March 6, 1956 R. C. BAKER ET AL 2,737,244

MULTIPLE BALL RELEASE DEVICES FOR WELL TOOLS

Filed April 25, 1952 2 Sheets-Sheet 1

Fig. 1.

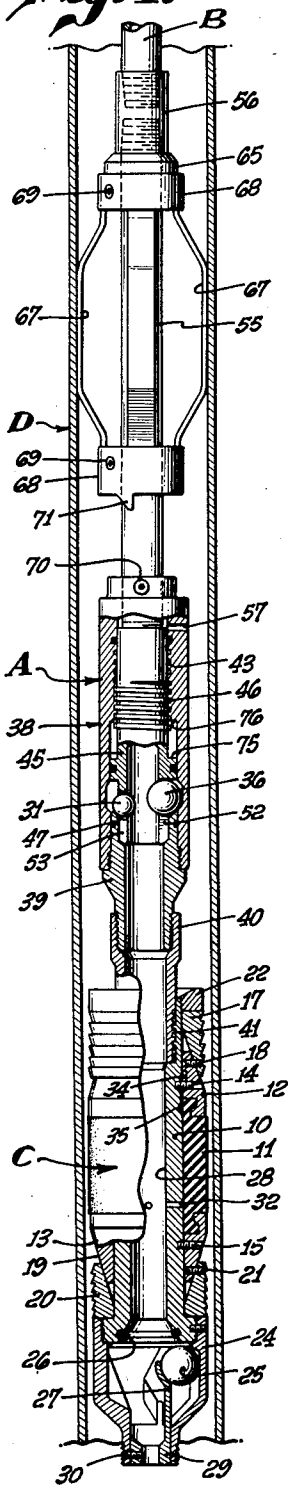


Fig. 2.

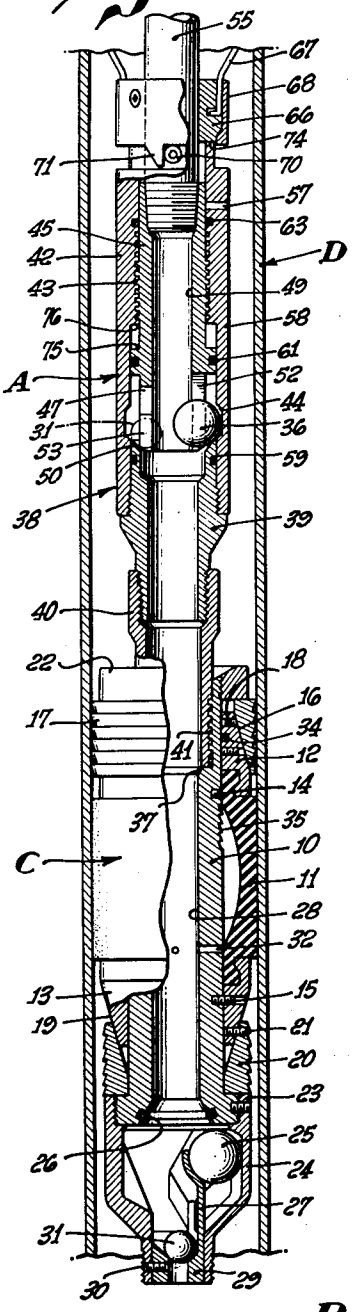


Fig. 3.

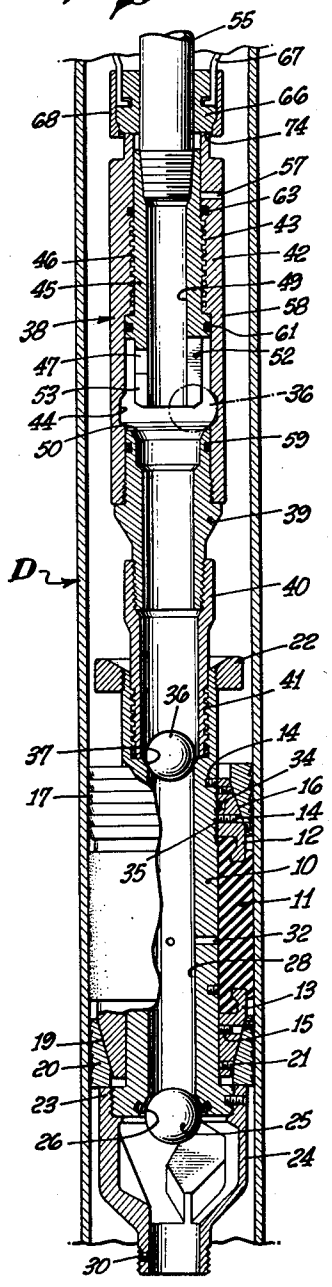


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Fig. 4.

