Dec. 11, 1934. J. H. HOWARD ET AL 1,983,854

WELL PRODUCTION APPARATUS

Filed Nov. 6, 1931 2 Sheets-Sheet 1

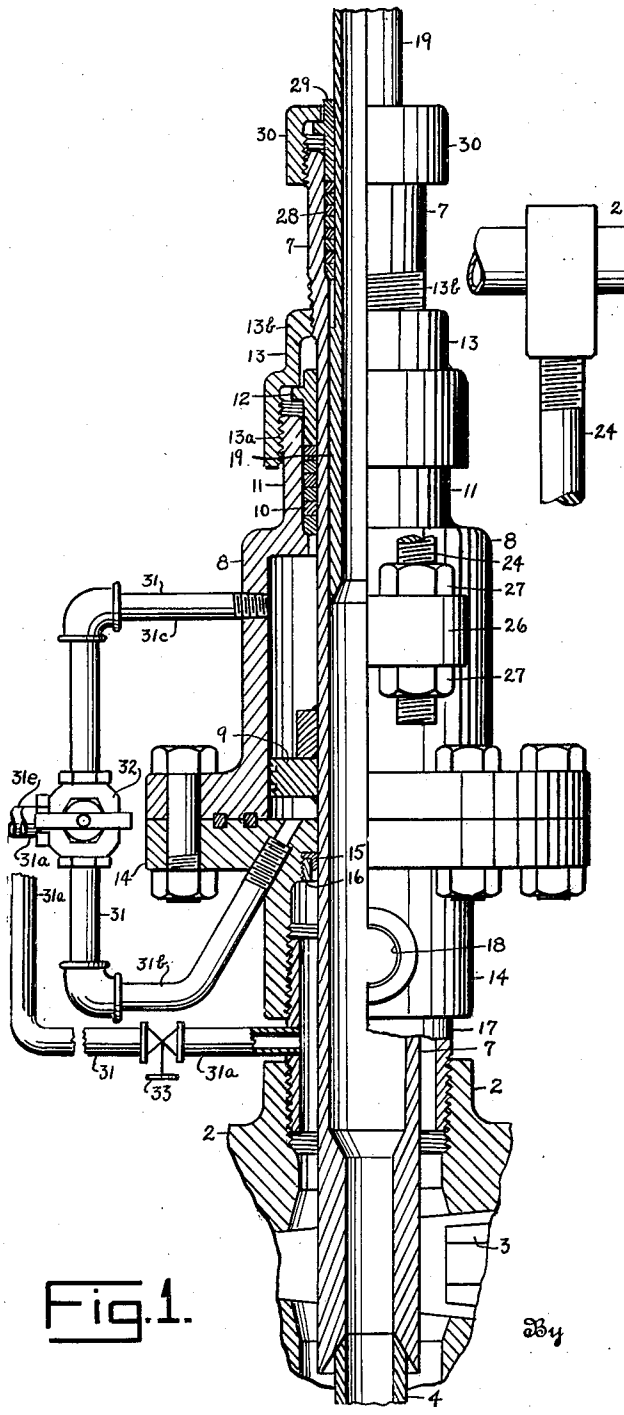

Fig. 1.

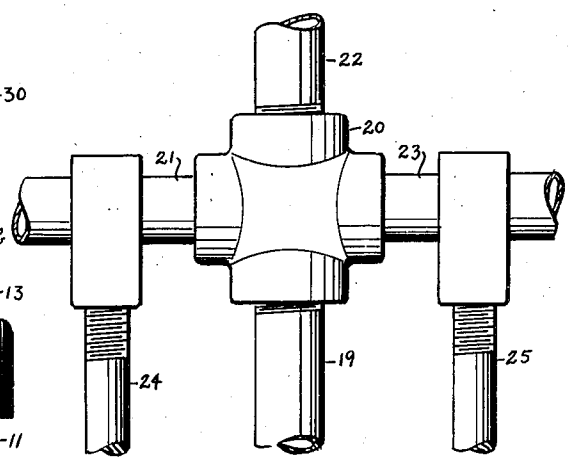

Fig. 2.

