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BACK CIRCULATING VALVE

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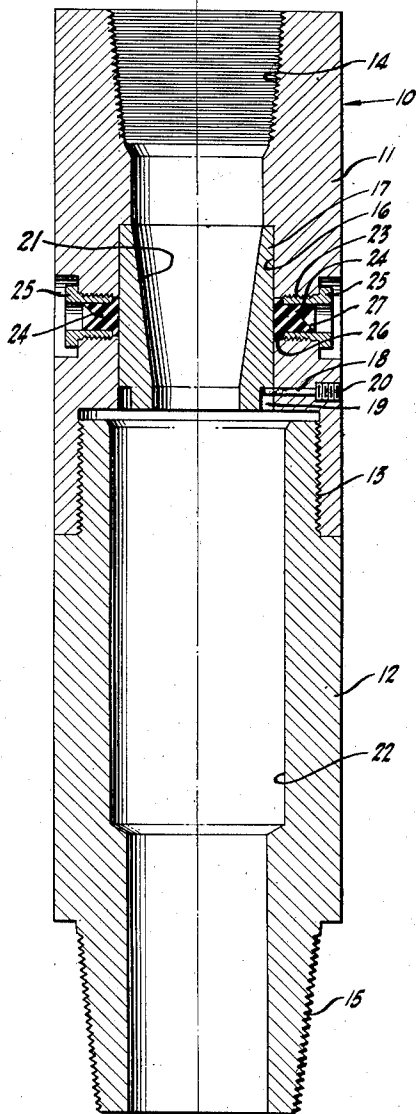


FIG-1

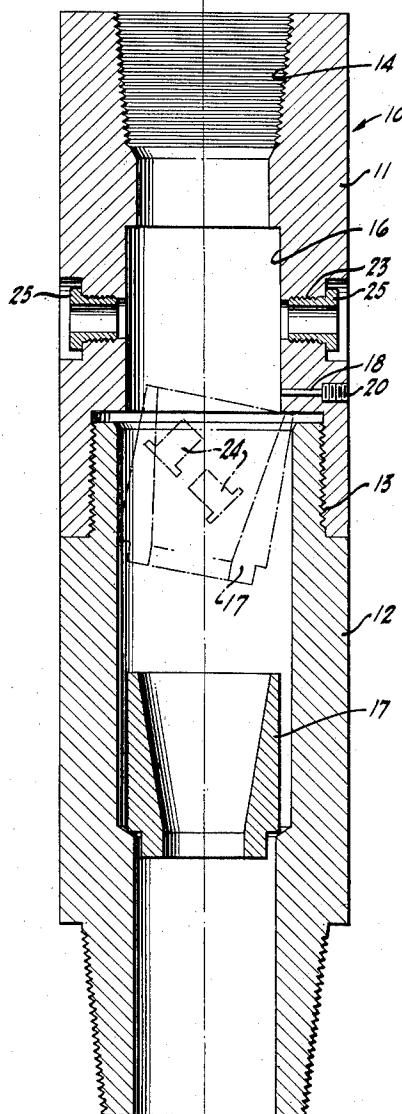


FIG-2

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## BACK CIRCULATING VALVE

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7 Claims. (Cl. 166—224)

This invention relates to an oil well tool. More particularly, the invention relates to a back circulating valve adapted to be inserted in a well string.

In oil well production practice, it is necessary at various times to circulate drilling mud or other fluid down the annular space between a well string and a casing or well bore, through a valve in the well string and up through the well string. Sometimes this reverse circulation is performed to back scuttle gas and oil under control from the well string; for instance, to eliminate a fire hazard. Also, sometimes during the pulling of a well string, it is necessary to reverse circulate to maintain control over the well which may get somewhat out of control for various reasons; for example, because the hydrostatic head in the well drops due to the removal of the well string from the region of the well fluid, allowing high pressure areas previously controlled by the hydrostatic head to get somewhat out of control.

Various other back circulating valves are available but, in general, these have been operable only when the well string was bottomed or set in the well by means of a packer or slips or the like, these valves being operable by relative rotational or longitudinal movement between the lower portion of the well string which is fixed in the well and carries one part of the valve, and the upper free portion of the well string which carries the other part of the valve.

