

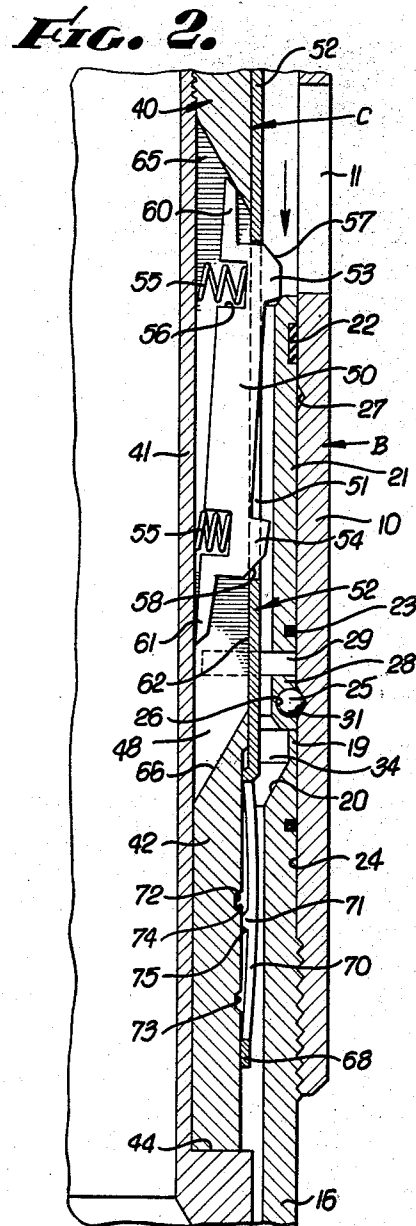
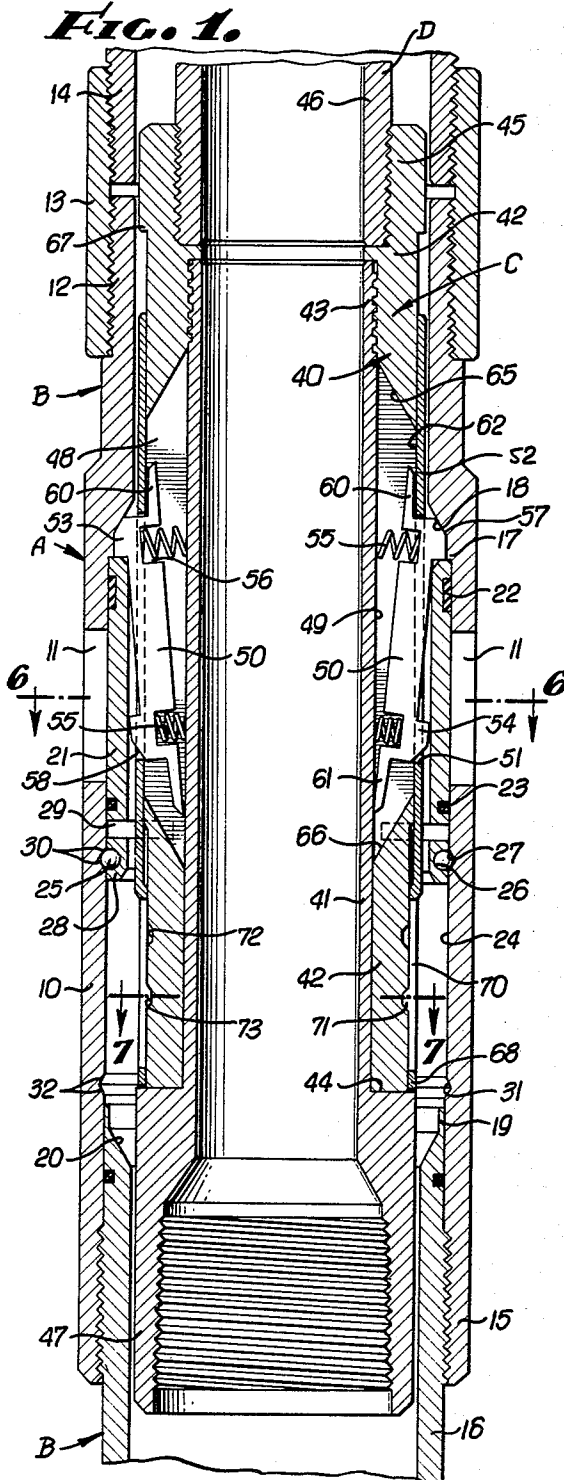
Jan. 19, 1965

