

[54] **SLIDING SLEEVE ASSEMBLY FOR A HYDRAULICALLY SET WELL PACKER**

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[52] U.S. Cl. .... **166/120, 166/179, 166/224**  
 [51] Int. Cl. .... **E21b 23/06, E21b 33/12**  
 [58] Field of Search ..... **166/120, 141, 179, 224**

[56] **References Cited**

**UNITED STATES PATENTS**

3,115,188	12/1963	Cochran et al. ....	166/224
3,151,681	10/1964	Cochran .....	166/224
3,115,187	12/1963	Brown .....	166/224
3,180,419	4/1965	Cochran et al. ....	166/120

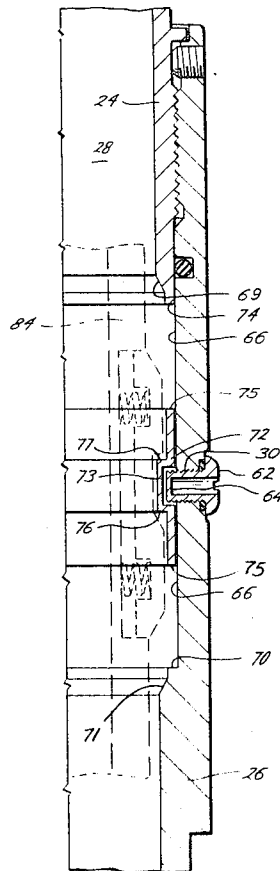
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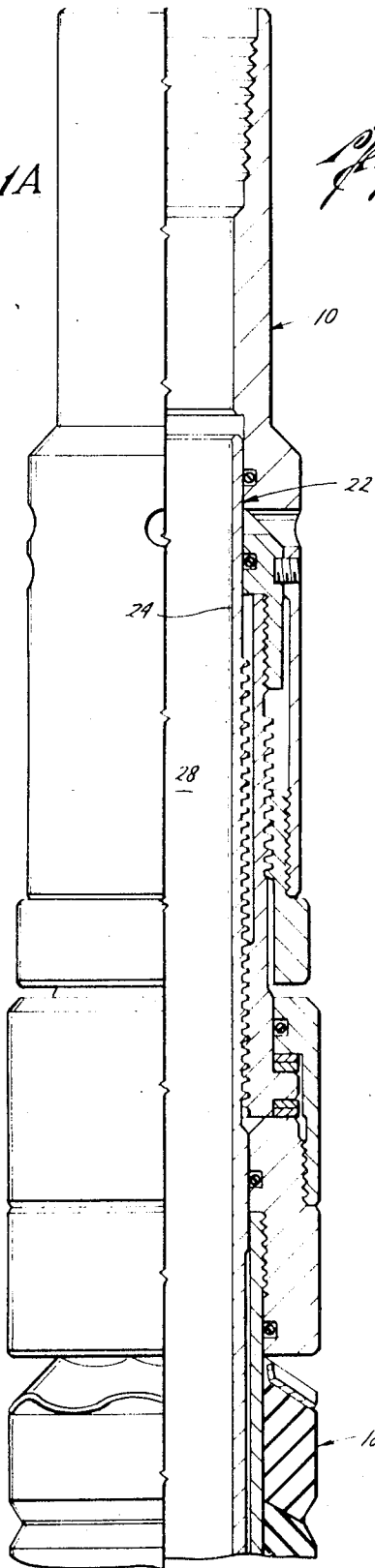
[57] **ABSTRACT**

A sliding sleeve assembly for opening the setting port of a hydraulically set well packer which may be positioned for actuation in either an upwardly or downwardly direction. A shearable plug initially blocking the setting port and positioned in an elongate recess in the packer which extends equal distances on either side of the setting port with a shoulder at each end of the recess and a sliding sleeve telescopically positioned in the recess and in engagement with the plug whereby when the sleeve is longitudinally moved the plug is sheared. The sleeve including two actuation shoulders facing in opposite directions for moving the sleeve in either direction. The shoulders at the ends of the recess being tapered for retracting a setting tool after the sleeve is shifted in the recess.

