

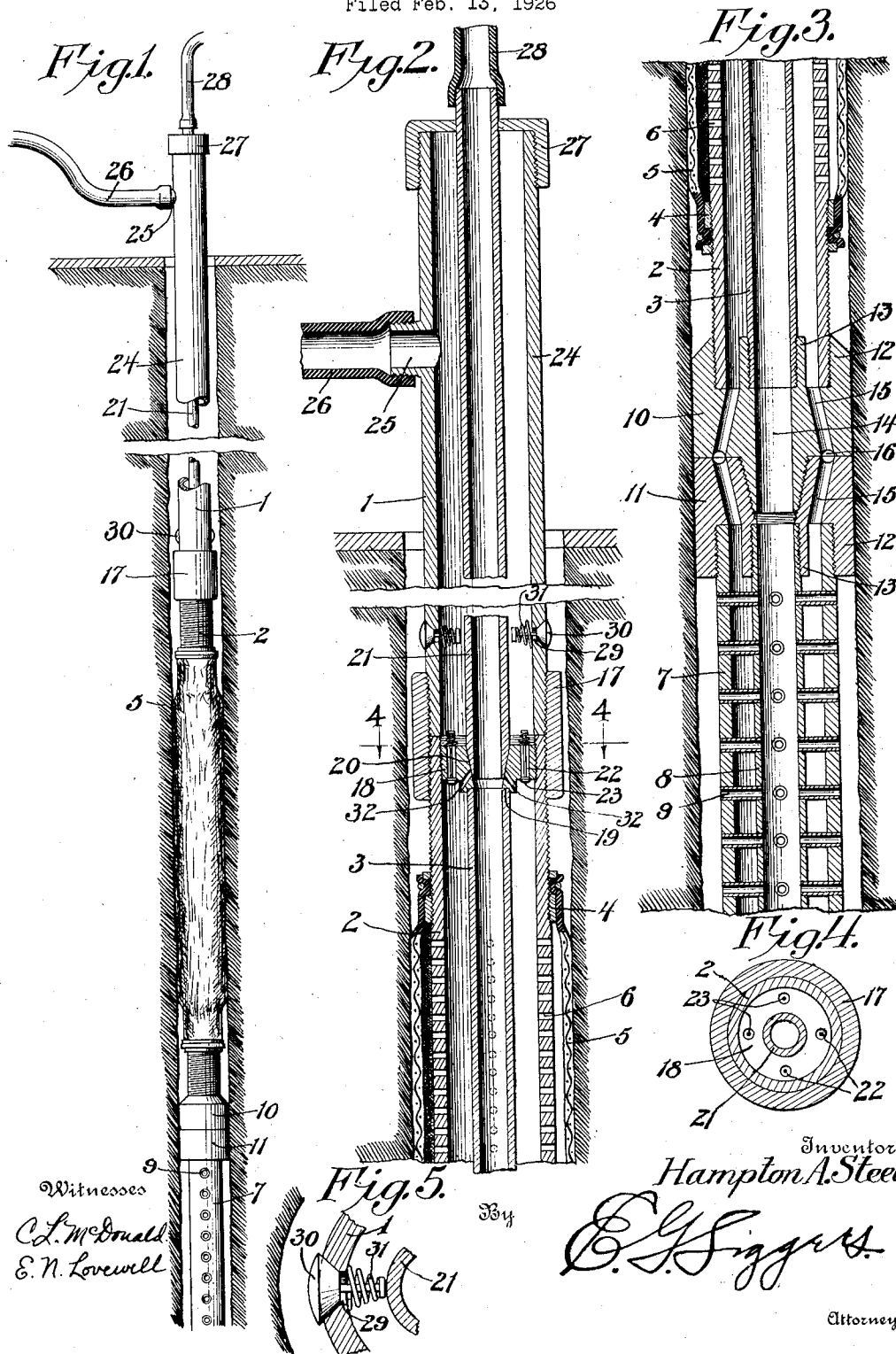
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MEANS FOR TESTING OR OPERATING OIL WELLS

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MEANS FOR TESTING OR OPERATING OIL WELLS.

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This invention relates to means for testing or operating oil wells before they are cased in, and particularly to means adapted to be used in connection with one or more packers according to a method similar to that disclosed in U. S. Patent No. 1,547,240 issued to me July 28, 1925.

