Sept. 26, 1967 W. D. WERNER 3,343,604

APPARATUS AND METHOD OF RUNNING MULTIPLE TUBING STRINGS

Filed Oct. 22, 1965 2 Sheets-Sheet 1

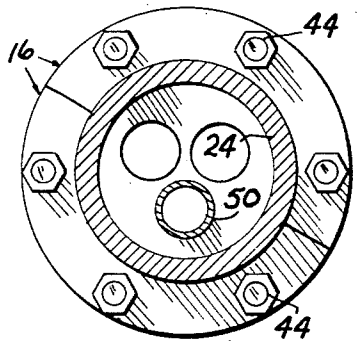


FIG. 4

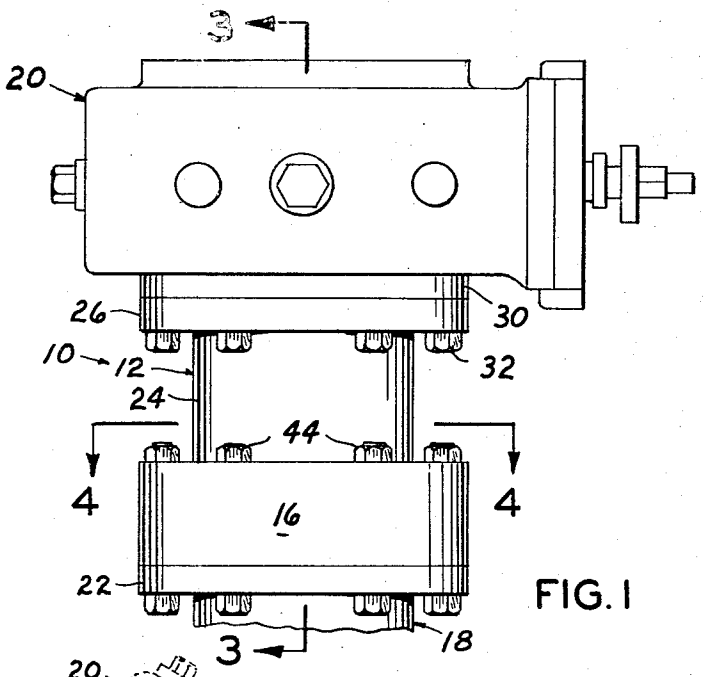


FIG. 1

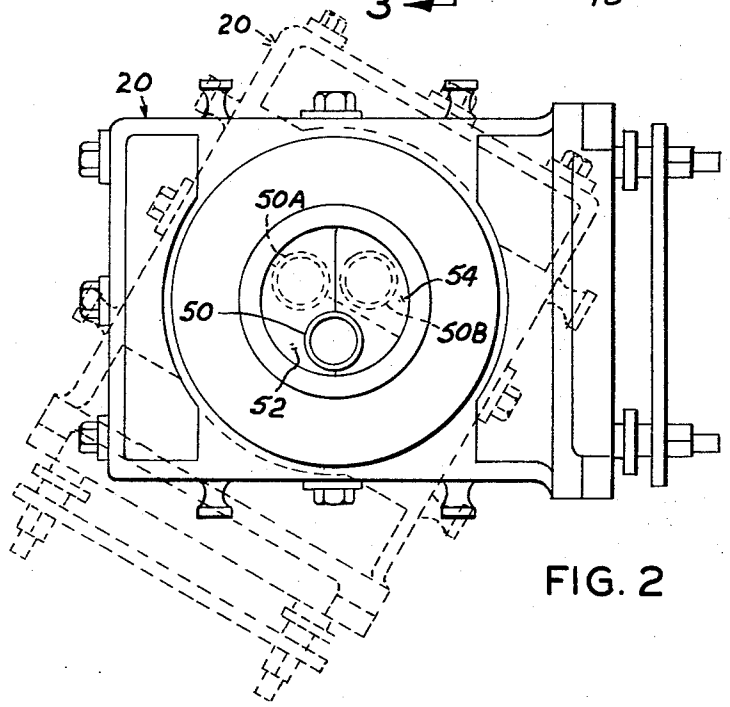


FIG. 2

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APPARATUS AND METHOD OF RUNNING MULTIPLE TUBING STRINGS

Filed Oct. 22, 1965 2 Sheets-Sheet 2

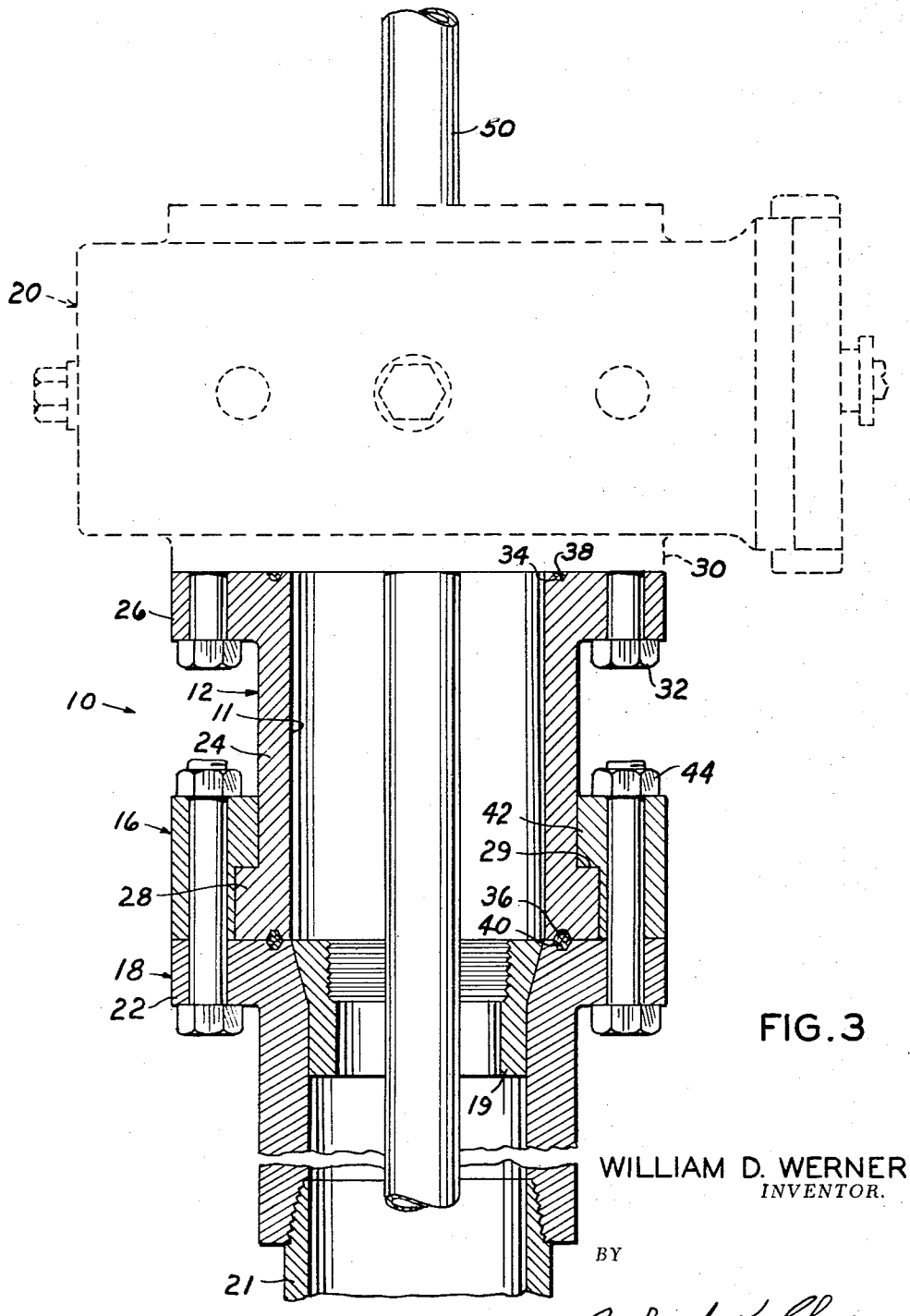


FIG. 3

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APPARATUS AND METHOD OF RUNNING MULTIPLE TUBING STRINGS

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3 Claims. (Cl. 166—46)

The present invention is an improvement over an application filed in the United States Patent Office by Paul J. Raymond on Nov. 29, 1963, Ser. No. 326,853, now abandoned, for Tubing String Positioning Connector Spool.

The present invention relates to an improvement in completing oil wells and more particularly to an apparatus and method for running multiple production tubing strings in an oil well.