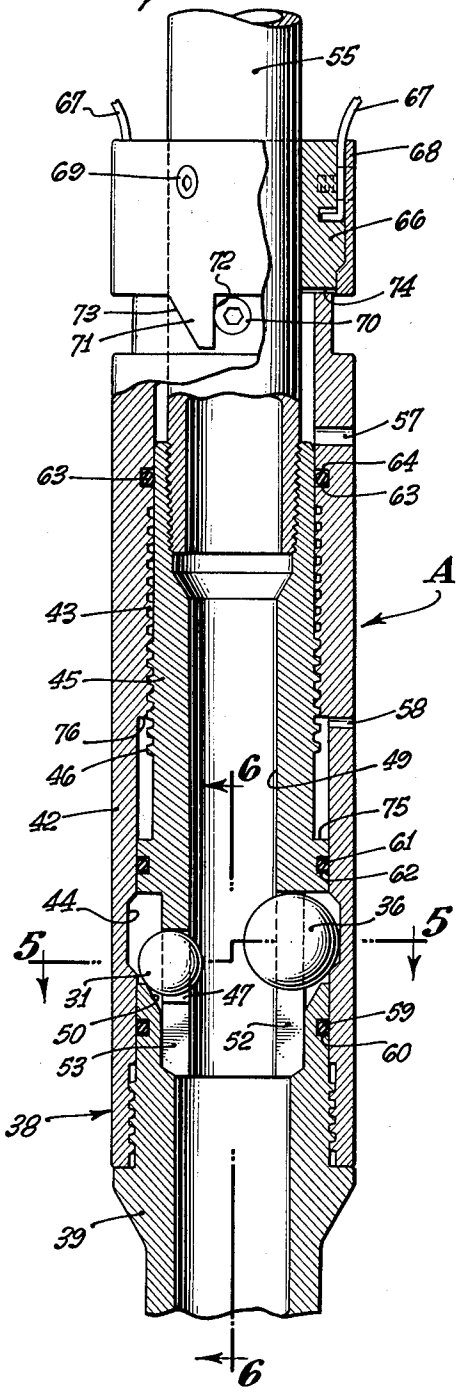



Fig. 5.

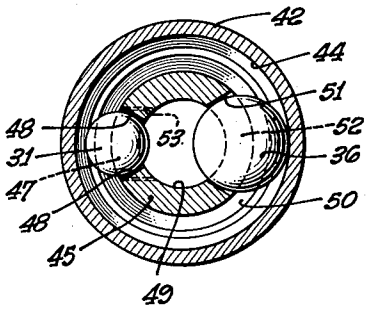
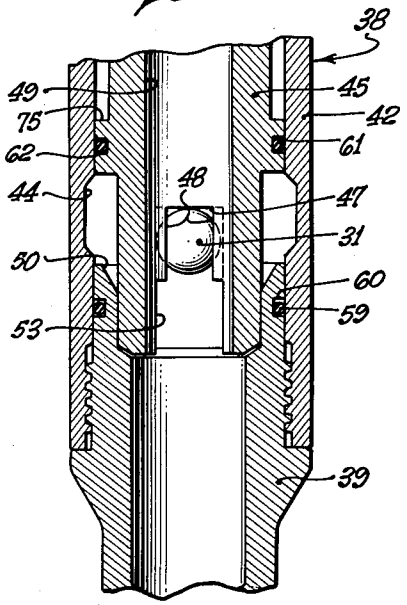



Fig. 6.

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United States Patent Office

2,737,244

Patented Mar. 6, 1956



2,737,244

# MULTIPLE BALL RELEASE DEVICES FOR WELL TOOLS

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Application April 25, 1952, Serial No. 284,348

12 Claims. (Cl. 166—124)

The present invention relates to well devices, and more particularly to apparatus useful in the performance of bridging, cementing, acidizing, testing, and similar functions in well bores.

Certain types of well packers, and similar devices, make use of valve elements to close a passage therethrough. Such closing may be accomplished by allowing gravitation, at different times, of individual ball or similar valve elements through the fluid in the tubular string to which the packer is secured, and into engagement with different seats associated with the packer. As an example, a valve element may gravitate through the tubular string into engagement with a companion seat in the well packer, to enable the packer to be set hydraulically in a well casing. After such setting and the performance of a particular function or functions with the well packer, another valve element may be allowed to gravitate through the tubular string into engagement with a companion seat in the packer, to prevent downward passage of fluid through the packer.

