Feb. 24, 1959 R. C. BAKER ET AL 2,874,931

TUBULAR STRING VALVE DEVICES

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FIG. 1.

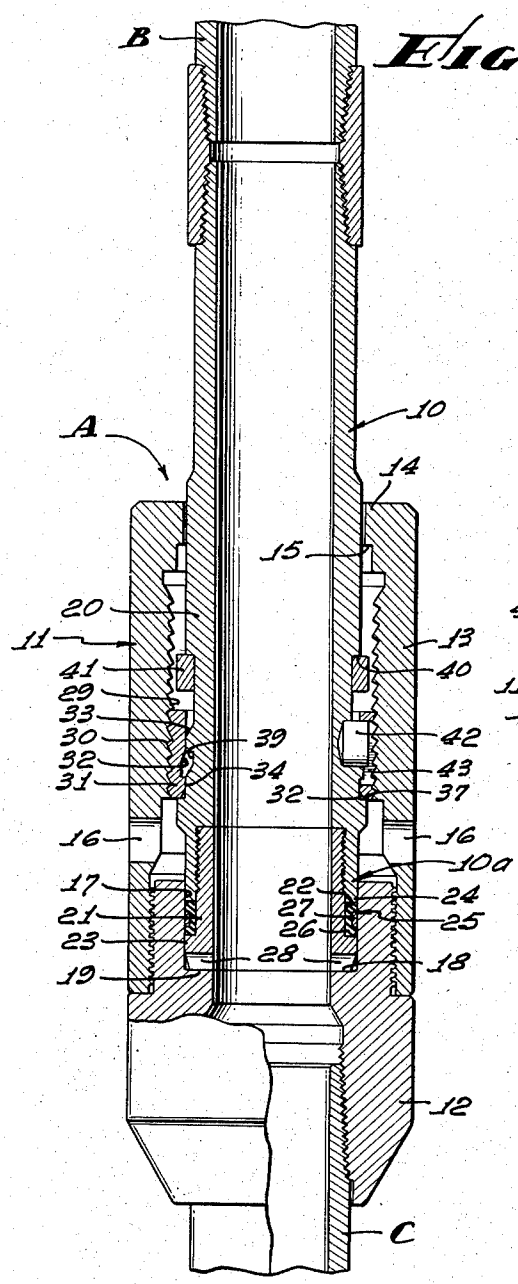
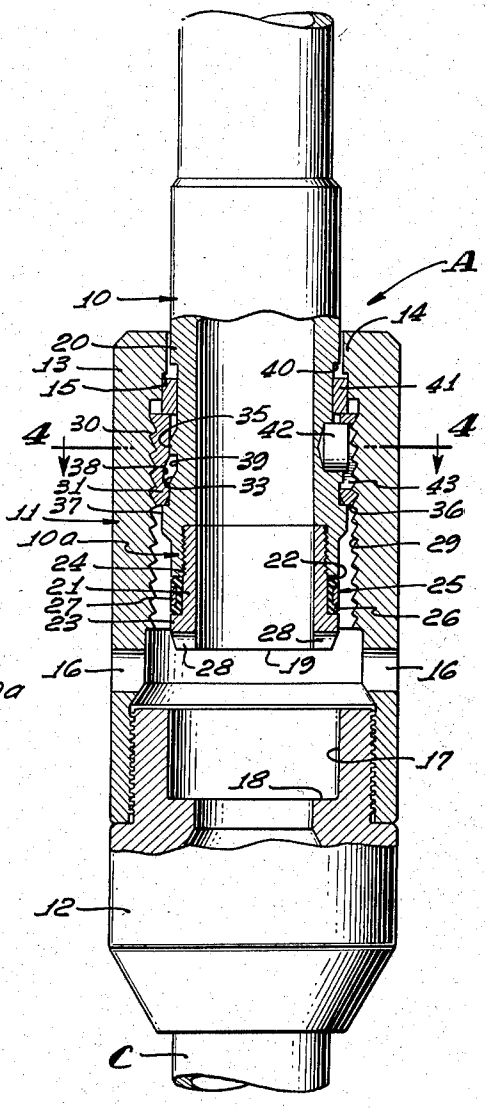


FIG. 2.