Some oil wells produce separately from more than one oil bearing formation. This is accomplished by running two or more tubing strings into the well casing in parallel rather than concentric relation wherein each tubing string produces oil from a different formation. In low pressure or dead wells these tubing strings can be run separately but where a multiple zone builds up pressure and starts flowing while running tubing it has generally been necessary to kill the well before installing tubing. In running tubing in such a well a blowout preventer having off-set rams is normally connected to the tubing head above the casing through which the first string of tubing may be run but after running and landing the first tubing string in position the blowout preventer must be disconnected from the tubing head and horizontally rotated in order to position its rams so that a second or third string of tubing may be run. This changing of the position of the blowout preventer requires considerable time due to the size and mass of the blowout preventer and during the time the blowout preventer is disconnected, the well is open or in other words no control means is connected with the well to stop an oil or gas flow in the event that formation pressures starts a flow of oil or gas through the first run tubing string or the casing.

It is, therefore, the principal object of this invention to provide a well completing apparatus and method for running multiple tubing strings in series so that the well may be shut in by the blowout preventer at any time during the installation of one or more tubing strings.

Another object of this invention is to provide a connector spool which may be interposed between a tubing supporting head and a blowout preventer which permits horizontal rotative movement of the blowout preventer about the vertical axis of the casing for running successive tubing strings.

Still another object is to provide a device of this class which may be released for horizontal rotation of the connected blowout preventer about the vertical axis of the casing without the removal of any connecting bolts or nuts.

Still another object is to provide a device of this class wherein mating parts of the device effect a fluid tight seal with adjacent parts.

Yet another object is to provide a method and means for running multiple parallel tubing strings separately or in series into a well while maintaining the well under control.

The present invention accomplishes these and other objects by providing a spool type connector which is interposed between a conventional tubing hanger head and a blowout preventer wherein the connector permits horizontal rotation of the blowout preventer with respect to the tubing head.

Other objects will be apparent from the following description when taken in conjunction with the accompanying two sheets of drawings, wherein:

FIGURE 1 is a side elevational view of the connector in operative position between a blowout preventer and a tubing head;

FIGURE 2 is a top plan view of FIG. 1;

FIGURE 3 is a vertical cross-sectional view, to a larger scale, taken substantially along the line 3—3 of FIG. 1; and,

FIGURE 4 is a horizontal cross-sectional view taken substantially along the line 4—4 of FIG. 1.

Like characters of reference designate like parts in those figures of the drawings in which they occur.

In the drawings:

The reference numeral **10** indicates the device, as a whole, which is tube-like in general configuration and includes a spool-like body portion **12** having a split ring member **16** surrounding its depending end portion. The device **10** is provided with a central bore or opening **11** coaxially interposed between a conventional tubing head **18** and a blowout preventer **20**. The diameter of the opening **11** is substantially equal to or greater than the inside diameter of the tubing head and well casing **21**. The tubing head **18** is of the multiple opening type which supports two or more parallel tubing strings by conventional slips or a multiple opening tubing hanger means or mandrel **19**. The head **18** is connected to the upper end portion of the well casing **21**, in a conventional manner. The tubing head includes an upper annular flange portion **22**.

The body or spool portion **12** is supported by the tubing head **18** and includes a central tubular section **24** provided with upper and lower annular flanges **26** and **28** at its respective ends. The lower flange **28** forms an upwardly facing annular shoulder **29**. Diametrically the depending flange **28** is smaller than the tubing head flange **22** upon which it rests in face to face contact. The upper flange **26** is secured to a depending flange **30** of the blowout preventer by bolts **32** in a conventional manner. The respective upper and lower face surfaces of the flanges **26** and **28** are provided with concentric annular grooves or recesses **34** and **36**, respectively, for receiving sealing rings or packing **38** and **40**, respectively, to effect a seal between the end surfaces of the flanges **26** and **28** with the tubing head flange **22** and the blowout preventer flange **30**.

The vertical height of the ring **16** is substantially greater than the thickness of the lower flange **28** and the ring **16** is provided with an inwardly projecting annular flange or lip portion **42** which overlaps the annular shoulder **29**. The ring **16** is connected to the tubing head flange **22** by bolts and nuts **44**. The spacing of that portion of the ring **16** between the lip **42** and its depending end surface is such that when the bolts **44** are tightened the lip **42** grips the shoulder **29** for the reasons readily apparent. The inside diameter of the ring and lip **42**, with respect to the outside diameter of the tubular section **24** and the lower flange **28**, permits the body **12** to be rotated within the ring **16** as described hereinbelow.

