June 7, 1966 D. V. CHENOWETH 3,254,722

FLUID ACTUATED RETRIEVABLE WELL TOOL

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FIG. 1a.

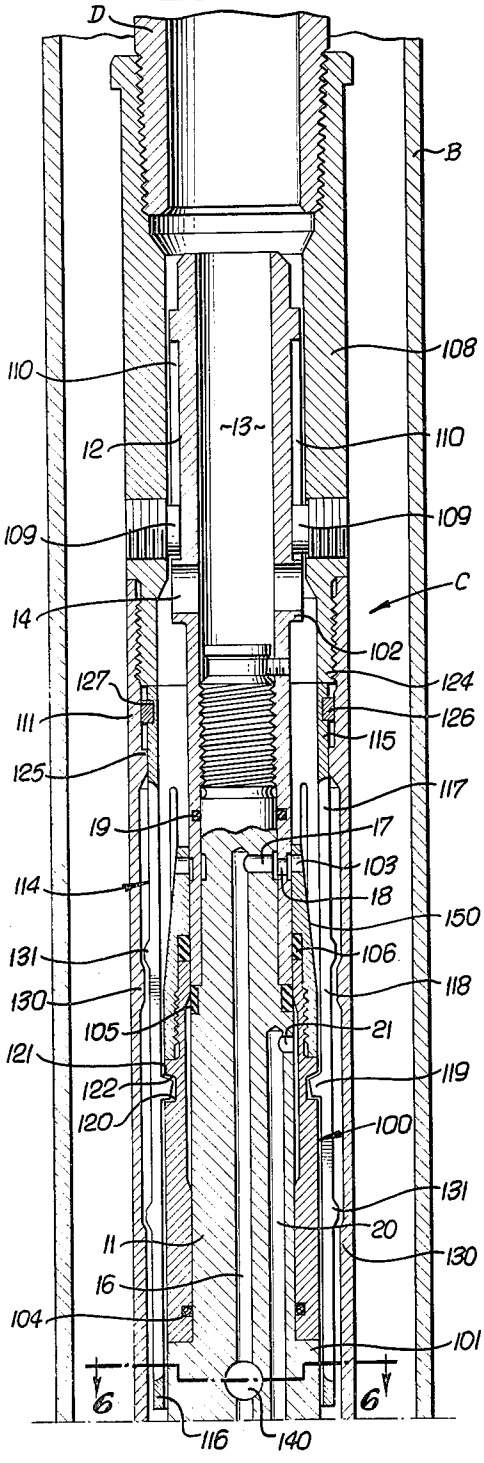
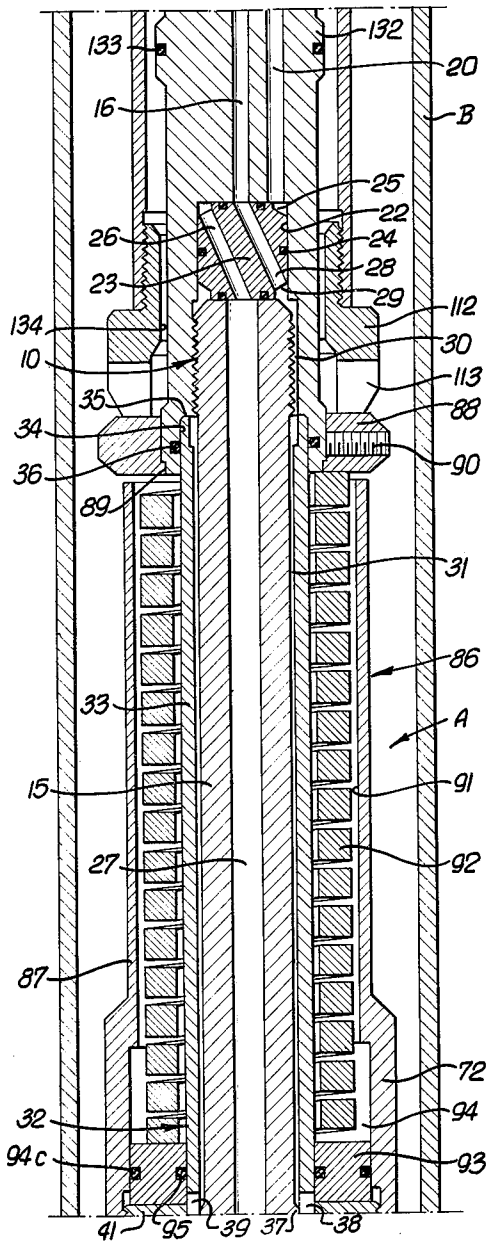


FIG. 1b.



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FIG. 1c.

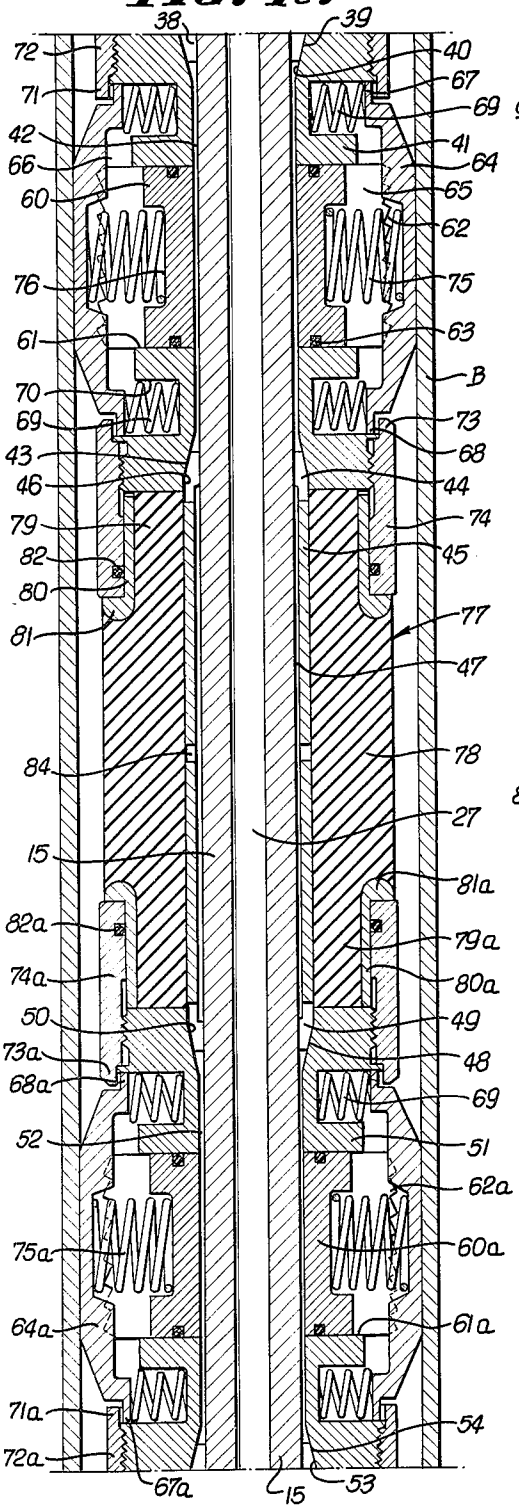
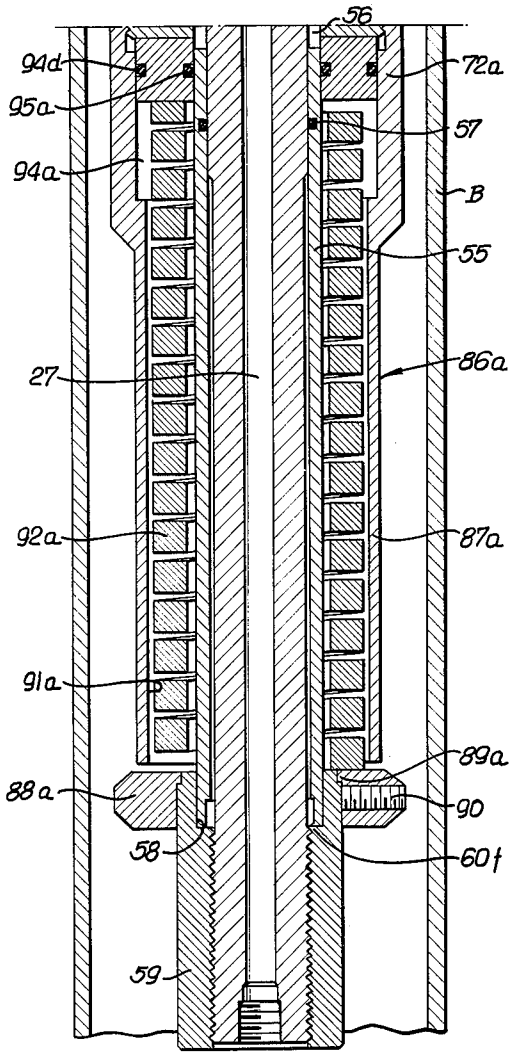


FIG. 1d.