W. D. MYERS  
APPARATUS FOR OPERATING SUBSURFACE SLEEVE  
VALVES AND SIMILAR WELL BORE DEVICES

3,166,128

Filed Dec. 31, 1962

3 Sheets-Sheet 1



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**FIG. 3.**

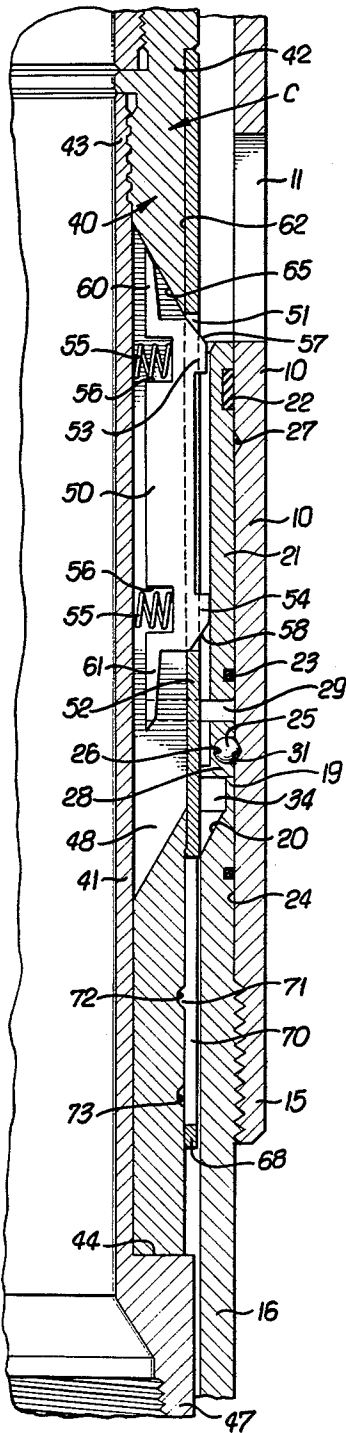
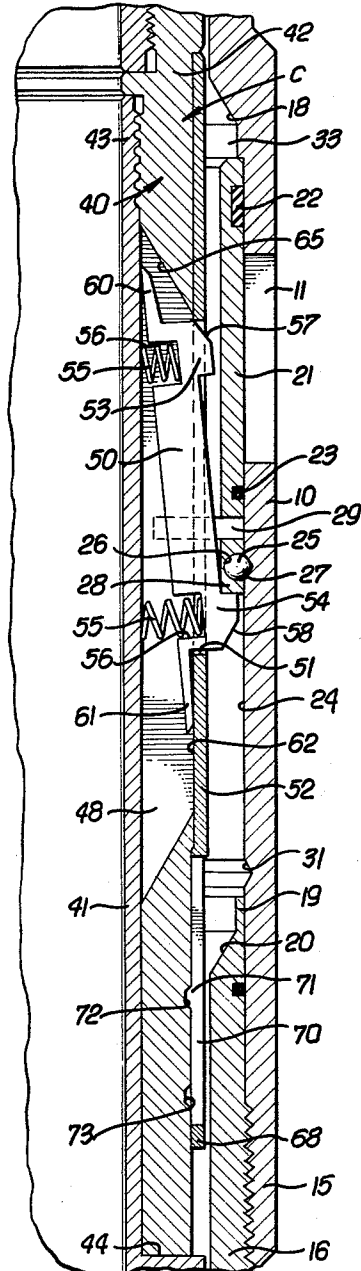


**FIG. 4.**



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**FIG. 5.**

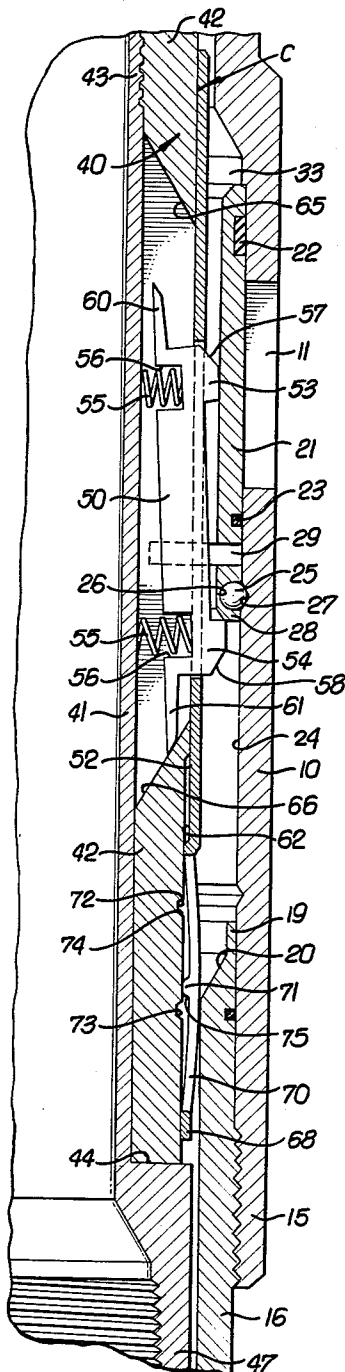


**FIG. 6.**

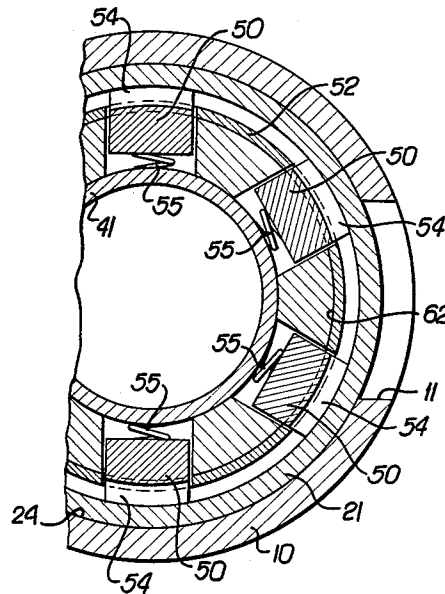
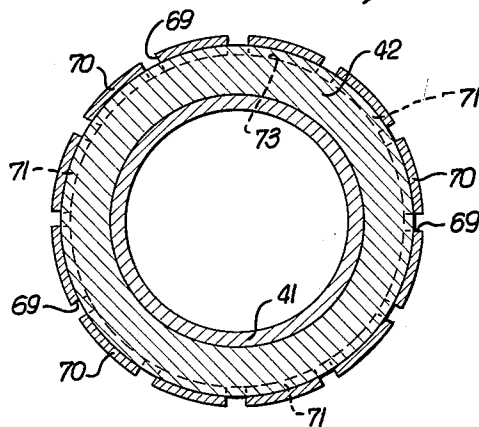