When the necessity for reverse circulation arises, the back circulation valve must be opened quickly to enable immediate control over the well to avoid damage and waste. In many instances there is not time, nor is it practical or in some cases possible, to reset a packer or again bottom the well string to enable opening of a back circulation valve.

It is therefore the principal object of this invention to provide a reverse circulating valve adapted to be connected between sections of well string, which valve can be opened when the well string is off bottom without setting a packer or similar device.

A preferred form of the invention is described in the following detailed specification and illustrated by way of example in the accompanying drawings, wherein:

Fig. 1 illustrates a sectional view of a valve embodying the principles of the invention, the valve being shown in its closed position.

Fig. 2 is a similar view of the valve shown in Fig. 1 and illustrates the valve after it has been opened.

Referring now to the drawings, 10 indicates generally a tubular valve sub comprising upper and lower sections 11 and 12, respectively, threadedly connected together as indicated at 13. The upper end of the valve sub 10 is provided with a threaded box 14 and the lower end with a pin 15 to facilitate the insertion of the valve sub into a well string.

The lower end of the upper section 11 is counterbored as shown at 16 and a sleeve 17 is slidably received in said counterbore and retained therein by a shear pin 18 ex-

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tending inwardly from the wall of the section 11 into an annular notch 19 cut into the lower outer edge of the sleeve 17. A pipe plug 20 is threaded into the outer surface of the tubular section 11 behind the shear pin 18 to retain said pin in position. The sleeve 17 has a downwardly and inwardly tapered inner surface 21 for purposes hereinafter described. The tubular bore 22 in the lower section 12 is slightly larger in diameter than the counterbore 16 in the upper section 11.

The upper section 11 is provided with a plurality of radially extending ports 23 adjacent the counterbored portion thereof. A sealing plug 24 of rubber or other suitable elastic material is held in each of the ports 23 by a tubular seal retainer 25 which surrounds the plug 24 and is threaded into said port 23. Each of the plugs 24 has an external annular flange 26 which is confined between the tubular seal retainer 25 and the sleeve 17. Each of the plugs 24 has a conical depression 27 formed in its outer end.

In the use of the device, the elements are assembled in the manner shown in Fig. 1 and the sub is inserted into a well string. As the well string is lowered, the hydrostatic pressure acting on the outer end of the plugs 24 tends to force the plugs inwardly and because of the conical depression 27 tends to expand the plug outwardly into tight sealing engagement with the retainer 25.

When it is desired to open the ports 23 to permit back circulation, a suitable sinker bar (not shown) is dropped through the string. When the bar reaches the valve, suitable projections thereon contact the tapered surface 21 of the sleeve 17 and force the sleeve downwardly into the larger bore 22 in the lower sub section 12 breaking the shear pin 18.

When the sleeve 17 is moved downwardly out of the way, the pressure surrounding the well string forces the plugs 24 inwardly out of the ports 23 to permit circulation therethrough. Since the sleeve 17 is of smaller external diameter than the bore 22 in the lower sub section 12, the sleeve 17 will tilt therein and is thereby prevented from re-entering the counterbore 16 and interfering with the flow through the ports 23 in the manner shown in the dot-dash lines in Fig. 2.

While I have shown and described the preferred form of my invention, it is obvious that various changes may be made in its construction by those skilled in the art, without departing from the spirit of the invention as defined in the appended claims.

Having thus described my invention, what I claim and desire to secure by Letters Patent is:

1. A back circulating apparatus comprising a tubular sub adapted to be inserted in a well string, said sub having a smaller diameter portion and an enlarged diameter portion therebelow defining a downwardly facing shoulder therebetween, a sleeve slidably mounted in said smaller diameter portion, releasable means normally retaining said sleeve in said smaller diameter portion, at least one lateral port in said sub adjacent said sleeve, and a substantially cylindrical plug of elastic material in each port, the inner end of each plug being against said sleeve, said sleeve being movable downwardly into said enlarged diameter portion and prevented from re-entry into said smaller diameter portion by engagement with said downwardly facing shoulder.

2. A back circulating apparatus comprising a tubular sub adapted to be inserted in a well string, a sleeve mounted in said sub, releasable means normally retaining said sleeve in its uppermost position in said sub, a plurality of lateral ports in said sub adjacent the sleeve, a cylindrical plug of elastic material in each of said ports, the inner end of each of said plugs being against said sleeve, and a conical depression formed in the outer end of each of said plugs.

