

Oct. 23, 1962

S. E. LOY III, ET AL

3,059,700

GAS LIFT MANDREL FOR USE IN WELLS

Filed Dec. 30, 1960

FIG. 1.

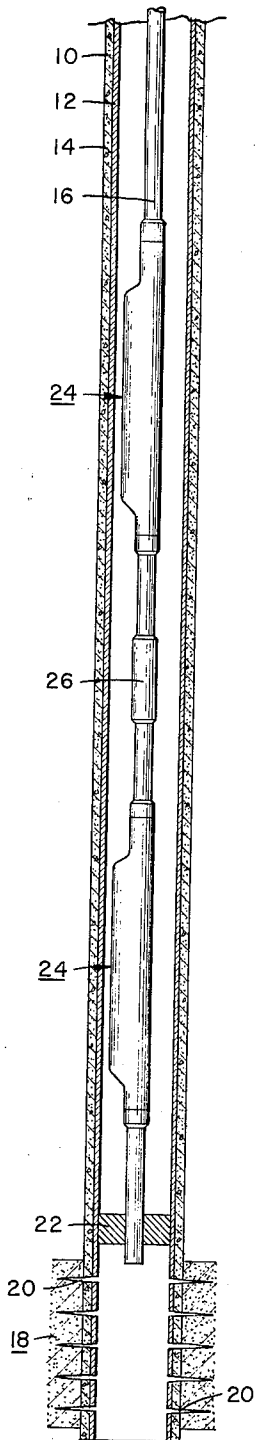


FIG. 2.

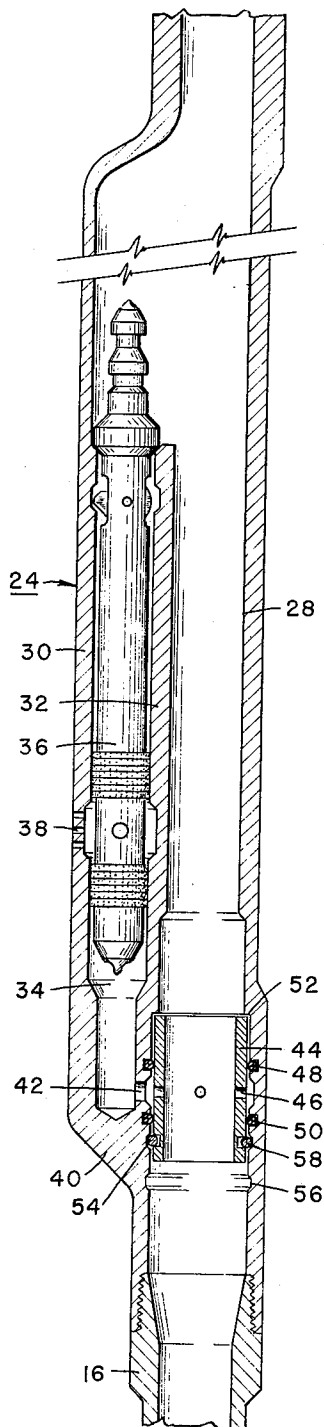


FIG. 3.

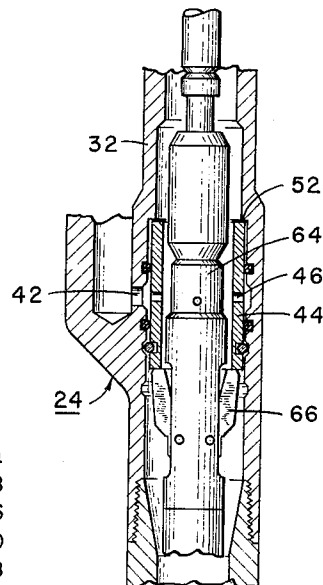
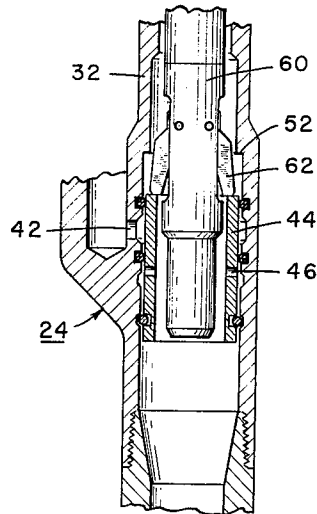


FIG. 4.

INVENTORS.
SAMUEL E. LOY, III,
WILLIAM C. LINDSEY,
BY *Frank S. Tridell*
ATTORNEY.