**FIG. 7.**



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3,166,128

## APPARATUS FOR OPERATING SUBSURFACE SLEEVE VALVES AND SIMILAR WELL BORE DEVICES

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15 Claims. (Cl. 166—214)

The present invention relates to subsurface well bore apparatus, and more particularly to apparatus adapted to be moved in a well conduit, such as a well casing or liner string, to perform certain functions therewithin.

An object of the invention is to provide apparatus embodying a self-contained device for shifting a valve in a particular direction in a conduit string disposed in a well bore and for automatically releasing itself from the valve to permit the device to continue moving through the conduit string in the same particular direction.

Another object of the invention is to provide apparatus embodying a self-contained device for shifting a valve in opposite directions in a conduit string between opened and closed conditions and for automatically releasing itself from the valve so that the device can continue to move within the conduit string in the same directions as when shifting the valve.

A further object of the invention is to provide apparatus embodying a self-contained device adapted to be latched or coupled to a member in a well conduit when moved in one direction in the conduit and for automatically releasing itself from the well conduit member to permit its continued movement through the well conduit in such one direction.

An additional object of the invention is to provide apparatus embodying a self-contained device adapted to be latched or coupled to a member in a well conduit when moved in opposite directions in the conduit and for automatically releasing itself from the conduit member to permit its continued movement through the well conduit in both of such opposite directions.

Still another object of the invention is to provide apparatus of the above-described character which is capable of giving a positive indication to the operator at the top of the well bore of its operations therewithin.

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:

FIGURE 1 is a longitudinal section through an apparatus embodying the invention, with its parts in one operative position;

FIG. 2 is a quarter longitudinal section, on an enlarged scale, of the apparatus illustrated in FIG. 1, with its parts in another relative position;

FIG. 3 is a view similar to FIG. 2 illustrating the apparatus with its parts in still another relative position;

FIG. 4 is a view similar to FIG. 2 illustrating the apparatus with its parts in their relative position for operating in a reverse manner to that illustrated in FIG. 1;

FIG. 5 is a view similar to FIG. 4 of parts of the apparatus in another relative position;

FIG. 6 is an enlarged cross-section taken along the line 6—6 on FIG. 1;

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FIG. 7 is an enlarged cross-section taken along the line 7—7 on FIG. 1.

The apparatus illustrated in the drawings includes a valve device A to be shifted between opened and closed conditions, the valve device being incorporated within a tubular string B adapted to be disposed in a well bore. The tubular string may be a casing or liner string, its valve device including an outer tubular body member 10 having one or more side ports 11 therein through which fluid can flow between the interior and exterior of the tubular string. The upper end of the tubular member may be constituted as a threaded pin 112 adapted to be threadedly secured to a collar 13, which, in turn, is threaded onto an upper conduit string section 14. The lower end of the tubular member may be constituted as a threaded box 15 threadedly connected to the upper end of a lower section 16 of the tubular string.

The ported region of the tubular member 10 has an internal diameter substantially greater than the normal internal diameter of the sections 14, 16 of the tubular string. As shown, the ported region of the tubular member is defined by an upper stop shoulder 17 formed therein, there being an upwardly tapering surface 18 in the tubular member adjacent to this stop shoulder. The upper end of the lower tubular section 16 forms a lower stop shoulder 19, there also being a downwardly tapering shoulder 20 adjacent to the lower stop shoulder.

Passage of fluid through the side ports is controlled by a shiftable sleeve valve 21, which is adapted to be disposed across the ports 11 in engagement with the upper stop shoulder 17, to close the latter, as shown in FIG. 1. Upper and lower side seal rings 22, 23 are carried by the sleeve valve 21 for sealing against the inner wall 24 of the tubular member on opposite sides of the ports to prevent valve leakage. The sleeve valve member 21 is releasably retained in its port closing position by a releasable detent device, such as one or more ball latching detent elements 25, each carried in a pocket 26 in the lower portion of the valve sleeve and adapted to be received in an upper internal groove 27 in the tubular member. The lower portion 28 of the sleeve 21 carrying each ball detent member is separated from the main portion of the sleeve valve by a slot 29 so that such lower sleeve portion is yieldable in an inward direction to allow the ball detent member 25 to be cammed out of the groove. The upper groove 27 has tapered side walls 30 engaged by each ball detent element to urge the latter inwardly when a sufficient downward force is imposed on the sleeve valve 21.

When the sleeve valve 21 is shifted downwardly to a position opening the ports 11, such as disclosed in FIGS. 2 and 3, the ball detent elements 25 snap into a lower releasable retaining groove 31 to hold the sleeve valve 21 in such lower position, this lower groove also having tapered side walls 32 for camming the ball detent elements inwardly out of the groove when sufficient longitudinal force is imposed on the sleeve valve.