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FIG. 2a.

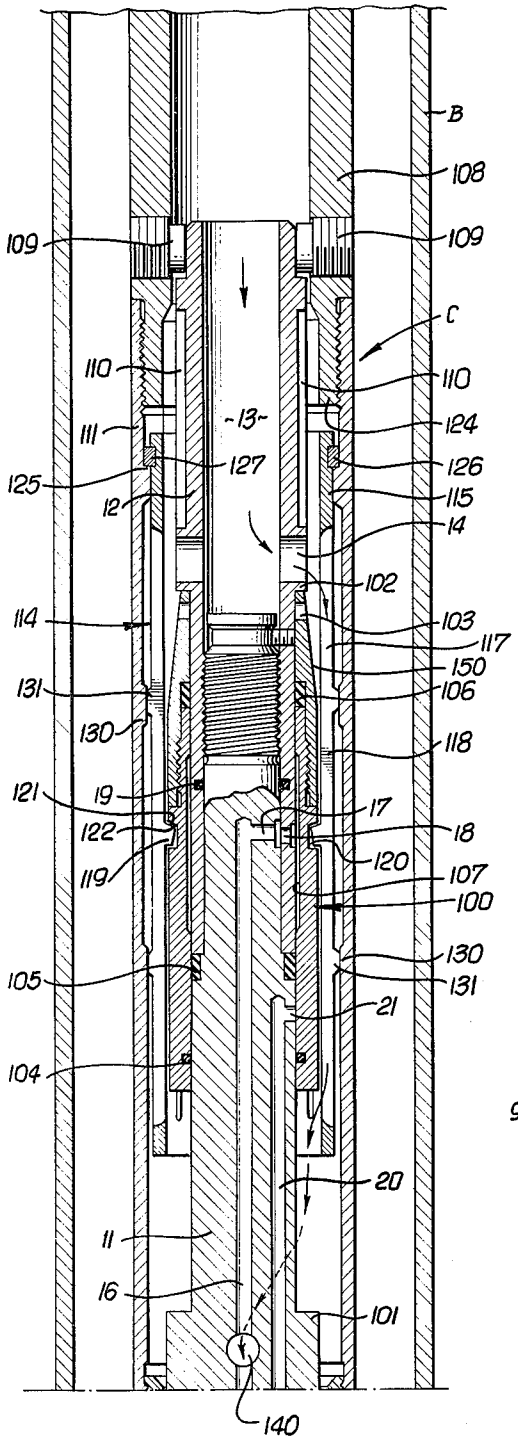
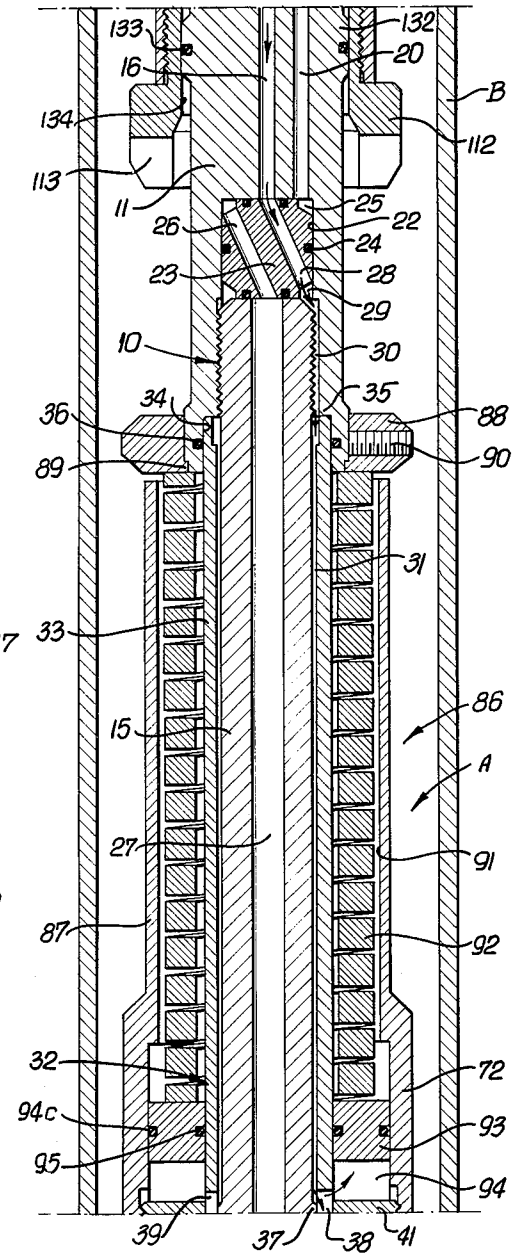


FIG. 2b.



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FIG. 2c.

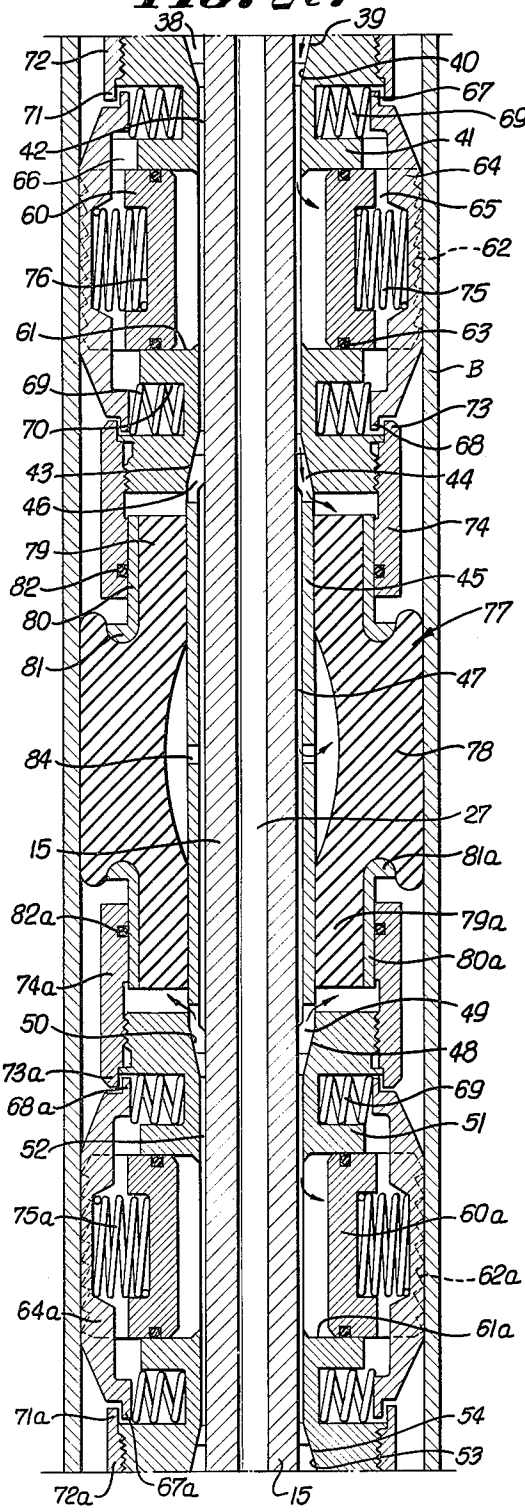
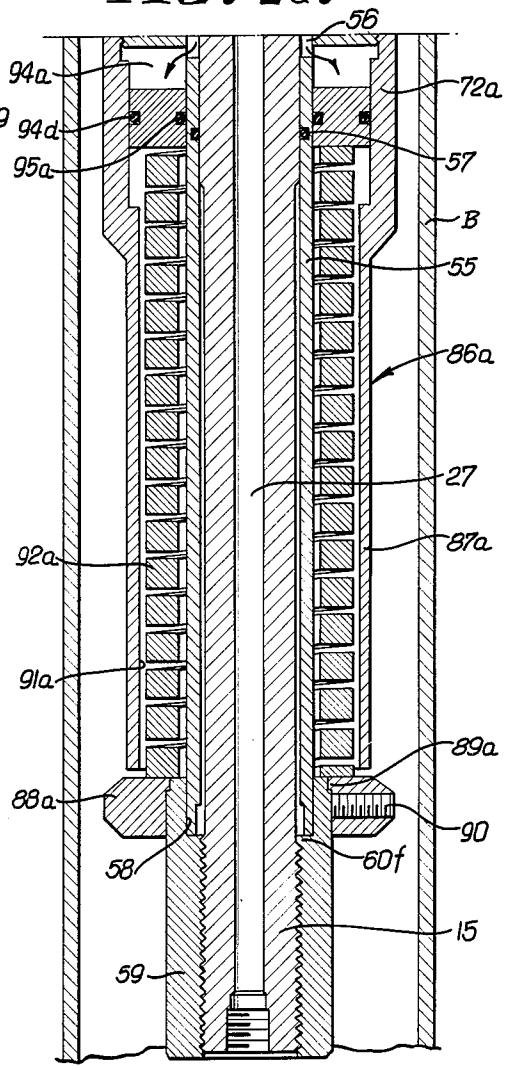


FIG. 2d.



