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C. NEWBURN

SAND TESTING TOOL

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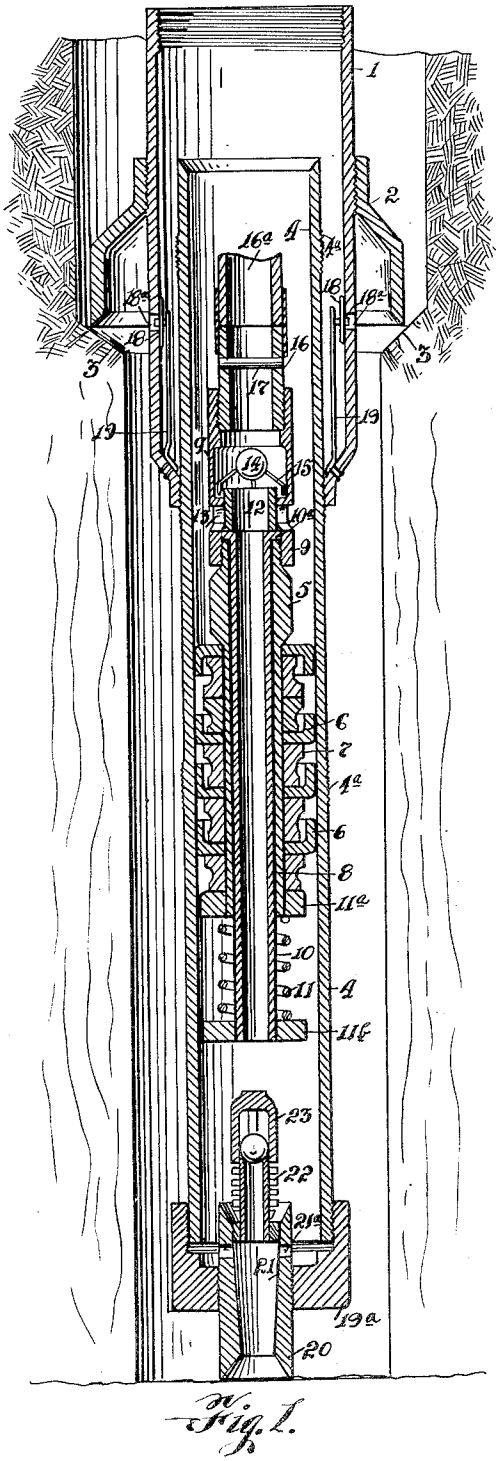


Fig. 1.

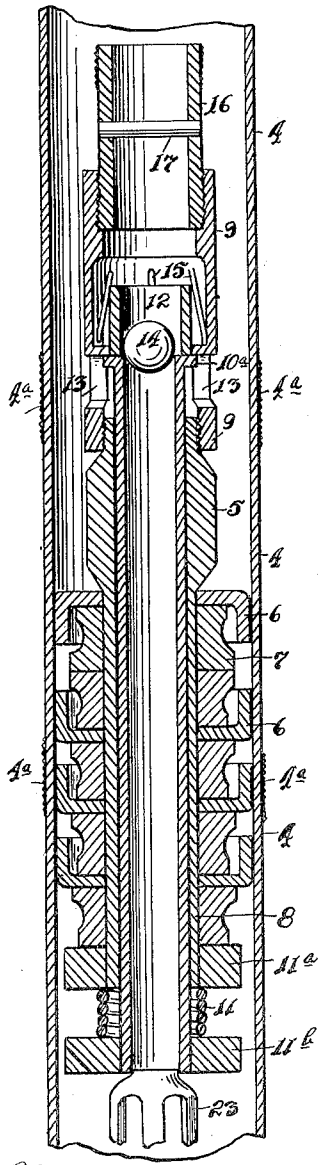


Fig. 2.

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SAND-TESTING TOOL.

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This invention relates to rotary well tools and equipment and it has particular reference to a new and useful tool and process for the purpose of obtaining tests of sands and mineral strata chiefly in oil field operations, and its objects are primarily, to provide equipment for readily and effectively making a preliminary test of oil sand or other mineral producing strata, in order to determine the advisability of installing a casing therein.