When the sleeve valve 21 occupies its upper port closing position, its upper end extends inwardly of the upper stop shoulder 17, defining a circumferential groove 33 with the upper tapered shoulder 18 of the tubular member. Similarly, when the sleeve valve 21 occupies its lower position, its lower end extends inwardly of the lower shoulder 19 and defines a lower circumferential recess or groove 34 with the lower tapered shoulder 20.

The valve sleeve 21 is shifted between its open and closed positions by a shifting apparatus C which becomes coupled to the valve sleeve and which then becomes automatically coupled therefrom after it has been shifted to another position. The shifting apparatus can shift the valve sleeve from an upper position to a lower position,

automatically releasing itself from the valve sleeve to permit it to move downwardly in the conduit string B, if desired, below the position of the valve sleeve. Similarly, it is shiftable upwardly into coupling relation to the valve sleeve to shift the latter from a lower position to an upper position, then becoming automatically released from the valve sleeve for continued upward movement through the valve sleeve and in the conduit string.

As disclosed, the shifting apparatus C includes a tubular mandrel or body 40 made of several sections. As shown, a first section 41 is piloted within a second section 42, the inner section 41 having an upper threaded pin 43 threadedly secured to the second body section 42 and also having a transverse shoulder 44 engaging the lower end of the second section. The two body sections 41, 42 actually function as one, the body or mandrel 40 being made in the two sections for convenience of manufacture and assembly of the apparatus. The second or upper body or mandrel section 42 has an upper threaded box 45 for threaded attachment to the lower end of a section 46 of a tubing string D which may extend through the well bore to the top thereof. The first or lower body section 41 of the mandrel may have a threaded box 47 adapted to threadedly receive a companion member (not shown) therebelow, such as a tubing string or a suitable tool disposed in the tubular string B.

The outer body section 42 has a plurality of circumferentially spaced longitudinal slots 48 extending completely through its wall and forming with the inner section longitudinal grooves 49. An elongate latch member 50 is disposed in each body groove, each latch member extending outwardly through a longitudinal slot 51 in a carrier sleeve 52 slidably mounted on the exterior of the outer body section 42. Each latch member has longitudinally spaced and oppositely arranged upper and lower dogs or lugs 53, 54 adapted to project outwardly of its companion sleeve slot 51, being urged outwardly by longitudinally spaced helical compression springs 55, each being received within a companion socket 56 in the latch opposite a dog 53, 54, with its inner end bearing upon and slidable against the base of the groove 49 provided by the periphery of the inner body section 41.

Each latch has its upper dog 53 facing downwardly and adapted to engage the upper end of the valve sleeve 21 for the purpose of shifting it downwardly along the outer tubular member 10, its lower dog 54 facing upwardly and adapted to engage the lower end of the valve sleeve to shift the latter upwardly along the tubular member. The upper outer corner 57 of each upper dog is tapered in an upward and inward direction; whereas, the lower outer corner 58 of the lower dog 54 is tapered in a downward and inward direction. The longitudinal extent of the upper dog 53 is substantially the same or slightly less than the upper circumferential recess 33 between the upper end of the valve sleeve 21 and the upper tapered shoulder 18 when the valve sleeve is in its uppermost position, the longitudinal extent of the lower dog 54 being substantially the same as but no greater than the distance between the lower end of the valve sleeve and the lower tapered shoulder 20 when the valve sleeve 21 is in its lowermost position. With this relationship of parts, the upper dog 53 can be shifted laterally outwardly into the recess 33, as shown in FIG. 1, and into coupling engagement with the upper end of the valve sleeve 21. The lower dog 54 can be shifted laterally outwardly into the lower circumferential recess 34 and in engagement with the lower end of the valve sleeve.

Each longitudinal slot 51 in the latch carrier sleeve 52 has a length only slightly exceeding the longitudinal distance between the upper end of the upper dog 53 and the lower end of the lower dog 54. Each dog has upwardly and downwardly extending tangs or fingers 60, 61 projecting from the upper and lower dogs 53, 54, respectively, and within the latch sleeve 52, these fingers being adapted to engage the inner wall 62 of the latch sleeve to limit

the extent of outward shifting of each latch dog under the influence of its spring 55. The fingers or tanks 60, 61 have another purpose, and that is to be engaged by latch releasing members when a particular set of dogs is to be released from the valve sleeve 21.

As shown, the inner and major portion of each latch 50 and its upper and lower tangs or fingers 60, 61 are disposed in a longitudinal body groove 49. The longitudinal extent of each groove 49 is substantially greater than the overall length of a latch. The upper end of each groove 49 is defined by a retracting cam surface 65 inclined in an upward and inward direction and adapted to engage the upper tang or finger 60. The lower end of each groove is defined by a lower latch retracting cam surface 66 inclined or tapering in a downward and inward direction. When the upper cam surface 65 engages the upper tang 60 and moves downwardly therealong, it will shift the upper dog 53 inwardly. When the lower cam surface 66 engages the lower tang or finger 61 and moves upwardly therealong, it will shift the lower latch finger or dog 54 inwardly, as described hereinbelow.

