

Aug. 15, 1967

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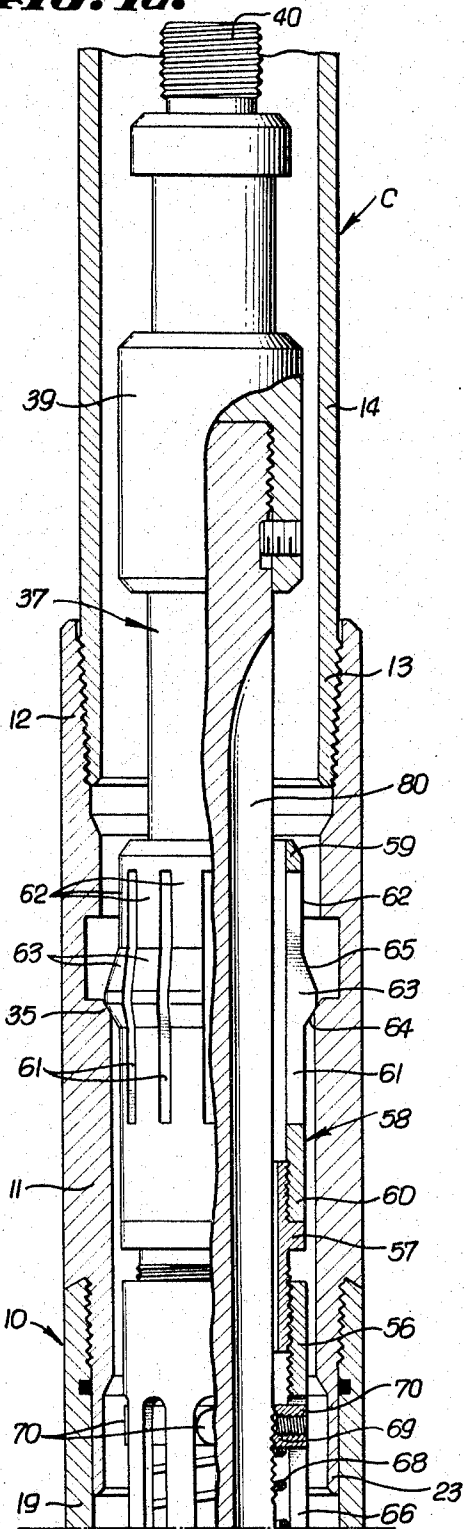
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SUBSURFACE SHIFTING APPARATUS

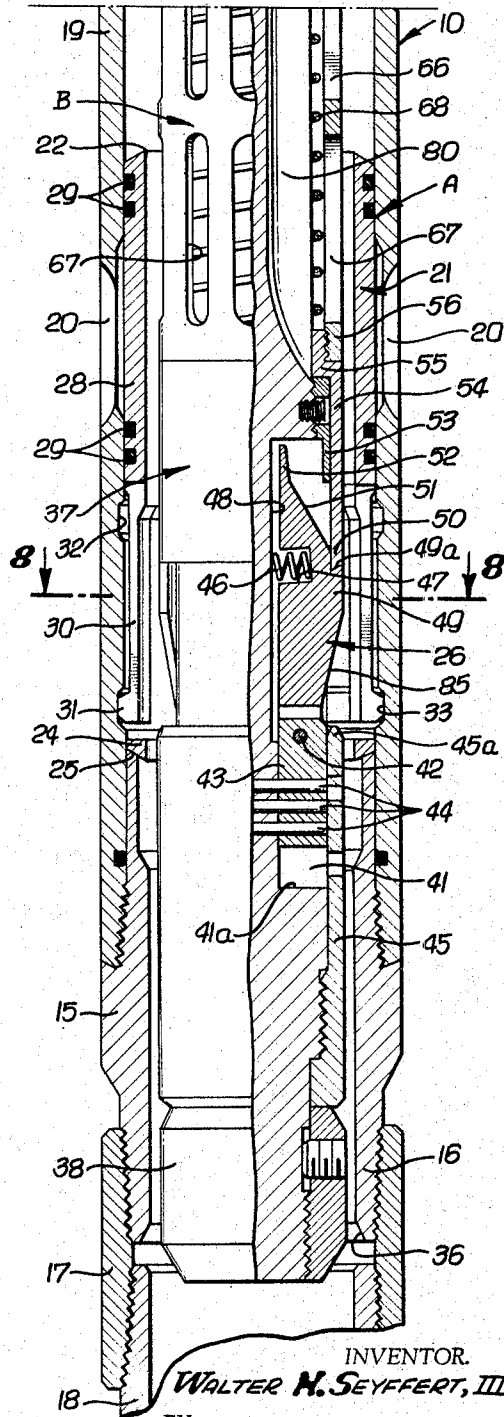
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5 Sheets-Sheet 1

**FIG. 1a.**



**FIG. 1b.**



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SUBSURFACE SHIFTING APPARATUS

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FIG. 2a.

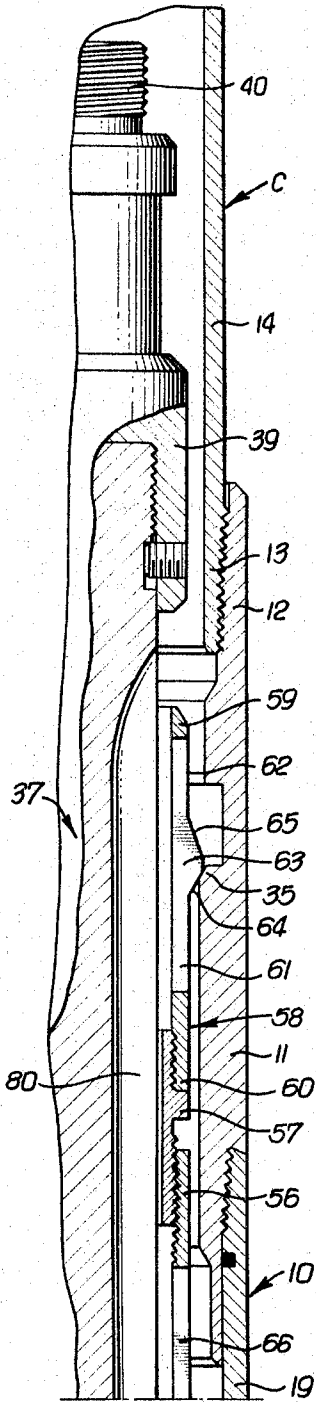


FIG. 2b.

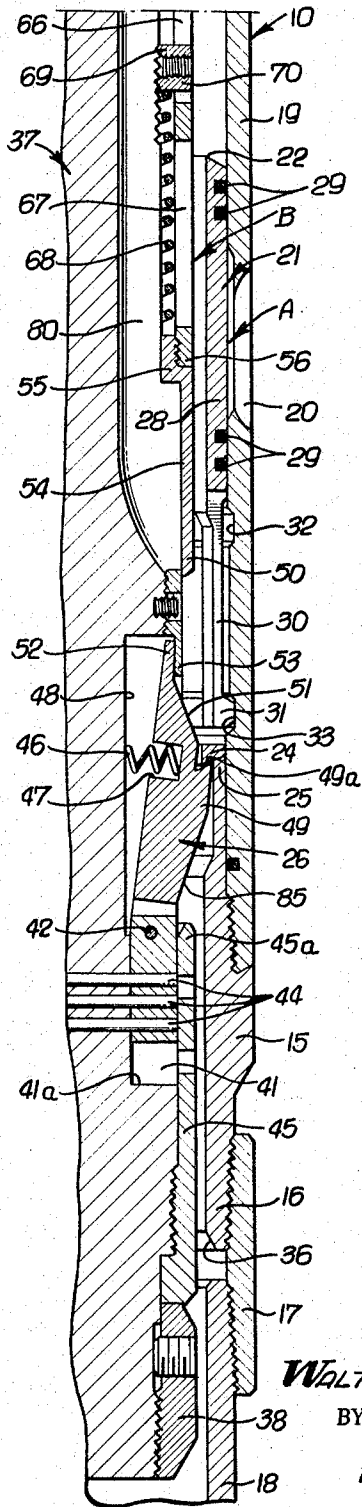
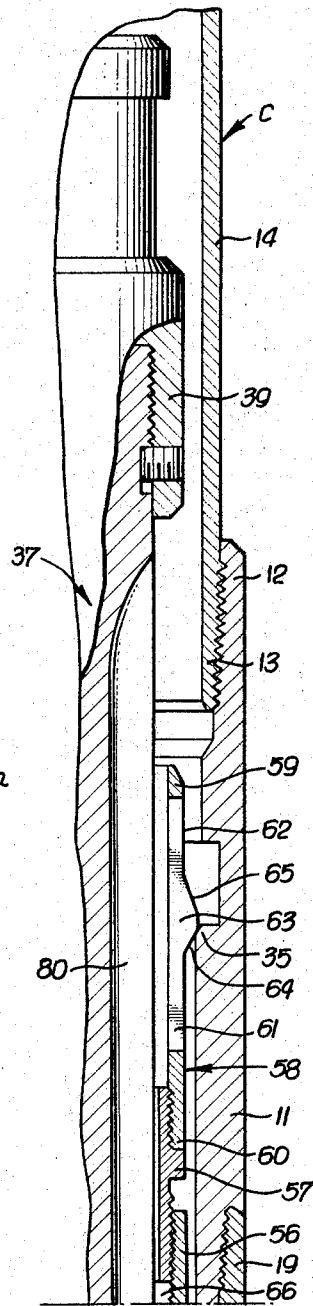