In carrying out the method as described in the above-mentioned patent, a duplex pipe line of special construction is used in the drilling operation, and when drilling is completed, or at any time during the drilling operation, when it is deemed advisable to test for gas or oil, the pipe line is withdrawn from the hole, and the cutting tool, as well as the grief joint used in operating the same, are removed. A specially constructed pipe section and one or more packers are then attached to the lower end of the duplex pipe line, and the latter is again lowered into the well preparatory to the testing operation.

One of the objects of the present invention is to provide an attachment which may be used in connection with the ordinary single string of drill pipe for carrying out substantially the same method, thereby obviating the necessity of using a special set of drilling tools, and considerably reducing the expense of the entire operation.

A further object of the invention is to provide means for maintaining a constant pressure on the packer, at the same time permitting a circulation of water or mud outside the drill pipe while a test is being made, thus preventing the hole from caving, and preventing the tools from freezing or sticking.

The specific construction of the invention in its preferred embodiment, and the principles of its operation will be more fully explained in the following detailed description, which is to be considered in connection with the accompanying drawing illustrating the same.

In the drawing:

Figure 1 is a side elevation of the invention in position for operation.

Figure 2 is a central vertical section through the invention.

Figure 3 is a central vertical section through a portion of the testing apparatus which is below the portion shown in Figure 2.

Figure 4 is a horizontal section taken on the line 4-4 of Figure 2.

Figure 5 is a fragmentary section illustrating one of the valves on an enlarged scale.

The present invention is adapted to be used in connection with a single string of drill pipe 1, to the lower end of which is connected a duplex pipe length, consisting of outer and inner pipe sections 2 and 3, respectively. Each end of the outer pipe section 2 is threaded for a considerable distance to receive rings 4, which secure the ends of an inflatable packer 5. Within this packer, the pipe section 2 is provided with numerous holes 6, through which water or other fluid under pressure may be forced against the inside of the packer 5 to force the same against the sides of the hole, and effectually cut off the strata to be tested from the strata above.

To the lower ends of the pipe sections 2 and 3 there is connected a duplex pipe length of special construction, consisting of outer and inner concentric sections 7 and 8, and numerous nipples 9 connecting the interior of the section 8 with the hole without materially obstructing the annular passage between the two sections 7 and 8. This duplex pipe length is connected to the sections 2 and 3 by a tool joint, consisting of two mating members 10 and 11, having concentric threaded flanges 12 and 13 adapted to receive the outer and inner pipe sections, which are connected by the joint. This tool joint has a central passage providing communication between the pipe sections 3 and 8, and an outer passageway 15 affording communication between the outer pipe sections 2 and 7. The adjacent ends of the members 10 and 11 are provided with circular grooves 16, so that the passageways 15 in the two members will always be in communication when the joint is connected. If the test is made at the bottom of the well, only one packer will be need. If, however, the test is made on strata located at a considerable distance from the bottom of the well, a second packer may be used at the lower end of the sections 7 and 8, as described in the above-mentioned patent.

The pipe section 2 is connected at its upper end to the single string of drill pipe 1 by the usual form of coupling member 17. The upper end of the pipe section 2 is also threaded internally to receive an annular head 18, which is formed in its under

face with an annular seat 19, adapted to receive the upper end of the pipe section 3, the latter for this reason being a little shorter than the outer section 2. The bore through the head 18 is downwardly tapered to form a conical seat 20, adapted to receive the bevelled lower end of a tubing 21, which is lowered into the drill pipe 1 after the latter with the packer secured to its lower end is lowered into position for testing. The outer portion of the head 18 is provided with a number of ports or passageways 22, controlled by downwardly opening check valves 23, which permit water to be pumped through the drill pipe 1 and the pipe section 2 to inflate the packer, after the tubing 21 has been seated, but prevent back pressure and deflation of the packer after operation of the pump has been stopped.

It will be understood that in using the device for testing, a pipe section 24 is connected to the upper end of the drill pipe 1 in place of the grief joint. This pipe section 24 has a laterally disposed nipple 25 to which may be connected a hose 26, leading from a rotary water pump. The upper end of the pipe section 24 is provided with a cap 27 or the like, through which the pipe 21 is inserted, and a suitable discharge hose 28 may be connected to the upper end of the pipe 21.