The invention further comprehends such a tool, arranged so as to permit the drill pipe to function as a substitute for the casing and tubing, thus to obviate materially the expense incident to the provision of such equipment, in addition to the elimination of rods and other pumping equipment, until the nature and value of the sand may be determined.

Heretofore, when "pay" sand, including oil or gas sand, was encountered during the process of drilling, the operator was required to pull the drill pipe and form a seat or shoulder in the hole in order to support a casing assembly, which is in turn run into the hole. The drill pipe is then again run into the hole for the purpose of washing the sand, which has been left exposed at the bottom of the hole. The drill pipe is then withdrawn to bail out the hole, and as a further test, a tubing assembly, usually consisting of a two inch pipe provided with a working barrel on the bottom, is run into the hole, in addition the sucker rods and traveling valve assembly. After the pumping equipment is assembled and installed, the pumping or testing operation begins. The present invention proposes, with a view of economy in time and expense, to reduce substantially the number of operations required in testing a sand or other productive mineral strata.

With the foregoing and other objects and advantages in view, the invention has particular reference to certain novel features of construction and assembly of parts, which will be enumerated in the course of the following detail description, and fully illustrated in the accompanying drawings, wherein:

Figure 1 represents a sectional view of the invention in vertical elevation as the same appears in the well to allow circulation of water through the tool to wash the well prior to the pumping operation.

Figure 2 is a fragmentary sectional view, also in vertical elevation, showing the port opening and valve closing arrangement subsequent to the washing operation, to permit pumping.

In proceeding further in detail, 1 denotes a drill pipe, upon which is threaded a shoe 2, arranged to rest upon a shoulder 3 formed in the wall of the hole. At a spaced distance below the shoe 2, the drill pipe is diminished and threaded interiorly to receive a short working barrel 4, in which a traveling valve 5 reciprocates. The traveling valve is equipped with the usual compression cups 6 and circumferential retaining rings 7, disposed about the tubular member 8, threaded into the cage 9.

Within the tubular member 8 is disposed a tubular plunger 10, arranged to reciprocate freely therein, as mentioned previously, and is of slightly greater length than the former, and further, is limited in its movement by a flange 10^a, resting on the top of the said member 8. An expansion spring 11 is mounted upon the plunger 10 between a collar 11^b thereon and a like collar 11^a mounted upon the end of the tubular member 8, whereby to normally retain the said plunger in the position illustrated in Figure 1. A sleeve 12 is further provided, which is disposed so as to rest upon the flange 10^a of the plunger 10, in a position to normally close the ports 13 in the valve cage 9, the purpose of which will be later made clear.

It will be further observed, by reference to the drawings, that a ball 14 is provided in the cage 9 and is supported upon the radially disposed flexible fingers 15, secured to the walls of the said cage 9, as illustrated, directly above said sleeve 12. The joint 16, threaded into the top of the cage 9 is adapted to receive the rod assembly 16^a, which is, in this instance, small tubing whereby to permit the fluid to be pumped therethrough if desired. A movement limiting means for the ball 14 is provided also in the joint 16, which consists of a pin 17 disposed diametrically through the member, as shown.

Radially disposed interiorly of the diminished portion of the drill pipe 1 is a plurality of back pressure valves, composed of gaskets 18, disposed over aperture 18^a and held in position thereon by a leaf spring 19, which latter is secured at a spaced point from the apertures to the walls of the said drill pipe.

Returning to the working barrel 4, a ter-

minal plug 19ª is affixed to the bottom thereof and is centrally apertured and threaded to receive the standing valve seat 20, provided with a central fluid passage 21 and ports 21ª. The standing valve 22 is mounted in this seat 20, interiorly of the working barrel 4, and is composed of the usual cage 23, having the usual ball valve therein.

It is frequently the case during the process of drilling that sand is encountered having evidences of commercially valuable mineral and a test is required to be made of the strata in order to predetermine the value thereof or whether the installation of casing, tubing or other pumping equipment is warranted. After a predetermined depth into the prospective sand is attained, the testing tool, consisting of the drill pipe 1, shoe 2 and the joint of drill pipe upon which the latter is affixed, is substituted for the drill bit, which has formerly been withdrawn, and is lowered into the hole in such a manner as to permit the shoe 2 to rest upon the shoulder 3 formed within the hole.