FIG. 3a.



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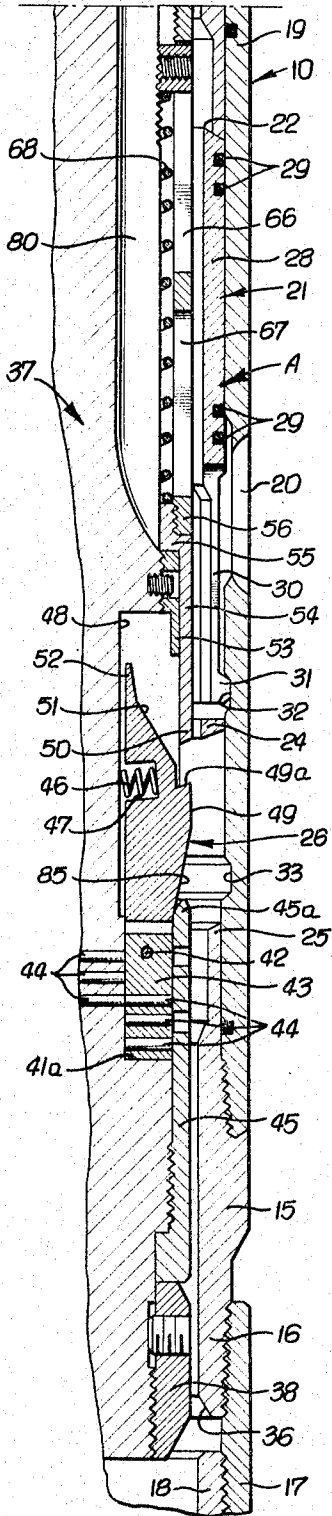
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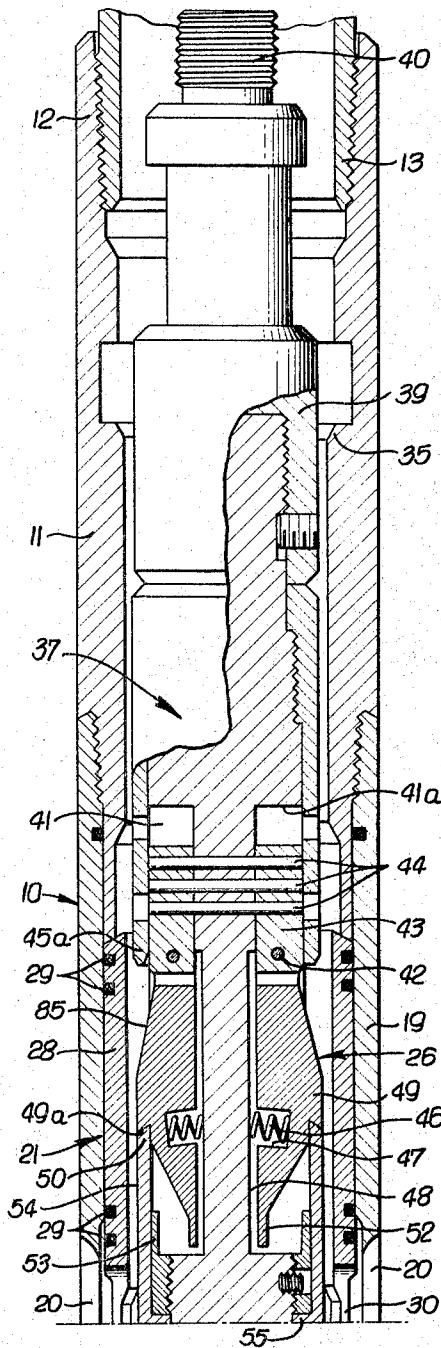
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**FIG. 3b.**



**FIG. 4a.**



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SUBSURFACE SHIFTING APPARATUS

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FIG. 4b.

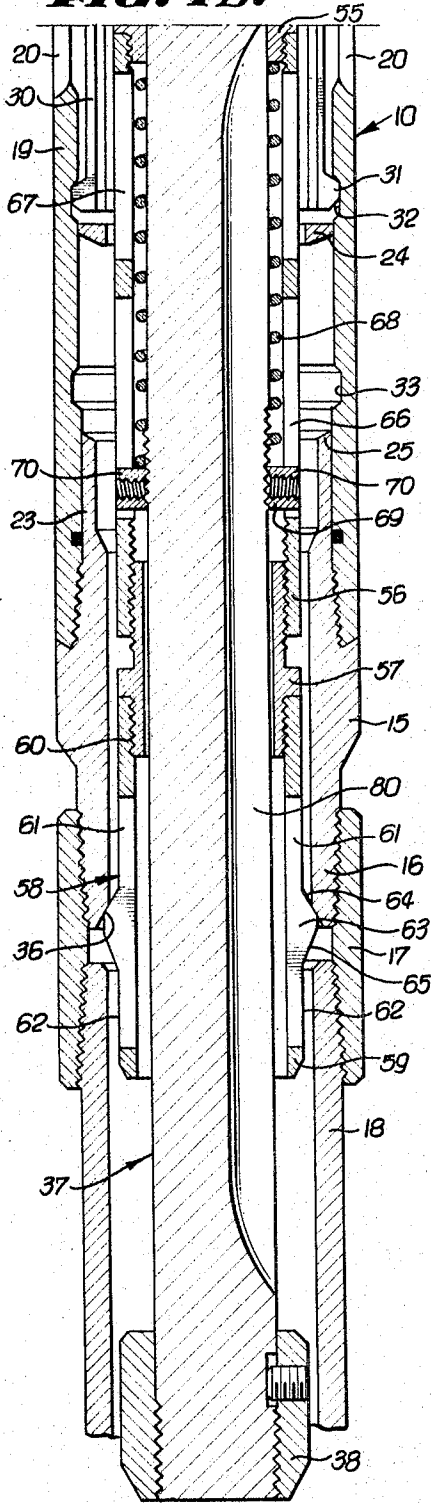


FIG. 5a.