A substantial amount of time is required for the gravitation of the valve elements through the tubular string into engagement with their companion seats, especially when the tubular string is quite long and filled with heavy drilling mud, or other viscous fluid. Moreover, the bouncing of each valve element along the inner wall of the tubular string during its descent may nick or mar its surface to the extent that it will fail to make a fluid tight seal with its companion seat.

Accordingly, an object of the present invention is to obviate the need for the valve elements to travel through the length of the tubing string in order to reach their companion valve seats.

Another object of the invention is to retain the different ball, or equivalent, valve elements in ineffective positions in the vicinity of their companion valve seats and release them selectively whenever their engagement with such seat is desired.

A further object of the invention is to retain a ball, or equivalent, valve element in ineffective position in the vicinity of its companion seat in a well tool, and to prevent inadvertent release of such valve element during lowering of the equipment in the well bore.

Yet another object of the invention is to retain a ball, or equivalent, valve element in ineffective position in the vicinity of its companion seat in a well tool, and to effect release of such valve element to allow its engagement with said seat despite the fact that the well tool is not anchored or set in the well bore.

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, with parts shown in elevation, through apparatus embodying the invention, with the parts being disposed in the position they occupy during lowering of the apparatus through a string of well casing;

Fig. 2 is an enlarged sectional view similar to Fig. 1, with the parts occupying another relative position, and with the lower well packer partially set in the well casing;

Fig. 3 is a view similar to Fig. 2, with the parts occupying still another relative position, and with the well packer anchored in packed-off condition in the well casing;

Fig. 4 is an enlarged longitudinal section, with parts in elevation, through the ball releasing and dropping portion of the apparatus illustrated in Fig. 1, with the plurality of balls retained in ineffective position;

Fig. 5 is a cross-section taken along the line 5—5 on Fig. 4;

Fig. 6 is a fragmentary longitudinal section taken along the line 6—6 on Fig. 4.

As illustrated in the drawings, a ball releasing device A may constitute the lower portion of a tubular string B, which is releasably attached to a well packer C, to be lowered through a string of casing D to the desired point at which the packer is to be anchored to the casing in packed-off condition. The well packer C may be of any suitable construction, the one shown being of the type specifically described in the United States Letters Patent No. 2,121,051.

Essentially, the packer consists of a tubular body **10** to which the lower end of the ball releasing device A may be secured. Although not illustrated, the lower end of the releasing device may be secured to intervening apparatus, which is, in turn, attached to the well packer. The body **10** has an inflatable packing sleeve **11** surrounding it, whose upper and lower ends are suitably secured, respectively, to upper and lower conical expanders **12, 13** attached to the body originally by one or more shear screws **14, 15.** The outer surface **16** of the upper expander **12** tapers upwardly and inwardly, and is engaged by correspondingly tapered upper segmental slips **17** secured to it originally in retracted position by shear screws **18.** Similarly, the outer surface **19** of the lower expander **13** is tapered inwardly in a downward direction, and engages correspondingly tapered lower segmental slips **20** secured to it originally in retracted position by shear screws **21.** The upper end of the body **10** carries an abutment ring **22** engageable by the upper end of the upper segmental slips **17,** and the lower end of the body is provided with a lower abutment **23** for engagement with the lower end of the lower segmental slips **20.**

A valve housing and guide **24** is secured to the lower end of the body **10** and has a back pressure ball valve **25,** preferably buoyant in cement slurry, originally prevented from engaging its companion valve seat **26** on the body by a retainer arm **27** which holds the ball against the housing **24** to one side of the central passage **28** through the body **10.** The arm **27** extends upwardly from a trip ball seat **29** originally secured to the lower end of the valve housing **24** by a suitable shear screw **30.**

As described in the aforesaid Patent No. 2,121,051, a tripping ball **31** may be lowered through the tubular string B and into engagement with the tripping ball seat **29,** closing the apparatus against further downward flow of fluid therethrough. This enables pressure to be built up in the tubing string B and packer body **10** to a sufficient degree to initiate setting of the packer. The fluid under pressure may pass outwardly of the body

through its lateral ports 32 opening into the interior of the packing sleeve 11, elongating the latter in an upward direction and exerting an upward force against the upper expander 12, shearing the expander and slip screws 14, 18, moving the expander 12 upwardly along the body 10 and the upper slips 17 radially outward along the abutment 22 into anchoring engagement with the wall of the well casing D (Fig. 2).