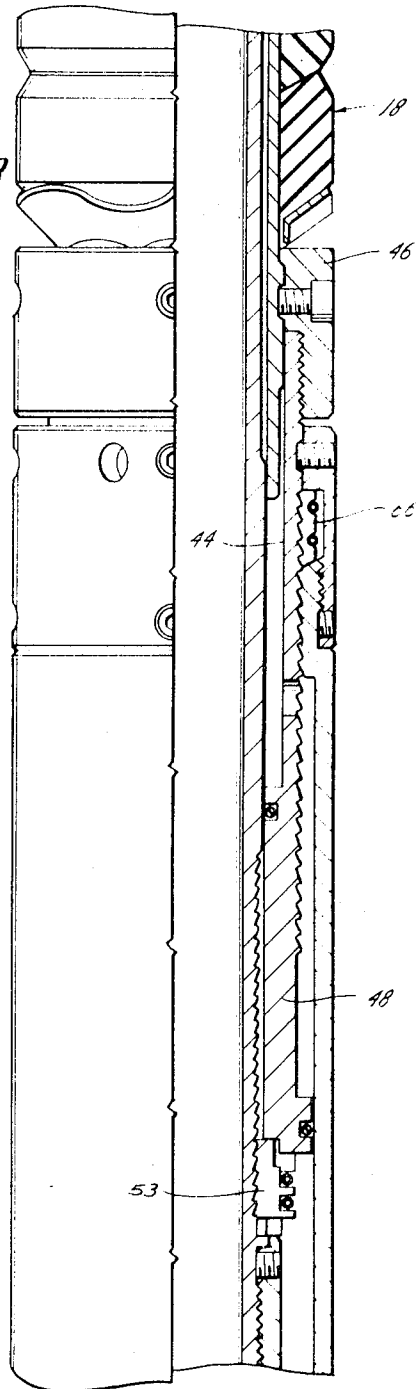
**5 Claims, 6 Drawing Figures**



*Fig. 1A*



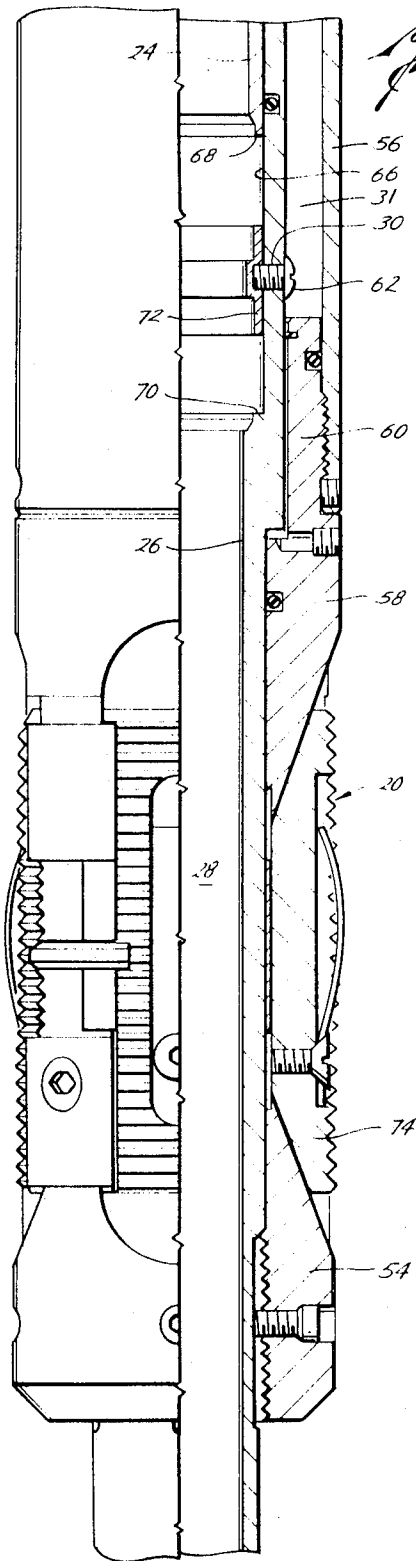
*Fig. 1B*



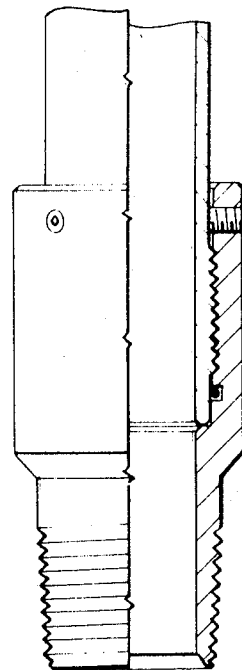
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*Fig. 1C*