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FIG. 3.

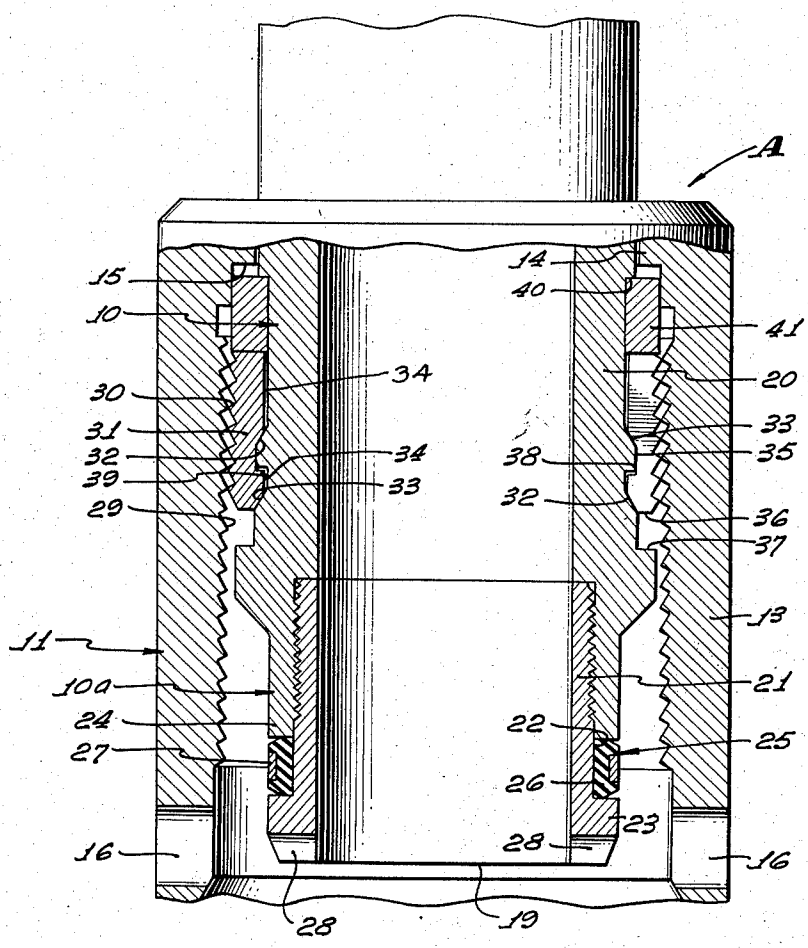
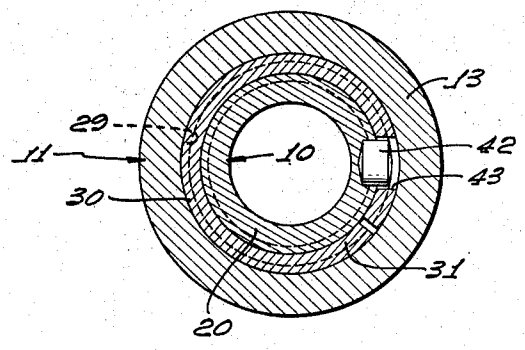


FIG. 4.



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2,874,931

TUBULAR STRING VALVE DEVICES

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Application August 12, 1955, Serial No. 527,996

12 Claims. (Cl. 251—218)

The present invention relates to valve devices, and more particularly to valves capable of use in well bores for the purpose of controlling flow of fluids between the interior and exterior of tubular strings, such as tubing and drill pipe.

An object of the present invention is to provide a telescopic valve, particularly useful in a tubular string to be disposed in a well bore, which can be easily and repeatedly shifted between open and closed positions.

Another object of the invention is to provide a telescopic valve of the character indicated which can be shifted to open position by rotating the tubular string in a right-hand direction, and which is shiftable to closed position without the necessity for rotating the tubular string in either direction. By virtue of the valve being operable in this manner, there is no opportunity for the threaded joints of the tubular string to unscrew or loosen inadvertently.