At some suitable point, preferably above the coupling 17, one or more ports 29 are provided, each of these ports being formed with an outwardly facing conical seat adapted to receive the head of a relief valve 30. The stem of the valve inside the pipe is surrounded by a coiled spring 31 of sufficient strength to maintain the valve on its seat until a predetermined pressure is reached. Such pressure will be sufficient to inflate the packer 5 to cause it to be held firmly against the sides of the well, but will not be sufficient to burst the packer in case some unusual cavity or crevice should be met with. When the device is in operation, water or mud will be introduced through the drill pipe with sufficient pressure to be forced outwardly past the valves 30, and will circulate outside of the pipe 1, so as to prevent caving, and to prevent the pipe from freezing or sticking.

The apparatus herein described will be used in substantially the same manner as that described in the above-mentioned patent. After the cutting tool and grief joint are disconnected from the drill pipe, the packer and parts associated therewith are connected to the lower end of the pipe line and lowered into position. The section 24 is then connected to the upper end of the pipe line, and the pipe 21 is lowered until its lower end engages the conical seat 20. Before lowering the pipe 21, a plug will be inserted

in its lower end. After the packer has been inflated by water introduced into the outer pipe section by the use of a rotary pump, a weight or go-devil is dropped down the inside of the pipe 21 to knock out the plug and permit the well to flow.

If the test does not show a satisfactory production, the testing apparatus may be withdrawn and the drilling operations resumed. To facilitate the withdrawal, ports 32 are provided in the head 18 leading from the conical seat 20 to the interior of the packer section 2. These ports are covered during the testing operation by the lower end of the tubing 21, but are uncovered as soon as the latter is raised and permit the packer to collapse at once so that it may be readily withdrawn.

It is to be understood that the apparatus attached to the lower end of the drill pipe 1 will include as many packers, and as many of the sections 7, 8 as may be necessary to shut off the strata to be tested from the other strata, leaving the former free to flow through the nipples 9 and up through the tube 21.

The provision of the head 18 with its conical seat makes it possible to carry out this method with the ordinary single string of drill pipe, thus obviating the necessity of providing a special set of drilling tools. The provision of one or more of the relief valves 30 makes it possible to keep the packer expanded with a constant maximum pressure. At the same time the water or fluid will be under sufficient pressure to open the valves and to circulate about the outside of the drill pipe, thereby preventing the hole from caving, and the pipe from freezing or sticking.

As explained in the above-mentioned patent, it is possible to determine the rate of flow of oil or gas, if any, before going to the expense of casing in the well. If desired, the apparatus may be left in the hole, and satisfactory production may be obtained without any casing at all. It is also possible to use a pump in the section 3, allowing the sucker rod to pass up through the tube 21. If a number of productive sands are located at different levels, a sufficient number of duplex pipe sections and packers may be used to block off the various sands, and production may be obtained from all of them simultaneously.

While I have shown and described in detail the specific construction of one form in which the invention may be embodied, it is to be understood that this is merely for the purpose of illustration, and that many modifications thereof may be devised without departing from the salient features of the invention as expressed in the claims.

What is claimed is:

1. In an oil well apparatus, the combina-

tion of a duplex pipe length comprising inner and outer pipe sections, the outer section being perforated, a packer secured around said outer section and enclosing said perforations, and a head secured in the upper end of said duplex pipe length, said head having a smooth conical seat with openings therethrough into the outer pipe section, an opening located centrally of the seat and leading into said inner pipe section, and ports outside of said seat leading into said outer pipe section.

2. In an oil well apparatus, the combination of a duplex pipe length comprising inner and outer pipe sections, the outer section being perforated, a packer secured around said outer section and enclosing said perforations, means for coupling the upper end of the outer section to the lower end of a single string of drill pipe, a head threaded into the upper end of said outer section and having means to secure said inner section, said head being formed in its upper face with a conical seat for receiving the lower end of a pipe when the latter is lowered within the drill pipe, said head having an opening within the seat leading into said inner pipe section, and ports outside of said seat leading into said outer pipe section.