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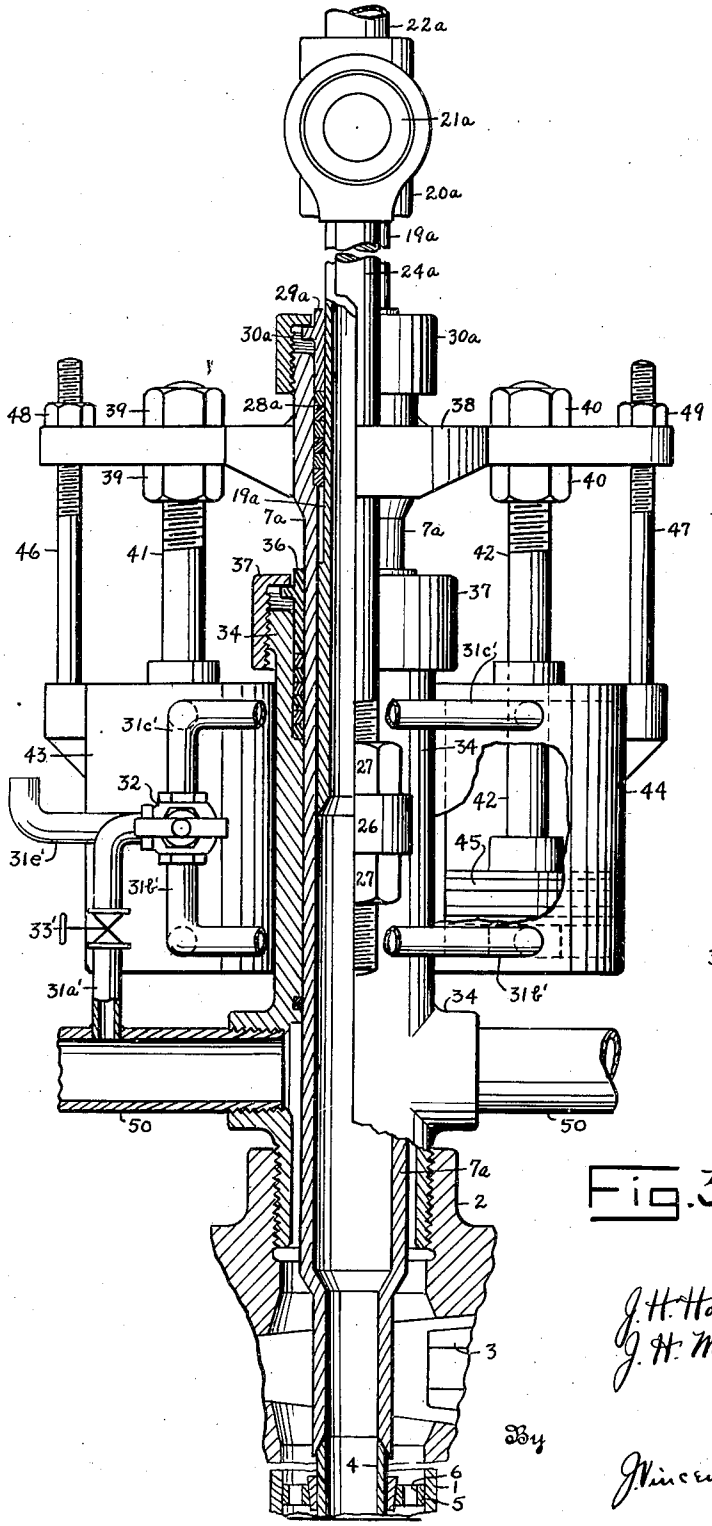

Fig. 3.

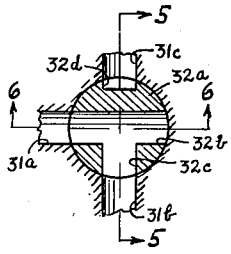

Fig. 4.

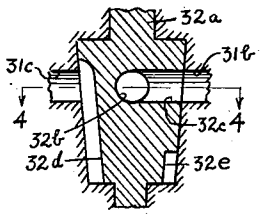

Fig. 5.

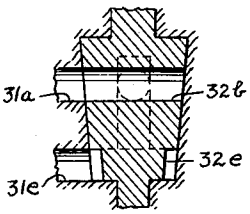

Fig. 6.