Since the upper slips 17 now prevent further upward movement of the upper expander 12, the taking of an elevating strain on the tubular string B and its attached valve retaining device A, as well as the packer body 10, first compresses the packing sleeve 11 into fluid tight engagement with the packer body 10 and casing wall, and then shears the lower expander and slip screws 15, 21, causing the lower abutment 23 to shift the lower slips 20 upwardly along the lower expander 13 and radially outward into anchoring engagement with the wall of the well casing. Thereafter, an increase of the fluid pressure to a predetermined degree shears the trip ball seat screw 30 and blows the seat 29, together with the back pressure ball retaining arm 27 and the trip ball 31 downwardly out of the packer apparatus, freeing the back pressure ball valve 25 for engagement with its companion seat 26. The packer is held in its set position by engagement of a ratchet ring 34 in the upper expander 12 with annular ratchet teeth 35 on the body 10, which precludes downward movement of the latter with respect to the expanders 12, 13, slips 17, 20 and packing 11 (Fig. 3).

Thereafter, cement slurry, or other fluid, may be pumped through the tubular string B and apparatus A, C for discharge from the lower end of the packer. The bleeding off of pressure within the tubular string allows the back pressure ball 25 to move upwardly and engage its companion seat 26, preventing return or upward flow of fluid through the packer apparatus (Fig. 3).

When it is desired to prevent downward passage of fluent materials through the packer apparatus, a bridging ball element 36 has heretofore been lowered, or allowed to gravitate, through the tubular string B into engagement with an upper valve seat 37 in the packer body 10. This bridging ball valve member 36 then prevents downward passage of fluid through the well packer C, and since the back pressure valve member 25 prevents upward passage of fluid through the apparatus, a bridging packer is thereby provided which prevents flow of fluid through the well packer apparatus in both directions, thereby causing it to function as a bridge plug.

As indicated above, the trip ball 31 and the bridging ball 36 have heretofore been allowed to gravitate through the tubular string B, which is a time consuming operation. By virtue of the apparatus A disclosed herein, both the trip ball and the bridging ball valve elements are initially located in the vicinity of the well packer C and are lowered through the well casing D with the well packer. These ball elements do not interfere with the functioning of the well packer at all, being retained in ineffective position until they are purposely and individually released to cooperate with their companion seats 29, 37.

As disclosed in the drawings, the ball retaining and releasing device A forms the lower end of the tubular string B. It includes a ball retaining housing portion 38, including a lower section 39 threaded into a sub 40 detachably secured to the upper portion of the packer body 10, as by means of a left-hand threaded connection 41. The lower section of the housing is screwed into an upper or cylinder section 42 that has an upper female left-hand thread 43 disposed substantially above an enlarged chamber 44 provided therein. A plurality of valve elements 31, 36, which may be in the form of ball members, are initially disposed within the upper section 42 of the housing 38. Thus, the trip ball 31, which is to engage the trip ball seat 29 at the lower portion of the well packer, may be confined in the housing by a retainer sub 45 which has left-hand male threads 46 threadedly engaging



the female threads 43 in the cylindrical section 42 of the housing. This retainer sub 45 extends downwardly from its threaded portion 46, and has a slot 47 provided in its side wall receiving the trip ball 31. The sides 48 of the slot are tapered (Fig. 5), converging inwardly toward each other, to prevent inward movement of the ball 31 into the central passage 49 through the retainer sub 45. The ball 31 is also prevented from moving downwardly by engaging the upper end 50 of the lower housing section 39.

In a similar manner, another ball 36, such as the bridging ball which is to engage the upper valve seat 37 in the packer body 10, is prevented from moving out of the upper housing section 42. In view of the usual greater diameter of the bridging ball 36, the upper section is provided with the enlarged chamber 44 in which the bridging ball may be partially located. The bridging ball 36 is prevented from moving downwardly out of the chamber 44 and housing 38 by the tapered side walls 51 of another slot 52 formed through the lower portion of the retainer sub 45, the ball 36 engaging the tapered sides 51, which converge toward each other in an inward direction, and also engaging the upper end 50 of the lower housing section 39 and the lower portion of the chamber 44.