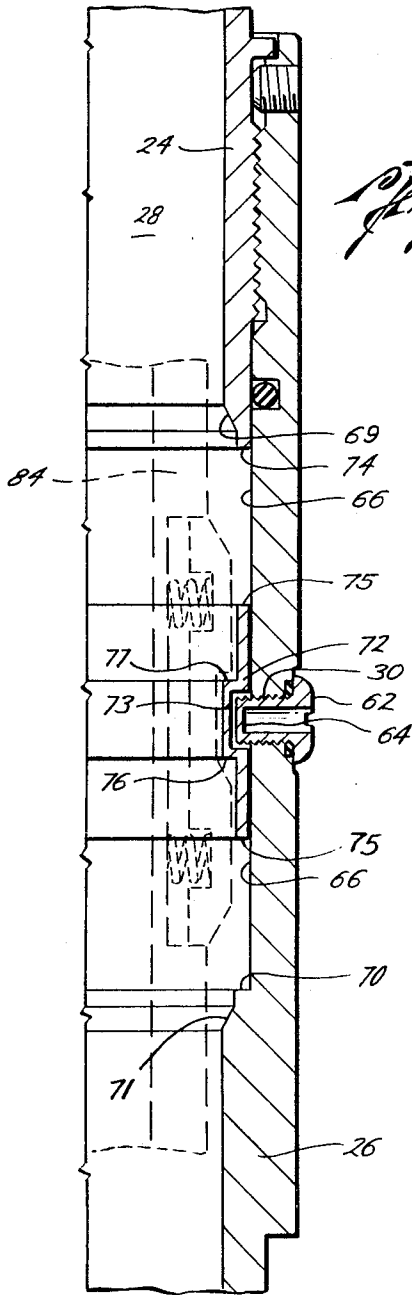


*Fig. 1D*

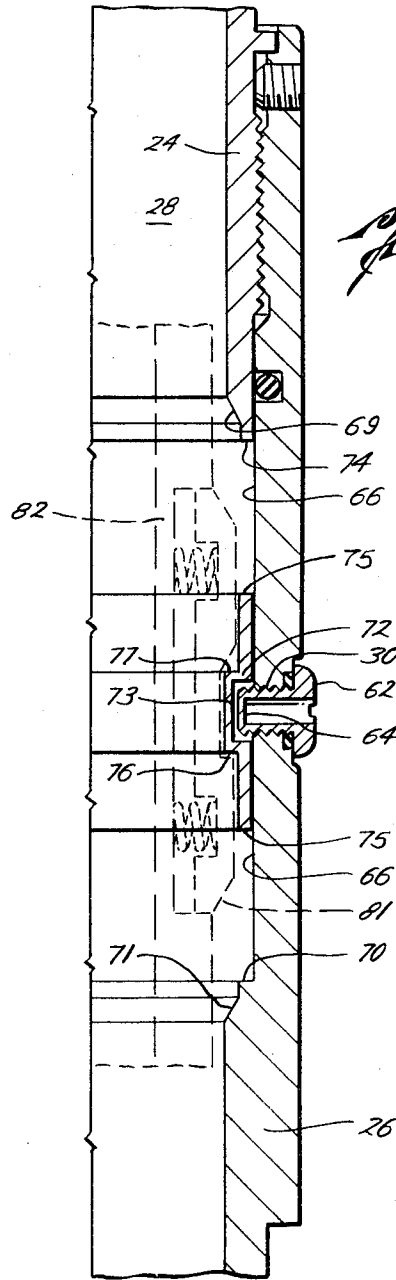
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*Fig. 3*



*Fig. 2*

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## SLIDING SLEEVE ASSEMBLY FOR A HYDRAULICALLY SET WELL PACKER

### BACKGROUND OF THE INVENTION

Hydraulically set well packers, such as shown in U.S. Pat. No. 3,456,723, are old. And the use of sliding sleeves initially covering the setting port in order to prevent premature setting of the packer, such as when packers are used in tandem spaced one below another, is old. However, for various reasons, it may be preferred to actuate the sliding sleeve by either an upward movement or a downward movement. In the past, this has required separate packers depending upon the mode of actuation desired.