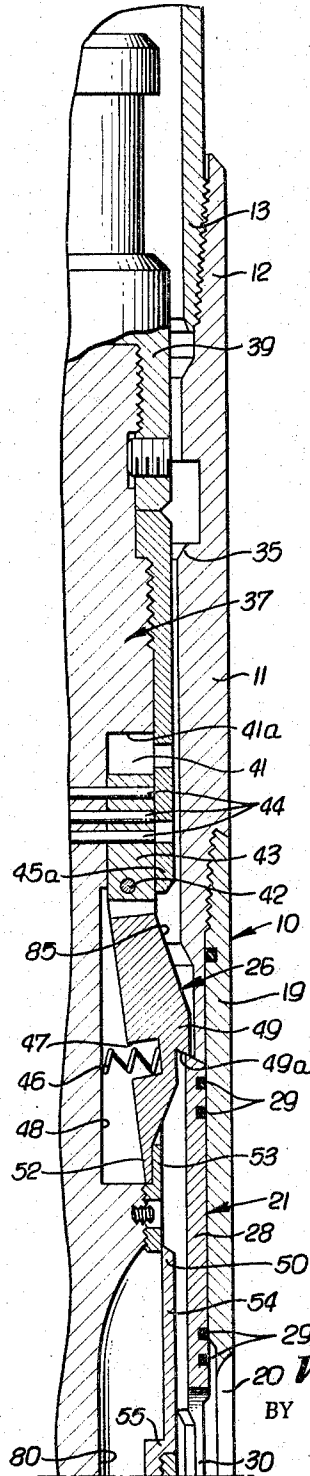
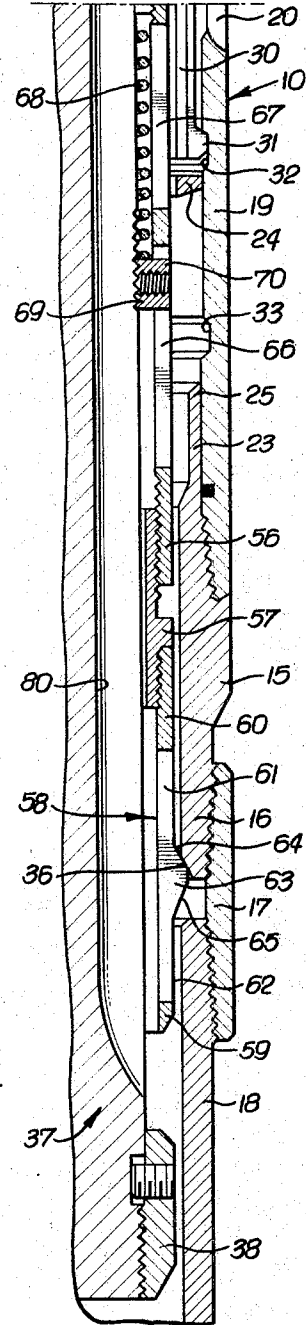


FIG. 5b.



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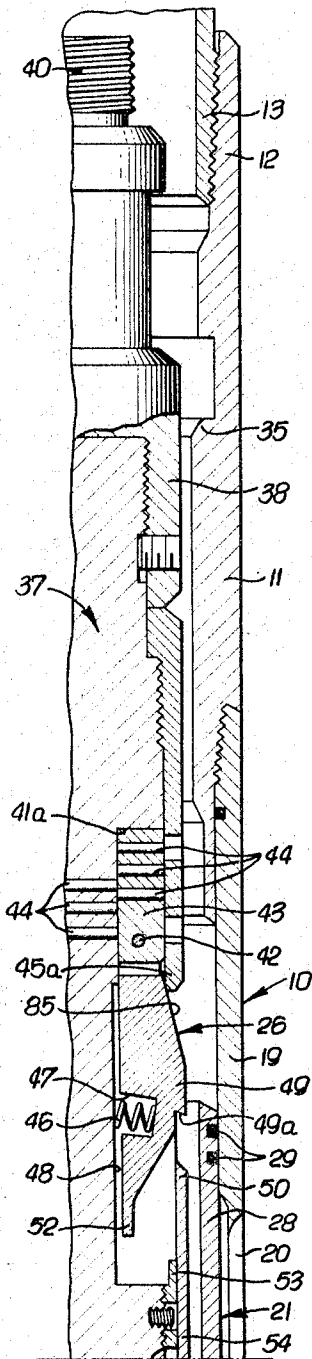
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SUBSURFACE SHIFTING APPARATUS

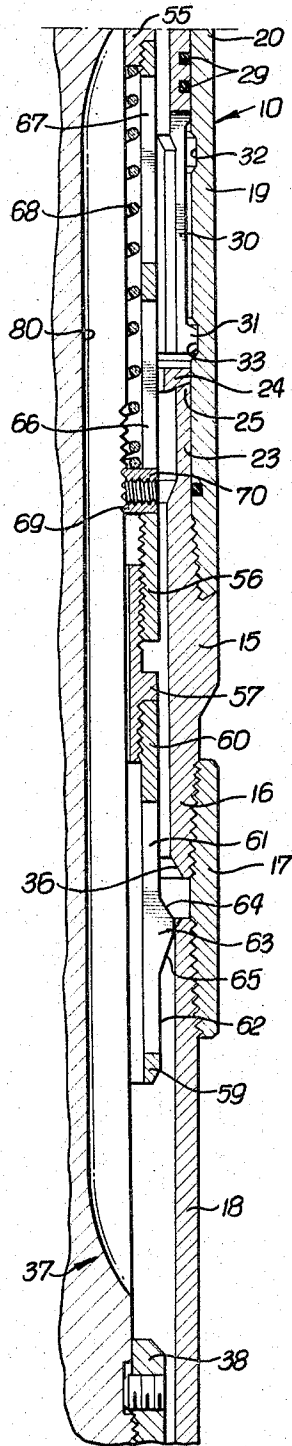
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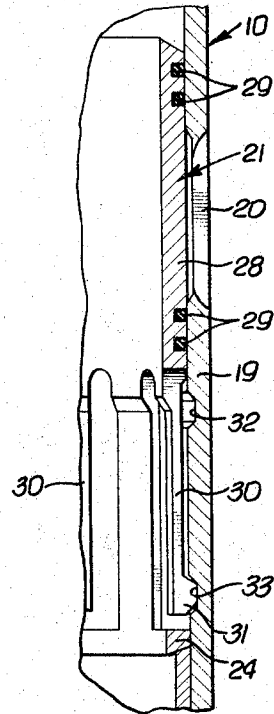
**FIG. 6a.**



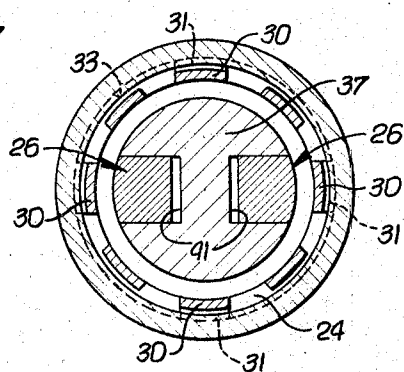
**FIG. 6b.**



**FIG. 7.**



**FIG. 8.**



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**SUBSURFACE SHIFTING APPARATUS**

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Filed Jan. 25, 1965, Ser. No. 427,806  
19 Claims. (Cl. 166—226)

**ABSTRACT OF THE DISCLOSURE**

Apparatus for shifting a valve sleeve or other device in a well bore by engaging a shifting dog therewith mounted on a body, the dog being held in retracted position by a retaining and retracting sleeve shiftable along the body from holding position to allow outward expansion of the dog, the sleeve being reshifted to its retracted and holding position by a spring.

The present invention relates to subsurface well bore apparatus, and more particularly to apparatus for shifting other devices, such as valve mechanisms, in a well bore.

An object of the invention is to provide an improved subsurface apparatus capable of shifting another device, such as a valve sleeve, in a well bore, or a plurality of devices in a well bore, the apparatus being selectively operable as to its shifting of the device, or one or more of a plurality of devices.

Another object of the invention is to provide subsurface shifting apparatus for shifting a valve device, or the like, in a well bore, and embodying shifting dogs adapted to be coupled to the device, such dogs being retracted automatically after shifting of the device and releasably retained in such retracted position.

A further object of the invention is to provide subsurface shifting apparatus for shifting a valve device or the like in a well bore, embodying expandable shifting dogs, in which the shifting dogs can be released from the device at any time and return to their retracted position in a normal manner, the dogs being forcibly returned to a released and retracted position in the event their release and retraction in a normal manner cannot be effected.