3. In an oil well apparatus, the combination of duplex pipe length comprising inner and outer sections, a tool joint for connection to their lower ends, the upper end of the outer section being internally threaded and extending beyond the upper end of the inner section, a head secured by the internal threads and having an annular seat in its lower face receiving the upper end of said inner pipe section, means for coupling the upper end of the outer section to the lower end of a single string of drill pipe, said head having a central bore leading into said inner pipe section, and ports leading into the outer pipe section, and a conical seat formed in the upper face of the head between said bore and ports for receiving the lower end of a tube when the latter is lowered within the drill pipe.

4. In an oil well apparatus, the combination of a duplex pipe length comprising inner and outer pipe sections, the outer section being perforated, a packer secured around said outer section and enclosing said perforations, means for introducing fluid under pressure into the outer pipe section to inflate the packer, passageways affording communication between the inner pipe section and the earth strata below the packer, means for conducting to the surface any oil which may flow from said strata, and a relief valve above the packer to limit the pressure on the latter to a predetermined maximum and to permit said fluid to circulate around the outside of the pipe.

5. In an oil well apparatus, the combina-

tion of a duplex pipe length comprising an outer section and an inner section, passageways leading from the inner section through the surrounding outer section and affording communication between the interior of the inner section and the sides of the well, but leaving sufficient room for free circulation of water through the outer section, an elastic packer adjacent said pipe sections, means for inflating the packer by fluid introduced through said outer section, and a relief valve limiting the pressure on the packer to a predetermined maximum and permitting said fluid to circulate around the outside of the pipe above the packer.

6. In an oil well apparatus, the combination of a duplex pipe length comprising inner and outer pipe sections, the outer section being perforated, a packer secured around said outer section and enclosing said perforations, whereby the packer may be inflated by fluid introduced under pressure through said outer pipe section, a port affording communication from the inside of the outer pipe section to the well cavity outside the pipe and separated by the packer from the strata to be tested, and a relief valve for said port to permit the fluid introduced into the outer pipe section to circulate around the outside of the pipe when its pressure upon the inside of the packer reaches a predetermined amount.

7. In an oil well apparatus, the combination of a duplex pipe length comprising inner and outer pipe sections, the outer section being perforated, a packer secured around said outer section and enclosing said perforations, a head secured in the upper end of said duplex pipe length, said head having a bore leading into said inner pipe section and forming a conical seat, and ports outside of said seat leading into said outer pipe section, and a relief valve operable by the pressure of fluid in the outer section to limit the pressure on the packer to a predetermined maximum and to permit said fluid to circulate around the outside of the pipe.

8. In an oil well apparatus, the combination of a duplex pipe length comprising inner and outer sections, the outer section being perforated, a packer secured around said outer section and enclosing said perforations, means for coupling the upper end of the outer section to the lower end of a single string of drill pipe, a head threaded into the upper end of said outer section and having means to secure said inner section, said head being formed in its upper face with a conical seat for securing the lower end of a tube when the latter is lowered within the drill pipe, said head having a central bore within the seat leading into said inner pipe section and ports outside of said seat leading into said outer pipe section, and

a relief valve above the packer to limit the pressure on the latter to a predetermined maximum and to permit fluid introduced into said outer section to be expelled there-
 5 through and to circulate around the outside of the drill pipe.

9. In an oil well apparatus, the combination of a duplex pipe length comprising inner and outer pipe sections, the outer section being perforated, a packer secured
 10 around said outer section and enclosing said perforations, a head secured in the upper end of said duplex pipe length, said head having a central downwardly tapered bore
 15 forming a seat, said bore leading into the inner pipe section, ports outside of said seat leading into said outer pipe section, and check valves preventing back pressure through said ports.

20 10. In an oil well apparatus, the combi-

nation of a duplex pipe length comprising inner and outer pipe sections, the outer section being perforated, a packer secured around said outer section and enclosing said
 25 perforations, a head secured in the upper end of said duplex pipe length, said head having a central downwardly tapered bore leading into said inner pipe section and forming a seat, a tubing having a tapered
 30 lower end adapted to rest on said seat, ports through said head outside of said seat, check valves preventing back pressure through said ports, and other ports leading from the tapered seat to said outer section and covered by the lower end of said tubing when
 35 the latter is seated.

In testimony, that I claim the foregoing as my own, I have hereto affixed my signature.

HAMPTON ADAMS STEELE.