The present invention is directed to the improvement in a sliding sleeve assembly which may be positioned in the packer and actuated in either an upwardly or downwardly position as desired whereby a single packer model may be used regardless of the mode of actuation.

### SUMMARY

The present invention is directed to an improvement in a sliding sleeve assembly for opening of the setting port of a hydraulically set well packer which may be positioned in the packer and actuated in either an upwardly or downwardly direction.

Another object of the present invention is the provision of a sliding sleeve assembly having a shearable plug initially blocking the setting port and an elongate recess in the packer body extending an equal distance on either side of the setting port with a shoulder at each end of the recess with a sliding sleeve telescopically positioned in the recess and in engagement with the plug whereby when the sleeve is longitudinally shifted the plug is sheared opening the setting port.

A still further object of the present invention is the improvement of a reversible sliding sleeve assembly wherein the sleeve includes two actuation shoulders positioned on the sleeve but facing in opposite directions for moving the sleeve in either direction.

A further object of the present invention is the improvement of a reversible setting sleeve assembly wherein the shoulders at the end of the recess include tapered surfaces retracting the setting sleeve after the sleeve has been shifted and the plug sheared.

Other and further features and advantages will be apparent from the description of the structure and operation of the present invention.

### BRIEF DESCRIPTION OF THE DRAWINGS

FIGS 1A, 1B, 1C and 1D are fragmentary elevational views, partly in cross section, illustrating one type of hydraulically set well packer utilizing the present invention which drawings are a continuation of each other,

FIG. 2 is an enlarged fragmentary elevational view, in cross section, showing the reversible sliding sleeve assembly of the present invention in position for actuation by upward movement, and

FIG. 3 is an enlarged fragmentary cross-sectional view of the reversible sliding sleeve assembly of the present invention in position for actuation in a downward direction.

### DESCRIPTION OF THE PREFERRED EMBODIMENT

The present invention will be described, for convenience only, as applied to the hydraulic set packer described in U.S. Pat. No. 3,456,723 although it is to be understood that the present invention may be utilized in any suitable hydraulic set type packer.

Referring now to the drawings, and particularly to FIGS. 1A through 1D, the packer of the present invention is generally indicated by the numeral 10. The packer 10 includes the usual packer seal means generally indicated by the numeral 18 and a slip assembly generally indicated by the numeral 20, both of

which are shown in their retracted positions. The packer 10 also includes a mandrel 22, which for convenience includes an upper portion 24 and a lower portion 26 secured together, and internal passageway 28 in communication with a running in string (not shown) for receiving hydraulic fluid to set the packer and includes at least one setting port 30 for passage of the hydraulic pressure for setting the slip assembly 20 and the packer seal means 18.

A lower cone 54 is provided secured to the mandrel 26 and positioned against the lower end of the slips 74 of the slip assembly 20. A hydraulically actuated slip expanding means which includes slip setting sleeve 56 is provided above the slip assembly 20 and includes an upper movable slip cone 58 and a piston 60 which is exposed to hydraulic pressure in a chamber 31 which communicates with port 30 for actuation of the piston 60 for expanding the slip assembly outwardly and into engagement with a well casing (not shown).

A hydraulically actuated packer seal expanding means includes packer seal setting sleeve 44, the upper end 46 of which is positioned adjacent the bottom of the seal means 18, and the lower end of which is provided with a piston 48 and which is exposed to hydraulic pressure in the chamber 31 for movement upwardly against the packer seal means 18 for setting the seal 18.

A one-way clutch 66 is provided between the slip setting sleeve 56 and sleeve 44 and a one-way clutch 53 is provided between the sleeve 44 and the mandrel 24 allowing the slip assembly 20 to be expanded and locked in position and to allow the packer seal means 18 to be expanded and locked in the expanded position.

Thus, hydraulic pressure may be applied through the passageway 28 and through the setting port 30 and against both of the pistons 48 and 60 for allowing the slip setting sleeve 56 to move downwardly carrying the upper slip cone 58 to expand the slip assembly 20 into setting engagement and after which the seal setting sleeve 44 is moved upwardly to compress and expand the packer seal means 18 outwardly into a sealing relationship. The above named description and operation is more fully described in U.S. Pat. No. 3,456,723.