Rotation of the retainer sub 45 to the right, or in a clockwise direction, as viewed from the top of the well bore, will cause the retainer sub to feed upwardly within the housing 39, the balls 31, 36 rotating with the sub 45. When moved upwardly to a certain extent, the trip ball 31 will be released, inasmuch as the tapered sides 48 of its companion slot 47 are relatively short in extent, extending downwardly to a much lesser length than the tapered sides 51 of the slot 52 confining the bridging ball 36. As most clearly shown in Fig. 6, partial upward movement of the retainer sub 45 with respect to the housing 39 will lift the sub and its tapered sides 48 out of engagement with the ball 31, positioning an enlarged slot portion 53, which is wider than the ball diameter, opposite the ball 31 and allowing the trip ball to drop through the enlarged slot portion 53 and through the lower housing section 39, sub 40 and packer body 10 into engagement with the trip ball seat 29 (Fig. 2 position).

Continued rotation of the retainer sub 45 to the right will continue its elevation within the valve housing 38, the ball 36 rotating with the sub, and will eventually move the lower ends of the tapered slot sides 51 out of engagement with the bridging ball 36, whereupon the ball member 36 may also gravitate into engagement with its companion seat 37 formed in the upper portion of the packer body 10.

The retainer sub 45 is rotated by rotating the tubular string B. Thus, the retainer sub is threaded onto the lower end of a nipple 55 whose upper end is threaded into a collar 56, which is, in turn, threaded onto the lowermost tubing section B. When the tubing string, nipple and retainer sub are rotated with respect to the valve housing 38, the retainer sub 45 is shifted upwardly, any fluid above the retainer sub being allowed to pass outwardly through a bleeder hole 57 in the upper housing section or cylinder 42 provided above the female thread 43. Any fluid between the retainer sub 45 and upper housing section below the female thread 43 can flow outwardly through the bleeder hole 58 in the upper section immediately below the female thread.

Leakage of fluid between the interior of the ball releasing apparatus and its exterior is prevented by providing a suitable thread seal 59 in a groove 60 in the lower section 39 engaging the inner surface of the cylinder 42, and also by providing a packing or seal ring 61 in a groove 62 in the retainer sub 45 engaging the inner cylindrical wall of the cylinder 42. If desired, a wiper ring 63 may be disposed in a groove 64 in the cylinder above its left-hand thread 43 for engagement with the cylindrical periphery of the retainer sub 45, to preclude mud, or other

harmful materials, from moving into the threads 43, 46 and possibly interfering with the rotation of the retainer sub 45 with respect to the valve housing 38.

Since the tripping ball 31 is to be released from its restrained position within the valve housing 38 prior to engagement of any portions of the well packer C with the wall casing, the well packer cannot offer any restraint to rotation of the valve housing 38; so as to enable the retainer sub 45 to be threaded in an upward direction within the latter, to release the trip ball. For this reason, a rotation retarding device forms part of the ball retaining apparatus A. Such device is in the form of longitudinally spaced upper and lower collars 65, 66 slidable on the nipple 55 and having outwardly bowed and circumferentially spaced friction drag springs 67 suitably secured thereto, as by means of encompassing rings 68 and set screws 69 passing through the rings for threaded reception into the collars. These springs 67 frictionally engage the inner wall of the well casing D and tend to prevent rotation or longitudinal movement, for that matter, of the upper and lower drag collars 65, 66 within the well casing.

During lowering of the apparatus A, C through the well casing D to the desired point at which the packer is to be anchored in packed-off condition, the drag device 65—69 will move relatively in an upward direction along the nipple 55 until its upper collar 65 engages the collar 56 connecting the nipple to the tubing section B. When in this position, the valve housing 38 is uncoupled from the drag device 65—69, and it rotation cannot be resisted or retarded by this latter device. However, when the location is reached in the well casing at which the well packer C is to be set, the tubing string B is elevated a comparatively short distance, to move a coupling element 70, in the form of a screw or pin secured to the upper portion of the upper valve section 42 and projecting outwardly therefrom, into transverse alignment with a lug or dog 71 which is integral with and depends from the lower collar 66. One face 72 of the dog is parallel to the axis of the collar 66, whereas its other face 73 is inclined in a downward direction toward the parallel face. Such inclination is provided so that elevation of the tubing string B, nipple 55, retainer sub 45 and valve housing 38 with respect to the drag device 65—69 will properly locate the coupling screw 70 against the underside 74 of the collar 66. In the event the screw happens to engage the inclined face 73 of the dog 71, such inclined face will partially rotate the valve housing 38 with respect to the drag collar 66, causing engagement of the screw 70 with the underside of the lower collar.