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UNITED STATES PATENT OFFICE

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WELL PRODUCTION APPARATUS

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Application November 6, 1931, Serial No. 573,324

5 Claims. (Cl. 166—15)

One type of conventional well production apparatus includes a casing having a master valve, a sectional tubing within the casing and extending through the valve, and means to separate the sections of the tubing so that the master valve may be closed between the separated sections without removing the tubing from the casing.

This invention has for its specific object the provision of new and improved means whereby fluid under pressure may be utilized to separate and unite the tubing sections.

The preferred embodiments of the invention are illustrated by the accompanying drawings, of which Fig. 1 is a sectional elevation of one embodiment of the invention; Fig. 2, a fragmentary detail view illustrating the pipe holding means adapted for use with the embodiment shown by Figs. 1 and 3; Fig. 3, a sectional elevation of another embodiment of the invention; Fig. 4, a detail vertical section of the valve of Figs. 1 and 3, taken on the line 4—4 of Fig. 5; and Figs. 5 and 6, horizontal sections on the lines 5—5 and 6—6, respectively of Fig. 4.

In the drawings, the conventional well casing is indicated at 1. (Fig. 3.) On the upper end of this casing is mounted the valve 2 having a gate 3. Within the casing 1 is a sectional tubing, the lower section 4 of which is stationarily held in the casing by a suitable anchor 5. The anchor 5 has fluid ducts 6 to permit the passage of fluid upwardly between the casing and the tubing.

Referring now particularly to Fig. 1, the upper section 7 of the tubing extends from the lower section 4 upwardly through the valve 2. Surrounding the upper section 7 is a cylinder 8 in which is reciprocable a piston 9 comprising a ring welded on the tubing section 7. The upper end of the cylinder is sealed by a packing 10 fitting in a reduced extension 11, surrounding the tubing section 7, and compressed by a suitable gland 12 actuated by the ring 13. The ring 13 is threaded on the extension 11 at 13*a* and on the tubing section 7 at 13*b*, and serves to releasably hold the tubing section 7 on the tubing section 4, as shown by Fig. 1. The lower end of the cylinder 8 is closed by the base 14, in which the tubing section 7 snugly fits. A packing 15, compressed by a threaded ring 16 may be employed to seal the space between the tubing 7 and the base 14. The base 14 is connected to the valve 2 by the hollow coupling 17.

Fluid may flow upwardly between the tubing and the casing, through the valve 2 about the tubing section 7 and out of the outlet 18.

Fluid may also flow upwardly from the lower section 4 of the tubing into the upper section 7, and then outwardly through the pipe 19 into the coupling 20 and then into flow lines 21, 22 and 23. The flow lines are connected to various valved pipes constituting what is commonly called a Christmas tree. The pipe 19 is held in place by tie rods 24 and 25 connected, respectively, to flow pipes 21 and 23, and to cylinder 8. Fig. 1 illustrates the connection of tie rod 24 to the cylinder 8 by means of a lug 26 through which the tie rod 24 extends and in which it is fixed by the nuts 27. The pipe 19 is thereby held stationary. The upper section 7 of the tubing surrounds and is slidable on the lower end of the pipe 19 and is sealed thereto by a suitable packing 28 compressed by gland 29 actuated by threaded ring 30.

It will be obvious that when the tubing section 7 is in the position shown by Fig. 1, it is in the path of the gate 3 of the valve so that the gate cannot be closed. The means provided by this invention for moving the upper section 7 of the tubing upwardly out of the path of the gate 3 and then downwardly into engagement with the lower tubing section 4 includes the cylinder 8 and piston 9, above referred to, and a pipe indicated generally at 31 and a valve 32 for directing fluid under pressure in the casing to the lower and upper sides of piston 9, successively. This pipe 31 includes a branch 31*a* leading from the coupling 17 into the valve 32; a branch 31*b* leading from the valve 32 to the lower portion of the cylinder 8; a branch 31*c* leading from valve 32 to the upper portion of the cylinder 8; and an outlet 31*e* leading from the valve.