While, of course, the setting port 30 may be opened at all times if desired, a sliding sleeve means for initially blocking the port 30 may be provided to initially close the setting port 30 and after the packer is placed in position a setting or shifting tool is passed to the packer to shift the sliding sleeve to uncover the port for setting the packer. Sometimes it is desirable to move the sliding sleeve in a particular direction. For example, a stronger upward jar may be obtained for moving the sleeve upwardly than downwardly. However, if all of the sliding sleeves in a tandem installation are set for upwardly movement and the lower most packer is set first and fails to obtain a good seal, which requires the entire tandem installation to be removed, the upwardly setting shifting tool will open the ports of all of the upper packers as it is withdrawn from the tubing string, and necessitate redressing all the packers which is undesirable. This can be avoided by providing packer setting port sliding sleeves in a tandem installation which are actuated by a downward movement.

But since the prime purpose of a packer of the type described in this invention when used in tandem installations is to provide means to set and test the lowermost packer first and then set and test the second lowermost packer, etc., up the hole, a shifting tool such as an Otis Model B retractable shifting tool assembly may be utilized and provided with means to allow the tool to be initially passed downwardly through the upper packers without shifting the sliding sleeves downward but upon manipulation of the shifting tool lowering in means will activate the shifting tool into the downwardly shifting configuration. In this case, should one of the lowermost packing not set properly, the shifting tool may be withdrawn from the tubing string without disturbing the packer setting port sliding sleeves in the upper packers. However, it can be appreciated that the shifting tool for operating more than one packer sliding sleeve in a downward direction

in a sequence from the lowermost packer upward is complicated to operate. Therefore, it is desirable to have hydraulically set packers with sliding sleeves that may be actuated downwardly and some packers that are actuated by an upward shifting movement of the sleeve. In the past, it has been necessary for an operator to carry one inventory of packers which will be operable by downward movement and a second inventory of packers which are operable by an upwardly releasing sliding sleeve in order to provide packers which will be operable in the desired direction. Patent application entitled Sliding Sleeve Assembly for a Hydraulically Set Well Packer filed concurrently herewith by James H. Current discloses one type of sliding sleeve assembly which may be reversibly positioned in a packer for shifting to an open position by either upward or downward actuation.

However, it is noted that there are well conditions that could arise after the packer or packers are in place in the well bore that would make it desirous to change the direction of actuation of the sleeve. The present invention is directed to providing a sliding sleeve assembly which may be positioned in the packer for shifting to an open position by either upward or downward actuation.

Referring now to FIGS. 1C, 2 and 3, a shearable plug 62 may be provided in the setting port 30. The plug 62 is preferably hollow and thus when the plug end 64 is sheared the fluid may flow from the internal passageway 28 in the packer into the chamber 31 for actuating the packer. The internal passageway 28 of the packer includes an elongate tubular recess 66 which may be formed between the ends of mandrel sections 24 and 26. A shoulder 68 and 70 are provided at opposite ends of the recess 66 and a sliding sleeve 72 is telescopically positioned in the recess 66 for movement therein. Initially, the sliding sleeve 72 is in engagement with the shearable setting plug 62, here shown as the plug 62 being in an annular groove 73 in the sleeve 72. Thus, as the sliding sleeve 72 is shifted longitudinally, the end 64 of the setting plug 62 is sheared to open the port 30 to set the packer.

It is to be noted that the shoulders 70 and 74 at the ends of the recess 66 are both equal distance from the axis of the setting port 30. It is noted that the sleeve 72 is symmetrical about the axis of plug 62 and that ends 75 of the setting sleeve 72 are positioned a sufficient distance from the shoulders 70 or 74 at the ends of the recess 66 when the sleeve 72 is in engagement with the setting plug 62 which will permit actuation of the sleeve 72 in either direction. Thus, and referring to FIGS. 2 and 3, the setting sleeve 72 is positioned for a sliding movement in the recess 66 in a longitudinal direction, either upwardly or downwardly as desired, without requiring any change in the remainder of the packer 10.