A further object of the invention is to provide a telescopic valve to be incorporated in a tubular string adapted for disposition in a well bore, in which the valve is capable of transmitting the turning effort of the tubular string to another tool connected to the lower end of the valve, both when the valve is in an open position and in a closed position.

Yet another object of the invention is to provide a telescopic valve having parts that thread or screw upwardly to open the valve when the tubular string is rotated in a right-hand direction, the valve parts merely ratcheting in a downward direction (without rotation) when the valve is to be closed, in which upward threading of the valve parts to open position is facilitated.

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, partially in side elevation, of a valve device, with its parts in closed position;

Fig. 2 is a view similar to Fig. 1, with the valve device in open position;

Fig. 3 is an enlarged sectional and side elevational view of the valve device in open position, the valve being movable toward closed position;

Fig. 4 is a cross-section taken along the line 4—4 on Fig. 2.

The valve device A disclosed in the drawings is adapted to be secured to the lower portion of a tubular string B, such as tubing or drill pipe, extending to the top of a well bore and by means of which it is lowered through

the latter to the desired location at which the apparatus is to be used. The lower portion of the valve device A is attachable to a lower tool C, only the body portion of which is disclosed. The lower tool C may be a well packer adapted to be anchored in packed-off condition in a well casing as a result of imposing a downward weight on the packer elements (not shown).

The valve device A includes an inner mandrel or body 10 threadedly connected to the lower end of the tubular string B, and telescopically disposed within an outer member or housing 11, the lower portion 12 of which is threadedly attached to the upper end of the body C of the lower tool. The outer housing 11 may consist of the lower portion 12 just described, which is threaded into an upper housing portion 13 terminating in an upper inwardly directed flange 14, the lower face of which provides a downwardly facing stop shoulder 15. Adjacent and above the lower housing portion 12, the upper portion 13 may be provided with a plurality of side ports 16 which establish communication between the interior and exterior of the housing 11.

The lower housing portion 12 has an internal cylindrical valve seating surface 17 thereon terminating in a stop shoulder 18 against which the lower end 19 of the inner mandrel 10 can engage. This inner mandrel includes an upper portion 20 which is threaded onto a lower portion 21. When threadedly attached to each other to their fullest extent, the upper and lower mandrel portions 20, 21 provide an external groove 22, which is defined between a lower outwardly directed shoulder or flange 23 on the lower portion and the lower end 24 of the upper portion. A valve sealing structure 25 is secured in this groove. As specifically disclosed, the valve seal includes a generally U-shaped rubber or rubber-like seal ring 26 encompassed by a metallic reinforcing ring disposed therewithin, the periphery of the metallic ring and the peripheral portion of the non-metallic seal ring being substantially flush with each other.

When the mandrel 10 occupies its lower position within the housing 11, the lower part 10*a* of the mandrel, which actually constitutes a valve head, and the seal structure 25 are disposed within the cylindrical valve seat 17, the seal ring 26 sealing against the latter, to close the ports 16 and prevent fluid from flowing between the interior of the mandrel 10 and the exterior of the housing 11. The lower end of the mandrel may have diametrically opposed slots 28 provided therein for the reception of a suitable tool or wrench (not shown) in threading the lower mandrel portion 21 into the upper mandrel portion 20. This lower end 19 is adapted to seat against the lower shoulder or stop 18 provided on the lower portion 12 of the housing, which will determine the lowermost position of the mandrel 10 within the housing 11, and which will also facilitate transmission of torque or rotary motion between the mandrel and the housing, as described hereinbelow.