Another object of the invention is to provide subsurface apparatus embodying a valve device and a shifting apparatus for placing such device in an open or closed condition, fluid flowing through the valve device and engaging the shifting apparatus being prevented from releasing the shifting apparatus from the valve device.

This invention possesses many other advantages, and has other objects which may be made more clearly apparent from a consideration of a form in which it may be embodied. This form is shown in the drawings accompanying and forming part of the present specification. It will now be described in detail, for the purpose of illustrating the general principles of the invention; but it is to be understood that such detailed description is not to be taken in a limiting sense, since the scope of the invention is best defined by the appended claims.

Referring to the drawings:

FIGURES 1a and 1b together constitute a longitudinal section, with parts shown in side elevation, of a shifting apparatus disposed in a valve device which the apparatus is to shift to another position, the dogs of the shifting apparatus being in a retracted position, FIG. 1b being a lower continuation of FIG. 1a;

FIGS. 2a and 2b are partial sectional views of the apparatus illustrated in FIGS. 1a and 1b, with the dogs released for engagement with the valve device in order

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that such device can be shifted, FIG. 2b being a lower continuation of FIG. 2a;

FIGS. 3a and 3b are views corresponding to FIGS. 2a and 2b illustrating the dogs of the shifting apparatus forcibly released from the valve apparatus in the event their normal release cannot be effected, FIG. 3b being a lower continuation of FIG. 3a;

FIGS. 4a and 4b are views similar to FIGS. 1a and 1b illustrating the shifting device in an inverted position from the one illustrated in FIGS. 1a and 1b and with the dogs retained in their retracted position, FIG. 4b being a lower continuation of FIG. 4a;

FIGS. 5a and 5b are partial longitudinal sections through the apparatus illustrated in FIGS. 4a and 4b illustrating the dogs released and in position for shifting the valve device to another position, FIG. 5b being a lower continuation of FIG. 5a;

FIGS. 6a and 6b are views corresponding to FIGS. 5a and 5b illustrating the dogs forcibly shifted to and retained in their retracted positions, FIG. 6b being a lower continuation of FIG. 6a;

FIG. 7 is a fragmentary longitudinal section through the valve device in its closed position;

FIG. 8 is a section taken along the line 8—8 on FIG. 1b. A valve device A and another apparatus B for shifting the valve device between open and closed positions are illustrated in the drawings, the valve device being incorporated in a tubular string C, such as a string of tubing, extending to the top of the well bore, and the shifting apparatus B being movable down through the tubing string for releasable connection to the valve device on a suitable running-in string (not shown), such as a wire line, extending to the top of the well bore.

The valve device A includes an outer tubular member 10 comprising an upper section 11 having an upper threaded box 12 for threaded attachment to a lower pin 13 of a tubing section 14 thereabove. The tubular member 10 also includes a lower section 15 having a lower threaded pin 16 for threaded attachment to a lower coupling 17 which is, in turn, threadedly connected to a lower tubing section 18. The upper and lower sections are threadedly secured to the upper and lower ends, respectively, of an intermediate tubing section 19 having a plurality of side ports 20 therein for the passage of fluid between the interior and exterior of the tubular member. These ports can be closed by a valve sleeve 21 slideable longitudinally in the intermediate tubing member between an upper open position, in which the upper end 22 of the valve sleeve engages a stop terminal 23 provided by the lower end of the upper section 11, and a lower position in which the valve sleeve is closed across the ports with its lower end 24 in engagement with an upper terminal 25 on the lower section 15. When the valve sleeve is engaged with either the upper or lower stop terminals 23, 25, its upper and lower end portions 22, 24 project laterally inwardly of such terminals, so as to provide upper and lower inwardly projecting shoulders on the sleeve adapted to be engaged by the coupling dogs 26 of the shifting apparatus B, as described hereinbelow.

The valve sleeve 21 includes an upper circumferentially continuous portion 28 adapted to be disposed on opposite sides of the ports 20 to close the same, leakage of fluid around the valve sleeve being prevented by upper and lower side seal rings 29 on the latter sealingly engaging the inner wall of the intermediate section 19 of the tubular body member 10 on opposite sides of the ports. The valve sleeve includes a releasable latch portion in the form of circumferentially spaced longitudinally legs 30 terminating in outwardly extending feet 31 that tend to spring outwardly into an upper or lower circumferential groove 32, 33 within the intermediate housing section.

The sides of each groove and the upper and lower ends of the feet 31 are tapered so as to cam the feet out of a particular groove in which it is located when sufficient longitudinal force is imposed on the valve sleeve 21 by the shifting device B.

The feet 31 are disposed in the lower groove 33 to releasably retain the valve sleeve in the closed position illustrated in FIG. 1*b*. A sufficient upward force imposed on the valve sleeve 21 will cause the feet to be cammed inwardly by the upper tapered surface of the lower groove, the valve sleeve then being shifted upwardly to the port opening position illustrated in FIG. 3*b*, in which the latch feet 31 spring outwardly into the upper groove 32, to releasably retain the valve sleeve in its open position. Upon the exertion of sufficient downward force on the valve sleeve 21, the lower ends of the latch feet 31 engage the lower tapered side of the upper groove 32, which will cam the latch feet inwardly, allowing the valve sleeve to be shifted downwardly to its closed position across the ports, the feet again snapping spring-like inherently into the lower groove 33.

The upper section 11 of the tubular member has an upper stop shoulder 35 therein tapering in a downward and inward direction, the lower end 36 of the lower section of the tubular member providing a stop shoulder tapered in an upward and inward direction. These stop shoulders 35, 36 are locating and control devices for determining the ability of the latch dogs 26 to be coupled to the valve sleeve 21 for the purpose of shifting the latter, as described hereinbelow.

The shifting apparatus B includes a main mandrel or body 37 having a lower guide 38 threadedly secured on its lower end, and an upper sub 39 threadedly secured to its upper end, this sub having an appropriate threaded pin 40, or other connecting device, for securing the mandrel directly or indirectly to a wire line (not shown), or other running-in and retrieving string, by means of which the shifting apparatus is lowered in the tubular string C and removed therefrom. The mandrel 37 has a pair of opposed longitudinal grooves or slots 41 therein, each of which receives a coupling dog 26, the lower end of the dog being pivotally secured, as by a pivot pin or hinge pin 42, to a key or block 43 disposed in the groove 41 and initially retained therewithin in a predetermined position spaced above the lower end 41*a* of the slot by one or a plurality of shear pins 44 releasably attaching it to the mandrel. A retaining and safety retracting sleeve 45 is threadedly attached to the mandrel and extends upwardly across the grooves 41 and the keys 43, the upper end of such sleeve, however, terminating below the coupling dogs 26 when the shear pins 44 are intact.

Each coupling dog is urged outwardly of its groove by a helical compression spring 46 disposed in a socket 47 in each dog and bearing against the inner base 48 of the groove. The intermediate portion of each dog is constituted as an outwardly projecting finger 49 which is adapted to engage an end 24 of the valve sleeve 21, the end 49*a* of the finger being tapered in a downward and inward direction, as disclosed in FIGS. 1*a* to 3*b*, and adapted to engage a companion tapered end 24 on the valve sleeve. Above the tapered end 49*a* of the finger, the coupling dog has a longitudinal surface 50 generally parallel to the axis of the mandrel when the dog is in the retracted position within its groove 41, such surface merging into a tapered retracting surface 51 inclined in an upward and inward direction and which, in turn, merges into a longitudinally extending stop finger 52 on the coupling dog. When the coupling dog is unrestrained, its spring 46 will shift or expand it laterally outwardly to the extent limited by engagement of the upper finger 52 with a stop sleeve 53 threadedly or otherwise suitably secured to the mandrel 37 and extending across the upper ends of the grooves 41.