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FIG. 3a.

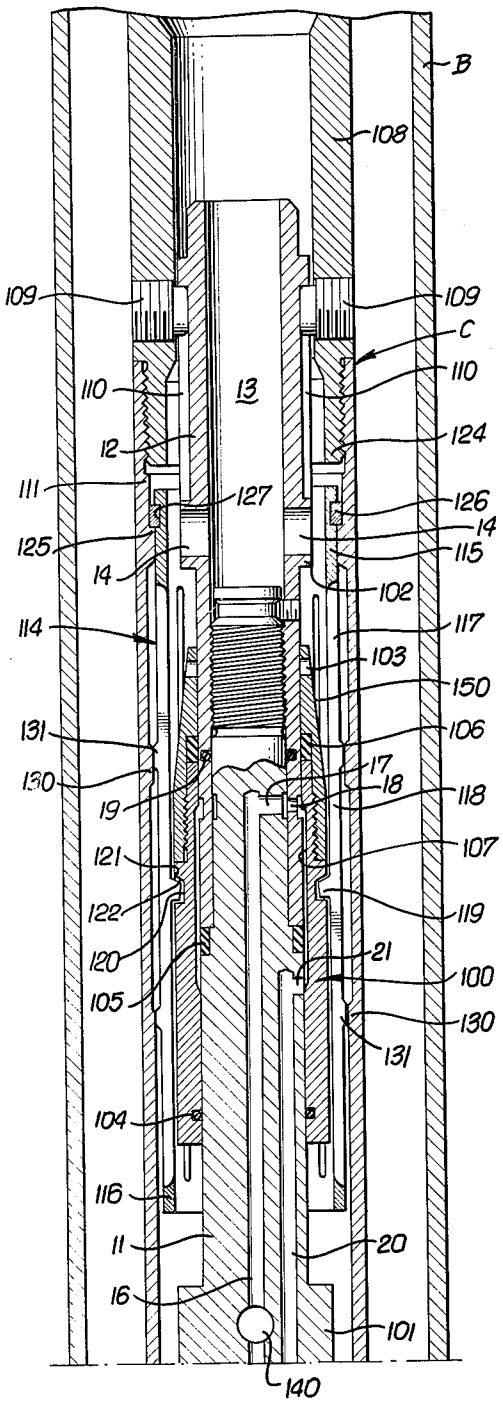
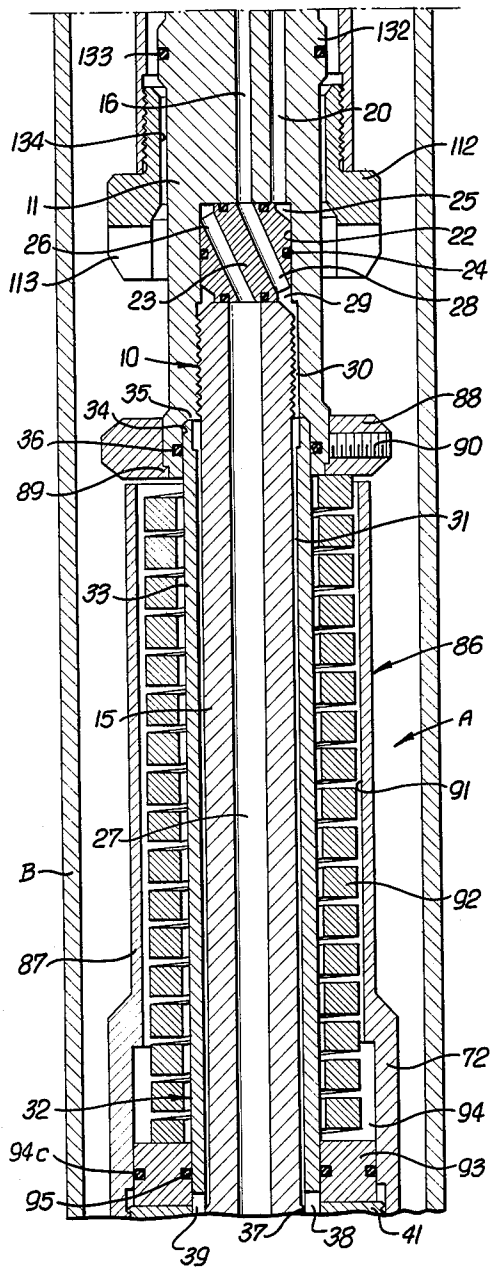


FIG. 3b.



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FIG. 4.

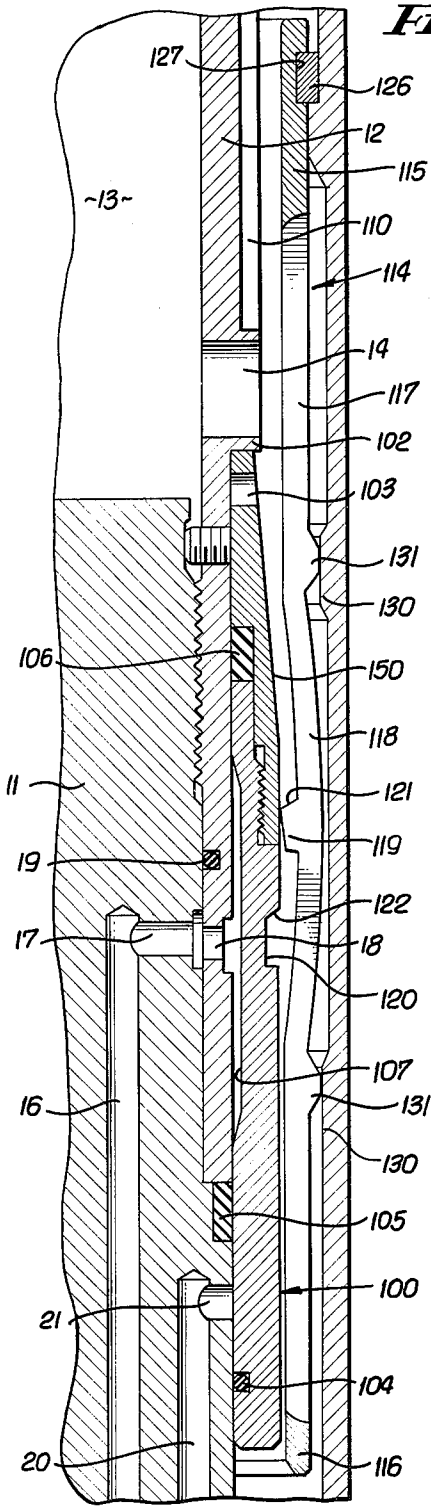


FIG. 5.

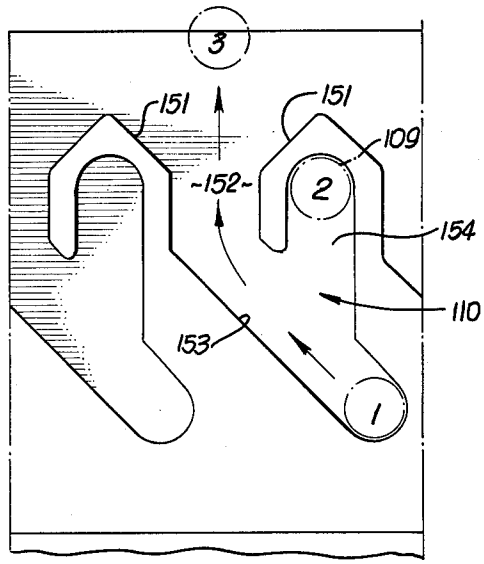
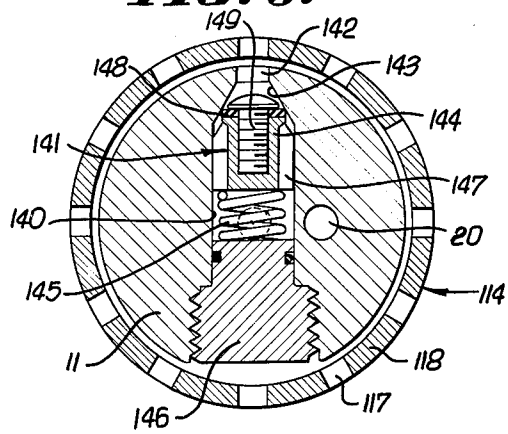


FIG. 6.