The valve 32 is illustrated in detail by Figs. 4, 5 and 6. It includes a plug 32*a* having extending therethrough a diametrical bore 32*b*, and extending from the center thereof outwardly a radial bore 32*c*. The plug 32*a* also has a longitudinal groove 32*d* communicating with an annular groove 32*e* in its base portion.

Now, it will be apparent that when the plug 32*a* is in the position shown by Figs. 4, 5 and 6, fluid under pressure may pass from the casing through the branch 31*a* of the pipe into the plug 32*a*. It will pass into the diametrical bore 32*b*, and then out of the radial bore 32*c* into the branch 31*b* of the pipe by which it will be directed to the lower portion of the cylinder 8. The fluid under pressure will force the piston 9 upwardly, and the piston will carry the tubing section 7 upwardly out of the path of the gate 3 which may then be closed. The fluid in the cylinder 8 above the piston 9 will escape through the branch 31*c* of the pipe into the longitudinal

groove 32*d* of the plug, into the annular groove 32*e* of the plug and out of the outlet 31*e*.

When the plug 32*a* is rotated through 180 degrees in an anti-clockwise direction (Fig. 4), the radial bore 32*c* is made to communicate with the branch 31*c* of the pipe and the longitudinal groove 32*d* is made to communicate with the branch 31*b* of the pipe. Fluid under pressure will then flow from the casing through the branch 31*a* of the pipe, into the diametrical bore 32*b* of the plug, out of the radial bore 32*c* of the plug, into the branch 31*c* of the pipe by which it will be directed to the upper portion of the cylinder 8 to force the piston 9 downwardly. And the fluid in the cylinder beneath the piston 9 may then escape through the branch 31*b* of the pipe into the longitudinal groove 32*d* of the plug, into the annular groove 32*e* of the plug and out of the outlet 31*e*.

The tubing section 7, therefore, may be moved upwardly away from the tubing section 4 out of the path of the gate 3, and then downwardly into engagement with the tubing section 4 by operating the valve 32.

If desired, the branch 31*a* of the pipe may be provided with a valve 33 so that the cylinder and branch pipes adjacent thereto may be completely cut off from the casing.

It will be understood that in order to permit movement of the upper section 7 of the tubing, the threads 13*b* of the ring 13 are disconnected from the upper section 7 of the tubing by rotating the ring 13, before fluid is introduced into the cylinder 8.

Referring now to Fig. 3, the embodiment shown includes a housing 34 mounted on the valve 2. The upper section 7*a* of the tubing in this embodiment, which is somewhat different from the upper section 7 of the tubing in the embodiment shown by Fig. 1, extends upwardly through and is slidable in the housing 34, fitting snugly therein and sealed thereto by a packing 35 having the usual gland 36 and ring 37.

The section 7*a* is slidable on the lower end of a fixed pipe 19*a* which is connected to the coupling 20*a* and held in place by suitable tie rods, one of which is shown at 24*a* connected to a branch pipe 21*a* leading from the coupling 20*a* and secured to the housing 34 by a suitable lug 26 and bolts 27. The tubing section 7*a* is sealed to the pipe section 19*a* by a suitable packing 28*a* including a gland 29*a* and ring 30*a*.

Rigidly mounted on the tubing sections 7*a* is a crosshead 38 and to this crosshead are secured by bolts 39 and 40 piston rods 41 and 42, respectively. The piston rods 41 and 42 are connected to pistons in cylinders 43 and 44, respectively. The piston to which rod 42 is connected is indicated at 45. The cylinders 43 and 44 are stationarily mounted, in any suitable manner, on the housing 34. The crosshead 38 is normally held in its lowermost position by tie rods 46 and 47 extending upwardly from the cylinders and having on their upper extremities nuts 48 and 49. The tubing section 7*a* is thereby normally held in contact with the lower tubing section 4.

The valve 32 is the same as that in the Fig. 1 embodiment. It is connected to a flow pipe 50 leading from the housing 34 by a branch 31*a'*. The branches 31*b'* and 31*c'* are connected, respectively, to the lower and upper portions of the cylinders 43 and 44. The branch outlet is indicated at 31*e'*. The branch 31*a'* may be provided with a suitable valve 33'.