The dogs 26 are normally held in their retracted position against the compressive force exerted by the springs

46 by a retracting and retaining device including a lower sleeve 54 slidably mounted on the mandrel and adapted to extend downwardly across the stop sleeve 53 and the grooves 41 into engagement with the upper ends 49*a* of the fingers 49 and in encompassing relation with the intermediate longitudinal surfaces 50 of the dogs, thereby holding them in their retracted position. The downward position of the sleeve 54 is determined by engagement of its inwardly directed shoulder 55 with the upper end of the stop sleeve 53 secured to the mandrel. The retracting sleeve device further includes an upper control sleeve 56, the lower end of which is threadedly secured to the retracting and retaining sleeve 54 and the upper end of which is threadedly secured to a connector or adjuster sleeve 57 which is, in turn, threadedly attached to a collet latch sleeve 58 surrounding the mandrel 37. This collet latch sleeve has circumferentially continuous upper and lower portions 59, 60 and circumferentially spaced slots 61 therebetween forming spring-like arms 62 having intermediate dogs or fingers 63 projecting laterally outwardly. Each dog or finger 63 has a downwardly tapering or inclined lower surface 64 which is engageable with the tapered stop shoulder 35 on the upper section 11 and, when the device is used in an inverted position as described hereinbelow, with the tapered shoulder 36 at the lower end of the lower section 15. Each dog also has an upper tapered cam surface 65 inclined in an upward and inward direction, the angle of inclination of this upper cam surface being much steeper than that of the surface 64.

The control sleeve 56 has upper and lower circumferentially spaced longitudinal slots 66, 67 therethrough, the entire control and retracting sleeve mechanism being urged in a downward direction along the mandrel by a helical compression spring 68 encompassing the mandrel 37, with its lower end engaging the upper end of the retractor and retaining sleeve 54, and its upper end engaging a spring seat 69, in the form of a nut, threadedly secured to the mandrel 37, the nut having outwardly projecting pin portions 70 slidable in the upper slots 66. The spring 68 yieldably urges the retractor and retaining sleeve 54, the control sleeve 56, connector 57, and collet latch 58 downwardly of the mandrel 37, but such parts can shift relatively upwardly of the mandrel so as to remove the retracting and retaining sleeve 54 from its retaining relation with the coupling dogs 26.

In the use of the device in shifting a valve sleeve 21 from its closed position illustrated in FIG. 1*b* upwardly to its open position, the shifting apparatus B is disposed in the well bore with its dogs 26 facing in an upward direction, such as shown in FIGS. 1*a* to 3*b*, inclusive. The spring 68 and sleeve 54 are retaining the coupling dogs in their inward position. The upper sub 39 is suitably secured to the wire line (not shown), as through the agency of a set of jars (not shown), and the apparatus B is lowered in the tubing string C. During lowering of the tubing string, the dogs or fingers 63 may expand out into its coupling recesses and tend to arrest downward movement of the latch sleeve 58, connector 57, control sleeve 56 and retracting sleeve 54, but the helical spring 68 has sufficient strength to prevent such relative upward shifting of the retracting sleeve 54 from the dogs. Even if such shifting were to occur, a continuation of the downward movement of the apparatus would cause the pins 70 on the spring seat nut to engage the control sleeve 56 at the lower ends of the upper set of slots 66 and pull the external sleeve mechanism and the tapered fingers 63 through the coupling recess until the fingers 63 again ride on the wall of the tubing string, the spring 68 then re-expanding and shifting the retracting and retaining sleeve 54 downwardly, the lower end of such sleeve engaging the tapered retracting surfaces 51 on the dogs and reshifting the dogs inwardly against the compressive force of the springs 46.

When the shifting mechanism B reaches the valve portion A of the apparatus, the lower surfaces 64 of the

dogs or fingers 63 engage the stop shoulder 35, and since such stop shoulder projects inwardly to a substantial extent, that is, inwardly of the tubing string wall, it offers substantial resistance to downward movement of the collet latch 58 and of the connector 57, control sleeve 56 and retracting and retaining sleeve 54 attached thereto. Accordingly, continued downward movement of the mandrel 37, assisted if need be by the upper jars (not shown), will shift the dogs 26 connected thereto downwardly below the retracting sleeve 54, the latter being relatively elevated with respect to the dogs 26 and permitting the springs 46 to expand the coupling dogs outwardly. At this time, the coupling dogs are located below the lower end 24 of the valve sleeve and in a position to cause the tapered fingers 49 to project laterally under the valve sleeve 21 and become engaged with its lower end 24, such as disclosed in FIG. 2b. Upward movement of the wire line and mandrel 37 connected thereto, or its upward jarring if need be, will then move the dogs 26 upwardly, forcing the valve sleeve 21 upwardly to cam its latch feet 31 out of the lower groove 33, the valve sleeve shifting upwardly to the extent determined by engagement of its upper end 22 with the lower terminal 23 on the lower end of the upper tubular member section 11, at which time the valve sleeve 21 is in its fully open position, as illustrated in FIG. 3b.

During such upward movement, if fluid under pressure tends to flow inwardly through the ports 20 and tends to engage the dogs and shift them inwardly, such tendency is resisted in view of the reverse angle that the ends 49a of the fingers 49 makes with the lower end 24 of the valve sleeve. Such end portions 49a, 24 are tapered in a downward and inward direction, preventing the fluid pressure from shifting the coupling dogs 26 inwardly from engagement with the sleeve. The fluid can, however, flow through the slotted portions 66, 67 of the control sleeve 56. To facilitate upward flow of fluid in the tubing string, one or more longitudinal grooves 80 are provided in the mandrel 37 through which such fluid can flow to the upper portion of the mandrel and into the tubing string C thereabove.

During the upward movement of the valve sleeve 21 under the action of the dogs 26 coupled thereto, the mandrel 37 moves upwardly, the helical spring 68 re-expanding partially and shifting the retracting sleeve 54 downwardly toward the dogs 26 and into engagement with their retracting surfaces 51. When the valve sleeve 21 has been shifted upwardly to its fullest extent to open the ports 20, the mandrel 37 will have raised the collet fingers 63 above the shoulder 35, so that lowering the mandrel a short distance will lower the dogs 26 away from the lower end 24 of the valve sleeve 21, permitting the spring 68 to shift the retracting sleeve 54 downwardly to its fullest extent, its lower end bearing against the tapered retracting surfaces 51 on the dogs and shifting them fully inwardly to their initial retracted position, the valve shifting apparatus now having been returned to substantially the position illustrated in FIGS. 1a and 1b.

The shifting device B can now be elevated in the tubing string C and removed entirely therefrom, if desired, or it can be lowered in the tubing string in the event it is desired to shift another valve device at a lower location in the tubing string. If the latter purpose is desired, a downward jarring is imposed on the mandrel, which will shift the spring seat nut 69, 70 downwardly until it engages the intermediate portion of the control sleeve 56. The coupling dogs 26 will have been expanded outwardly by the springs 46, but in view of their outer tapered surfaces 85 on their lower portions, such dogs will not become coupled to any device. When sufficient force is exerted downwardly on the control sleeve 56 and the collet latch 58 attached thereto, the dogs or fingers 63 are cammed inwardly by the stop shoulder 35, which will then allow the apparatus B to move down through the valve device A to a position therebelow. After the dogs

or fingers 63 are released from the stop shoulder 35, the spring 68 will reexpand and shift the retracting sleeve 54 downwardly along the dogs and engage their tapered surfaces 51 to shift the dogs inwardly once again to their retracted position within the grooves or slots 41.

When a lower valve mechanism (not shown) is reached, which can correspond to the valve mechanism A illustrated in the drawings, the dogs or fingers 63 will engage a lower stop shoulder 35 and the apparatus can be operated in the same manner as described above for the purpose of shifting the valve sleeve 21 of the lower mechanism upwardly within its tubular member 10. Following such upward shifting, the coupling dogs 26 are released by slightly lowering the mandrel 37, being held in released position by the retracting and retaining sleeve 54. The apparatus can now be elevated through the tubing string C, the upper fingers 65 moving into and out of coupling recesses relatively easily in view of the fact that their upper cam surfaces 65 are more steeply tapered than the lower cam surfaces 64 on the fingers. Such movement, however, through restrictions and coupling spaces will retain the sleeve 54 disposed in encompassing relation to the dogs 26, the latter remaining in their retracted position.