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FLUID ACTUATED RETRIEVABLE WELL TOOL

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Filed May 6, 1963, Ser. No. 278,183
29 Claims. (Cl. 166—120)

The present invention relates to subsurface well bore apparatus, and more particularly to tools adapted to be set in well bores, such as anchors, well packers, and bridge plugs.

An object of the present invention is to provide an improved apparatus adapted to be anchored by fluid pressure in a well bore, and maintained in its anchored condition by trapping fluid under pressure within the apparatus. If desired, the trapped fluid pressure can be relieved to release the apparatus and allow its movement in the well bore to a new location therein, or to the top of the well bore.

Another object of the invention is to provide a retrievable packer or bridge plug adapted to be anchored in packed-off condition in a well bore by application of fluid pressure thereto derived from a suitable source, and in which the packer or bridge plug remains in its fluid pressure set condition in the well bore despite discontinuance of pressure application from the source, the fluid pressure being relieved, when desired, to release the packer or bridge plug from the well bore.

A further object of the invention is to provide apparatus adapted to be set by fluid pressure in the well bore, and embodying a pressure accumulator for maintaining the fluid pressure in the apparatus at a sufficient value to insure its retention in its set condition despite relative movement of some parts of the apparatus tending to diminish or relieve the fluid pressure therewithin.

An additional object of the invention is to provide an aparatus, such as a bridge plug, adapted to be anchored in a well bore, and embodying fluid actuated, laterally movable anchor elements, in which the fluid in the well bore cannot shift the anchor elements outwardly against the well bore during running of the tool therein, or withdrawal therefrom, thereby insuring against dulling of the anchor elements so that they remain in a sharp condition for appropriate embedding in the wall of 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:

FIGURES 1*a*, 1*b*, 1*c* and 1*d* together constitute a longitudinal section through a bridge plug apparatus embodying the invention disposed in a well casing, with the parts in condition for lowering the apparatus in the well casing to a desired setting location, FIGS. 1*b*, 1*c* and 1*d* constituting lower continuations of FIGS. 1*a*, 1*b* and 1*c*, respectively;

FIGS. 2*a*, 2*b*, 2*c* and 2*d* are views corresponding to FIGS. 1*a* to 1*d*, illustrating the bridge plug anchored in packed-off condition in the well casing, FIGS. 2*b*, 2*c* and 2*d* being lower continuations of FIGS. 2*a*, 2*b* and 2*c*, respectively;

FIGS. 3*a* and 3*b* are views similar to FIGS. 1*a* and 1*b*, illustrating the apparatus conditioned for withdrawal from the well casing, FIG. 3*b* being a lower continuation of FIG. 3*a*;

FIG. 4 is an enlarged partial longitudinal section illustrating the releasing of the running-in and retrieving tool from the bridge plug, after the latter has been set in the well casing;

FIG. 5 is a developed view of the control head slot and pin device for releasably connecting the running-in and retrieving tool to the bridge plug;

FIG. 6 is an enlarged section taken along the line 6—6 on FIG. 1*a*.

The particular well tool A illustrated in the drawings and embodying the invention is a bridge plug adapted to be anchored in packed-off condition in a well casing B (or well bore) against longitudinal movement therewithin in both upward and downward directions. The bridge plug can be connected to a running-in and retrieving tool C suitably secured to the lower end of a tubular string D extending to the top of the well bore, by means of which the bridge plug can be lowered to the desired setting location in the well casing, and also shifted from such location and elevated to the top of the well bore.

As shown, the bridge plug A includes an elongate body structure **10**, including an upper valve body portion **11** threadedly connected, or otherwise secured, to a control head **12** extending thereabove, the control head having a central passage **13** opening at its upper end and communicating with the exterior of the control head through a plurality of side ports **14**. The lower portion of the valve body **11** is threadedly secured to the upper end of an inner body member **15**. The valve body **11** has a longitudinal passage **16** therein communicating with the exterior of such body at its upper end through a side port **17** communicating with a companion side port **18** in the lower portion of the control head, leakage of fluid between the control head and the valve body being prevented by a suitable side seal **19**. A longitudinal pressure equalizing passage **20** is also provided in the valve body **11**, its upper end communicating with the exterior of the valve body through a side port **21**.

The lower ends of the passages **16**, **20** open into a chamber **22** between the body members **11**, **15**, containing a fluid director head **23** clamped between the valve body **11** and the upper end of the inner body member **15**. Leakage of fluid around the exterior of the head **23** is prevented by a suitable side seal **24** thereon engaging the side wall of the chamber **22**. The upper end of the head has a recess **25** communicating with the lower end of the equalizing passage **20**, and opening into this recess is the upper end of a passage **26**, the lower end of which opens into the central passage **27** through the inner body member **15** that extends completely therethrough, opening into the well bore at its lower end. The lower end of the other valve body passage **16** communicates with an inclined passage **28** in the fluid director head **23**, the lower end of which communicates with a lower recess **29**, which, in turn, communicates with a longitudinal passage or groove **30** in the lower portion of the valve body **11**, this groove communicating with an annular passage **31** formed between the inner body member **15** and a composite outer body structure **32**.

The composite outer body **32** includes an upper accumulator section **33** received within a counterbore **34** in the lower end of the valve body **11** and abutting against a downwardly facing shoulder **35** on the latter. Leakage of fluid between the valve body **11** and the upper section **33** is prevented by a suitable side seal **36** on the body engaging the periphery of the upper section. The lower end of the upper section **33** contacts an enlarged peripheral portion **37** of the inner body **15**, the lower end of the annular passage **31** between the inner body and upper section opening into slots or ports **38** in the lower end **39** of the upper section **33**. The lower end **39** of the upper section is beveled or tapered, engag-

ing a companion internal taper 40 at the upper portion of an upper anchor section 41 surrounding the inner body 15 and spaced therefrom to provide an annular passage 42 therebetween, which communicates with the slots or ports 38 through the upper section.

The lower portion 43 of the upper anchor body section 41 is tapered or beveled, engaging a companion taper or bevel 44 on the upper end of a sleeve 45 forming the packing section of the outer body structure 32, the upper end of the sleeve having slots or ports 46 communicating with the annular passage 42 between the upper anchor body 41 and inner body member 15. These slots or ports open into an annular passage 47 between the sleeve 45 and inner body member 15. The lower end 48 of this body sleeve has ports 49 communicating with the annular passage 47 between the sleeve and inner body member, such lower end being tapered and engaging a companion taper 50 on the upper end of a lower anchor body section 51 spaced from the inner body member 15 to provide a continuation 52 of the annular passages thereabove. The lower end 53 of this anchor body member, in turn, is tapered, engaging a companion tapered upper end 54 of a lower accumulator body section 55 which is slotted or provided with ports 56. Leakage of fluid between the lower accumulator body section 55 and the inner body member 15 below the ports 56 is prevented by a suitable side seal 57 on the accumulator section 55 engaging the periphery of the body 15. The lower end of the lower accumulator section is received within a counterbore 58 in a body nut 59 threaded on the lower end of the inner body member 15 and engaging the base 60*f* of the counterbore.

By appropriately tightening the lower nut 59 on the body member 15, the lower accumulator body section 55 is forced against the lower anchor body section 51, which, in turn, is forced against the packing body section 45, the upper end of the latter bearing against the upper anchor body section 41, which bears against the upper accumulator section 33, the upper end of this last-mentioned section engaging the shoulder 35 at the lower portion of the valve body 11. Thus, all of these parts of the outer body structure 32 are appropriately clamped against one another. Because of the threaded attachment of the valve body 11 to the inner body member 15, the inner body member and the outer body structure 32 surrounding it are firmly secured to one another in assembled relation.

The packer bodies 10, 32 can be anchored to the wall of the well casing B against movement in an upward direction by a plurality of circumferentially spaced gripping elements or pistons 60 mounted in radial cylindrical bores or cylinders 61 formed in the upper anchor body section 41. The inner end of each cylinder 61 is open to the annular passage 42 between the anchor body section and the inner body member 15 so that fluid under pressure can urge the upper gripping elements 60 outwardly to embed their exterior upwardly facing teeth 62 into the wall of the well casing. Leakage of fluid between each gripping element 60 and the wall of its cylinder 61 is prevented by a suitable piston ring 63 mounted on the gripping element and slidably and sealingly engaging the cylinder wall.