1

3,059,700

GAS LIFT MANDREL FOR USE IN WELLS

Samuel E. Loy III, Midland County, and William C. Lindsey, Harris County, Tex., assignors, by mesne assignments, to Jersey Production Research Company, Tulsa, Okla., a corporation of Delaware
Filed Dec. 30, 1960, Ser. No. 79,874
2 Claims. (Cl. 166-224)

This invention relates to wells from which oil is produced by means of a gas lift system. More particularly, this invention is an improved gas lift mandrel for use in such wells.

If an oil producing well does not have sufficient formation pressure to flow the oil from the formation to the earth's surface, some sort of pressure increasing mechanism must be included in the well. One form of pressure increasing system consists of a plurality of gas lift valves vertically spaced apart within the production tubing.

It often occurs that workover operations such as squeeze cementing must be performed in the well after the production tubing including the gas lift valves have been permanently placed within the well. When workover operations are required, the gas lift valve in each gas lift mandrel must be removed by wireline and a dummy valve placed in the gas lift mandrel. The dummy valve is also positioned by means of wireline tools.

Gas lift mandrels for permanently completed wells must be pressure tight during workover operations and must be capable of passing wireline tools when sealed. Once the dummy valves are in place and pressure tested, the well may be reworked.

From the above, it can be seen that before workover operations can be performed, a wireline must be lowered in the production tubing to remove the gas lift valve; then a dummy valve must be lowered into the tubing also by means of wireline. After the workover operations are complete, the dummy valve must be removed by wireline and the gas lift valve placed in the mandrel by wirelines. This involves four wireline trips. The time involved in valve pulling and setting operations depends on the number of valves installed in the well; however, two to three days are commonly consumed in performing the wireline manipulations necessary.

This invention is a novel gas lift mandrel which is constructed in such a manner that the number of wireline manipulations necessary is substantially reduced.

The invention as well as its many advantages may be understood by reference to the following detailed description and drawings in which:

FIG. 1 is a schematic view illustrating a production tubing with a plurality of gas lift mandrels connected thereto;

FIG. 2 is an elevational view, partly in section, showing the new gas lift mandrel;

FIG. 3 is a sectional elevational view showing one manner in which the sleeve in the mandrel may be moved to pressure seal the gas lift valve; and

FIG. 4 illustrates one manner in which the sleeve in the mandrel may be moved to provide fluid communication between the inside of the production tubing and the gas lift valve for oil production.

Referring to FIG. 1, there is shown a schematic representation of a permanently arranged tubing for gas lift oil production. The well 10 includes the usual casing 12 cemented in place by the usual cement 14.

The production tubing 16 is shown lowered in place with its lower extremity positioned above an oil producing formation 18. Perforations 20 have been made through the casing 12 and cement 14 to the formation 18 to permit the oil to flow from formation 18 through perforations 20 and upwardly through production tubing 16 to the

2

earth's surface. A packer 22 pressure seals the formation 18 so that oil is directed upwardly through production tubing 16 rather than through the annulus between the production tubing 16 and the casing 12.

The production tubing 16 includes a plurality of vertically spaced-apart offset type gas lift mandrels 24. A landing nipple 26 is also provided within production tubing 16 for landing various instruments, such as a tubing extension, if required.

The structure of each of the new gas lift mandrels 24 is identical. FIG. 2 shows in sectional elevational view this new type gas lift mandrel.

Referring to FIG. 2, the gas lift mandrel 24 consists of a first elongated pipe 28 having its top and bottom open for connection to the rest of the production tubing. A second elongated pipe portion 30 is also provided in the mandrel 24. Pipes 28 and 30 have a common peripheral portion 32, thus forming a side pocket 34. The gas lift valve 36 is shown positioned within the side pocket 34 of the mandrel. Circulating ports 38 may be provided within the pipe 30.

The top of the side pocket 34 is open so that the gas lift valve 36 can be placed within the pocket. The bottom of the pocket is closed by means such as the inwardly and downwardly tapering portion 40 which is integrally connected to the elongated pipe portion 28.

A gas lift port 42 extends from the pocket 34 through the common peripheral portion 32 to the interior of the pipe 28. Mounted within the pipe 28 at a point adjacent the gas lift port 42 is a slidable sleeve member 44. The slidable sleeve member 44 is provided with a plurality of openings 46.

Fluid sealing means such as O-rings 48 and 50 are positioned above and below the gas lift port 42 and within circular grooves provided within the pipe 28 to receive the O-rings 48 and 50.

