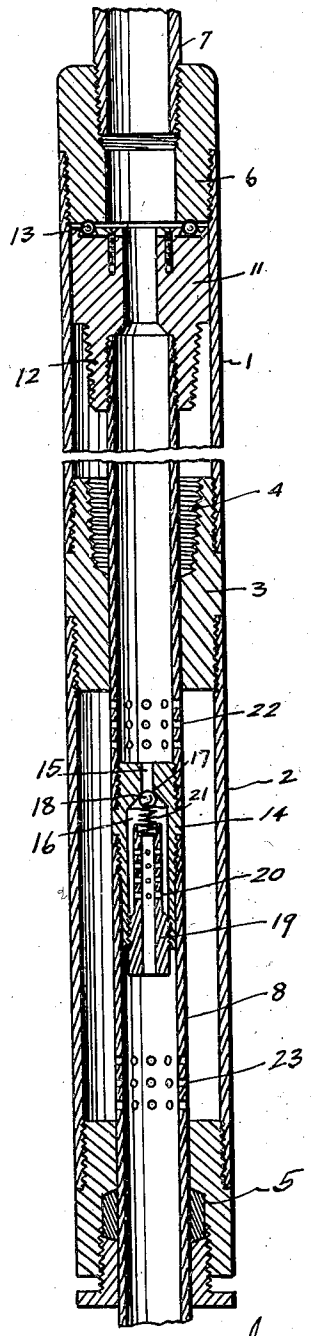


Fig. 3.

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UNITED STATES PATENT OFFICE

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SAND TESTER

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This invention relates to a sand tester.

One object of the invention is to provide a tool of the character described that may be readily attached to a tubular operating string such as a drill stem and lowered into a well, through the drilling fluid therein and whereby a strata thought to contain oil may be tested for the presence or absence of oil without the necessity of setting casing, thus dispensing with the setting of the casing if the oil be not found.

Another object of the invention is to provide a tool of the character described that may be lowered into the well while closed against the entrance of drilling fluid, and seated in the "rat hole" if there be a "rat hole" and the test made, and which is of such construction that if there be no "rat hole", the strata to be tested may be pierced and the test made.

A still further feature of the invention resides in the provisions of a testing tool of the character described whereby a sample of oil from an oil bearing strata may be obtained and trapped, and withdrawn to the ground surface in a substantially uncontaminated state.

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 drawing, wherein:

Figure 1 shows a fragmentary vertical sectional view of the tool in position to be lowered into the well bore preparatory to making a test.

Figure 2 shows a fragmentary vertical sectional view of the probe, forming the lower end of the tool, and

Figure 3 shows a fragmentary vertical sectional view of the tool in position to receive a sample.

Referring now more particularly to the drawing, wherein like numerals of reference designate similar parts in each of the figures, the numerals 1 and 2 designate upper and lower sections of the barrel which are connected by an inside coupling 3 to which said sections are threaded, said coupling 3 having an internally threaded box 4 at its upper end. The lower end of the barrel 1 is provided with the stuffing box 5 and connected to the upper end thereof there is a reducing nipple 6 into which the upper end of the operating stem, or string of pipe, 7 may be threaded.

There is a tubular test stem 8 which is fitted closely through the coupling 3 and through the stuffing box and whose lower end terminates in a perforated probe 9. This test stem carries a suitable packer 10 of any preferred structure, located beneath the barrel and which is provided to form a fluid tight joint with the wall of the well to restrain the drilling fluid above from entering the strata being tested.

Fitted closely within the upper section of the barrel and connected to the upper end of the stem 8 there is a coupling member 11 whose lower end is formed with an outwardly threaded pin 12, which is adapted to be screwed into the box 4.

The upper end of this coupling member 11 is provided with suitable antifriction bearings 13 for a purpose to be hereinafter explained.

Incorporated into the stem 8 there is an inside coupling 14 having a fluid passageway 15 therethrough whose lower end is enlarged as at 16, forming a valve seat 17 which is controlled by the downwardly opening valve 18. Threaded into the lower end of the coupling 14 there is a tubular nipple 19 whose upper end is reduced and provided with perforations 20 and which forms a support for the coil spring 21 which in turn supports the valve 18 and normally holds said valve closed.