Each gripping element 60 is maintained properly oriented in its cylinder 61, with its teeth 62 disposed in planes normal to the axis of the apparatus by a drag block 64 which can also function as a spring seat and orienting bar. This drag block fits within a longitudinal slot 65 extending through the outer portion of each gripping element and across aligned slots 66 in the anchor body 41 on opposite sides of the cylinder, the upper and lower terminals 67, 68 of each drag block being engaged by helical compression springs 69, disposed in radial sockets 70 in the anchor body, urging the blocks 64 outwardly into frictional engagement with the wall of the well casing. Outward movement of the drag blocks is prevented by their upper terminals 67 engaging a lower stop portion 71 of an upper cylinder 72 threadedly secured to the upper portion of the anchor body 41 and by engagement of their lower terminals 68 with an upper stop portion 73 of a cylinder 74 threaded on the lower portion of the anchor body 41.

The drag blocks 64 serve to center the apparatus A in the well casing B, as well as resist its movement therewithin. They also serve as spring seats for helical compression retractor springs 75, each of which is disposed in a central socket 76 in a gripping element 60, the inner end of the spring engaging the base of the socket 76 and the inner end engaging the drag block 64. Each spring 75 urges its associated gripping element 60 inwardly of the anchor body 41 with its teeth 62 substantially completely within the confines of such body.

Longitudinally spaced from the upper anchor body 41 and separated by an intervening packing structure 77 is a lower anchor portion of the apparatus adapted to anchor it to the well casing against downward movement therewithin. Essentially, the lower anchor structure is the same as the upper anchor structure with respect to its gripping elements 60*a*, drag blocks 64*a*, retracting springs 75*a*, and springs 69 for urging the drag blocks 64*a* outwardly into frictional engagement with the wall of the well casing B. However, the gripping elements 60*a* are oppositely arranged with respect to the upper set of gripping elements 60, the teeth 62*a* of the lower set facing in a downward direction so as to be anchored to the well casing against downward movement. The inner ends of the lower cylinders 61*a* containing the lower gripping elements 60*a* communicate with the central passage 52 between the lower anchor body section 51 and the inner body member 15. Outward movement of the drag blocks 64*a* is limited by engagement of their upper terminals 68*a* with a lower stop portion 73*a* of a lower cylinder 74*a* threaded on the upper end of the lower anchor body 51, and by engagement of their lower terminals 67*a* with the upper stop portion 71*a* of a lower cylinder 72*a* threadedly secured to the lower end of the anchor body 51 and depending therefrom. Fluid under pressure in the annular passage 52 between the lower anchor body section and the inner body member urges the lower gripping elements 60*a* outwardly to embed their teeth 62*a* in the wall of the well casing B.

Disposed between the upper and lower anchor body sections 41, 51 is the packing structure 77 of which the upper cylinder 74 and lower cylinder 74*a* form a part, these cylinders being directed from the upper and lower anhcor bodies 41, 51 toward each other. The packing structure further includes a packing sleeve 78 of a pliant, elastic material, such as synthetic or natural rubber, this packing sleeve surrounding and engaging the body section 45 with its upper portion 79 of a reduced external diameter to fit within a piston skirt 80 slidable in the upper cylinder 74, the upward position of the skirt in the cylinder being limited by a lower skirt flange 81 engaging the lower end of the cylinder 74. Leakage of fluid between the skirt and cylinder is prevented by a suitable side seal 82 on the cylinder slidably and sealingly engaging the periphery of the skirt.

The lower portion 79*a* of the packing sleeve 78 is also of reduced external diameter, fitting within a lower piston skirt 80*a* slidable in the cylinder 74*a*. Downward movement of the skirt 80*a* is limited by engagement of its upper flange 81*a* with the upper end of the lower cylinder 74*a*. Leakage of fluid between the lower skirt and lower cylinder is prevented by a suitable side seal ring 82*a* on the lower cylinder slidably and sealingly engaging the periphery of the lower skirt 80*a*. When the packing sleeve 78 is in its retracted position, its upper end is closely adjacent to the lower end of the upper anchor body 41, its lower end being closely adjacent to the upper end of the lower anchor body 51, the upper

and lower portions 79, 79*a* of the packing sleeve 78 fitting snugly within their respective skirts.

When fluid under sufficient pressure is disposed in the annulus 47 between the inner and outer body structures 10, 32, such fluid under pressure can pass through ports 84 in the mid-portion of the packing body section 45 to the interior of the packing sleeve 78 for the purpose of inflating the latter and expanding it outwardly against the wall of the well casing. At the same time, the fluid under pressure can pass through the ports 46 to the upper end of the packing sleeve 78 and also through the lower ports 49 to the lower end of the packing sleeve, shifting the end portions 79, 79*a* of the packing sleeve and their respective skirts 80, 80*a* toward each other to shorten the overall length of the packing 78 and facilitate its outward expansion or "ballooning" into sealing engagement with the wall of the well casing B (see FIG. 2*c*).

Pressure in the annular passages 42, 47, 52 will simultaneously act upon the inner ends of the upper and lower sets of gripping elements 60, 60*a* and also upon the packing sleeve 78 to shift or expand the gripping elements outwardly into anchoring engagement with the wall of the well casing and also to expand the packing sleeve into firm sealing engagement with the wall of the well casing, expansion of the packing sleeve 78 being facilitated by the ability of its upper and lower ends to move toward each other, thereby reducing the amount of stretch that would otherwise be required in and imparted to the packing sleeve.

As described hereinbelow, the pressure in the annular passages expanding and holding the gripping elements 60, 60*a* outwardly and also inflating the packing sleeve 78 and moving its ends toward each other is trapped therewithin. Such trapped pressure is maintained at a comparatively high value to insure retention of the bridge plug in its anchored and packed-off condition by one or a plurality of pressure accumulators. As disclosed, an upper accumulator 86 is provided, as well as a lower accumulator 86*a*. The upper accumulator includes the upper cylinder 72 previously described, which is integral with a spring housing 87 extending upwardly therefrom to a spring seat 88 suitably secured to the lower portion of the valve body 11, as by providing an inwardly directed flange 89 engaging a shoulder on the valve body to prevent upward shifting of the seat relative to the body. The seat 88 is held in place on the body a suitable set screw 90. Contained within an annular space 91 between the spring housing 87 and the upper section 33 of the outer body structure 32 is a strong, helical compression spring 92, the upper end of which bears against the spring seat 88 and the lower end of which bears against an annular piston 93 disposed in an annular cylinder space 94 defined between the upper cylinder 72 and the upper body section 33.

The spring 92 urges the piston 93 downwardly into engagement with the upper end of the upper anchor body section 41. The slots or ports 38 in the upper body section permit fluid in the annular passage 31 to pass to the underside of the movable piston 93. When such pressure is sufficient, the piston is moved upwardly within the cylinder to further compress the spring 92, leakage of fluid upwardly between the piston and the cylinder 72 being prevented by an external piston ring 94*c* on the piston slidably engaging the wall of the cylinder, and leakage of fluid between the piston 93 and the upper body section 33 being prevented by an inner seal ring 95 mounted on the piston and slidably and sealingly engaging the periphery of the upper body section. Fluid pressure shifting the movable piston 93 upwardly in its cylinder 72 stores additional energy in the spring 92, and in view of the fact that the fluid under pressure is trapped within the various passages in the apparatus, as described hereinbelow, the spring force acting on the piston 93 and tending to shift it downwardly tends to maintain the fluid under pressure.

The lower accumulator 86*a* is similar to the upper accumulator 86 but is oppositely arranged. Thus, the lower cylinder 72*a* is integral with a spring housing portion 87*a* depending therefrom that extends to a lower spring seat 88*a* which is prevented from moving downwardly of the body nut 59 by an inwardly directed flange 89*a* on the seat engaging the nut. A suitable set screw 90 threaded in the seat and bearing against the nut 59 prevents inadvertent removal of the seat from the body nut. The lower end of a strong, helical compression spring 92*a* bears against the seat 88*a* and is located in the annular space 91*a* between the housing 87*a* and the lower accumulator body section 55, the upper end of this spring bearing against a lower piston 93*a* disposed in the annular cylinder space 94*a* between the lower cylinder and the upper portion of the lower body section 55, the piston being slidable along both the lower cylinder 72*a* and the periphery of the lower accumulator section 55. Leakage of fluid between the piston 93*a* and the cylinder 72*a* is prevented by an outer side seal ring 94*d* on the lower piston, and between the latter and the lower accumulator body section 55 by an inner side seal ring 95*a* on the piston engaging the periphery of the lower section.

