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OFFSET MANDREL FOR SMALL DIAMETER TUBING

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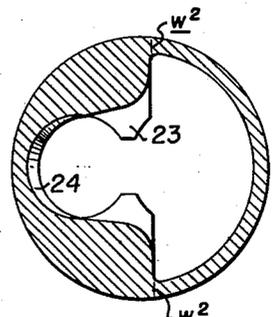
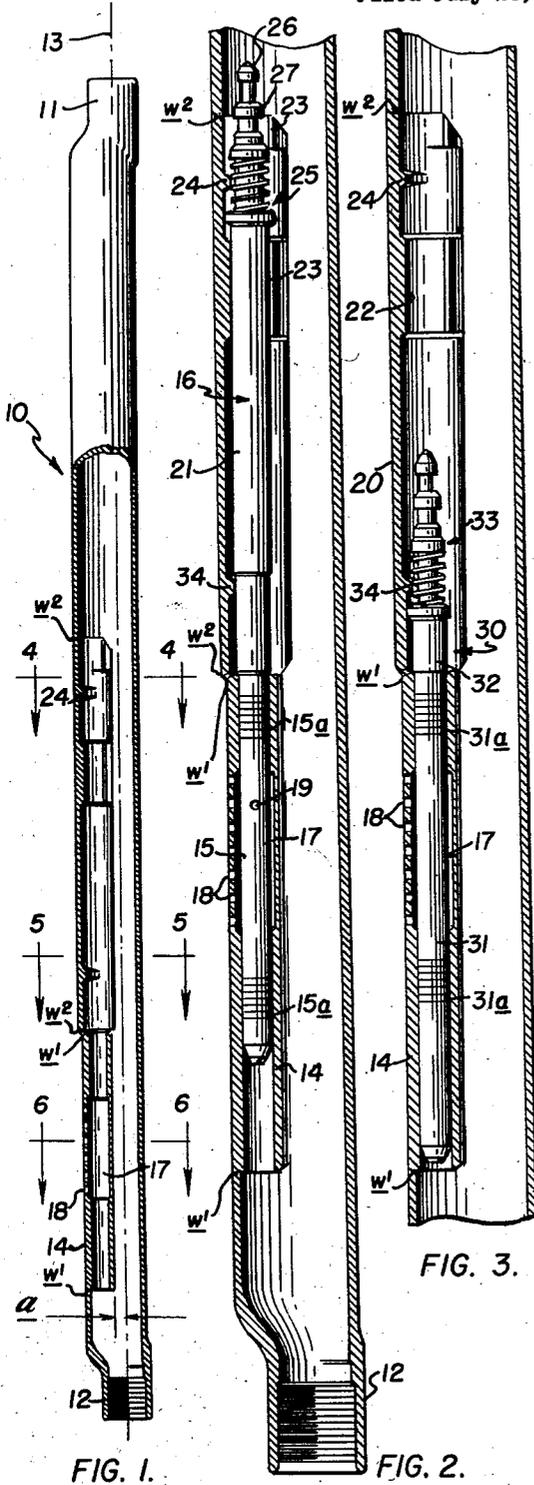


FIG. 4.

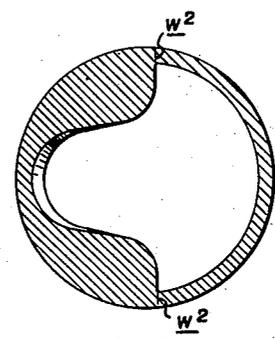


FIG. 5.

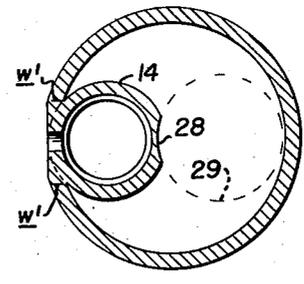


FIG. 6.

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1

2,824,525

OFFSET MANDREL FOR SMALL DIAMETER TUBING

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9 Claims. (Cl. 103—232)

This invention relates to gas lift valves, chokes, valve blanks and the like installed in and removed from special sections in the tubing of oil wells by means of wire lines, such as described in U. S. Patent No. 2,664,162, issued December 29, 1953. Particularly, the invention has reference to improvements in special tubing sections or mandrels for receiving gas lift valves, etc., in laterally offset portions thereof.

An object of the invention is to make possible relatively small mandrels capable of accommodating gas lift valves or the like having relatively large operating mechanisms. To a large extent, the diameter and length of the operating mechanism determine the volume of fluid raised during a period of time.

A particular object of the invention is to provide a relatively small diameter mandrel of circular cross section, and one which may be washed over by means of an additional length of tubing therearound in the event the well becomes filled, or partly filled, with sand.

