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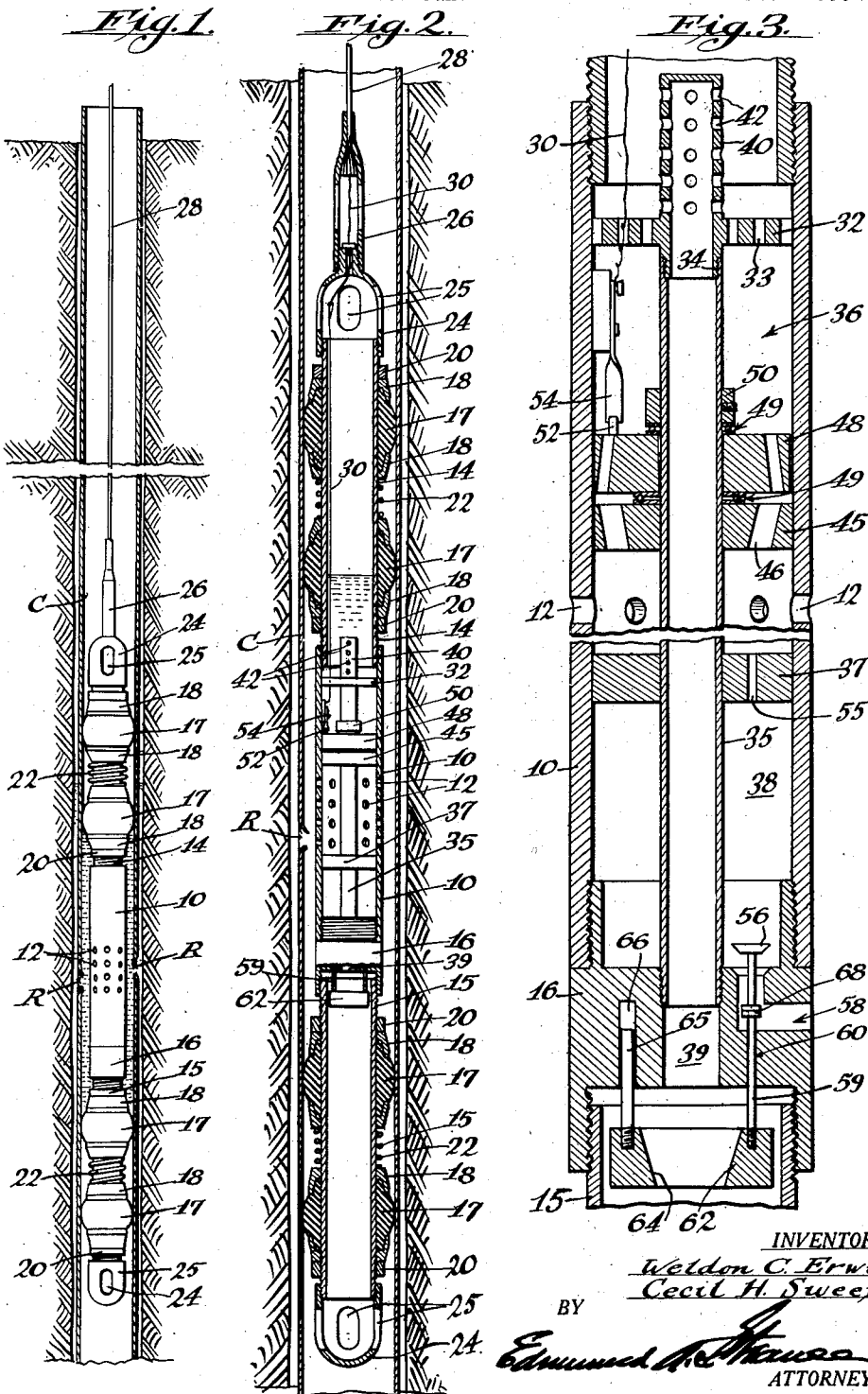
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OIL WELL TESTER AND SAMPLER FOR DETERMINING POINT OF FLUID ENTRY