The spring 92*a* presses the lower piston 93*a* against the lower end of the lower anchor body section 51. However, fluid under pressure in the annular passage 52 between the lower anchor body 51 and inner body member 15 can pass through the ports 56 to the upper end of the lower piston 93*a*, forcing it downwardly against the pressure of its spring 92*a* within the lower cylinder section 72*a*. Since the fluid under pressure is trapped, as stated above, the downward shifting of the lower piston 93*a* in the lower cylinder further compresses the spring 92*a* and stores energy in it, the spring bearing against the piston and urging it against the fluid in the cylinder 72*a* and tending to maintain the fluid pressure in the entire apparatus.

Passage of fluid under pressure into the several fluid conducting passages is controlled by a valve mechanism that includes the upper valve body portion 11 of the bridge plug. A valve sleeve 100 surrounds the valve body portion 11, this valve sleeve being adapted to occupy a lower position in engagement with a body stop shoulder 101, and also an upper position in engagement with a stop shoulder 102 on the control head 12 below its side ports 14. When the valve sleeve 100 is in the lower position (FIG. 1*a*), the upper portions of the longitudinal passages 16, 20 in the valve body are prevented from communicating with one another. However, the passage 16 that communicates with the movable elements of the bridge plug is open to the exterior of the apparatus through one or a plurality of ports 103 in the upper portion of the valve sleeve 100. When the valve sleeve is in its upper position on the valve body 11 (FIG. 2*a*), communication between the longitudinal passages 16, 20 is prevented, since the lower portion of the valve sleeve is disposed across the lower port 21, leakage of fluid in both directions along the sleeve valve being prevented by a lower seal ring 104 on the sleeve valve engaging the periphery of the valve body, and by a seal ring 105 on the valve body 11 above the port engaging the inner wall of the valve sleeve. A third seal ring 106 on the valve sleeve 100 engages the periphery of the control head skirt 12*a* above the upper ports 17, 18 to close such ports.

When the valve sleeve 100 is disposed in an intermediate position (FIG. 3*a*), an inner annular passage 107 in the valve sleeve establishes intercommunication between both upper and lower ports 18, 21 and their respective passages 16, 20, thereby opening the passage 16 leading to the various cylinders and packing element

to the well bore below the lower end of the inner body member 15, as explained hereinafter.

The valve sleeve 100 is shifted by suitably manipulating the tubular string D and the running-in and retrieving or setting tool C connected thereto. The running-in and retrieving tool includes an upper body portion 108 to which pins 109 are affixed which are movable in control slots 110 of the head 12. Threaded on the lower portion of the upper tool member 108 is a sleeve 111, the lower end of which is threadedly secured to a retrieving head 112 having a plurality of lateral slots 113 extending therethrough. Longitudinal movement of the setting tool C with respect to the bridge plug body 11 and control head 12 shifts the valve sleeve 100 to various positions through the agency of a latch sleeve 114. The upper portion 115 of this latch sleeve is circumferentially continuous, which is also true of its lower portion 116. Between such portions, the latch sleeve has circumferentially spaced elongate slots 117 that provide elongate latch arms 118 integral with inwardly directed fingers 119 adapted to be received within a peripheral groove 120 in the valve sleeve 100. The upper ends 121 of the fingers and the upper side 122 of the groove are tapered in a downward and inward direction, providing coengageable cam surfaces 121, 122 for camming the fingers 119 outwardly of the groove when the running-in and retrieving tool C is to be released from the valve sleeve 100. The latch sleeve 114 is shifted downwardly by engagement of the lower end 124 of the upper retrieving tool section 108 with the upper end of the latch sleeve. Upward movement of the latch sleeve 114 is obtained by transmitting it from a lower shoulder 125 of the retrieving tool sleeve 111 to a ring 126 mounted in a peripherial groove 127 in the latch sleeve 114. Lost motion is provided between the ring 126 and the end 124 and shoulder 125 to permit limited longitudinal movement of the retrieving head sleeve 111 along the latch sleeve 114.

The retrieving tool C is shifted upwardly to shift the valve sleeve 100 from its lower position to an upper position on the valve body 11. When the shoulder 125 engages the sleeve ring 126, restricted portions 130 of the sleeve 111 of smaller internal diameter move upwardly and surround upper and lower enlargements 131 on the latch arms 118, so as to, in effect, shorten the span of each arm and increase its resistance to outward deflection. A continuation of the upward movement of the running-in tool C then shifts the latch sleeve 114 upwardly with it, the latch fingers 119 remaining in the valve sleeve groove 120 and causing the valve sleeve 100 to shift upwardly. When the vale sleeve has been shifted to its uppermost position, as disclosed in FIG. 2*a*, the retrieving head 112 is disposed around an enlarged seat 132 on the valve body 11, preventing fluid from passing therebetween. If desired, a suitable seal ring 133 can be mounted on the enlarged seat for engagement with the inner surface 134 of the retrieving head. Fluid under pressure can now be pumped down through the tubular string D, flowing downwardly through the control head passage 13 and discharging from its ports 14 to the interior of the retrieving sleeve 111, and down through the latch sleeve 114. The valve sleeve 100 is in its closed position, as shown in FIG. 2*a*, the fluid under pressure then passing into a lateral passage 140 controlled by a check valve 141 (FIG. 6) and into the passage 16 leading to the cylinders 72, 72*a*, 61, 61*a*, 74, 74*a* and the packinging element 78.

As shown in FIG. 6, the lateral passage 140 includes an inlet port 142 communicating with the exterior of the valve body 11, which opens into a tapered valve seat 143 surrounding the lateral passage 140. A valve head 144 is urged into sealing engagement with this seat by a helical compression spring 145 bearing thereagainst and also against a spring seat 146 threaded into the outer end of the passage to close the same. The valve head 144 may have suitable longitudinal ribs 147 slidable along the wall of the transverse passage 140 and may also carry a seal 148 held thereagainst by a screw 149 for sealing engagement with the tapered valve seat. When the fluid pressure overcomes the force of the spring 145, the valve head 144 is shifted from its seat 143 to allow the fluid under pressure to flow through the inlet port 142 and seat 143 into the passage 140, and then into the longitudinal passage 16 through the valve body 11 to the fluid pressure actuated devices surrounding the inner body member 15.

When the bridge plug A is anchored in packed-off condition in the well casing, the valve sleeve 100 and retrieving tool C occupy the position illustrated in FIG. 2*a*. A continuation of the upward movement of the tubular string D and running-in and retrieving tool C will exert a sufficient force on the latch sleeve 114 to cause the latch fingers 119 to be cammed out of the groove 120, thereby releasing the running-in tool from the bridge plug A and allowing it to be withdrawn on the tubular string D to the top of the well bore, leaving the bridge plug A set in the well casing.

In the event the bridge plug A is to be released and removed from the well casing B, the running-in and retrieving tool C is lowered in the well casing until the latch sleeve 114 moves over the control head 12 and the fingers 119 engage an upper tapered guide surface 150 on the valve sleeve 100. When this occurs, the retrieving tool body 108 and sleeve 111 move downwardly a short distance relative to the latch sleeve 114 to bring the end 124 of the upper tool section 108 into engagement with the upper end of the latch sleeve. This disposes the restricted portions 130 of the outer sleeve 111 below the protuberances 131 on the latch arms 118, increasing the support distance of each latch arm to the distance between the upper and lower circumferentially continuous portions 115, 116 of the latch sleeve. The latch fingers 119 can thereby engage the tapered surface 150 on the valve sleeve 100 and deflect the latch arms 118 more readily than when the shorter length of the latch arms (distance between protuberances 131) was effective for deflection, the latch fingers 119 sliding along the surface of the valve 100 until they are opposite the valve sleeve groove 120, whereupon they will be moved by the inherent contractibility of the arms 118 into the groove, thereby recoupling the running-in and retrieving apparatus C to the valve sleeve 100.

The location of the running-in and retrieving tool C with respect to the bridge plug A is determined by the pin and slot connection 109, 110. A single control slot 110 and pin 109 can be used, or a plurality of circumferentially spaced control pins and slots can be employed. As shown, each slot 110 opens upwardly of the control head 12, there being tapered downwardly converging walls 151 adapted to guide the pin 109 mounted on the retrieving tool into the upper end or entrance 152 of the control slot. The pin 109 can engage an inclined guide wall 153 which directs it to a lowermost or running-in position of the tool C, designated the No. 1 position in FIG. 5. The control pin 109 can move upwardly within a retrieving slot portion 154 disposed to one side of the entrance slot portion 152 to the upper end of the retrieving slot portion, which is designated the No. 2 position in FIG. 5, in which location the bridge plug A is conditioned to be elevated in the well casing B. When the retrieving tool C is shifted so as to move its control pin upwardly through the entrance opening 152 to a position above the slot 110, which is designated the No. 3 position in FIG. 5, the bridge plug A is condtioned for setting through application of fluid pressure through the tubular string D and the retrieving head C, such fluid pressure passing through the check valve controlled transverse passage 140 to the pressuring passage 16 that communicates with the cylinders and packing sleeve surrounding the composite body structure.