Pipe 28 is provided with an internal shoulder 52 against which the top portion of sleeve 44 is adapted to mate. The pipe 28 is also provided with vertically spaced-apart recesses 54 and 56 which are located below the gas lift port 42. An annular spring 58 is mounted about the sleeve 44 and below the O-rings 48 and 50. Sleeve 44 is locked in either an upper or lower position by the positioning of annular spring 58 in recess 54 or 56, respectively.

In operation, the elements of the gas lift mandrel 24 are normally in the positions shown in FIG. 2. The sleeve 44 is in its upper position so that the openings 46 place the gas lift port 42 in fluid communication with the gas lift valve 36. Thus, oil is produced upwardly through the production tubing 16 and its gas lift mandrels 24.

When it becomes necessary to perform workover operations such as squeeze cementing, a wireline tool is simply lowered down the production tubing 16 to engage the top of the sleeve 44 to move the slidable sleeve downwardly as shown in FIG. 3. Notice that the gas lift valve 36 remains in the side pocket 34. Thus, the wireline operations formerly required to remove the gas lift valve and replace it with a dummy valve are eliminated. No dummy valve is required.

As shown in FIG. 3, the sleeve 44 may be moved downwardly by means of a tool 60 having dogs 62 which are spring biased outwardly. The movement of sleeve 44 downwardly moves the openings 46 in the sleeve 44 to a position such that openings 46 no longer provide fluid communication to the gas lift port 42. The full opening through sleeve 44 permits the required tools for the workover operations to be lowered through the production tubing and gas lift mandrels after the setting tool 60 is removed.

After the workover operations are completed, the sleeve 44 can be returned to its original position by lowering a

3

setting tool 64 having spring biased dogs 66, down the production tubing (see FIG. 4). The setting tool 64 is lowered through the sleeve 44 until the spring biased dogs 66 are permitted to engage the lower portion of sleeve 44. Thereafter, movement of setting tool 64 upwardly moves the sleeve 44 upwardly and again places the openings 46 in fluid communication with the gas lift port 42. The well may then be returned to production without ever requiring the removal of the gas lift valve. If desired, the operations performed by setting tools 60 and 64 may be performed by a single tool of the type shown at page 1976, volume 2, of the "Composite Catalog of Oil Field Equipment and Services," 1957 edition.

From the foregoing, it is seen that by using this new gas lift mandrel, the number of wireline manipulations is substantially cut in half from the number of wireline manipulations formerly required.

We claim:

1. A gas lift mandrel for use in wells comprising: a unitary member having a first elongated pipe portion having an open top and an open bottom, and a second elongated pipe portion having an open top in fluid communication with said first elongated pipe and a closed bottom, said first elongated pipe and said second elongated pipe having a common peripheral portion thus forming a pocket for receiving a gas lift valve, said unitary member having a gas lift port interconnecting the pocket and the interior of the first elongated pipe portion; a slidable sleeve within the first elongated pipe portion and adjacent said gas lift port, said slidable sleeve having at least one opening therein normally in fluid communication with the gas lift port whereby said slidable sleeve may be moved to a position moving the opening from fluid communica-

4

tion with said gas lift port; and means for limiting the slidable movement of said sleeve.

2. A gas lift mandrel for use in wells comprising: a unitary member having a first elongated pipe portion having an open top and an open bottom, and a second elongated pipe portion having an open top in fluid communication with said first elongated pipe and a closed bottom, said first elongated pipe and said second elongated pipe having a common peripheral portion thus forming a pocket for receiving a gas lift valve, said unitary member having a gas lift port interconnecting the pocket and the interior of the first elongated pipe portion; a slidable sleeve within the first elongated pipe portion and adjacent said gas lift port, said slidable sleeve having at least one opening in the side thereof; fluid sealing means positioned within the first elongated pipe portion and above and below the gas lift port and also in contact with the sleeve; and an annular spring member mounted about said sleeve adapted to lockingly engage either one of the two vertically spaced-apart recesses formed in said first elongated pipe portion whereby the slidable sleeve may be moved to a first position to place said opening into fluid communication with the gas lift port and to a second position to move the opening from fluid communication with said gas lift port.

References Cited in the file of this patent

UNITED STATES PATENTS

2,804,830	Garrett et al.	Sept. 3, 1957
2,846,014	Daffin et al.	Aug. 5, 1958
2,924,278	Garrett et al.	Feb. 9, 1960
2,948,341	Fredd	Aug. 9, 1960
2,970,648	Daffin et al.	Feb. 7, 1961