The mandrel 10 can be telescoped downwardly with respect to the housing 11 to place the valve head 10*a* in port closing position within the cylindrical seat 17, without the necessity of rotating the mandrel in either direction. However, rotation of the mandrel 10 to effect its elevation to port opening position is required. As is specifically disclosed, the housing member 13 above the ports 16 is provided with internal left-hand threads 29 of a ratchet type, which threads are engageable by companion external threads 30 provided on a split ratchet sleeve or ring 31 encompassing the mandrel. The ratchet ring 31 has a plurality of longitudinally spaced internal cam surfaces 32 that are inclined in a downward and outward direction cooperable with companion longitudinally spaced external cam surfaces 33 on the upper man-

drel member 20, to insure that the ratchet ring 31 can be urged in an outward direction, to place its threads 30 in full meshing engagement with the internal threads 29 of the mandrel. The upper ends of the cam surfaces 32 on the ratchet ring terminate at cylindrical holding surfaces 34 parallel to the axis of the apparatus, which are engageable with companion external cylindrical surfaces 35 that extend downwardly from the ends of the external cam surfaces 33 on the mandrel. When the holding surfaces 34, 35 are in engagement with each other, the ratchet ring 31 is held in its outward direction in full threaded engagement with the internal housing thread 29. Such position is definitely determined by the engagement of the lower end 36 of the ratchet sleeve with a lower outwardly directed shoulder or flange 37 on the mandrel.

Upon relative downward movement of the mandrel 10 with respect to the ratchet ring 31, the holding surfaces 34, 35 are moved out of engagement to each other, the upper cam portion 33 on the mandrel being disposed opposite an internal recess 38 in the ratchet sleeve 31, and the lower cam portion 32 of the ratchet sleeve being opposite a peripheral groove 39 in the mandrel. When the parts are in this position (see Fig. 3), the split ratchet ring 31 can be cammed inwardly by the internal and external threads 29, 30 to disengage the latter from each other and permit the mandrel 10 to be moved downwardly and without rotation within the housing 11, in the manner hereinafter described.

The mandrel 10 can push the ratchet ring 31 down through the internally threaded housing 11, and without rotation, by causing a downwardly directed shoulder 40 on the mandrel to engage a split thrust ring 41 encompassing the mandrel below the shoulder, the thrust ring 41, in turn, engaging the upper end of the ratchet sleeve 31. When the ratchet sleeve 31 is being pushed down through the housing, the lower stop shoulder 37 on the mandrel is spaced downwardly a particular distance from the lower end 36 of the ratchet sleeve (Fig. 3).

As stated above, the valve is shifted to open position as a result of rotating the mandrel 10 in a right-hand direction. The rotation of the mandrel is transmitted to the ratchet ring 31 through a pin or key 42 secured to the mandrel 10 and extending outwardly into an enlarged hole or opening 43 in the split ratchet ring at the leading end portion of the latter. When the mandrel 10 is turned to the right, the pin 42 will engage the leading side of the hole 43 and will tend to pull the ratchet ring 31 inwardly slightly, so that its threads 30 do not bind against the companion internal threads 29 of the housing 11. The mandrel 10 is rotated, to rotate the ratchet ring 31, which will cause the latter and the mandrel to thread upwardly with respect to the housing 11, to shift the valve head 10*a* and its sealing structure 25 upwardly and out of the cylindrical seat 17 for the purpose of opening the ports 16.

The apparatus A is made up at the top of the well bore and the mandrel 10 lowered within the housing 11 to its fullest extent. Such lowering movement will cause the mandrel shoulder 40 to engage the thrust ring 41, urging the latter against the ratchet ring 31. The ratchet ring will contract, because of the camming action of the internal threads 29 on the external ratchet ring threads 30, the ring being movable downwardly and without rotation along the internal threads 29 until the lower end 19 of the mandrel engages the housing shoulder 18, which assures disposition of the valve head 10*a* and its seal 25 in proper sealing relation to the cylindrical valve seat 17. At this time, the ratchet ring 31 will be elevated slightly above the mandrel shoulder 37. Since it is desired, when the apparatus is in the well bore, to manipulate the tool C secured to the lower end of the valve mechanism, by imparting left-hand turning effort to the mandrel 10, the latter, following engagement of its lower end 19 with the stop shoulder 18 on the lower housing 12, is turned the required distance to the left, which will effect downward feeding of the ratchet sleeve 31 along the mandrel 10 and the housing 11 to the position in which the lower end 36 of the ratchet sleeve engages the stop shoulder 37 on the mandrel, which is the position shown in Fig. 1.