With the coupling screw 70 in transverse alignment with the dog 71, rotation of the tubing string B, nipple 55 and retainer sub 45 to the right will, at first, rotate the valve housing 38 and well packer C attached thereto to the right with it, until the coupling screw 70 engages the face 72 of the dog 71. When this occurs, the friction drag springs 67 prevent any further rotation of the valve housing 38. Continued rotation of the tubing string, nipple and retainer sub to the right will then elevate the retainer sub 45 within the stationary valve housing 38 and enable the trip ball 31 to be released, in the manner described above, whereupon it will gravitate into engagement with its trip ball seat 29 and allow fluid pressure to be built up for the purpose of setting the upper slips 17, all in the manner described above.

The retainer sub 45 is only rotated several revolutions to release the trip ball 31 from its retained position within the valve housing 38. It is not rotated sufficiently to elevate the retainer sub within the valve housing to the further extent required to release the bridging ball 36 from its confined position. This latter action only occurs after the necessary cementing or other operation has been performed with the anchored well packer C. When it is desired to preclude downward passage of fluid through the well packer C, the tubing string B, nipple 55 and retainer sub 45 can be rotated to a further extent, which will then free the bridging ball 36, as illustrated in Fig. 3, allowing it to drop into engagement with its companion valve seat 37 in the well packer. For that matter, rotation of the tubing string B can continue, a shoulder 75 on the retainer sub 45 engaging a companion shoulder 76 in the upper housing section 42 to preclude further upward threading of the retainer sub with respect to the valve housing. When this occurs, rotation of the tubing string, nipple and retainer sub will also rotate the valve housing 38 with them, and this valve housing will rotate the sub 40 with respect to the packer body 10, which is now held against movement by the anchoring of the slips 17, 20 against the wall of the well casing D. As a result, the left-hand threaded connection 41 between the sub 40 and the packer body 10 is released, the sub threading in in upward direction out of the body and allowing the entire bridging apparatus A, without its balls 31, 36, to be elevated in the well casing and withdrawn completely from the well bore.

It is, accordingly, apparent that a valve retaining and releasing apparatus has been provided which enables the trip ball 31 to be released, despite the absence of anchoring of the well packer C against the well casing D. It is preferred that the drag device 65—69 not be coupled to the bridging ball releasing device A during descent of the apparatus in the well casing, since inadvertent rotation may occur between the retainer sub 45 and the valve housing 38 of sufficient extent to release the trip ball 31, and also the bridging ball 36. By allowing the drag device 65—69 to shift upwardly out of coupling or clutching engagement with the valve housing 38, the latter is not restrained, nor is there any tendency for it to rotate with respect to the retainer sub 45. However, when the trip ball 31 is to be released, it is a simple matter to elevate the tubing string B the slight distance necessary to clutch or couple the valve housing 38 to the drag device 65—69.

The valve elements 31, 36 are released selectively and individually when desired. They do not interfere with the operation of the apparatus when retained within the valve housing 38. Thus, prior to the setting of the well packer C in the well casing D, full circulation can be established down through the tubular string B and the apparatus. It is only when the tubular string has been elevated a slight distance and purposely rotated that the tripping ball 31 can be released. The rotation is of limited extent; so as not to release the bridging ball 36 until desired. This bridging ball can be released after the packer has been anchored in packed-off condition within the wall casing. By continuing the rotation of the tubing string B, and the parts attached thereto, after the bridging ball 36 has been released, the entire valve housing 38, and the parts connected to it and depending therefrom, are released from the well packer C, enabling these parts to all be removed to the top of the well bore for subsequent use in the same or another well bore.

The inventors claim:

1. In well apparatus: tubular means providing a fluid passage; valve means within said tubular means movable downwardly within said pasage; restraining means separate from said valve means and adapted to be connected to a running-in string for lowering said apparatus in a well bore; means providing an axial connection between said restraining means and tubular means in order that rotation of said restraining means will shift said restraining means longitudinally with respect to said tubular means; said restraining means engaging said valve means to prevent its downward movement within said passage and said restraining means being rotatable by said running-in string with respect to said tubular means to disengage said restraining means from said valve means and release said valve means for downward movement within said passage; and means movable selectively into coupling engagement with said tubular means for resisting rotation of said tubular means and out of coupling en-

gagement with said tubular means so as not to resist rotation of said tubular means.

2. In well apparatus: tubular means providing a fluid passage; valve means within said tubular means movable downwardly within said passage; restraining means separate from said valve means and adapted to be connected to a running-in string for lowering said apparatus in a well bore; means providing an axial connection between said restraining means and tubular means in order that rotation of said restraining means will shift said restraining means longitudinally with respect to said tubular means; said restraining means engaging said valve means to prevent its downward movement within said passage and said restraining means being rotatable by said running-in string with respect to said tubular means to disengage said restraining means from said valve means and release said valve means for downward movement within said passage; means movable longitudinally on said tubular means and adapted to resist rotation of said tubular means; and coengageable clutch means on said longitudinally movable means and tubular means, engageable upon longitudinal movement in one direction of said tubular means relative to said longitudinally movable means, to couple said tubular means to said longitudinally movable means, said coengageable clutch means being disengaged upon longitudinal movement of said tubular means in the opposite direction to uncouple said tubular means from said longitudinally movable means.