It will be observed in the drawings that the working barrel 4 is of limited length and is further provided with spaced circumferential threads 4ª, which permit its depth to be predetermined in accordance with the depth of the sand to be tested. When in place, the back pressure valves 18ª, as previously described, permit circulation of water through the sand to wash the hole clean of mud and other extraneous substance before making arrangements for pumping.

After the foregoing is accomplished, a string of small tubing 16ª is assembled, upon which the traveling valve is applied, is lowered into the well into the position illustrated in Figure 1, which shows the ball 14 seated upon fingers 15 within the cage 9, whereby to permit free circulation of water therethrough. The water is injected through the valve tubing, past the unseated valve downward through the ports 21ª in the standing valve seat 20 and upward through the back pressure valves 18ª, after thoroughly washing the sand.

The Figure 2 illustrates the position of the sleeve 12 in releasing the ball 14, immediately before the plunger 10 is reverted to normal position by the spring 11, and when in this position, the sleeve is engaged on its sides by the fingers 15, the friction thereof holding the sleeve against downward movement.

The advantage derived through retaining the sleeve 12 in the position shown and described relative to the member 9, is to permit effusion of fluid, entering the plunger 10 from below, through the ports 13, to be conveyed upwardly through the drill pipe 1, by raising the ball 14. Moreover, such fluid as passes the ball 14 into the tubing 16ª may be elevated therein quite as effectively as in the manner previously described, making an equivalent of two strings of tubing. On the other hand, should the ports 13 be closed by the sleeve 12 in the manner shown in Figure 1, the tubing would function in the capacity of a string of pump rods, as well as the tubing through which the fluid is elevated; the fluid passing upwardly through the plunger 10, past the seated ball 14 and into the tubing 16ª. This arrangement, while furnishing only a single discharge tubing, may be desirable by some operators and may be accomplished by forcing the fingers 15 outwardly so that the pressure thereof against the sleeve 12, when raised, would not be sufficiently strong to hold the same.

Subsequent to the washing process, the traveling valve is set down upon the standing valve 23, as in Figure 2, causing the said valve 23 to be pressed still further down into the seat 20, sufficiently to close the ports 21ª therein, simultaneously causing upward movement of the plunger 10, due to the expansion spring 11, which action, with flange 10ª on said plunger, elevates the sleeve or collar 12, to expand the fingers 15, in which position the said sleeve 12 remains, thus to release the ball 14, permitting the same to drop through the sleeve and seat upon the flange 10ª. The expansion spring 11 forces the plunger 10 back to normal position as illustrated in Figure 1. It will be understood that upon raising the sleeve 12 by the above described action, the ports 13 in the cage 9 are opened, whereby to effect pumping of fluid through the drill pipe 1, however, by closing these ports, the fluid may be quite as effectively elevated through the small valve pipe 16ª.

It should be understood that all the elements of the invention have been incorporated in the foregoing as set forth in the appended claims however, should it be desired, certain minor changes and modifications may be resorted to as fall within the meaning and scope of the said claims, without departing from the spirit and intent of the invention.

I claim:—

1. An oil sand testing tool including in combination with a drill pipe having back pressure valves integral therewith, a shoe mounted on said drill pipe at a spaced point from its bottom end; a working barrel threaded into said drill pipe; a standing valve therein, provided with an apertured seat; a traveling valve reciprocable within said working barrel comprising a tubular member threaded into a cage, the latter having a ball suspended therein; a sleeve disposed beneath said ball arranged to normally cover ports in said cage; a spring controlled plunger movably mounted in said tubular member disposed to impinge said sleeve; means to permit circulation of water down-

wardly past said suspended ball, through said standing valve seat and upwardly through said back pressure valves, and means to impart downward movement to said traveling valve to actuate said plunger to simultaneously seat the ball and close the ports in said standing valve seat to prepare said tool for pumping.