The lower end of the housing 11 is threadedly secured to the body of the tool C, such as a retrievable packer, and the apparatus is then lowered in the well bore or well casing by means of the tubular string B attached to the upper end of the mandrel 10. When the location is reached at which the lower tool C is to be operated or set, a left-hand torque is taken on the mandrel 10. Inasmuch as the ratchet ring 31 cannot move downwardly along the mandrel 10 to any further extent, and since the lower end 19 of the mandrel engages the stop shoulder 18 on the housing, such left-hand torque is transmitted through the pin 42 and the ratchet ring 31 to the housing 11, and from the housing to the body of the retrievable packer C, the latter then being manipulated so as to cause its setting, as by lowering the tubular string B and the valve device A the required distance, for the purpose of effecting an anchoring of the slips and packing structure (both not shown) of the lower tool C against the wall of the well casing.

When the valve is to be opened, the tubing string B and mandrel 10 are rotated to the right, the rotation being transmitted through the pin 42 to the ratchet ring 31. This right-hand rotation will elevate the ratchet ring 31 along the mandrel 10 and the housing 11 until the lower end of the ratchet sleeve hole 43 engages the pin 42, whereupon the mandrel 10 will elevate, to raise its head 10*a* and seal 25 completely out of the cylindrical seat 17, to open the side ports 16. The upward threading motion then proceeds until the split thrust ring 41 engages the inwardly directed shoulder 15 at the upper end of the housing, whereupon further rotation of the mandrel 10 relative to the housing 11 cannot take place. At this time, if desired, any right-hand rotation of the tubular string B and mandrel will be transmitted through the pin 42 and ratchet sleeve 31 to the housing 11, causing the latter to rotate, as well as the body of the lower tool C connected thereto.

If it is desired to again close the valve, it is only necessary to shift the mandrel 10 downwardly with respect to the housing 11. Downward movement of the housing will be resisted or prevented by the tool C connected to its lower portion. When the mandrel is shifted downwardly, it will be placed in a position with respect to the ratchet sleeve 31, in which the mandrel holding surfaces 35 are out of alignment with the ratchet sleeve holding surfaces 34. The parts will occupy the position disclosed in Fig. 3, wherein the mandrel shoulder 40 engages the thrust ring 41, the latter engaging the upper end of the ratchet sleeve 31. A mere downward movement of the mandrel 10 will now allow the ratchet sleeve 31 to retract, ratcheting past the internal threads 29 until the mandrel 10 is disposed in its lowermost position within the housing once again, such as shown in Fig. 1, in which the ports 16 are closed. When the lower end 19 of the mandrel engages the stop shoulder 18 in the housing, the ratchet sleeve 31 will be in a higher position than the one illustrated, since the sleeve will be up against the thrust ring 41. As was pointed out above, however, if it is again desired to transmit left-hand rotation through the mandrel 10 to the housing 11 and the body of the lower tool C, the tubing string B and mandrel 10 are merely rotated to the left by a slight amount, which motion will be transmitted from the pin 42 to the ratchet sleeve 31, causing the latter to thread downwardly along the housing threads 29 to the position shown in Fig. 1, and into engagement with the lower mandrel shoulder 37. Left-hand rotation can now be transmitted between the mandrel 10 and the housing 11.

From the foregoing description, it is apparent that the

valve A can be shifted to open position at any time merely by rotating the tubular string B and mandrel 10 to the right. It can be shifted to closed position without the necessity for rotating the tubing string and mandrel in the reverse direction, or, for that matter, from rotating in either direction. All that is necessary is to move the mandrel 10 downwardly within the housing 11, the ratchet sleeve 31 ratcheting over the threads 29 until the valve head 10*a* and the sealing structure 25 are fully disposed within the cylindrical seat 17.