3. In well apparatus: tubular means providing a fluid passage; valve means within said tubular means movable downwardly within said passage; restraining means separate from said valve means and adapted to be connected to a running-in string for lowering said apparatus in a well bore; means providing an axial connection between said restraining means and tubular means in order that rotation of said restraining means will shift said restraining means longitudinally with respect to said tubular means; said restraining means engaging said valve means to prevent its downward movement within said passage and said restraining means being rotatable by said running-in string with respect to said tubular means to disengage said restraining means from said valve means and release said valve means for downward movement within said passage; a friction drag device movable longitudinally on said tubular means and adapted to resist rotation of said tubular means; and coengageable clutch elements on said drag device and tubular means engageable with each other, upon longitudinal movement in one direction of said tubular means relative to said drag device, to couple said tubular means to said drag device, said clutch elements being disengaged upon longitudinal movement in the opposite direction of said tubular means relative to said drag device.

4. In well apparatus: tubular means providing a fluid passage; valve means within said tubular means movable downwardly within said passage; restraining means threadedly attached to said tubular means and adapted to be connected to a tubular string for lowering said apparatus in a well bore; said restraining means engaging said valve means when in one position with respect to said tubular means to prevent said valve means from moving downwardly within said passage; said restraining means being rotatable by the tubular string to thread said restraining means with respect to said tubular means to a position releasing said valve means for downward movement within said passage; and means movable selectively into coupling engagement with said tubular means for resisting rotation of said tubular means and out of coupling engagement with said tubular means so as not to resist rotation of said tubular means.

5. In well apparatus: tubular means providing a fluid passage; valve means within said tubular means movable downwardly within said passage; restraining means threadedly attached to said tubular means and adapted to be connected to a tubular string for lowering said apparatus in a well bore; said restraining means engaging said valve means when in one position with respect to said tubular means to prevent said valve means from moving downwardly within said passage; said restraining means being rotatable by the tubular string to thread said restraining means with respect to said tubular means to a position releasing said valve means for downward movement within said passage; means movable longitudinally on said tubular means and adapted to resist rotation of said tubular means, and coengageable clutch means on said longitudinally movable means and tubular means, engageable upon longitudinal movement in one direction of said tubular means relative to said longitudinally movable means, to couple said tubular means to said longitudinally movable means, said clutch means being disengaged upon longitudinal movement in the opposite direction of said tubular means relative to said longitudinally movable means.

6. In well apparatus: tubular means providing a fluid passage; valve means within said tubular means movable downwardly within said passage; restraining means threadedly attached to said tubular means and adapted to be connected to a tubular string for lowering said apparatus in a well bore; said restraining means engaging said valve means when in one position with respect to said tubular means to prevent said valve means from moving downwardly within said passage; said restraining means being rotatable by the tubular string to thread said restraining means with respect to said tubular means to a position releasing said valve means for downward movement within said passage; a friction drag device movable longitudinally on said tubular means and adapted to resist rotation of said tubular means; and coengageable clutch elements on said drag device and tubular means engageable with each other, upon longitudinal movement in one direction of said tubular means relative to said drag device, to couple said tubular means to said drag device, said clutch elements being disengaged upon longitudinal movement in the opposite direction of said tubular means relative to said drag device.

7. In well apparatus: tubular means providing a fluid passage; a plurality of valve elements within said tubular means movable downwardly within said passage; restraining means separate from said elements and adapted to be connected to a running-in string for lowering said apparatus in a well bore; means providing an axial connection between said restraining means and tubular means in order that rotation of said restraining means will shift said restraining means longitudinally with respect to said tubular means; said restraining means having holding portions engaging said valve elements to prevent their downward movement within said passage, one of said holding portions being of lesser longitudinal extent than another holding portion in order that rotation of said restraining means by said running-in string with respect to said tubular means causes disengagement of said one holding portion from the valve element it engages before said another holding portion is caused to disengage the valve element which it engages, to enable said valve elements to move successively downwardly within said passage.