Filed Jan. 10, 1927

2 Sheets-Sheet 1



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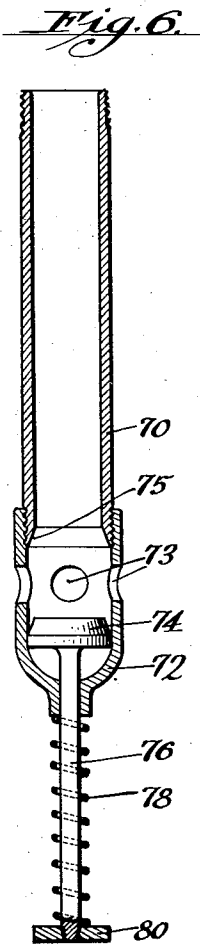
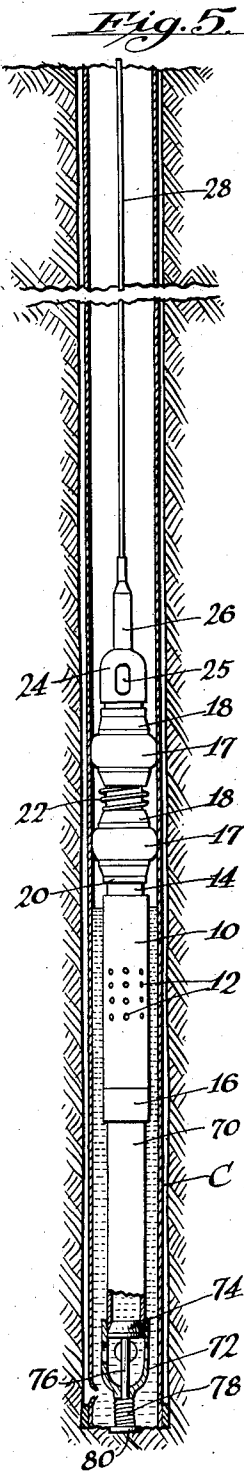
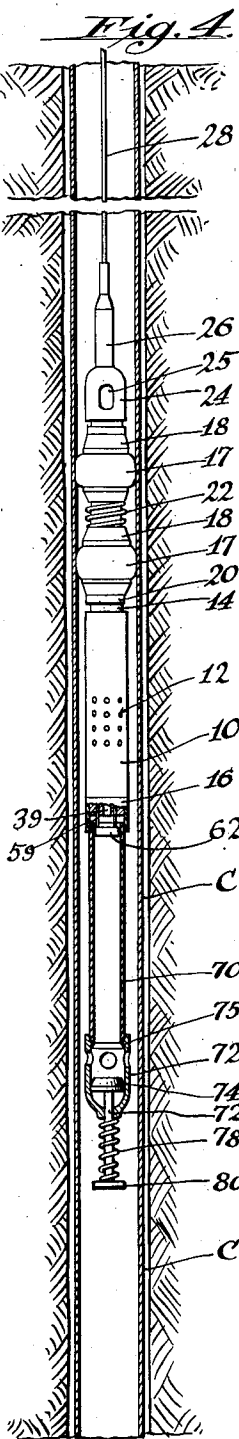
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2 Sheets-Sheet 2



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UNITED STATES PATENT OFFICE.

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OIL-WELL TESTER AND SAMPLER FOR DETERMINING POINT OF FLUID ENTRY.

Application filed January 10, 1927. Serial No. 160,091.

This invention relates to tools for determining the points of entry of fluids into deep wells and for taking samples of such fluids if desired. It has been particularly designed for use in oil wells and its primary object is to locate ruptures in well casings which ruptures may have been caused by wear, accident or otherwise. Another object is to take advantage of the movements of fluid entering a casing by causing the entering fluid to actuate a signal, preferably of the electrical type, and to insure the procuring of an accurate sample.

Briefly stated, the invention comprises a tool adapted to be lowered into a well by means of a cable, and provided with packing off means for shutting out fluids other than those which may be entering the well at the point being tested. The tool includes a body containing a turbine or other movable device adapted to actuate a make-and-break device or other signal and to be actuated by a stream of fluid passing through a break in the casing and caused to enter said body through perforations provided therein. Said fluid stream is directed past the turbine to a point of discharge beyond the packing off means. The body also includes a "thief" or sample chamber into which portion of the entering fluid is adapted to pass, and this chamber is controlled by means of a valve which is adapted to close under movement of fluid downward through the tool as it is being elevated for removal from the well. This fluid movement is permitted by reason of a tube which passes through said body and serves to by-pass the normal fluid content of the well, so that the device may be either raised or lowered. The invention resides further in the various other novel features of construction and arrangement and combinations thereof herein set forth.

In the accompanying drawings wherein certain embodiments of the invention are disclosed by way of illustration,

Fig. 1 is an elevation showing one form of the device in operative position within a well casing having a break.

Fig. 2 is an enlarged vertical section thereof.

Fig. 3 is a further enlarged vertical section showing the testing and sampling mechanism contained in the cylindrical body member.

Fig. 4 is a view chiefly in elevation show-

ing suspended in a well a form whose lower end is modified to adapt it to testing for fluids entering the bottom of the well, said lower end being shown in section.