In the event an upper valve sleeve 21 is now to be shifted upwardly, the apparatus is moved through such valve apparatus and is then re-lowered in order to bring the dogs and fingers 63 of the collet latch sleeve into engagement with the companion stop shoulder 35, after which the valve sleeve 21 can be shifted upwardly to an open position in the manner described above in connection with the apparatus illustrated in FIGS. 1a to 2b, inclusive.

If the dogs 26 cannot be released from the latch sleeve 21 in the normal manner described above, due to some foreign material, such as sand, in the tubular string C, or some other adverse condition, an upward jarring force is imposed thereon with the dogs engaging the lower end 24 of the valve sleeve. When such jarring force is sufficient, the shear pins 44 will be disrupted and the mandrel 37 and lower retaining and retracting sleeve 45 secured thereto shifted upwardly along the blocks or keys 43 to bring the upper end 45a of the sleeve 45 into contact with the downwardly tapering surfaces 85 on the lower portions of the coupling dogs, swinging the latter about their hinge pins 42 inwardly against the force of their springs 46 and retaining them in such inward position. The extent of upward movement of the mandrel 37 and sleeve 45 relative to the dogs 26 is limited by engagement of the mandrel at the lower end 41a of its grooves 41 with the keys or blocks 43, at which time the upper end 45a of the sleeve is encompassing the lower tapered surfaces 85 of the coupling dogs, as illustrated in FIG. 3b. The apparatus B can now be elevated through the tubing string C and removed completely therefrom, the dogs 26 being held in their retracted positions and being prevented from hanging up in the tubing string, as, for example, by catching in its coupling spaces, and the like.

The apparatus illustrated can also be used for shifting the valve sleeve 21 from its upper to its lower position, simply by reversing the tool B. That is, the sub 39 is connected to the mandrel 37 adjacent to the retaining and retracting sleeve 45 and the guide 38 can be threaded on the other end of the mandrel or body, the parts then being in the position illustrated in FIGS. 4a and 4b, which is merely an inverted condition from that illustrated in FIGS. 1a and 1b. The retaining and retracting sleeve 54 will hold the dogs 26 in their retracted position, any obstructions encountered by the collet latch 58 merely tending to hold the external sleeve device 58, 57, 56, 54 in the upper position relative to the mandrel. The apparatus B is lowered through the tubing string C until it passes through the valve device A, whereupon it can be re-elevated a slight distance to bring the collet latch fingers 63 into engagement with the lower shoulder 36



on the lower tubular section 15, which will then resist and prevent upward movement of the connector 57, control sleeve 56, and retracting and retaining sleeve 54. Accordingly, upward movement of the wire line and the mandrel 37 will pull the dogs 26 upwardly out of the retaining sleeve 54, their helical springs 46 expanding them outwardly. When this condition has been fully achieved, the dogs 26 and fingers 49 will be disposed above the upper end 22 of the valve sleeve, whereupon lowering of the wire line, any jars (not shown) connected thereto, and the mandrel 37 will cause the latch fingers 49 to engage the upper end of the sleeve 21, downward jarring on the apparatus then causing the mandrel 37 and dogs 26 to move downwardly, camming the valve sleeve fingers 31 inwardly from the upper groove 32 and effecting a downward shifting of the valve sleeve 21 to its fully closed position, in which its lower end 24 engages the upper stop terminal 25 on the lower tubular member section 15.

Elevation of the mandrel 37 and the coupling dogs 26 will now allow the helical spring 68 to expand and shift the sleeve devices externally of the mandrel in an upward direction, forcing the end of the retracting and retaining sleeve against the retracting surfaces 51 on the coupling dogs 26 and shifting the latter inwardly, the parts of the shifting apparatus B all returning to the positions illustrated in FIGS. 4a and 4b. The shifting apparatus can now be either elevated or lowered in tubular string C, as desired, for the purpose of either actuating a lower valve device or devices (not shown), an upper valve device or devices (not shown), or merely to be elevated in the tubular string and removed therefrom at the top of the hole.

As was described in connection with FIGS. 3a and 3b, in the event the coupling dogs 26 cannot be released in a normal manner from the upper end 22 of the valve sleeve, with the dogs in the inverted position illustrated in FIG. 5b, a downward jarring action is imposed on the mandrel 37 and on the dogs, shearing the pins 44 and shifting the mandrel and retracting sleeve 45 fixed thereto downwardly with respect to the dogs, so that the sleeve 45 engages their outer surfaces 85 and shifts the dogs inwardly from the valve sleeve 21. Elevation of the mandrel 37 will now result in the retracting sleeve 54 and control sleeve 56 being shifted upwardly by the helical spring 68 to bring the retracting sleeve into engagement with the tapered surfaces 51 on the coupling dogs in order to hold the dogs inwardly against the force of the springs 46. Even if the retracting sleeve 54 does not move upwardly sufficiently to hold the dogs inwardly, since they are facing in a downward direction, they will freely ratchet over any coupling spaces, and the like, in the tubular string during upward movement of the apparatus there-within, and will not interfere with such upward movement.

I claim:

1. In apparatus for operating a device in a well bore: a body having a connection thereon for fixedly securing said body to a running-in string to be lowered in the well bore on the running-in string; coupling means mounted on said body for longitudinal movement therewith and shiftable from a retracted position on said body laterally outwardly thereof for engagement with the device; retaining and retracting means shiftable on said body into engagement with said coupling means to retain said coupling means in retracted position on said body; means preventing relative rotation between said retaining and retracting means and said body; means connected to said retaining and retracting means for relatively shifting said retaining and retracting means on said body from retaining engagement with said coupling means to allow said coupling means to shift laterally outwardly of said body; and means for shifting said retaining and retracting means longitudinally of the well bore and on said body into engagement with said coupling means to move said cou-

pling means from its lateral outward position to retracted position on said body.

2. In apparatus for operating a device in a well bore: a body adapted to be lowered in the well bore on a running-in string; coupling means on said body shiftable from a retracted position on said body laterally outwardly thereof for engagement with the device; retaining and retracting means shiftable on said body into engagement with said coupling means to retain said coupling means in retracted position on said body; means connected to said retaining and retracting means and engageable with the device for holding said retaining and retracting means relatively stationary in the well bore to allow said body to be moved longitudinally in one direction and shift said coupling means therewith from retaining engagement with said retaining and retracting means to allow said coupling means to shift laterally outwardly of said body; and yieldable means engaging said retaining and retracting means for shifting said retaining and retracting means back into engagement with said coupling means to move said coupling means from its lateral outward position to retracted position on said body.

3. In apparatus for operating a device in a well bore: a body adapted to be lowered in the well bore on a running-in string; a coupling dog carried by said body; spring means tending to shift said dog laterally outwardly of said body for engagement with the device; retaining and retracting means shiftable longitudinally on said body between a position engaging and retaining said dog in retracted position on said body and a position permitting said spring means to shift said dog laterally outwardly of said body; means connected to said retaining and retracting means engageable with the device for holding said retaining and retracting means relatively stationary in the well to allow said body to be moved longitudinally of said retaining and retracting means and shift said dog from engagement with said retaining and retracting means; and spring means engaging said body and retaining and retracting means for shifting said retaining and retracting means relatively longitudinally of said body into engagement with said dog to retract said dog on said body.

4. In apparatus for operating a device in a well bore: a body adapted to be lowered in the well bore on a running-in string; a coupling dog carried by said body; spring means tending to shift said dog laterally outwardly of said body for engagement with the device; a retaining and retracting sleeve shiftable longitudinally on said body between a position engaging and retaining said dog in retracted position on said body and a position permitting said spring means to shift said dog laterally outwardly of said body; means connected to said sleeve and engageable with the device for holding said sleeve relatively stationary in the well bore to allow said body to be movable longitudinally of said sleeve and shift said dog from said sleeve; and spring means engaging said body and sleeve for shifting said sleeve longitudinally of said body into engagement with said dog to retract said dog on said body.