A further object of the invention is to provide a relatively small offset mandrel for the described purpose, yet one having full bypass opening; that is, having a bypass opening as large as the inside diameter of the well tubing in which the mandrel is installed.

In the accompanying drawing,

Figure 1 is a broken elevation and sectional view of a special tubing section or mandrel embodying the features of the invention.

Figure 2 is an enlarged vertical section of the lower end of the mandrel shown in Figure 1, and illustrating a gas lift valve installed therein.

Figure 3 is a vertical sectional view similar to Figure 2, but showing a valve blank or dummy installed therein.

Figures 4, 5 and 6 are transverse sectional views taken on lines 4—4, 5—5, and 6—6 of Figure 1.

The numeral 10 generally designates a mandrel in accordance with the invention and includes aligned threaded cylindrical ends 11 and 12 for connection with lengths of well tubing, not shown. The axial center of the tubing is indicated at 13 by means of a dashed line. The body of the mandrel 10 is cylindrical and is offset with respect to the axial center 13 of the well tubing, and the circular cross section thus provided is capable of retaining higher pressures than elliptical cross sections, such as shown in Figure 14 of the referred to Patent No. 2,664,162.

The body 10 is made of steel tubing and includes a tubular receiver 14 in the lower end of the offset portion for receiving the relatively small diameter of a nose 15 secured to the lower end of a gas lift valve 16 as shown in Figure 2. The tubular receiver 14 is preferably turned on a lathe for economy of construction, and includes an enlarged reamed inside diameter intermediate its ends, thus providing an annulus 17 around the center portion of the nose 15 when the latter is installed in operating position. Ports 18 are provided in the outer surface of the receiver 14 and provide passage through the side of the mandrel 10 to a port 19 in the valve nose 15, and

2

which port communicates with the operating mechanism of the valve 16 by means of passages. Preferably, the tubular receiver 14 is installed in the mandrel 10 by means of cutting an opening in the side of the latter and welding the receiver in place. The last referred to weld is indicated at w^1 in the drawing. The valve nose 15 is provided with ring seals $15a$ above and below the valve nose port 19, and which seals engage the inside surface of the receiver 14 above and below the annulus 17.

A latching section 20 is provided in the offset side of the mandrel 10 above the tubular section 14, and which section is welded in place, as at w^2 after cutting an opening in the mandrel for that purpose. The entire length of the latching section is open along the side thereof adjacent the center 13 of the well tubing for allowing sand, cement or debris to drop more easily and to allow the valve 16 to extend toward the center of the mandrel 10 when installed therein, and whereby valves 16 having relatively large diameters may be installed in mandrels having relatively small transverse dimensions. As shown in Figure 1, and indicated by the letter a , the tubular section 14 and the latching section 20 are in alignment with each other, and are downwardly and outwardly inclined with reference to the axial center 13 of the well tubing. The portion of the valve 16 containing the operating mechanism is indicated at 21.

A semicircular elongated guide 22 is provided in the latching section 20 for receiving the body of the valve 16, and which guide is provided with inwardly directed projections 23 above and below a latching lug 24 for engaging the latch assembly 25 mounted on the upper end of the valve 16. Any suitable latch means may be employed, but the latch assembly shown is the same as described and illustrated in my copending application, Serial No. 431,211, filed May 20, 1954. The valve assembly is raised and lowered by means of a wire line, not shown, and suitable tools on the lower end of the line engage shoulders 26 and 27 on the upper end of the valve assembly for raising and lowering the latter.

As shown in Figure 6, the side of the tubular receiver 14 toward the tubing center line 13 is longitudinally grooved, as at 28, to accommodate large diameter tools, not shown, such as swabs, when the latter are raised and lowered through the well tubing. The full opening diameter of the tubing is shown by means of dotted lines 29. During certain operations requiring full opening, the inwardly inclined large diameter gas lift valve 16 is removed and a cylindrical blank 30 is installed in the receiver 14. The cylindrical blank 30, sometimes referred to as a dummy, includes a nose 31 of the same diameter as the nose 15 heretofore described, together with a relatively short cylindrical body 32 of larger diameter on the upper end thereof. A suitable latch assembly 33 is secured to the upper end of the cylindrical body 32, and the latch shown is also the same as described in connection with my copending application, Serial No. 431,211, filed May 20, 1954. An arcuate lug 34 is provided in the inner surface of the latching section 20 for engaging the latch assembly 33, and which lug is below the previously described latching lug 24. As in connection with the nose 15 for the valve assembly 16, the dummy nose 31 includes ring seals $31a$ above and below the mandrel inlets 18 when the blank is in place.