The sliding sleeve 72 includes two actuating shoulders 76 and 77 which face in opposite directions for engagement by a shifting tool for moving the sleeve in either direction.

The shoulders 70 and 74 at the end of the recess 66 may also include tapered surfaces 69 and 71, respectively, which act on a setting tool and assist in disengaging the setting tool from the sliding sleeve 72 after the sleeve 72 has been shifted.

In use, the setting sleeve 72 may be assembled when the packer 10 is assembled in the position shown in FIGS. 2 and 3 in which the setting sleeve may be actuated by a sliding upward movement in FIG. 2, or as shown in FIG. 3 in which the setting sleeve 72 may be actuated by a downward movement.

Referring now to FIG. 2, a conventional shifting tool such as Otis Model B is shown in dotted outline as 82 which may be passed downwardly through the setting sleeve 72 and thereafter released as is conventional so that on upward movement the shifting tool 82 will engage shoulder 76 and on an upward jar will shear shearable plug 62 and the sleeve 72 will be moved upwardly opening the port 30. Upon upward shifting of the sleeve 72 fluid from the internal passageway 28 in the packer 10 will flow through the sheared plug 62 and set the packer 10. It is to be noted that when the shifting tool moves downwardly through the sleeve 72, the tapered shoulder 81 on the shifting tool will contact the upper actuat-

ing shoulder 77 but will not actuate the sleeve 72.

After the sleeve 72 shifts to an upward position, the tapered shoulder 69 will contact and retract the shifting tool 82 thereby releasing the tool 82 from the shoulder 76 on the setting sleeve 72.

The downwardly moving setting sleeve 72, as best seen in FIG. 3, is actuated by a shifting tool 84 shown in dotted outline, which may be a conventional shifting tool such as an Otis Model B, or a modification thereof, which on downward movement through passageway 28 will engage the actuating shoulder 77 on sleeve 72 and upon jarring the tool 84 the sleeve 72 will shear the setting plug 62 allowing hydraulic fluid pressure to flow from the passageway 28 through port 30 to actuate and set the packer.

Thus, the main advantage of the sliding sleeve of the present invention is that the decision as to which direction to shift the sleeve 72 can be made even after the packers are run in the well as well as after assembly.

The present invention, therefore, is well adapted to carry out the objects and attain the ends and advantages mentioned as well as others inherent therein.

What is claimed is:

1. In a hydraulically set well packer having a setting port in communication with an internal passageway, the improvement in a sliding sleeve assembly for opening the port comprising,

means initially blocking the setting port, said internal passageway including an elongate recess extending on either side of the setting port, a shoulder at each end of the recess,

a sliding sleeve telescopically positioned in the recess and in engagement with the initially blocking means whereby when the sleeve is longitudinally moved, the initially blocking means is opened, said sleeve including two actuating shoulders facing in opposite directions for engagement by a shifting tool for moving the sleeve in either direction, and

each end of the sleeve positioned a distance from the recess shoulders which will permit actuation of the sleeve in either direction.

2. The apparatus of claim 1 in which the sleeve is extended equal distances in both longitudinal directions from the port when the sleeve is in engagement with the initially blocking means.

3. The apparatus of claim 1 wherein the shoulders at the ends of the recess include tapered surfaces for retracting a setting tool after the sleeve has been shifted.

4. The apparatus of claim 1 wherein said initially blocking means is a shearable plug.

5. In a hydraulically set well packer having a setting port in communication with an internal passageway, the improvement in a sliding sleeve assembly for opening the port comprising,

a hollow shearable plug closed at one end initially blocking the setting port,

said internal passageway including an elongate recess extending equal distances on either side of the setting port, a shoulder at each end of the recess,

a sliding sleeve telescopically positioned in the recess and in engagement with the closed end of the shearable plug whereby when the sleeve is longitudinally moved, the plug is sheared opening the port,

said sleeve including two actuating shoulders extending into the internal passageway of the well packer and facing in opposite directions for engagement by a shifting tool for moving the sleeve in either direction,

each end of the sleeve positioned a distance from the recess shoulders which will permit actuation of the sleeve in either direction, and

said sleeve extending equal distance from the axis of the port whereby regardless of the position of assembly of a sleeve to the plug, the sleeve can be actuated in either direction.

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