5. In apparatus for operating a device in a well bore: a body adapted to be lowered in the well bore on a running-in string; a coupling dog carried by said body; spring means tending to shift said dog laterally outwardly of said body for engagement with the device; a retaining and retracting sleeve shiftable longitudinally on said body between a position engaging and retaining said dog in retracted position on said body and a position permitting said spring means to shift said dog laterally outwardly of said body; means connected to said sleeve and engageable with the device for holding said sleeve relatively stationary in the well bore to allow said body to be movable longitudinally of said sleeve and shift said dog from said sleeve; and spring means engaging said body and sleeve for shifting said sleeve longitudinally of said body into engagement with said dog to retract said dog on

said body; said holding means including elements engageable with the device and yieldable laterally inwardly from holding relation to the device upon exertion of a predetermined longitudinal force on said holding means.

6. In apparatus for operating a device in a well bore: a body adapted to be lowered in the well bore on a running-in string; a coupling dog carried by said body; spring means tending to shift said dog laterally outwardly of said body for engagement with the device; a retaining and retracting sleeve shiftable longitudinally on said body between a position engaging and retaining said dog in retracted position on said body and a position permitting said spring means to shift said dog laterally outwardly of said body; a latch sleeve connected with said retaining and retracting sleeve and including cam fingers engageable with a shoulder on the device for holding said retaining and retracting sleeve relatively stationary in the well bore to allow said body to be moved longitudinally and shift said dog from said retaining and retracting sleeve, said fingers being cammed inwardly from the shoulder upon exertion of a predetermined longitudinal force on said latch sleeve; and spring means engaging said body and retaining and retracting sleeve for shifting said retaining and retracting sleeve longitudinally of said body into engagement with said dog to retract said dog on said body.

7. In apparatus for operating a device in a well bore: a body adapted to be lowered in the well bore on a running-in string; coupling means on said body shiftable from a retracted position on said body laterally outwardly thereof for engagement with the device; retaining and retracting means shiftable on said body into engagement with said coupling means to retain said coupling means in retracted position on said body; means connected to said retaining and retracting means for relatively shifting said retaining and retracting means on said body from retaining engagement with said coupling means to allow said coupling means to shift laterally outwardly of said body; means for shifting said retaining and retracting means relative to said body into engagement with said coupling means to move said coupling means from its lateral outward position to retracted position on said body; means releasably connecting said coupling means to said body for longitudinal movement therewith, said releasable means being releasable upon exertion of a predetermined force thereon by said body; and means on said body engageable with said coupling means, after release of said releasable means, to retract said coupling means on said body.

8. In apparatus for operating a device in a well bore: a body adapted to be lowered in the well bore on a running-in string; a coupling dog carried by said body; spring means tending to shift said dog laterally outwardly of said body for engagement with the device; retaining and retracting means shiftable longitudinally on said body between a position engaging and retaining said dog in retracted position on said body and a position permitting said spring means to shift said dog laterally outwardly of said body; means connected to said retaining and retracting means engageable with the device for holding said retaining and retracting means relatively stationary in the well bore to allow said body to be moved longitudinally of said retaining and retracting means and shift said dog from engagement with said retaining and retracting means; spring means engaging said body and retaining and retracting means for shifting said retaining and retracting means relatively longitudinally of said body into engagement with said dog to retract said dog on said body; means releasably connecting said dog to said body for longitudinal movement therewith, said releasable means being releasable upon exertion of a predetermined force thereon by said body; and means on said body engageable with said dog, after release of said releasable means, to retract said dog on said body.

9. In apparatus for operating a device in a well bore: a body adapted to be lowered in the well bore on a running-in string; a coupling dog carried by said body; spring means tending to shift said dog laterally outwardly of said body for engagement with the device; a retaining and retracting sleeve shiftable longitudinally on said body between a position engaging and retaining said dog in retracted position on said body and a position permitting said spring means to shift said dog laterally outwardly of said body; a latch sleeve connected with said retaining and retracting sleeve and including cam fingers engageable with a shoulder on the device for holding said retaining and retracting sleeve relatively stationary in the well bore to allow said body to be moved longitudinally and shift said dog from said retaining and retracting sleeve, said fingers being cammed inwardly from the shoulder upon exertion of a predetermined longitudinal force on said latch sleeve; spring means engaging said body and retaining and retracting sleeve for shifting said retaining and retracting sleeve longitudinally of said body into engagement with said dog to retract said dog on said body; means releasably connecting said dog to said body for longitudinal movement therewith, said releasable means being releasable upon exertion of a predetermined force thereon by said body; and another sleeve on said body engageable with said dog, after release of said releasable means, to retract said dog on said body.

10. In apparatus adapted to be lowered in a well bore: tubular means adapted to form part of a tubular string to be disposed in the well bore and having a side port; a valve sleeve slidable longitudinally on said tubular means between positions opening and closing said port; a body adapted to be lowered through the tubular string on a running-in string to be disposed within said tubular means; coupling means on said body shiftable from a retracted position on said body laterally outwardly thereof into coupling engagement with said valve sleeve to enable said body to be moved longitudinally in said tubular means and shift said valve sleeve between said positions with respect to said port; retaining and retracting means shiftable on said body into engagement with said coupling means to retain said coupling means in retracted position on said body; means connected to said retaining and retracting means and engageable with said tubular means for arresting movement of said retaining and retracting means in said tubular means to allow said body to be moved longitudinally of said retaining and retracting means and shift said coupling means therewith from retaining engagement with said retaining and retracting means to allow said coupling means to shift laterally outwardly of said body into a position to be coupled to said valve sleeve; and means engaging said retaining and retracting means for shifting said retaining and retracting means back into engagement with said coupling means to move said coupling means from its lateral outward position to retracted position on said body.

11. In apparatus adapted to be lowered in a well bore: tubular means adapted to form part of a tubular string to be disposed in the well bore and having a side port; a valve sleeve slidable longitudinally in said tubular means between positions opening and closing said port; a body adapted to be lowered through the tubular string on a running-in string within said tubular means; a coupling dog carried by said body; spring means tending to shift said dog laterally outwardly of said body into coupling relation with said valve sleeve to enable said body to be moved longitudinally in said tubular means and shift said valve sleeve between said positions with respect to said port; retaining and retracting means shiftable on said body into engagement with said dog to retain said dog in retracted position on said body; means connected to said retaining and retracting means and engageable with said tubular means for arresting movement of said retaining and retracting means in said tubular means to allow said body to be moved longitudinally of said retaining and

retracting means and shift said dog therewith from retaining engagement with said retaining and retracting means to allow said dog to shift laterally outwardly of said body into a position to be coupled to said valve sleeve; and spring means engaging said body and retaining and retracting means for shifting said retaining and retracting means relatively longitudinally of said body into engagement with said dog and retract said dog on said body.

12. In apparatus adapted to be lowered in a well bore: tubular means adapted to form part of a tubular string to be disposed in the well bore and having a side port; a valve sleeve slidable longitudinally in said tubular means between positions opening and closing said port; a body adapted to be lowered through the tubular string on a running-in string within said tubular means; a coupling dog carried by said body; spring means tending to shift said dog laterally outwardly of said body into coupling relation with said valve sleeve to enable said body to be moved longitudinally in said tubular means and shift said valve sleeve between said positions with respect to said port; a retaining and retracting sleeve shiftable longitudinally on said body between a position engaging and retaining said dog in a retracted position on said body and a position permitting said spring means to shift said dog laterally outwardly of said body; means connected to said retaining and retracting sleeve and engageable with said tubular means for holding said retaining and retracting sleeve relatively stationary in said tubular means to allow said body to be moved longitudinally of said sleeve and shift said dog from said retaining sleeve whereby said dog can move laterally outwardly into a position to be coupled to said valve sleeve; and spring means engaging said body and retaining and retracting sleeve for shifting said retaining and retracting sleeve longitudinally of said body into engagement with said dog to retract said dog on said body.