The latch carrier sleeve 52 and the latches 50 projecting through its slots 51 are movable relatively longitudinally of the body 40 of the apparatus within limits, as determined by engagement of the upper end of the sleeve 52 with an upper shoulder 67 at the upper portion of the body 40, and by engagement of the lower end 68 of the sleeve with the lower shoulder 44 of the mandrel or body. The latch sleeve 52 is releasably held in either its upper or lower positions by a releasable holding device. As shown, the lower portion of the carrier sleeve 52 is provided with a plurality of circumferentially spaced longitudinally extending slots 69 providing longitudinal arms 70 that have intermediate inwardly projecting cam fingers or dogs 71 which are adapted to be received in either an upper circumferential body groove 72 or a lower circumferential body groove 73. Each body groove has tapered outwardly diverging side walls 74 adapted to coact with companion tapered side walls 75 on the cam fingers or lugs 71, such that the exertion of a sufficient longitudinal force between the side 74 of a groove 72 or 73 and the companion side of the cam fingers 71 will cam the fingers 71 outwardly of the groove and effect release between the body 40 and the carrier sleeve 52. When the cam fingers come opposite the same groove 72 or 73 or the other groove 73 or 72, the spring arms 70 inherently snap the fingers into such groove, automatically relatching or reconnecting the carrier sleeve 52 to the body 40.

When the carrier sleeve 52 and the latches 50 are in a downward position along the body 40, such as disclosed in FIG. 1, the springs 55 can shift the lugs 53, 54 outwardly of the sleeve 52, the upper retracting cam surface 65 being a substantial distance above the upper tangs or fingers 60. The upper springs 55 can shift the upper lugs or dogs 53 outwardly to an extent sufficient for its reception within the upper recess 33 and in a position to be coupled to the upper end of the sleeve valve 21. When the carrier sleeve 52 and latches 50 are in an upper position along the body or mandrel 40, the lower retracting surface 66 is spaced below the lower tangs or fingers 61 by a substantial extent, the lower springs 55 being capable of shifting the lower lugs or dogs 54 outwardly into the lower recess 34, where the lower dogs 54 can become coupled to the lower end of the valve sleeve 21.

When the carrier sleeve 52 is releasably latched to the body or mandrel by reception of its cam fingers in a circumferential body groove 72 or 73, the carrier sleeve 52, mandrel 40 and the latches 50 move longitudinally as a unit. When sufficient resistance is encountered, as by inability to shift the valve sleeve 21 longitudinally to any further extent, the exertion of sufficient longitudinal force on the body or mandrel 40, by appropriate manipulation of the tubing string D, will cause the body 40 to cam the fingers 71 out of a particular groove 72 or 73 in which they were received, disconnecting the carrier sleeve 52

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from the body, and allowing the latter to move longitudinally of the carrier sleeve and the latch members 50, to shift one of the cam surfaces 65, 66 into engagement with its adjacent latch tangs or fingers 60, 61, which will then cam a particular upper or lower set of lugs 53 or 54 inwardly from coupling engagement with the valve sleeve 21, releasing the shifting apparatus C from the valve sleeve 21 and permitting its longitudinal movement there-through.

As disclosed in FIG. 1, the valve sleeve 21 is in a port closing position. If it is desired to shift it to a port opening position, the shifting apparatus C is secured to the tubing string D and lowered in the well bore, the carrier sleeve 52 being latched in its lower position on the body 40, as disclosed in FIG. 1. The apparatus will enter the tubular string B and the lower dogs 54 of the latches will shift inwardly within the valve sleeve 21, since the lower tapered or beveled corners 58 will merely ride past the upper end of the valve sleeve. However, the upper dogs 53 will be forced outwardly by the upper springs 55 into the upper recess 33, the upper dogs coming to rest upon the upper end of the valve sleeve 21. A sufficient downward force is then imposed through the tubing string D on the body 40 of the tool, which is transmitted through the cam fingers 71 to the carrier sleeve 52, and from this sleeve to the upper dogs 53, shifting the latches 50 downwardly, and in view of the coupling of the upper dogs 53 with the upper end of the sleeve 21, overcoming the retaining force of the ball detents 25 in the upper groove 27, releasing the latter from this groove and allowing the sleeve 21 to shift downwardly in the tubular member 10. The cam fingers 71 disposed in the groove 73 require a much greater force to effect release of the carrier sleeve 52 from the body 40 than is required to inwardly deflect the ball detent members 25 from the tubular member groove 27. Accordingly, the valve sleeve 21 is shifted downwardly, as a result of downward movement of the tubing string D and apparatus C, to the full port opening position, such as disclosed in FIG. 2, in which the ball detents 25 will snap into the lower groove 31, the valve sleeve engaging the lower stop shoulder 19, which will preclude its further downward movement.