8. In well apparatus: tubular means providing a fluid passage; a plurality of valve elements within said tubular means movable downwardly within said passage; restraining means separate from said elements and adapted to be connected to a running-in string for lowering said apparatus in a well bore; means enabling said restraining means to move longitudinally with respect to said tubular means; said restraining means having a first holding portion engageable with one valve element only to prevent downward movement of said one valve element within said passage and a different second holding portion engageable with another valve element only to prevent

downward movement of said another valve element within said passage; said restraining means being movable longitudinally by said running-in string with respect to said tubular means to disengage said first holding portion from said one valve element and then disengage said second holding portion from said another valve element to release said valve elements successively for downward movement within said passage.

9. In well apparatus of the type including a well packer having normally retracted means, hydraulically operable means for expanding said normally retracted means outwardly, and a valve seat engageable by a valve element for enabling fluid pressure to be built up in said well packer to operate said hydraulically operable means and expand said normally retracted means; the combination therewith of tubular means connected to said well packer and containing said valve element, restraining means separate from said valve element and adapted to be connected to a running-in string, means providing an axial connection between said restraining means and tubular means in order that rotation of said restraining means will shift said restraining means longitudinally with respect to said tubular means, said restraining means engaging said valve element to prevent its downward movement into engagement with said seat and said restraining means being rotatable by said running-in string with respect to said tubular means to disengage said restraining means from said valve element and release said valve element for downward movement into engagement with said seat; means movable longitudinally on said tubular means and adapted to resist rotation of said tubular means; and coengageable clutch means on said longitudinally movable means and tubular means, engageable upon longitudinal movement in one direction of said tubular means relative to said longitudinally movable means, to couple said tubular means to said longitudinally movable means.

10. In well apparatus of the type including a well packer having normally retracted means, hydraulically operable means for expanding said normally retracted means outwardly, and a valve seat engageable by a valve element for enabling fluid pressure to be built up in said well packer to operate said hydraulically operable means and expand said normally retracted means; the combination therewith of tubular means connected to said well packer and containing said valve element, restraining means separate from said valve element and adapted to be connected to a running-in string, means providing an axial connection between said restraining means and tubular means in order that rotation of said restraining means will shift said restraining means longitudinally with respect to said tubular means, said restraining means engaging said valve element to prevent its downward movement into engagement with said seat and said restraining means being rotatable by said running-in string with respect to said tubular means to disengage said restraining means from said valve element and release said valve element for downward movement into engagement with said seat, a friction drag device movable longitudinally on said tubular means and adapted to resist rotation of said tubular means, and coengageable clutch elements on said drag device and tubing means, engageable with each other upon longitudinal movement in one direction on said tubular means relative to said drag device, to couple said tubular means to said drag device.



11. In well apparatus: tubular means providing a fluid passage; a plurality of valve elements within said tubular means movable downwardly within said passage; restraining means separate from said elements and adapted to be connected to a running-in string for lowering said apparatus in a well bore; means providing an axial connection between said restraining means and tubular means in order that rotation of said restraining means will shift said restraining means longitudinally with respect to said tubular means; said restraining means having a first holding portion engageable with one valve element only to prevent downward movement of said one valve element within said passage and a different second holding portion engageable with another valve element only to prevent downward movement of said another valve element within said passage, said first holding portion being disengaged from said one valve element prior to disengagement of said second holding portion from said another valve element in response to rotation of said restraining means by said running-in string with respect to said tubular means, whereby said one valve element is first movable downwardly in said passage followed by said another valve element.

12. In well apparatus: tubular means providing a fluid passage; a plurality of valve elements within said tubular means movable downwardly within said passage; restraining means separate from said elements and adapted to be connected to a running-in string for lowering said apparatus in a well bore; means providing an axial connection between said restraining means and tubular means in order that rotation of said restraining means will shift said restraining means longitudinally with respect to said tubular means; said restraining means having a first holding portion engageable with one valve element only and coacting with said tubular means so that said first holding portion and tubular means jointly engage and prevent downward movement of said one valve element within said passage, said restraining means having a different second holding portion engageable with another valve element only and coacting with said tubular member so that said second holding portion and tubular means jointly engage and prevent downward movement of said another valve element within said passage; said restraining means being rotatable by said running-in string with respect to said tubular means to shift said first holding portion to a predetermined extent allowing said one valve element to disengage from said first holding portion and tubular means and move downwardly within said passage while said second holding portion and tubular means continue to engage said another valve element and prevent its downward movement in said passage; said restraining means being rotated to a further extent with respect to said tubular means to shift said second holding portion to a further predetermined extent allowing said another valve element to disengage from said second holding portion and tubular means and move downwardly within said passage.

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