The inventors claim:

1. In a control valve adapted to be secured to a tubular string for disposition in a well bore: first and second telescopically arranged members adapted to be moved into and out of valve sealing relation with respect to each other to place said valve selectively in open position or closed position; said first member having a first thread; a latch member movable with and laterally on said second member and having a second thread companion to and meshable with said first thread; said latch member being movable laterally in one direction on said second member into threaded engagement with said first thread to enable said telescopically arranged members to rotate and move longitudinally in one direction relative to each other to place said telescopically arranged members in one of said valve positions; said latch member being movable laterally in the other direction on said second member to an extent sufficient to bring said threads out of engagement with each other to enable said latch member and second member to be moved relatively longitudinally in the other direction and without rotation past said first thread and along said first member to place said telescopically arranged members in the other of said valve positions, said threads being of sufficient longitudinal extent that said second thread meshes with said first thread when said telescopically arranged members are in said one of said valve positions and also when said telescopically arranged members in said other of said valve positions; means coupling said latch member and said other member against substantial rotation with respect to each other; and stop means on said telescopically arranged members engageable with each other when said valve is in one of said positions to permit rotary motion to be transmitted from one of said telescopically arranged members through said coupling means and latch member to said other telescopically arranged member.

2. In a control valve adapted to be secured to a tubular string for disposition in a well bore: first and second telescopically arranged members adapted to be moved into and out of valve sealing relation with respect to each other to place said valve selectively in open position or closed position; said first member having a first thread; an expansible and retractable latch ring movable with and laterally on said second member and having a second thread companion to and meshable with said first thread; said latch ring being movable laterally in one direction on said second member into threaded engagement with said first thread to enable said members to rotate and move longitudinally in one direction relative to each other to place said members in one of said valve positions; said latch ring being movable laterally in the other direction on said second member to an extent sufficient to bring said threads out of engagement with each other to enable said latch member and second member to be moved relatively longitudinally in the other direction and without rotation past said first thread and along said first member to place said members in the other of valve positions, said threads being of sufficient longitudinal extent that said second thread meshes with said first thread when said members are in said one of said valve positions and also when said members are in said other of said valve positions; means coupling said latch ring and said other member against substantial rotation with respect to each other; and stop means on said members engageable with each other when said valve is in one of said positions to permit rotary motion to be transmitted from one of said members through said coupling means and latch ring to the other of said members.

3. In a control valve adapted to be secured to a tubular string for disposition in a well bore: inner and outer members telescopically arranged one within the other and having valve elements coengageable to close the valve upon relative longitudinal movement in one direction between said members and disengageable from each other to open the valve upon relative longitudinal movement in the opposite direction between said members; one of said members having a first thread; a laterally movable latch member movable longitudinally with said other member and also movable longitudinally relative to said other member and having a second thread companion to and meshable with said first thread; means coupling said latch member and said other member against substantial rotation with respect to each other; said threads being engageable with each other to effect relative longitudinal movement between said members in one direction in response to relative rotation between said members; said latch member being adapted to ratchet along said first thread to permit relative non-rotary longitudinal movement between said members in the opposite direction; coengageable holding surfaces on said latch member and said other member for holding said second thread meshed with said first thread when said latch member occupies one longitudinal position on said other member, said surfaces being disengageable when said latch member occupies another longitudinal position on said other member to permit said latch member to ratchet along said first thread; and stop means on said telescopically arranged members engageable with each other when said threads are meshed to permit rotary motion to be transmitted from one of said telescopically arranged members through said coupling means and latch member to said other telescopically arranged member.

4. In a control valve adapted to be secured to a tubular string for disposition in a well bore: inner and outer members telescopically arranged one within the other and having valve elements coengageable to close the valve upon relative longitudinal movement in one direction between said members and disengageable from each other to open the valve upon relative longitudinal movement in the opposite direction between said members; said outer member having an internal thread; a laterally movable latch member movable longitudinally with said inner member and also longitudinally relative to said inner member and having an external thread companion to and meshable with said internal thread; means coupling said latch member and inner member against substantial rotation with respect to each other; said threads being engageable with each other to effect relative longitudinal movement between said members in one direction in response to relative rotation between said members; said latch member being adapted to ratchet along said internal thread to permit relative non-rotary longitudinal movement between said members in the opposite direction; coengageable holding surfaces on said latch member and inner member for holding said external thread meshed with said internal thread when said latch member occupies one longitudinal position on said inner member, said surfaces being disengageable when said latch member occupies another longitudinal position on said inner member to permit said latch member to ratchet along said internal thread; and stop means on said telescopically arranged members engageable with each other when said threads are meshed to permit rotary motion to be transmitted from one of said telescopically arranged members through said coupling means and latch member to said other telescopically arranged members.