The inability of the valve sleeve 21 to move downwardly to a further extent will also prevent the latches 50 and their carrier sleeve 52 from moving downwardly to a further extent. Accordingly, the imposition of a sufficient downward force on the tubing string D and the body or mandrel 40 will cam the fingers 71 out of the lower body groove 73, releasing the body 40 from the carrier sleeve 52 and allowing the body to shift downwardly of the sleeve 52 and the latches 50, bringing the upper retracting cam surface 65 into engagement with the upper tangs 60, and then camming such tangs and the upper lugs 53 inwardly to the extent at which the upper lugs or dogs 53 are disengaged from the upper end of the valve sleeve 21, as disclosed in FIG. 2, full engagement occurring when the body moves downwardly so that its upper groove 72 is opposite the cam fingers 71, whereupon the spring arms 70 will snap such cam fingers into the upper groove 72. At this time, the parts are in the position illustrated in FIG. 3, the latches 50 having been fully released from the valve sleeve 21, whereupon the shifting mechanism C, including its latches 50, can be shifted downwardly within the valve sleeve 21 and the tubular member 10, and through the tubular string B therebelow, if desired. The lower tapered corners 58 of the latches will merely slide along the tapered surface 20 of the lower tubular section 16 and the upper dogs 53 will also engage such tapered surface and be shifted inwardly. Thus, continued downward movement of the tubing string D and the shifting mechanism C can occur to the desired extent.

Assuming the valve to be in the open position disclosed in FIG. 3, it can be shifted to the closed position when the latches 50 are initially disposed below the valve sleeve

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21 by elevating the tubing string D, which will elevate the body 40 and the latch mechanism 50, 52. The upper tapered corners 57 of the latch dogs 53 will engage the lower end of the sleeve 21, which will merely shift such upper portions inwardly of the sleeve 21. The lower dogs 54, however, will be shifted outwardly by their springs 55 into the lower recess 34 and will engage and be coupled to the lower end of the valve sleeve. Upward movement of the tubing string D and body 40 will now carry the carrier sleeve 52 and the latches 50 upwardly with them, the ball detents 25 being cammed out of the lower groove 31 and the valve sleeve 21 being shifted upwardly to its position fully across the ports 11, to close the same, and to the extent limited by engagement of the upper end of the valve sleeve with the upper shoulder 17, at which time the ball detent or detents 25 will snap into the upper retaining groove 27 (FIG. 4). The valve sleeve 21 cannot move upwardly to any further extent, which is also true of the latches 50 and the carrier sleeve 52. A continuation of the upward strain on the tubing string D and body 40 will then cause the lower tapered side 74 of the upper body groove 72 to cam the fingers 71 outwardly to release the body 40 from the latch sleeve 52, allowing the body to move upwardly of the latch sleeve and the latches 50, bringing the lower retracting cam surface 66 into engagement with the lower fingers 61 and shifting them inwardly, effecting release of the lower dogs or lugs 54 from the lower end of the sleeve 21, as illustrated in FIG. 5. When the dogs 54 have been fully released from the valve sleeve 21, the lower body groove 73 will be disposed opposite the sleeve fingers 71, the latter snapping into such groove and again releasably coupling the carrier sleeve 52 to the body 40, as disclosed in FIG. 1. The tubular string D and the shifting apparatus C can now be moved upwardly, the dogs 53, 54 sliding through the sleeve 21 and along the upper groove surface 18 into the confines of the upper portion of the tubular member 10 and into the tubular string B thereabove. The tubing string D and the shifting mechanism C can now continue their upward movement, and, if desired, the entire apparatus C can be withdrawn from the well bore.

The shifting and releasing mechanism C is self-contained, since it is the retracting cam surfaces 65, 66 that release the latches 50 from coupling relation to the valve sleeve 21. Moreover, because of the substantial force that can be required to release the body 40 of the tool from the carrier sleeve 52, a positive indication is given to the operator at the top of the well bore that a valve sleeve 21 has been shifted to a desired position, since the shifting force first increases and then will decrease upon camming of the latch fingers 71 from a particular groove 72 or 73, and also by release of the dogs 53 or 54 from the valve sleeve 21. Thus, the operator is not only advised of the fact of shifting the valve sleeve 21 to a port opening or a port closing position, but also of the fact of release of the shifting mechanism C therefrom.

I claim:

1. In subsurface well bore apparatus: a ported member adapted to form part of a conduit positioned in a well bore; valve means for controlling flow of fluid through the port of said member; support means movable through the conduit; latch means movably mounted on said support means and including an upper portion adapted to be coupled to said valve means for moving said valve means downwardly within said ported member and a lower portion adapted to be coupled to said valve means for moving said valve means upwardly within said ported member; means on said support means engageable with said upper portion for uncoupling said upper portion from said valve means upon continued downward movement of said support means; and means on said support means engageable with said lower portion for uncoupling said lower portion from said valve means upon continued upward movement of said support means.

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2. In subsurface well bore apparatus: a ported member adapted to form part of a conduit positioned in a well bore; valve means for controlling flow of fluid through the port of said member; support means movable through the conduit; latch means movably mounted on said support means and including upper and lower portions adapted to be coupled selectively to said valve means; means releasably securing said latch means to said support means and releasable by said support means upon being subjected to a force imposed thereon by said support means, whereby said support means and latch means move jointly downwardly within said ported member to couple said upper portion to said valve means and move said valve means downwardly within said ported member, said support means and latch means being movable jointly upwardly within said ported member to couple said lower portion to said valve means and move said valve means upwardly within said ported member; means on said support means engageable with said upper portion after release of said securing means, for uncoupling said upper portion from said valve means upon continued downward movement of said support means; and means on said support means engageable with said lower portion for uncoupling said lower portion from said valve means upon continued upward movement of said support means.