Operation

In operation the device **10** is interposed between and connected to the tubing head **18** and blowout preventer **20** as described hereinabove.

A first string of tubing, indicated at **50**, is run into the well and landed or supported by its upper end portion in a conventional manner by one of the openings in the tubing head hanger means **19**. As shown in FIG. 2, the blowout preventer **20** is equipped with off-set rams **52** and **54** which are normally in retracted full hole open position while running the tubing **50** but which may be moved to a closed sealing position around the periphery of the tubing **50** in the event the well starts producing oil or gas.

When the tubing **50** is landed its upper open end, not shown, temporarily is plugged and the nuts and bolts **44** are loosened. This loosens the intimate contact of the meeting surfaces of the lip **42** and shoulder **29** and permits the blowout preventer **20** to be horizontally rotated with the body **12** to the position shown by dotted lines in FIG. 2. The amount of rotation is dependent upon the number of tubing strings to be run in the well. In the example shown, three strings of tubing **50**, **50A** and **50B**, are to be run in series. The blowout preventer is consequently rotated 120° from the position shown by solid lines to position its rams **52** and **54** so that the second string of tubing **50A** may be run. The second tubing string **50A** is similarly run, landed, connected with a second opening in the hanger means **19** and temporarily plugged. Thereafter, the blowout preventer **20** is horizontally rotated another 120° to position its rams for receiving and passing the third string of tubing **50B**. Thus it may be seen that the device **10** permits a horizontal rotating ram positioning movement of the blowout preventer while maintaining the well under control by the blowout preventer at all times while running parallel multiple tubing strings in series. After the third tubing string **50B** has been run and landed, the blowout preventer **20** and device **10** are disconnected from the tubing head **18** by removing the split ring **16**. Thereafter conventional oil and gas production control connections or fittings, not shown, are connected with the tubing head **18**.

Obviously the invention is susceptible to some change or alteration without defeating its practicability, and I therefore do not wish to be confined to the preferred embodiment shown in the drawings and described herein, further than I am limited by the scope of the appended claims.

I claim:

1. A method of maintaining a well equipped with a casing and a tubing head under pressure control while parallel tubing strings are being run, comprising: running a first tubing string into said well through a blowout preventer and a connector spool coaxially connected with said tubing head; landing said first tubing string in said well by connecting said first tubing string to a first opening of a multiple opening hanger means in said tubing head; temporarily plugging said first tubing string; horizontally rotating said blowout preventer about the vertical axis of said casing and said tubing head so that the opening is aligned with a second opening in said multiple opening hanger means; running a second tubing string into said well through said blowout preventer, said connector spool and said second opening; landing said second tubing string in said well by connecting said second tubing string to the second opening in said tubing hanger means; temporarily plugging said second tubing string; and removing said blowout preventer and said connector spool from said tubing head.

2. A method of maintaining a well equipped with a casing and a tubing head under pressure control while parallel tubing strings are being run, comprising: running a first tubing string into said well through a blowout preventer, having rams provided with an off-set opening, and a connector spool coaxially connected with said tubing head; landing said first tubing string in said well by connecting said first tubing string to a first opening of a multiple opening hanger means in said tubing head; temporarily plugging said first tubing string; horizontally rotating said blowout preventer about the vertical axis of said casing and said tubing head so that the off-set opening in said rams is aligned with a second opening in said multiple opening hanger means; running a second tubing string into said well through said blowout preventer, said connector spool and said second opening; landing said second tubing string in said well by connecting said second tubing string to the second opening in said tubing hanger means; temporarily plugging said second tubing string; and removing said blowout preventer and said connector spool from said tubing head.

3. In an apparatus for positioning and running multiple parallel tubing strings in a well having a casing and a tubing head, said tubing head having a multiple opening hanger means, the combination of: a blowout preventer, said blowout preventer having rams provided with a tubing string receiving and passing opening off-set with respect to the vertical axis of said casing; and a connector spool connected to said blowout preventer and coaxially interposed between said blowout preventer aud said tubing head, said connector spool comprising a tubular section having a flanged lower end forming an upwardly facing annular shoulder, the lower surface of said flanged end flatly contacting said tubing head, a split ring surrounding the lower flanged end of said tubular section and connected with said tubing head, said split ring having an inwardly projecting lip overlapping said annular shoulder, whereby said blowout preventer and the tubular section of said conncetor spool may be horizontally rotated about the vertical axis of said casing to successively align the off-set opening in said rams with the openings in said multiple opening hanger means.

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