The apparatus A is lowered in the well casing B by placing the running-in and retrieving tool C over its upper control head 12 and valve body portion 11, with the control pins 109 occupying the No. 1 position, at which time the valve sleeve 100 is in its lowermost position on the valve body and its relief port 103 is in communication with the passage 16 communicating with the various cylinders and the packing sleeve 78. All of the parts occupy the positions illustrated in FIGS. 1*a*–1*d*. The pressure transmitting passage 16 communicates with the fluid in the well casing surrounding the apparatus A through the pressure relief port 103, and the fact that the retrieving head 112 is out of sealing relation to the enlarged seat 132, the fluid being permitted to pass between the passage 16 and the casing B externally of the bridge plug A through the lower slots 113 in the retrieving head. As a result, the pressure internally and externally of the apparatus is equalized during its lowering in the well casing. The drag blocks 64, 64*a* frictionally resist such lowering action, but their frictional resistance is readily overcome by the tubular string D, the downward force being exerted through the pins 109 and the control bar or head 12 onto the body structure 10, 32.

When the location in the well casing is reached at which the bridge plug is to be set, the tubing string D is turned to the right and elevated slowly to move the pins 109 along the inclined guide walls 153 and through the entrance openings 152 of the slot 110 to a position thereabove, which is the No. 3 position disclosed in FIG. 5. During such movement, the shoulder 125 of the sleeve 111 of the running-in and retrieving tool C engages the ring 126 to shift the latch sleeve 114 upwardly, the fingers 119 carrying the valve sleeve 100 upwardly with it into engagement with the upper stop shoulder 102, which locates the retrieving head 112 around the enlarged seat 132 of the valve body 11, thereby preventing fluid from passing downwardly between the head and such enlarged seat (FIGS. 2*a*–2*d*). The upper end of the passage 16 is now closed, which then allows fluid under pressure to be pumped down through the tubular string D and through the control head passage 13 and ports 14 into the retrieving head sleeve 111, flowing downwardly therethrough and entering the inlet port 142 of the transverse passage 140, unseating the head 144 from its companion seat 143 so that the pressure then passes into the valve body passage 16 and through the inclined passage 28 of the fluid director head 23 to the lower recess 29, from where the fluid can pass through the longitudinal passage or passages 30 through the lower portion of the valve body 11 into the annular passage 31 between the upper body section 33 and inner body member 15.

The fluid under pressure then passes into the upper ports 38 and can shift the accumulator piston 93 upwardly in the cylinder 72 against the force of the upper spring 92. Fluid under pressure passes from the ports 38 into the annular passage 42 between the upper anchor body section 41 and the inner body member 15, acting upon the gripping elements 60 and shifting them outwardly into engagement with the wall of the well casing B against the force of their retractor springs 75. The same fluid under pressure then passes into the ports 46 of the packing body section 45, acting upon the upper end of the packing 78 and its sleeve 80 and uring them downwardly in the cylinder 74. At the same time, such fluid under pressure passes into the passage 47 between the packing body section 45 and inner body member 15, passing through the ports 84 to the interior of the packing sleeve 78 to inflate the latter. The same fluid under pressure also passes through the lower body section ports 49 to the lower end of the packing sleeve 78 and its piston sleeve 80*a*, urging such parts upwardly toward the upper ends, and thereby shortening the packing sleeve 78. The same fluid under pressure flows from these last-mentioned ports 49 into the annular passage 52 between the lower anchor body 51 and inner body member 15, acting on the

inner ends of the lower gripping elements 60*a* and shifting them outwardly against the casing. The same fluid under pressure passes through the ports 56 of the lower accumulator body section 55 and acts upon the lower piston 93*a*, urging such piston downwardly in the lower cylinder 72*a* and compressing the helical spring 92*a*.

Sufficient pressure is applied to the apparatus A to insure that the packing element 78 has been expanded into firm sealing engagement with the wall of the well casing and to insure proper embedding of the teeth 62, 62*a* of the upper and lower sets of gripping elements 60, 60*a* in the wall of the well casing, and to shift the upper and lower accumulator pistons 93, 93*a* in their respective cylinders to compress the springs 92, 92*a* and thereby store additional energy therein. When the pressure of the tubular string D is relieved, the check valve 144 closes against its seat 143 and traps the fluid pressure in the well packer, holding all of the elements in the condition to which they have been shifted, such as the condition illustrated in FIGS. 2*a*–2*d*.

The bridge plug A has now been firmly anchored in packed-off condition in the well casing B, allowing an upward pull to be taken on the tubular string D and the retrieving tool C, which will pull upwardly on the latch sleeve 114 and cam the fingers 119 out of the valve sleeve groove 120, releasing the running-in and retrieving tool C from the bridge plug. The running-in and retrieving tool can now be elevated in the well casing by upwardly moving the tubing string D.

Pressure in the well casing below the bridge plug is prevented from effecting its release. In fact, such pressure will act on the lower accumulator piston 93*a* and be transmitted to the fluid or liquid in the lower chamber 94*a*. If such pressure is higher than the pressure in the lower chamber, it will increase the fluid pressure tending to hold the gripping elements 60, 60*a* and packing element 78 expanded against the wall of the well casing. Similarly, any pressure differential that might exist above the bridge plug is incapable of releasing it from the well casing. In fact, if such pressure tends to exceed the trapped pressure in the plug, it will act upon the upper accumulator piston 93 and urge it downwardly of its cylinder 72 to increase the pressure of the liquid or fluid trapped in the bridge plug.

In the event that the fluid volume in the bridge plug tends to increase, as, for example, through the extrusion of packing material into the clearance spaces between the piston skirt flanges 81, 81*a* and the wall of the well casing B, the pressure will not be substantially relieved since the energy stored in the springs 92, 92*a* will shift the pistons 93, 93*a* in their cylinders 72, 72*a* to maintain adequate pressure in the system.

When the bridge plug A is to be released from the well casing and retrieved therefrom, or shifted to a new setting location therein, the running-in and retrieving tool C is lowered toward the bridge plug, moving over the control head 12 and the valve sleeve 100. The fingers 119 will slide along the tapered guide 150 onto the valve head, the pins 109 being guided by the tapered walls 151 into the entrances 152 of the slots, and shifted by the inclined guide walls 153 to the No. 1 position (FIG. 5). In shifting to such position, the valve sleeve 100 will be shifted downwardly along the valve body 11 to place the pressure relief port 103 of the valve sleeve in communication with the passage 16 through the valve body. This will allow the fluid pressure trapped within the tool to bleed outwardly from the several cylinders and passages into the well casing, the springs 92, 92*a* shifting the accumulator pistons 93, 93*a* back to their initial positions, the retractor springs 75, 75*a* shifting the gripping elements 60, 60*a* to retracted positions back within the confines of their anchor bodies 41, 51, and the packing sleeve 78 inherently retracting to its initial position. The tubular string D and running-in and retrieving tool C are then elevated slowly to shift the sleeve 111 and the latch

sleve 114 upwardly, carrying the valve sleeve 100 upwardly with it, until the pins 109 are disposed in the upper ends of the locking portions 154 of the slots, which is the No. 2 position illustrated in FIG. 5. At this time, the valve sleeve 100 is disposed on the valve body 11 and control head 12 in the position illustrated in FIG. 3*a*, placing the longitudinal passages 16, 20 in communication with each other through the annular passage 107. At this time also, the restricted portions 130 of the retrieving sleeve 111 are disposed around and in embracing relation to the protuberances 131 of the latch arms 118, to increase their resistance to deflection. The tubular string D can now be elevated in the well casing, the pins 109 engaging the control head 12 to elevate the entire apparatus A in the well casing. Any pressure developed in the fluid in the well casing as a result of elevating the bridge plug therein cannot inadvertently expand the parts since a pressure differential will not be built up within the various cylinders and the packing sleeve. The fluid passage 16 communicating therewith also communicates through the sleeve passage 107 and the pressure equalizing passage 20 with the well casing B below the body 15 of the tool, the fluid having a ready path of flow through the pressure equalizing passage 20 in the valve body portion, the upper recess 25 surrounding the director head 23 and inclined passage 26 to the central passage 27 through the inner body member 15. Accordingly, the bridge plug A can be elevated rapidly through the fluid in the well casing. In fact, any pressure developed in the fluid in the well casing, as a result of elevating the bridge plug therein, will tend to hold the gripping members 60, 60*a* and packing sleeve 78 in their retracted positions.