3. In subsurface well bore apparatus: a ported member adapted to form part of a conduit positioned in a well bore; valve means for controlling flow of fluid through the port of said member; support means movable through the conduit; latch means movably mounted on said support means and including upper and lower portions adapted to be coupled selectively to said valve means; means releasably securing said latch means to said support means and releasable by said support means upon being subjected to a force imposed thereon by said support means, whereby said support means and latch means move jointly downwardly within said ported member to couple said upper portion to said valve means and move said valve means downwardly within said ported member; said support means and latch means being movable jointly upwardly within said ported member to couple said lower portion to said valve means and move said valve means upwardly within said ported member; stop means on said ported member engageable by said valve means to limit upward and downward movement of said valve means; means on said support means engageable with said upper portion, after engagement of said valve means with said stop means and release of said securing means, for uncoupling said upper portion from said valve means upon continued downward movement of said support means; and means on said support means engageable with said lower portion, after engagement of said valve means with said stop means and release of said securing means, for uncoupling said lower portion from said valve means upon continued upward movement of said support means.

4. In subsurface well bore apparatus: a ported member adapted to form part of a conduit positioned in a well bore; valve means for controlling flow of fluid through the port of said member; support means movable through the conduit and having a longitudinal groove; latch means mounted on said support means and including a latch member in said groove mounted for longitudinal and lateral movement with respect thereto and expandible laterally outwardly into coupling engagement with said valve means for moving said valve means longitudinally in one direction within said ported member; and means on said support means engageable with said latch member for retracting said latch member from coupling engagement with said valve means upon continued movement of said support means longitudinally in said one direction.

5. In subsurface well bore apparatus: a ported member adapted to form part of a conduit positioned in a well bore; valve means for controlling flow of fluid through the port of said member; support means movable through the conduit and having a longitudinal groove; latch means

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mounted on said support means including a carrier sleeve on said support means and a latch member carried by said sleeve and movable longitudinally and laterally in said groove with respect to said support means and expandible laterally outwardly into coupling engagement with said valve means; means releasably securing said carrier sleeve to said support means and releasable by said support means upon being subjected to a force imposed thereon by said support means, whereby said support means and latch means move jointly longitudinally in one direction within said ported member to move said valve means in said one direction within said ported member; and means on said support means engageable with said latch member, after release of said securing means, for retracting said latch member from coupling engagement with said valve means upon continued movement of said support means longitudinally in said one direction.

6. In subsurface well bore apparatus: a ported member adapted to form part of a conduit positioned in a well bore; valve means for controlling flow of fluid through the port of said member; support means movable through the conduit and having a longitudinal groove; latch means mounted on said support means including a carrier sleeve on said support means and a latch member carried by said sleeve and movable longitudinally and laterally in said groove with respect to said support means and expandible laterally outwardly into coupling engagement with said valve means; means releasably securing said carrier sleeve to said support means and releasable by said support means upon being subjected to a force imposed thereon by said support means, whereby said support means and latch means move jointly longitudinally in one direction within said ported member to move said valve means in said one direction within said ported member; stop means on said ported member engageable by said valve means to limit movement of said valve means in said one longitudinal direction; and means on said support means engageable with said latch member, after engagement of said valve means with said stop means and release of said securing means, for retracting said latch member from coupling engagement with said valve means upon continued movement of said support means longitudinally in said one direction.

7. In subsurface well bore apparatus: a ported member adapted to form part of a conduit positioned in a well bore; valve means for controlling flow of fluid through the port of said member; support means movable through the conduit; latch means mounted on said support means and including a latch member mounted for longitudinal and lateral movement with respect thereto and expandible laterally outwardly into coupling engagement with said valve means for moving said valve means longitudinally in opposite directions within said ported member; and means on said support means engageable with said latch member for retracting said latch member from coupling engagement with said valve means upon continued movement of said support means longitudinally in each of said opposite directions.

8. In subsurface well bore apparatus: a ported member adapted to form part of a conduit positioned in a well bore; valve means for controlling flow of fluid through the port of said member; support means movable through the conduit; latch means movably mounted on said support means and including a latch member adapted to be coupled to said valve means; said latch member having an upper coupling portion and a lower coupling portion; means releasably securing said latch means to said support means and releasable by said support means upon being subjected to a force imposed thereon by said support means, whereby said support means and latch means move jointly selectively downwardly or upwardly within said ported member to selectively engage said upper portion or said lower portion with said valve means and move said valve means selectively downwardly or upwardly within said ported mem-

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ber; stop means on said ported member engageable by said valve means to limit downward and upward movement of said valve means; and means on said support means engageable with said latch means, after engagement of said valve means with said stop means and release of said securing means, for uncoupling said latch member from said valve means upon continued movement of said support means in each of said downward and upward directions.

9. In subsurface well bore apparatus: a ported member adapted to form part of a conduit positioned in a well bore; valve means for controlling flow of fluid through the port of said member, support means movable through the conduit and having a longitudinal groove; latch means mounted on said support means including a carrier sleeve on said support means and a latch member carried by said sleeve and movable longitudinally and laterally in said groove with respect to said support means and expandible laterally outwardly into coupling engagement with said valve means; said latch member having an upper coupling portion and a lower coupling portion; means releasably securing said carrier sleeve to said support means and releasable by said support means upon being subjected to a force imposed thereon by said support means, whereby said support means and latch means move jointly selectively downwardly and upwardly within said ported member to selectively engage said upper portion or said lower portion with said valve means and move said valve means selectively downwardly and upwardly within said ported member; stop means on said ported member engageable by said valve means to limit downward and upward movement of said valve means; and means on said support means engageable with said latch means, after engagement of said valve means with said stop means and release of said securing means, for retracting said latch member from coupling engagement with said valve means upon continued movement of said support means in each of said downward and upward directions.