5. In a control valve adapted to be secured to a tubular string for disposition in a well bore: inner and outer

members telescopically arranged one within the other and having valve elements coengageable to close the valve upon relative longitudinal movement in one direction between said members and disengageable from each other to open the valve upon relative longitudinal movement in the opposite direction between said members; one of said members having a first thread; a laterally movable latch member movable longitudinally with said other member and also movable longitudinally relative to said other member and having a second thread companion to and meshable with said first thread; means coupling said latch member and said other member against substantial rotation with respect to each other; said threads being engageable with each other to effect relative longitudinal movement between said members in one direction in response to relative rotation between said members; said latch member being adapted to ratchet along said first thread to permit relative non-rotary longitudinal movement between said members in the opposite direction: coengageable holding surfaces on said latch member and said other member for holding said second thread meshed with said first thread when said latch member occupies one longitudinal position on said other member, said surfaces being disengageable when said latch member occupies another longitudinal position on said other member to permit said latch member to ratchet along said first thread; and coengageable stop means on said telescopically arranged members limiting the extent of relative longitudinal movement between said telescopically arranged members in a valve opening direction to permit rotary motion to be transmitted from one of said telescopically arranged members through said coupling means and latch member to said other telescopically arranged member.

6. In a control valve adapted to be secured to a tubular string for disposition in a well bore: inner and outer members telescopically arranged one within the other and having valve elements coengageable to close the valve upon relative longitudinal movement in one direction between said members and disengageable from each other to open the valve upon relative longitudinal movement in the opposite direction between said members; said outer member having an internal thread; a laterally movable latch member movable longitudinally with said inner member and also longitudinally relative to said inner member and having an external thread companion to and meshable with said internal thread; means coupling said latch member and inner member against substantial rotation with respect to each other; said threads being engageable with each other to effect relative longitudinal movement between said members in one direction in response to relative rotation between said members; said latch member being adapted to ratchet along said internal thread to permit relative non-rotary longitudinal movement between said members in the opposite direction; coengageable holding surfaces on said latch member and inner member for holding said external thread meshed with said internal thread when said latch member occupies one longitudinal position on said inner member, said surfaces being disengageable when said latch member occupies another longitudinal position on said inner member to permit said latch member to ratchet along said internal thread; and coengageable stop means on said members limiting the extent of relative longitudinal movement between said members in both valve opening and valve closing directions to permit rotary motion to be transmitted from one of said telescopically arranged members through said coupling means and latch member to said other telescopically arranged member.

7. In a control valve adapted to be secured to a tubular string for disposition in a well bore: an outer member; an inner member connectible to the tubular string and telescopically disposed within said outer member; said inner and outer members having valve elements thereon coengageable to close the valve upon relative downward movement of said inner member in said outer member and disengageable from each other to open the valve upon relative upward movement of said inner member in said outer member; said outer member having an internal thread; a laterally movable latch member movable longitudinally with said inner member and having an external thread companion to and meshable with said internal thread; means coupling said latch member and inner member for rotation together; said threads being engageable with each other in response to rotation of said inner member to effect upward longitudinal movement of said inner member within said outer member to disengage said valve elements; said latch member being adapted to ratchet downwardly along said internal threads to permit non-rotary downward movement of said inner member in said outer member to engage said valve elements with each other to close the valve; and stop means on said inner and outer members engageable with each other when said threads are meshed to permit rotary motion to be transmitted from one of said telescopically arranged members through said coupling means and latch member to said other telescopically arranged member.