2. An oil stand testing tool including in combination with the drill pipe having back pressure valves therein; a working barrel arranged to be threaded at spaced predetermined points intermediate its ends into the bottom end of said drill pipe, a standing valve and seat mounted in said working barrel having ports integral therewith; a traveling valve in said working barrel having a ball therein; means to hold said ball in unseated position within the cage; a sleeve mounted below said ball arranged to normally cover ports in said traveling valve cage; a plunger normally impinging the bottom of said sleeve, and means to actuate the traveling valve against said standing valve to seat the ball, thereby to simultaneously close the ports in said standing valve seat to prepare said tool for pumping.

3. A sand testing tool including in combination with a drill pipe, a working barrel in said drill pipe having a standing valve seat mounted in its bottom end provided with ports and supporting a standing valve; a traveling valve operable within said working barrel provided with a ball supported by radially disposed flexible fingers whereby to permit free circulation of water throughout said working barrel; a sleeve movable within said traveling valve below said ball; a spring controlled plunger arranged to normally impinge said sleeve, and means to actuate said traveling valve against said standing valve to move said plunger and sleeve upwardly to thereby expand said flexible fingers whereby to release and seat the said ball, and simultaneously close the ports in said standing valve seat.

4. A sand testing tool comprising in combination with the drill pipe, a working barrel mounted in the bottom of said drill pipe, a standing valve therein having ports therebeneath; a traveling valve in said working barrel, the latter comprising a tubular member threaded into a cage having ports therein; a sleeve arranged to normally cover said ports; a ball disposed upon spaced radially disposed flexible fingers above said sleeve; means to cause said plunger to move upwardly to permit said sleeve to expand said fingers to allow said ball to seat upon the end of said plunger, and means to simultaneously close said fluid passages adjacent said standing valve to prepare said tool for pumping.

5. A sand testing tool including a tubular working barrel arranged to be depended within a well and having a standing valve disposed in its bottom, a traveling valve operable within said working barrel provided with a cage, a ball suspended therein upon radially disposed fingers; a sleeve below said ball; concentrically arranged tubular members below said sleeve, the outer of which is threaded into said cage, the inner being spring controlled and normally impinging said sleeve; means to permit unrestricted passage of water downwardly through said working barrel to wash said well, and means to cause upward movement of said plunger to seat the ball whereby to effect pumping position of said traveling valve.

6. A sand testing device including a working barrel arranged to be depended within a well and carrying a standing valve having fluid passages therein; a valve reciprocable within said working barrel comprising independent concentrically arranged tubular members; a cage receivable by the outer of said tubular members; a ball suspended in unseated position therein; a sleeve mounted below said ball and impinged by the inner of said tubular members; means to permit passage of water entirely through said working barrel and valve to wash the bottom of the well and means to actuate said inner tubular member to effect upward movement of said sleeve to seat the ball and simultaneously close the fluid passages in said standing valve.

7. An apparatus of the character described including a stationary working barrel having a standing valve therein; a traveling valve reciprocal within said working barrel above said standing valve; a movable collar in said traveling valve arranged to normally cover ports therein; a ball suspended in normally unseated position above said collar; a yieldable plunger impinging the underside of said collar; means to permit the passage of fluid entirely through said traveling and standing valves, and means to actuate said traveling valve against said standing valve to simultaneously close said valves against the passage of fluid.

8. An apparatus of the character described including with the drill pipe having ports therein, a short barrel threadedly suspended thereby; a standing valve supported in the bottom of said barrel having exterior ports therein; a traveling valve movable above said standing valve and carrying a normally unseated ball valve; means to discharge a volume of water through said valves to be elevated through the ports of said drill pipe, and means to seat the valve of said traveling valve by moving the latter against said standing valve, to prepare the apparatus for pumping.

9. An apparatus for washing and testing sands including with a drill pipe, a stationary suspended working barrel, a standing

valve therein; a traveling valve above said standing valve having a ball valve therein; means to hold said latter valve in open position preparatory to closing each of said valves; means to permit circulation of fluid downward through each of said valves and upward through said drill pipe, and means to simultaneously close each of said valves by actuating said traveling valve against said standing valve, to prepare said apparatus for pumping.

In testimony whereof I affix my signature.

CLARENCE NEWBURN.