The stem 8 is provided with two series of perforations 22, 23 one above and the other beneath the valve mechanism above described and as shown in Figures 1 and 3.

In operation the tool is assembled as shown in Figure 1 and let down into the well bore. The valve 18 will be closed while the tool is being lowered and will exclude the drilling fluid from the sample chamber above. It is common to reduce the lower end

of the bore forming a "rat hole" 24 into the oil bearing strata and in case such "rat hole" is formed, the packer 10 will land in the upper end of the "rat hole" and form a fluid tight joint therewith with the perforated probe 9 down in the "rat hole." In case no "rat hole" has been formed the probe 9 may be forced down into the strata to be tested and the packer 10 will serve the same purpose as that above indicated. With the probe 9 in the formation to be tested the stem 7 may be turned to the right, turning the barrel and coupling 3 with it and the coupling member 11 being held stationary, said coupling 3 will be screwed off of the pin 12 and the barrel may then be lowered until the nipple 6 rests on the bearings 13. In this position the perforations 22, 23 will be up within the lower section 2 of the barrel as shown in Figure 3 and the fluid from the strata, if there be any, may then flow into the probe and up through the stem 8 and around the valve mechanism out through the lower openings 23 and up through the barrel and back into the stem through the openings 22, and thence on up into the drill stem 7. While the test is being completed the drill stem 7 may be rotated on the bearings 13 to prevent the stem from becoming stuck in the bore and if desired the drilling fluid in the well maintained under pressure or may be circulated while the test is being made. Thereupon the stem 7 and the barrel attached thereto may be elevated until the stuffing box 5 is above the perforations 23 and if desired the coupling 3 may be screwed again onto the pin 12 and the tool then withdrawn from the bore. The spring 21 is strong enough to hold the valve 18 closed so that the sample taken will be trapped in the sample chamber above said valve 18 and the sample thus trapped may be withdrawn to the ground surface with the tool in a substantially uncontaminated state for inspection.

In case pressure is encountered in the well and a blow out is threatened, fluid may be pumped down through the stem 7 and through the tool, the valve 18 opening to permit this, and the drilling fluid in the bore thus placed under pressure to counteract the gas pressure and to prevent such blow out.

When a sample has been taken as hereinabove explained and the barrel pulled upwardly into its upper position, preparatory to withdrawing the tool, the drilling fluid in the well bore will enter through the openings 23 and pass on down through the probe 9 so as to equalize the pressure above and below the packer 10 to the end that said packer may be readily lifted off of its seat in the rat hole and the tool withdrawn.

The drawing 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. A tool of the character described comprising a barrel, a tubular operating stem to the lower end of which the barrel is attached, a test stem having upper and lower openings and having a releasable, threaded connection with and extending beneath the barrel and whose lower end is formed into a probe adapted to be inserted into strata to be tested in a well bore and whose upper end has a sample chamber, sealing means between the test stem and barrel, said test stem upon release of said connection being movable into one position, relative to the barrel, to carry said sealing means beneath the openings to block said openings and to thereby effect the closing of said chamber to said strata and into another position to carry the sealing means between the openings to open said openings and chamber to said strata to permit fluid to flow from said strata into said chamber.

2. A tool of the character described comprising a barrel, a tubular operating stem to the lower end of which said barrel is attached, a tubular test stem associated with and extending beneath said barrel and whose lower end is formed into a probe adapted to be inserted into strata to be tested in a well bore, said test stem having a sample chamber provided with an outlet passageway, a valve normally closing said passageway, sealing means between the test stem and barrel, there being openings in the test stem one above and the other beneath said sealing means, said test stem being movable into one position, relative to the barrel, to carry said openings above said sealing means to thereby effect the communication of said strata with said chamber to permit the flow of fluid from the strata into said chamber, and said test stem being movable into another position, relative to said barrel, to interpose the sealing means between said openings to thereby trap said fluid in said chamber.