13. In apparatus adapted to be lowered in a well bore: tubular means adapted to form part of a tubular string to be disposed in the well bore and having a side port; a valve sleeve slidable longitudinally in said tubular means between positions opening and closing said port; a body adapted to be lowered through the tubular string on a running-in string within said tubular means; a coupling dog carried by said body; spring means tending to shift said dog laterally outwardly of said body into coupling relation with said valve sleeve to enable said body to be moved longitudinally in said tubular means and shift said valve sleeve between said positions with respect to said port; a retaining and retracting sleeve shiftable longitudinally on said body between a position engaging and retaining said dog in a retracted position on said body and a position permitting said spring means to shift said dog laterally outwardly of said body; means connected to said retaining and retracting sleeve and engageable with said tubular means for holding said retaining and retracting sleeve relatively stationary in said tubular means to allow said body to be moved longitudinally of said sleeve and shift said dog from said retaining sleeve whereby said dog can move laterally outwardly into a position to be coupled to said valve sleeve; spring means engaging said body and retaining and retracting sleeve for shifting said retaining and retracting sleeve longitudinally of said body into engagement with said dog to retract said dog on said body; said holding means including elements engageable with said tubular means and yieldable laterally inwardly from holding relation to said tubular means upon exertion of a predetermined longitudinal force on said holding means.

14. In apparatus adapted to be lowered in a well bore: tubular means adapted to form part of a tubular string to be disposed in the well bore and having a side port; a valve sleeve slidable longitudinally in said tubular means between positions opening and closing said port; a body adapted to be lowered through the tubular string on a

running-in string within said tubular means; a coupling dog carried by said body; spring means tending to shift said dog laterally outwardly of said body into coupling relation with said valve sleeve to enable said body to be moved longitudinally in said tubular means and shift said valve sleeve between said positions with respect to said port; a retaining and retracting sleeve shiftable longitudinally on said body between a position engaging and retaining said dog in a retracted position on said body and a position permitting said spring means to shift said dog laterally outwardly of said body; a latch sleeve connected with said retaining and retracting sleeve and including cam fingers engageable with a shoulder on said tubular means for holding said retaining and retracting means relatively stationary in the well bore to allow said body to be moved longitudinally and shift said dog from said retaining and retracting sleeve whereby said dog is in position to be coupled to said valve sleeve, said fingers being cammed inwardly from said shoulder upon exertion of a predetermined longitudinal force on said latch sleeve; and spring means engaging said body and retaining and retracting sleeve for shifting said retaining and retracting sleeve longitudinally of said body into engagement with said dog to retract said dog on said body.

15. In apparatus adapted to be lowered in a well bore: tubular means adapted to form part of a tubular string to be disposed in the well bore and having a side port; a valve sleeve slidable longitudinally on said tubular means between positions opening and closing said port; a body adapted to be lowered through the tubular string on a running-in string to be disposed within said tubular means; coupling means on said body shiftable from a retracted position on said body laterally outwardly thereof into coupling engagement with said valve sleeve to enable said body to be moved longitudinally in said tubular means and shift said valve sleeve between said positions with respect to said port; retaining and retracting means shiftable on said body into engagement with said coupling means to retain said coupling means in retracted position on said body; means connected to said retaining and retracting means and engageable with said tubular means for arresting movement of said retaining and retracting means in said tubular means to allow said body to be moved longitudinally of said retaining and retracting means and shift said coupling means therewith from retaining engagement with said retaining and retracting means to allow said coupling means to shift laterally outwardly of said body into a position to be coupled to said valve sleeve; means engaging said retaining and retracting means for shifting said retaining and retracting means back into engagement with said coupling means to move said coupling means from its lateral outward position to retracted position on said body; means releasably connecting said coupling means to said body for longitudinal movement therewith, said releasable means being releasable upon exertion of a predetermined force thereon by said body; and means on said body engageable with said coupling means, after release of said releasable means, to retract said coupling means on said body.

16. In apparatus adapted to be lowered in a well bore: tubular means adapted to form part of a tubular string to be disposed in the well bore and having a side port; a valve sleeve slidable longitudinally in said tubular means between positions opening and closing said port; a body adapted to be lowered through the tubular string on a running-in string within said tubular means; a coupling dog carried by said body; spring means tending to shift said dog laterally outwardly of said body into coupling relation with said valve sleeve to enable said body to be moved longitudinally in said tubular means and shift said valve sleeve between said positions with respect to said port; a retaining and retracting sleeve shiftable longitudinally on said body between a position engaging and retaining said dog in a retracted position on said body and a position permitting said spring means to shift said

dog laterally outwardly of said body; a latch sleeve connected with said retaining and retracting sleeve and including cam fingers engageable with a shoulder on said tubular means for holding said retaining and retracting means relatively stationary in the well bore to allow said body to be moved longitudinally and shift said dog from said retaining and retracting sleeve whereby said dog is in position to be coupled to said valve sleeve, said fingers being cammed inwardly from said shoulder upon exertion of a predetermined longitudinal force on said latch sleeve; spring means engaging said body and retaining and retracting sleeve for shifting said retaining and retracting sleeve longitudinally of said body into engagement with said dog to retract said dog on said body; means releasably connecting said dog to said body for longitudinal movement therewith, said releasable means being releasable upon exertion of a predetermined force thereon by said body; and another sleeve on said body engageable with said dog, after release of said releasable means, to retract said dog on said body.

17. In apparatus for operating a device in a well bore: a body adapted to be lowered in the well bore on a running-in string; coupling means on said body shiftable from a retracted position on said body laterally outwardly thereof for engagement with the device; retaining and retracting means shiftable on said body into engagement with said coupling means to retain said coupling means in retracted position on said body; means connected to said retaining and retracting means for shifting said retaining and retracting means relative to said body from retaining engagement with said coupling means to allow said coupling means to shift laterally outwardly of said body; spring means acting between said body and retaining and retracting means for relatively shifting said retaining and retracting means on said body into engagement with said coupling means to move said coupling means from its lateral outward position to retracted position on said body; means releasably connecting said coupling means to said body for longitudinal movement therewith, said releasable means being releasable upon exertion of a predetermined force thereon by said body; and means on said body engageable with said coupling means, after release of said releasable means, to retract said coupling means on said body.

18. In apparatus for operating a device in a well bore: a body adapted to be lowered in the well bore on a running-in string; coupling means on said body shiftable from a retracted position on said body laterally outwardly thereof for engagement with the device; retaining and retracting means shiftable on said body into engagement with said coupling means to retain said coupling means in retracted position on said body; means connected to said retaining and retracting means for relatively shifting said retaining and retracting means on said body from retaining engagement with said coupling means to allow said coupling means to shift laterally outwardly of said

body; means for shifting said retaining and retracting means relative to said body into engagement with said coupling means to move said coupling means from its lateral outward position to retracted position on said body; means releasably connecting said coupling means to said body for longitudinal movement therewith, said releasable means being releasable upon exertion of a predetermined force thereon by said body; and means on said body separate from said retaining and retracting means and engageable with said coupling means, after release of said releasable means, to retract said coupling means on said body.

19. In apparatus for operating a device in a well bore: a body adapted to be lowered in the well bore on a running-in string; coupling means on said body shiftable from a retracted position on said body laterally outwardly thereof for engagement with the device; retaining and retracting means shiftable on said body into engagement with said coupling means to retain said coupling means in retracted position on said body both during upward and downward movement of the apparatus in the well bore; means connected to said retaining and retracting means for relatively shifting said retaining and retracting means on said body from retaining engagement with said coupling means to allow said coupling means to shift laterally outwardly of said body; means for shifting said retaining and retracting means relative to said body into engagement with said coupling means to move said coupling means from its lateral outward position to retracted position on said body; means releasably connecting said coupling means to said body for longitudinal movement therewith, said releasable means being releasable upon exertion of a predetermined force thereon by said body; and means on said body engageable with said coupling means, after release of said releasable means, to retract said coupling means on said body; said retaining and retracting means being operable to retain said coupling means in retracted position during upward and downward movement of the apparatus in the well bore prior to release of said releasable means.

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