It will be apparent from the foregoing that when the nuts 48 and 49 are removed and the plug 32*a* of the valve is moved to the position shown by Figs. 4, 5 and 6, fluid will flow from the casing through the branch 31*a'* of the pipe into the branch 31*b'* of the pipe to the lower portions of the cylinders 43 and 44, and will force the pistons therein upwardly, so that the rods 41 and 42 will be moved upwardly, to elevate the crosshead 38 and the upper section 7*a* of the tubing so that the gate 3 may be closed. The fluid in the cylinders above the pistons may escape through the branch 31*c'* of the pipe and out of the outlet 31*e'*.

When the plug 32*a* of the valve is rotated through 180 degrees in an anti-clockwise direction (Fig. 4) fluid will flow from the casing through the branch 31*a'* of the pipe and the branch 31*c'* of the pipe into the upper portions of the cylinders 43 and 44 to force the pistons downwardly, the fluid beneath the pistons thereupon escaping through the branch 31*b'* of the pipe and outlet 31*e'*. And the tubing section 7*a* will thereby be moved downwardly into engagement with the tubing section 4.

It will be understood that the gate 3 is opened before the upper tubing section of either embodiment is moved downwardly.

While the drawings and the foregoing description disclose the utilization of fluid under pressure in the casing, fluid under pressure may be derived from some other source. The invention is not limited to the preferred embodiments disclosed. Various changes may be made within the scope of the following claims:

I claim:

1. In well apparatus: a casing; a casing valve mounted on said casing; a sectional tubing in said casing, the lower section of said tubing being anchored in said casing below the path of said valve, the upper section of said tubing extending upwardly from said lower section through said valve; a cylinder mounted on and above said valve; a piston connected to said upper section of said tubing and reciprocable in said cylinder; a pipe communicating with the upper and lower portions of said cylinder and with said casing and having an outlet; and a control valve to control the flow of fluid from said pipe into said cylinder below and above said piston and through said outlet, to cause movement of said upper section of said tubing out of the path of said casing valve and into contact with the lower section of said tubing, successively.

2. In well apparatus: a casing; a valve mounted on said casing; a sectional tubing, the lower section of said tubing being anchored in said casing below said valve; a coupling above and connected to said valve and having an outlet for fluid in said casing; a cylinder above and connected to said coupling; the upper section of said tubing extending upwardly from said lower section of said tubing, through said valve, coupling and cylinder; a piston in said cylinder and connected to said upper section of said tubing; and a pipe to direct fluid under pressure from said casing to the lower portion of said cylinder to force said piston upwardly and thereby elevate said upper section of said tubing to permit closure of said valve.

3. In well apparatus: a casing; a valve mounted on said casing; a sectional tubing, the lower section of said tubing being anchored in said casing below said valve; a coupling above and connected to said valve and having an outlet for fluid in said

casing; a cylinder above and connected to said coupling; the upper section of said tubing extending upwardly from said lower section of said tubing, through said valve, coupling and cylinder; a piston in said cylinder and connected to said upper section of said tubing; a pipe communicating with the upper and lower portions of said cylinder, and with said casing, and having an outlet; and a valve to control the flow of fluid through said pipe to cause up and down movement of the said upper section of said tubing.

4. In well apparatus: a casing; a valve mounted on said casing; a sectional tubing in said casing, the lower section of said tubing being anchored in said casing beneath the path of said valve; a cylinder mounted on said valve; the upper section of said tubing extending upwardly from the lower section of said tubing through said valve and through said cylinder; and a ring threaded to said tubing and cylinder to releasably hold said upper section of said tubing in engagement with said lower section of said tubing; said upper section of said tubing being movable upwardly after it is released by said ring, to permit closure of said valve.

5. In well apparatus: a casing; a valve in said casing; a sectional tubing in said casing, one of the sections of said tubing being anchored in said casing beneath the path of said valve; a cylinder above said valve; the upper section of said tubing extending upwardly from the lower section of said tubing through said valve into said cylinder; a piston connected to said upper section of said tubing and reciprocable in said cylinder; and means to introduce fluid under pressure into said cylinder to move said piston and thereby elevate said upper section of said tubing to permit closure of said valve.

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