3. A tool of the character described comprising a barrel, a tubular operating stem to the lower end of which the barrel is attached, a test stem associated with and extending beneath the barrel whose lower end is formed into a perforated probe, adapted to be inserted into a stratum in a well bore to be tested, said test stem having a sample chamber provided with an outlet, a back pressure valve normally closing said outlet, sealing means carried by the barrel through which the test stem works, a packer carried by the test stem for forming a seal with the walls of the bore to exclude fluid in the bore above from said stratum beneath, said stem being movable into either of two positions relative to the barrel and having a fluid passageway and openings one above and the other beneath

said sealing means whereby said passageway is open when the stem is in one of said positions to permit fluid to flow from the stratum upwardly through said stem into said chamber, said openings being movable above the sealing means to effect the closing of said passageway when the stem is in said other position to trap said fluid in said chamber.

4. A tool of the character described comprising a barrel, a tubular operating stem to the lower end of which the barrel is attached, a test stem associated with and extending beneath the barrel, said extended end being adapted to be inserted into a stratum to be tested in a well bore, means on the test stem for forming a fluid tight joint between said stem and the walls of the bore, a normally closed downwardly opening valve in said test stem, said test stem being movable into either of two positions relative to the barrel and having openings one above and another beneath said valve, said openings permitting the flow of fluid from said stratum into the test stem above said valve when said test stem is in one of said positions, packing between the test stem and barrel to prevent the back-flow of said fluid when said test stem is in said other position.

5. A tool of the character described comprising a barrel, a tubular operating stem to the lower end of which the barrel is attached, a test stem within and whose lower end is extended beneath said barrel, said extended end being adapted to be inserted into a stratum to be tested in a well bore, means for releasably attaching the upper end of said test stem rigidly to the barrel, a packer on the test stem beneath the barrel, a downwardly opening valve in the test stem normally preventing the upward flow of fluid through said test stem, said test stem being movable into either of two positions relative to the barrel and having openings so located relative to the valve as to permit fluid to flow from said stratum upwardly through the tool past said valve, said test stem and barrel being formed to prevent the back-flow of said fluid when the test stem is in the other of said positions.

6. A sand tester comprising a single string of pipe, a barrel at the lower end thereof, a test stem associated with and extending beneath the barrel and whose lower end has an inlet opening, said tool being provided with a sample chamber having an outlet through which a circulating fluid may be delivered from said string through said stem into the bore, means normally closing said outlet, sealing means between the barrel and stem, a packer carried by the test stem for forming a seal with the walls of the bore to exclude fluid in the bore above from a stratum beneath, said stem having a fluid passageway and openings and being movable, relative to the barrel, into upper and lower positions whereby when said stem is in the upper position the openings will be above the sealing means and fluid in the stratum will be permitted to flow upwardly through said stem into said chamber and whereby when said stem is in its lower position one opening will be above the sealing means and one opening below the sealing means and the passageway will be closed to trap the fluid in said chamber.

7. A sand tester comprising a single string of pipe, a barrel at the lower end thereof, a test stem associated with and extending beneath the barrel and whose lower end has an inlet opening, said tool being provided with a sample chamber having an outlet through which a circulating fluid may be delivered from said string through said stem into the bore, means normally closing said outlet, sealing means between the barrel and stem, a packer carried by the test stem for forming a seal with the walls of the bore to exclude fluid in the bore above from a stratum beneath, said stem having a fluid passageway and openings and being movable, relative to the barrel, into upper and lower positions whereby when said stem is in the upper position the openings will be above the sealing means and fluid in the stratum will be permitted to flow upwardly through said stem into said chamber and whereby when said stem is in its lower position one opening will be above the sealing means and one opening below the sealing means and the passageway will be closed to trap the fluid in said chamber.

8. A sand tester comprising a single string of pipe, a barrel at the lower end thereof, a test stem associated with and extending beneath the barrel and whose lower end has an inlet opening, said tool being provided with a simple chamber having an outlet through which a circulating fluid may be delivered from said string through said stem into the bore, means normally closing said outlet, sealing means between the barrel and stem, a packer carried by the test stem for forming a seal with the walls of the bore to exclude fluid in the bore above from a stratum beneath, said stem having a fluid passageway and openings and being movable, relative to the barrel, into upper and lower positions whereby when said stem is in the upper position the openings will be above the sealing means and fluid in the stratum will be permitted to flow upwardly through said stem into said chamber and whereby when said stem is in its lower position one opening will be above the sealing means and one opening below the sealing means and the passageway will be closed to trap the fluid in said chamber.

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

JAMES L. BADGETT.