In operation, any desired number of mandrels 10 are installed in a string of tubing in a well. Each valve assembly 16 to be installed is lowered through the tubing by means of a wire line, and the nose 15 is laterally shifted, lowered and secured in the tubular receiver 14 where it is held in place by means of the latch assembly 25. Thus, the valve 16 is in operating position until the same is removed by means of a wire line. Reference

is made to Patent No. 2,664,162 for valve installation and removal operations, and which reference is exemplary and does not comprise a limitation in the present description.

When full opening operations are required, such as swabbing, the valve or valves 16 are removed and the cylindrical blanks 30 are installed in place thereof, thus closing the ports 18 in the mandrel or mandrels 10.

By reason of the described mandrel construction, the individual mandrels 10 may be relatively short and of small diameter. Additionally, the described mandrels of cylindrical cross section are capable of withstanding high hydraulic and pneumatic pressures. Also, as pointed out in the foregoing, such construction does not cost as much to make as those having elliptical or similar transverse cross sections.

The invention is capable of variations by those versed in the art, and which variations may be within the scope of the appended claims.

What is claimed is:

1. In a well tubing, a flow control device receiving tubing section including a laterally offset portion, a tubular receiver within said offset portion including means communicating the interior of the tubular receiver with the exterior of said section, a flow control device adapted to be lowered into said receiving section or raised therefrom, including a body portion containing valve mechanism, and a nose portion of less diameter than the body portion adapted to fit within the tubular receiver, and port means communicating said first named port means with said valve mechanism, the internal diameter of the receiver being of such size as to snugly receive the nose portion of the flow control device.

2. In combination with a tubing in a well, a flow control device and a receiving section therefor as defined in claim 1, the construction wherein the side of said tubular receiver adjacent the axial center of said tubing is grooved to provide bypass means equal to the inside diameter of said tubing.

3. In combination with a tubing in a well, a flow control device receiving section, and a tubular receiver within the latter as defined in claim 1, the construction wherein an elongated guide arcuate in cross section is provided in said section above said tubular receiver, and wherein the side of said guide adjacent the axial center of said tubing is open.

4. In combination with a tubing in a well, a flow control device receiving section connected with said tubing and including a laterally offset portion therein, a tubular receiver within said offset portion and including means communicating the interior of said tubular receiver with the exterior of said section, a flow control device adapted to be lowered into said receiving section or raised therefrom including a body containing a valve mechanism, a cylindrical nose on one end of said body adapted to be received within said tubular receiver, the diameter of said nose being less than the greatest transverse dimension of said body and including port means therein communicat-

ing the first said means with said valve mechanism and the internal diameter of the receiver being of such size as to snugly receive the nose portion, and coacting latching means carried by the flow control device and receiving section respectively for securing the flow control device in said receiver.

5. A receiving section for a flow control device having a body portion and a reduced nose portion, said receiving section comprising aligned end portions adapted to be connected with aligned upper and lower lengths of well tubing, an enlarged intermediate portion partially offset laterally from the end portions, and a tubular receiver located within the lower offset portion adapted to receive the reduced nose portion only of the flow control device, and an arcuate guide in the offset portion of the receiving section above the tubular receiver adapted to accommodate the body portion of the flow control device.

6. A receiving section as set forth in claim 5, wherein the receiving section includes an internal shoulder for engaging latch means carried by the flow control device.

7. A receiving section as set forth in claim 5, wherein a plurality of arcuate guides are provided in the offset portion of the receiving section to accommodate the body portions of flow control devices of different lengths.

8. A receiving section as set forth in claim 7 having a plurality of internal shoulders at different levels corresponding in number with the number of arcuate guides, and each adapted to engage latch means carried by a flow control device.

9. A receiving section for a flow control device having a body portion and a reduced nose portion, said section comprising aligned end portions adapted to be connected with aligned upper and lower lengths of well tubing, an enlarged intermediate portion partially offset laterally from the end portions, and a tubular receiver located within the offset portion and adapted to receive the reduced nose portion only of a flow control device, said tubular receiver being open at its ends and having a substantially continuous wall portion, the internal diameter of the receiver being reduced at its upper and lower ends and thereby adapted to fit the nose portion of the control device and to prevent access to the enlarged body portion thereof and being enlarged intermediate its reduced portions to provide an annular recess for surrounding the nose portion of the flow control device when the same is positioned within said receiver, said receiver being apertured at its recessed portion to provide access between the recessed portion and the exterior of the section, and an arcuate guide in the offset portion of the receiving section above the tubular nose receiver adapted to accommodate the body portion of the flow control device.

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