Fig. 5 is a similar viewing showing said form at rest in the bottom of the well; and

Fig. 6 is an enlarged sectional detail of said lower end.

The form illustrated in Figs. 1 and 2 is shown as being suspended in a well casing —C— opposite a break or rupture —R— therein through which fluid is entering the well. This form comprises a cylindrical body member 10 having a plurality of openings or perforations 12 through which the fluid is adapted to enter said body 10, and to the upper and lower ends thereof are attached respectively the packing-off sections 14 and 15, section 15 being connected through the medium of a coupling block 16. Sections 14 and 15 carry spaced packing rubbers 17 whose ends are engaged by metal retainers 18, and the end retainers of each section 14 and 15 are in turn engaged by positioning rings 20 while the opposing retainers are engaged by expansion springs 22 which insure compression of the rubbers and proper engagement thereof with the inner walls of the casing —C— and thereby insure proper shutting off of the water, oil or other fluid above and below the device. The outer ends of the packing off sections are provided with cages 24 having large openings 25 for the admission or discharge of fluid as the tool is raised or lowered in the well, and the upper cage has a connection or socket 26 which receives the lower end of a supporting cable 28 carrying a conductor 30 for electricity. Said conductor 30 leads down through the section 14 into the cylindrical body 10 where it connects with a make-and-break device presently to be described.

In the upper end of cylinder 10 there is positioned a partition 32 perforated at 33 to form a strainer, the under side thereof having an integral annular connection 34 receiving the upper end of a by-passing tube 35 which is centrally disposed within the chamber 36 in said cylinder 10 and passes down through a partition 37 and a "thief" chamber 38 to the coupling block 16 into which its lower end is threaded in alinement with a bore 39 therein, which bore connects with the interior of packing off section 15. The upper side of the strainer plate 32 is

provided with a strainer cap 40 perforated as indicated at 42 for the passage of fluid to and from the tube 35.

Within the chamber 36 above the openings 12, there is located a spider or supporting plate 45 having fluid passages 46, and a turbine 48 is mounted for rotation about the tube 35 upon anti-friction bearings 49 between the turbine and the spider 45 on one side and between the turbine and a collar 50 fixed to the tube on the other side. The turbine carries a stud 52 or the like adapted upon rotation of the turbine to engage and actuate a make-and-break device 54 in circuit with the electric conductor 30.

Thus, when the tool is lowered into the well casing —C—, fluid will pass up through the section 15, the tube 35 and the section 14 to the upper end of the device by way of the cage openings 25, thereby allowing the tool to be lowered without material interference from the liquid in the well. At the same time the packing rubbers 17 will seal off from the inlet openings 12 in body 10 all fluid found above and below the tool. However, when the openings 12 come within range of fluid entering the casing —C— through a break or rupture —R—, the stream of such fluid is confined by the packers 17 and forced to travel through said openings 12 into the body 10 and upward past spider 45, whence it travels through turbine 48 and out through the strainer 32 to mingle with the fluid passing through tube 35. This movement causes rotation of the turbine 48 with consequent actuation of make-and-break 54 by the stud 52, thereby producing corresponding fluctuations of electric current in the conductor 30 and causing operation of any desired type of signaling means to which the conductor leads at the top of the well. Thus when the signal begins to function, the operator can note the length of cable paid out and thereby determine the location of the rupture. If the break is of considerable length, the signal will continue to operate as long as the device passes alongside thereof and fluid continues to enter the casing and pass through the turbine.

In order that the tool may be employed as a "thief" for taking samples of entering fluid, the partition 37 at the top of thief chamber 38 is provided with an outlet passage 55, while the coupling block 16 at the lower side of said chamber is provided with a valve 56 and an inlet passage 58 controlled thereby. Thus liquid entering the casing between packers 17 will be forced through said passage 58 and into the chamber 38. The valve stem 59 passes down through a guide channel 60 in block 16 and has its lower end anchored in a float 62 provided with a Venturi opening 64 aligned with bore 39, and the position of the float is maintained by means of a guide pin 65 secured

in the float and working in a guide channel 66 in the block 16.

Thus, when a sample of entering fluid is desired, the tool is allowed to remain opposite a rupture for a sufficient length of time for the fluid to enter through passage 58 and completely fill the thief chamber 38, the air in said chamber or any other fluid not desired being gradually vented through outlet 55 into chamber 36, the float keeping said valve open. As soon as the tool begins to rise when being withdrawn from the well, the rush of fluid downward through the tube 35 from the upper section 14 to the lower section 15, will, by reason of discharge into the venturi 64 of float 62, cause the float to be depressed, thereby seating the valve. When the device is received at the surface, the sample may be obtained by inserting a small tool into passage 58 and under a nut 68 on the valve stem and prying up on said nut to cause the valve to open.