8. In a control valve adapted to be secured to a tubular string for disposition in a well bore: an outer member; an inner member connectible to the tubular string and telescopically disposed within said outer member; said inner and outer members having valve elements thereon coengageable to close the valve upon relative downward movement of said inner member in said outer member and disengageable from each other to open the valve upon relative upward movement of said inner member in said outer member; said outer member having an internal thread; a laterally movable latch member movable longitudinally with said inner member and having an external thread companion to and meshable with said internal thread; means coupling said latch member and inner member for rotation together; said threads being engageable with each other in response to rotation of said inner member to effect upward longitudinal movement of said inner member within said outer member to disengage said valve elements; said latch member being adapted to ratchet downwardly along said internal threads to permit non-rotary downward movement of said inner member in said outer member to engage said valve elements with each other to close the valve; and stop means on said inner and outer members engageable with each other when said threads are meshed to permit rotary motion to be transmitted from one of said telescopically arranged members through said coupling means and latch member to said other telescopically arranged member; and means on said inner member engageable with said latch member to hold said latch member outwardly in threaded engagement with said inner threads.

9. In a control valve adapted to be secured to a tubular string for disposition in a well bore: an outer member; an inner member connectible to the tubular string and telescopically disposed within said outer member; said inner and outer members having valve elements thereon coengageable to close the valve upon relative downward movement of said inner member in said outer member and disengageable from each other to open the valve upon relative upward movement of said inner member in said outer member; said outer member having an internal thread; a split expansible and contractible latch ring movable longitudinally with said inner member and having an external thread companion to and meshable with said internal thread; said latch ring having an opening adjacent the leading end of its split; a pin on said inner member within said opening for engagement with the leading portion of said latch ring to transmit rotary motion of said inner member to said latch ring; said threads being engageable with each other to effect upward movement of said inner member within said

outer member in response to rotation of said inner member by said tubular string to disengage said valve elements from each other to open the valve; said latch ring being adapted to ratchet downwardly along said internal thread to permit non-rotary downward movement of said inner member in said outer member to coengage said valve elements to close the valve.

10. In a control valve adapted to be secured to a tubular string for disposition in a well bore: an outer member; an inner member connectible to the tubular string and telescopically disposed within said outer member; said inner and outer members having valve elements thereon coengageable to close the valve upon relative downward movement of said inner member in said outer member and disengageable from each other to open the valve upon relative upward movement of said inner member in said outer member; said outer member having an internal thread; a split, expansible and contractible latch ring movable longitudinally with said inner member and having an external thread companion to and meshable with said internal threads; said latch ring having an opening adjacent the leading end of its split; a pin on said inner member within said opening for engagement with the leading portion of said latch ring to transmit rotary motion of said inner member to said latch ring; said threads being engageable with each other to effect upward movement of said inner member within said outer member in response to rotation of said inner member by said tubular string to disengage said valve elements from each other to open the valve; said latch ring being adapted to ratchet downwardly along said internal thread to permit non-rotary downward movement of said inner member in said outer member to coengage said valve elements to close the valve; and coengageable stop means on said members limiting the extent of downward and upward movement of said inner member within said outer member.

11. In a control valve adapted to be secured to a tubular string for disposition in a well bore: an outer member; an inner member connectible to the tubular string and telescopically disposed within said outer member; said inner and outer members having valve elements thereon coengageable to close the valve upon relative downward movement of said inner member in said outer member and disengageable from each other to open the valve upon relative upward movement of said inner member in said outer member; said outer member having an internal thread; a split, expansible and contractible latch ring movable longitudinally with said inner member and having an external thread companion to and meshable with said internal threads; said latch ring having an opening adjacent the leading end of its split; a pin on said inner member within said opening for engagement with the leading portion of said latch ring to transmit rotary motion of said inner member to said latch ring; said threads being engageable with each other to effect upward movement of said inner member within said outer member in response to rotation of said inner member by said tubular string to disengage said valve elements from each other to open the valve; said latch ring being adapted to ratchet downwardly along said internal thread to permit non-rotary downward movement of said inner member in said outer member to coengage said valve elements to close the valve; coengageable stop means on said members limiting the extent of downward and upward movement of said inner member within said outer member; and means on said inner member engaging said latch ring to hold said latch ring outwardly in threaded engagement with said inner threads.

12. A control valve as defined in claim 6; wherein said threads are in mesh when said stop means are coengaged with said valve closed and also with said valve open.

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