10. In subsurface well apparatus: a ported member adapted to form part of a conduit positioned in a well bore; a sleeve valve shiftable longitudinally in said member between positions opening and closing its port; a body movable through the conduit; a latch sleeve slidable longitudinally on said body; a latch member carried by said latch sleeve for lateral movement with respect thereto and having a coupling portion expandible laterally outwardly into coupling engagement with said sleeve valve; means releasably securing said latch sleeve to said body, whereby said body, latch sleeve, and latch member move jointly in one longitudinal direction to move said sleeve valve in said one direction within said ported member; stop means on said ported member engaged by said sleeve valve to limit movement of said sleeve valve in said one direction; and cam means on said body engageable with said latch member adjacent to its coupling portion, after engagement of said sleeve valve with said stop means and release of said securing means, for retracting said coupling portion from said sleeve valve upon continued movement of said body in said one longitudinal direction.

11. In subsurface well apparatus: a ported member adapted to form part of a conduit positioned in a well bore; a sleeve valve shiftable longitudinally in said member between positions opening and closing its port; a body movable through the conduit and having a longitudinal groove; a latch sleeve slidable longitudinally on said body; a latch member carried by said latch sleeve and disposed in said groove for lateral movement with respect to said body and sleeve and expandible laterally outwardly into coupling engagement with said sleeve valve; said latch member having an upper coupling portion and a lower coupling portion; means releasably securing said latch sleeve to said body, whereby said

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body, latch sleeve, and latch member move jointly in opposite longitudinal directions to selectively engage said upper portion or said lower portion with said sleeve valve and move said sleeve valve selectively downwardly and upwardly within said ported member; stop means on said ported member engaged by said sleeve valve to limit upward and downward movement of said sleeve valve; and cam means on said body engageable with said latch member, after engagement of said sleeve valve with said stop means and release of said securing means, for retracting said latch member from said sleeve valve upon continued movement of said body in each of said downward and upward directions.

12. In subsurface well bore apparatus adapted for engagement with a portion of a conduit string disposed in a well bore: support means movable through the conduit; latch means movably mounted on said support means and including an upper portion adapted to be moved downward in the conduit string into coupling engagement with the portion of the conduit string and a lower portion adapted to be moved in the conduit string into coupling engagement with the portion of the conduit string; means on and movable longitudinally with said support means and into engagement with said upper portion to uncouple said upper portion from the portion of the conduit string upon continued downward movement of said support means; and means on said support means engageable with said lower portion for uncoupling said lower portion from the portion of the conduit string upon continued upward movement of said support means.

13. In subsurface well bore apparatus adapted for engagement with a portion of a conduit string disposed in a well bore: support means movable through the conduit; latch means movably mounted on said support means and including an upper portion adapted to be moved downwardly in the conduit string into coupling engagement with the portion of the conduit string and a lower portion adapted to be moved upwardly in the conduit string into coupling engagement with the portion of the conduit string; means releasably securing said latch means to said support means and releasable by said support means upon being subjected to a force imposed thereon by said support means; means on and movable longitudinally with said support means and into engagement with said upper portion, after release of said securing means, for uncoupling said upper portion from the portion of the conduit string upon continued downward movement of said support means; and means on said support means engageable with said lower portion, after release of said securing means, for uncoupling said lower portion from the portion of the conduit string upon continued upward movement of said support means.

14. In subsurface well bore apparatus adapted for engagement with a portion of a conduit string disposed in a well bore: a body movable through the conduit string; a latch sleeve slidable longitudinally on said body; a latch member carried by said sleeve for lateral movement with respect thereto and having a coupling portion expandible laterally outwardly into coupling engagement with the portion of the conduit string; means releasably securing said latch sleeve to said body, whereby said body, latch sleeve, and latch member move jointly in one longitudinal direction into engagement with the portion of the conduit string; and cam means on said body engageable with said latch member adjacent to its coupling portion, after engagement of said latch means with the portion of the conduit string and release of said securing means, for retracting said coupling portion from the portion of the conduit string upon continued movement of said body in said one longitudinal direction.

15. In subsurface well bore apparatus adapted for engagement with a conduit string disposed in a well bore: a body movable through the conduit string and having a longitudinal groove; a latch sleeve slidable longitudinally

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on said body; a latch member carried by said sleeve and disposed in said groove for lateral movement with respect to said body and sleeve and expandible laterally outwardly into coupling engagement with the conduit string; said latch member having an upper coupling portion and a lower coupling portion; means releasably securing said latch sleeve to said body, whereby said body, latch sleeve, and latch member move jointly selectively upwardly or downwardly within the conduit string to selectively couple the lower portion or the upper portion to the conduit string; and cam means on said body engageable with said latch member, after coupling engagement of said latch

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member with the conduit string and release of said securing means, for retracting said latch member from coupling engagement with the conduit string upon continued movement of said body in each of said downward and upward directions.

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