Where it is desired to test for fluid which may be entering at the bottom of a well, the lower packing off section 15 is replaced by a section 70 which has no packing-off elements. This section 70 carries on its lower end a cage 72 having fluid openings 73 and a valve 74 adapted to engage a valve seat 75, the valve stem 76 projecting through the cage and being actuated by a spring 78 bearing against a foot 80 on the lower end of said stem. When the tool is lowered into the bottom of a well as indicated in Fig. 5, the weight of the parts causes compression of the spring 78 and seating of the valve upon its seat 75, thus cutting off flow through openings 73 and forcing the fluid through openings 12 into the chamber 36 to cause operation of the turbine 48.

What we claim is:

1. A well tester comprising a body member adapted to be lowered into a well casing and having packing-off means connected therewith, said member enclosing a chamber, said chamber having a fluid inlet thereto within the confines of said packing-off means and an outlet leading beyond said means, and a moving device within said chamber adapted to actuate a signal and operable by a current of fluid flowing through said chamber.

2. A well tester comprising a body adapted to be lowered into a well and enclosing a fluid-receiving chamber, packing-off means carried by said body, said chamber having a fluid inlet within the confines of the packing-off means and an outlet beyond said means, a turbine within said chamber adapted to be actuated by a fluid current through said chamber, signaling means adapted to be actuated by said turbine, and by-passing means for conducting fluid from one side of the device to the other without passage thereof through the chamber.

3. A well tester adapted to be lowered into a well casing for detecting fluid leaks through the casing, comprising a body member adapted to be lowered into the casing, packing-off means carried by said member and adapted to be shut-off and confine fluid leaking into the casing, said chamber having a fluid inlet within the confines of said packing-off means and an outlet for discharging fluid beyond said means, a tube extending through said chamber and adapted to conduct another fluid from one side of said body member to the other as the device is raised and lowered, a rotary member mounted to rotate about said tube under influence of a fluid current moving from said inlet to said outlet, and signaling means actuable by said rotary member.

4. A well tester adapted to be lowered into a well casing comprising a body member enclosing a sample chamber and carrying packing-off means adapted to confine fluid leaking through the casing, said chamber having an inlet at its lower end for leaking fluid and a vent at its upper end, a valve for said inlet, a float connected with said valve for opening the valve, and a tube extending through said chamber and adapted to conduct another fluid stream from one end of the device to the other, said float having a Venturi opening in the path of discharge of said tube when fluid is passing downward through the tube whereby the effect of said discharge upon the float causes the valve to close.

5. A well tester comprising a hollow body member enclosing a fluid-sample receiving chamber and carrying packing-off means adapted to confine a stream leaking into the well, said chamber having a fluid inlet within the confines of said packing-off means and an outlet for discharge therebeyond, means for by-passing another stream of fluid from one side of the device to the other, a normally open valve for admitting the sample in said chamber, and means actuable by the stream of by-passing fluid for closing said valve when

the tester is being elevated from the well.

6. A well tester adapted to be lowered into a casing, comprising a body enclosing a pair of chambers, one of said chambers comprising a sample chamber, a movable member in the other chamber, signaling means actuated by said movable member, a by-passing tube passing through one of said chambers for conducting fluid from one end of the device to the other, packing-off means carried by the device and adapted to confine a fluid stream leaking into the well, each chamber having a fluid inlet within the confines of said packing-off means, and an outlet for discharge beyond said packing-off means whereby the stream of leaking fluid is directed through said chambers and said movable member is actuated thereby, a valve for said sample chamber for retaining a sample, and means actuable by the stream of by-passed fluid for operating said valve in one direction.

7. A well tester adapted to be lowered into a well casing, comprising a body enclosing a sample chamber and a second chamber thereabove, a tube extending through said chambers for by-passing a stream of fluid from one end of the device to the other, packing-off means on the device for confining a stream of fluid leaking into the well, each chamber having an inlet for leaking fluid within the confines of said packing-off means and an outlet for discharge beyond said means, a movable member in the second chamber adapted to be actuated by the fluid passing therethrough, a signaling means actuated by said member, a valve for the sample chamber adapted to retain a sample, and means controlling said valve, said controlling means being in the path of the by-passed fluid stream and actuable thereby when the fluid moves in one direction.

In witness that we claim the foregoing we have hereunto subscribed our names this 27th day of October, 1926.

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CECIL H. SWEET.