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3. A back circulating apparatus comprising a tubular sub adapted to be inserted in a well string, said sub having a smaller internal diameter portion and a slightly larger diameter portion therebelow defining a downwardly facing shoulder therebetween, a sleeve slidably mounted in said smaller diameter portion, said sleeve having an upper shoulder, releasable means for normally retaining said sleeve in said smaller diameter portion, a plurality of lateral ports in said smaller diameter portion opposite said sleeve, and a substantially cylindrical plug of elastic material retained in each of said ports to seal the same while the inner end of each of said plugs bears against said sleeve, said sleeve being slidable into said larger diameter portion to unseal said ports and retained therein by engagement of said shoulders.

4. A back circulating apparatus comprising a tubular sub adapted to be inserted in a well string, said sub having a smaller internal diameter portion and a slightly larger diameter portion therebelow defining a downwardly facing shoulder therebetween, a sleeve mounted in said smaller diameter portion and movable into said larger diameter portion, said sleeve being prevented from reentry into said smaller diameter portion by engagement with said downwardly facing shoulder, a plurality of lateral ports in said smaller diameter portion opposite said sleeve, a cylindrical plug of elastic material in each of said ports to seal the same while the inner end of each of said plugs bears against said sleeve, said sleeve being slidable into said larger diameter portion to uncover said ports and retained therein by engagement of said shoulders, and a conical depression formed in the outer end of each of said plugs.

5. A back circulating apparatus comprising a tubular sub adapted to be inserted in a well string, said sub having a smaller internal diameter portion and a slightly larger diameter portion therebelow, a sleeve mounted in said smaller diameter portion and slidable into said larger diameter portion, releasable means for normally retaining said sleeve in said smaller diameter portion, a plurality of lateral ports in said sub adjacent said sleeve, a cylindrical plug of elastic material in each of said ports, the inner end of each of said plugs being against said sleeve, an external radial flange adjacent the inner end of each of the plugs, and a tubular seal retainer surrounding each of said plugs and threaded into said ports, said retainers

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being adapted to confine said plug flanges between said retainers and said sleeve to seal said ports until said sleeve slides into said larger diameter portion.

6. A back circulating apparatus comprising a tubular sub adapted to be inserted in a well string, said sub having a smaller internal diameter portion and a slightly larger diameter portion therebelow defining a downwardly facing shoulder therebetween, an upwardly facing shoulder at the lower end of said enlarged diameter portion, a sleeve slidably mounted in said smaller diameter portion and movable into said larger diameter portion, said sleeve having upper and lower shoulders engageable with said downwardly and upwardly facing shoulders for retention in said larger diameter portion, releasable means for normally retaining said sleeve in said smaller diameter portion, a plurality of lateral ports in said sub adjacent said sleeve, a cylindrical plug of elastic material in each of said ports, the inner end of each of said plugs being against said sleeve, an external radial flange adjacent the inner end of each of the plugs, a tubular seal retainer surrounding each of said plugs and threaded into said ports, said retainers being adapted to confine said plug flanges between said retainers and said sleeve, and a conical depression formed in the outer end of each of said plugs, whereby said plugs seal said ports until said sleeve slides into said larger diameter portion.

7. A back circulating apparatus comprising a tubular sub adapted to be inserted in a well string, said sub having a smaller diameter portion and an enlarged diameter portion therebelow defining a downwardly facing shoulder therebetween, a sleeve slidably mounted in said smaller diameter portion, retarding means normally retaining said sleeve in said smaller diameter portion, at least one lateral port in said sub adjacent said sleeve, and a plug of elastic material in each port, the inner end of each plug being against said sleeve, said sleeve being movable downwardly into said enlarged diameter portion and prevented from re-entry into said smaller diameter portion by engagement with said downwardly facing shoulder.

#### References Cited in the file of this patent

#### UNITED STATES PATENTS

|           |               |               |
|-----------|---------------|---------------|
| 2,185,522 | Rollins       | Jan. 2, 1940  |
| 2,630,865 | Baker         | Mar. 10, 1953 |
| 2,645,288 | Deters et al. | July 14, 1953 |