I claim:

1. In a well tool adapted to be lowered in a well bore on a running-in string: a body structure; fluid actuated gripping means on said body structure expandible outwardly thereof; means for conducting fluid under pressure to said gripping means to expand said gripping means outwardly against the well bore to anchor said body structure in the well bore; means in said conducting means through which the conducted fluid must pass in expanding said gripping means for trapping said fluid under pressure applied to said gripping means to prevent release of said gripping means from the well bore; and means separate from said trapping means for relieving said fluid under pressure comprising a valve member slidable on the exterior of said body and means operable by the running-in string for shifting said valve member on said body.

2. In a well tool adapted to be lowered in a well bore on a running-in string: a body structure having a generally radial cylinder therein; a gripping member movable in said cylinder; means for conducting fluid under pressure to said cylinder and against said gripping member to shift said gripping member against the well bore to anchor said body structure in the well bore; means in said conducting means through which the conducted fluid must pass in expanding said gripping member for trapping said fluid under pressure in said cylinder to prevent release of said gripping member from the well bore; and means separate from said trapping means for relieving said fluid under pressure comprising a valve member slidable on the exterior of said body and means operable by the running-in string for shifting said valve member on said body.

3. In a well tool adapted to be lowered in a well bore on a running-in string: a body structure having a generally radial cylinder therein; a gripping member movable in said cylinder; means for conducting fluid under pressure to said cylinder and against said gripping member to shift said gripping member against the well bore to anchor said body structure in the well bore; means in said conducting means through which the conducted fluid must pass in expanding said gripping member for trapping said fluid under pressure in said cylinder to prevent release of said gripping member from the well bore; and means separate from said trapping means and operable by the running-in string for relieving said fluid under pressure to release said gripping member from the well bore.

4. In a well tool adapted to be set in a well bore: a body structure having a generally radial cylinder therein; a gripping member movable in said cylinder; a fluid pressure accumulator communicating with said cylinder and comprising a pressure member exposed to the pressure of fluid in said cylinder and a spring within said body structure bearing against said pressure member; means for conducting fluid under pressure to said accumulator and to said cylinder for action against said gripping member to shift said gripping member against the well bore to anchor said body structure in the well bore and to store fluid pressure energy in said accumulator whereby said accumulator maintains fluid pressure on the fluid conducted thereto; and means for trapping said fluid under pressure in said cylinder and accumulator to prevent release of said gripping member from the well bore.

5. In a well tool adapted to be set in a well bore: a body structure having a generally radial cylinder therein; a gripping member movable in said cylinder; a fluid pressure accumulator communicating with said cylinder and comprising a pressure member exposed to the pressure of fluid in said cylinder and a spring within said body structure bearing against said pressure member; means for conducting fluid under pressure to said accumulator and to said cylinder for action against said gripping member to shift said gripping member against the well bore to anchor said body structure in the well bore and to store fluid pressure energy in said accumulator whereby said accumulator maintains fluid pressure on the fluid conducted thereto; means for trapping said fluid under pressure in said cylinder and accumulator to prevent release of said gripping member from the well bore; and means for releasing said fluid under pressure from said accumulator and cylinder to release said gripping member from the well bore.

6. In a well tool adapted to be set in a well bore: a body structure; inflatable packing means on said body structure; a fluid pressure accumulator communicating with said packing means and comprising a pressure member exposed to the pressure of fluid in said packing means and a spring within said body structure bearing against said pressure member; means for conducting fluid under pressure to said accumulator and to the interior of said packing means to inflate and expand said packing means against the well bore and to store fluid pressure energy in said accumulator whereby said accumulator maintains fluid pressure on the fluid conducted thereto; and means for trapping said fluid under pressure in said packing means and accumulator to prevent release of said packing means from the well bore.

7. In a well tool adapted to be set in a well bore: a body structure; inflatable packing means on said body structure; a fluid pressure accumulator communicating with said packing means and comprising a pressure member exposed to the pressure of fluid in said packing means and a spring within said body structure bearing against said pressure member; means for conducting fluid under pressure to said accumulator and to the interior of said packing means to inflate and expand said packing means against the well bore and to store fluid pressure energy in said accumulator whereby said accumulator maintains fluid pressure on the fluid conducted thereto; means for trapping said fluid under pressure in said packing means and accumulator to prevent release of said packing means from the well bore; and means for releasing said fluid under pressure from said accumulator and packing means to release said packing means from the well bore.

8. In a well tool adapted to be set in a well bore: a body structure; packing means on said body structure; a fluid pressure accumulator communicating with said packing means and comprising a pressure member exposed to

the pressure of fluid in said packing means and a spring within said body structure bearing against said pressure member; means for conducting fluid under pressure to said accumulator and to an end portion of said packing means to shift said end portion toward said other end portion of said packing means and expand said packing means against the well bore and to store fluid pressure energy in said accumulator whereby said accumulator maintains fluid pressure on the fluid conducted thereto; and means for trapping said fluid under pressure to prevent release of the energy stored in said accumulator and to prevent release of said packing means from the well bore.

9. In a well tool adapted to be set in a well bore: a body structure; inflatable packing means on said body structure; a fluid pressure accumulator communicating with said packing means; means for conducting fluid under pressure to said accumulator and to the interior of said packing means and the end portions of said packing means to inflate and expand said packing means against the well bore, to shift said end portions relative to said body structure toward each other, and to store fluid pressure energy in said accumulator whereby said accumulator maintains fluid pressure on the fluid conducted thereto; and means for trapping said fluid under pressure to prevent release of the energy stored in said accumulator and to prevent release of said packing means from the well bore.

10. In a well tool adapted to be lowered in a well bore on a tubular running-in string: a body structure; fluid actuated gripping means on said body structure expandable outwardly thereof; inflatable packing means on said body structure; means for conducting fluid under pressure from the tubular running-in string to said gripping means and the interior of said packing means to expand said gripping means and packing means against the well bore; means for trapping said fluid under pressure applied to said gripping means and packing means to prevent release of said gripping means and packing means from the well bore; and means separate from said trapping means for relieving said fluid under pressure.

11. In a well tool adapted to be lowered in a well bore on a tubular running-in string: a body structure having a generally radial cylinder therein; a gripping member movable in said cylinder; packing means on said body structure; means for conducting fluid under pressure from the tubular running-in string to said cylinder and packing means to expand said gripping means and packing means against the well bore; means in said conducting means through which the conducted fluid must pass in expanding said gripping member for trapping said fluid under pressure to prevent release of said gripping member and packing means from the well bore; and means separate from said trapping means for relieving said fluid under pressure.

12. In a well tool adapted to be set in a well bore: a body structure having a generally radial cylinder therein; a gripping member movable in said cylinder; packing means on said body structure; a fluid pressure accumulator communicating with said cylinder and packing means; means for conducting fluid under pressure to said accumulator and to said cylinder and packing means to expand said gripping member and packing means against the well bore and to store fluid pressure energy in said accumulator whereby said accumulator maintains fluid pressure on the fluid conducted thereto; and means for trapping said fluid under pressure to prevent release of the fluid pressure energy stored in said accumulator and to prevent release of said gripping member and packing means from the well bore.

13. In a well tool adapted to be set in a well bore: a body structure having a generally radial cylinder therein; a gripping member movable in said cylinder; inflatable packing means on said body structure; a fluid pressure accumulator communicating with said cylinder and packing means; means for conducting fluid under pressure to said accumulator, cylinder, the interior of said packing means, and the end portions of said packing means to store fluid pressure energy in said accumulator, to expand said gripping member against the well bore, and to inflate said packing means against the well bore and shift said end portions toward each other; and means for trapping said fluid under pressure applied to said gripping means, packing means and accumulator to prevent release of said gripping means and packing means from the well bore.

14. In a well tool adapted to be set in a well bore; a body structure; fluid actuated anchoring means on said body structure expandible outwardly thereof and having external teeth thereon; means for conducting fluid under pressure to said anchoring means to expand said anchoring means outwardly against the well bore to anchor said body structure in the well bore; means for trapping said fluid under pressure applied to said anchoring means to prevent release of said anchoring means from the well bore; means providing communication between said conducting means and the well bore externally of said body structure; and shiftable valve means externally of said body structure for selectively preventing or permitting such communication.

15. In a well tool adapted to be set in a well bore: a body structure; fluid actuated anchoring means on said body structure expandible outwardly thereof and having external teeth thereon; inflatable packing means on said body structure; means for conducting fluid under pressure to said anchoring means and the interior of said packing means to expand said anchoring means and packing means against the well bore; means for trapping said fluid under pressure applied to said anchoring means and packing means to prevent release of said anchoring means and packing means from the well bore; means providing communication between said conducting means and the well bore externally of said body structure; and shiftable valve means externally of said body structure for selectively preventing or permitting such communication.

16. In a well tool adapted to be set in a well bore: a body structure having a generally radial cylinder therein; a gripping member movable in said cylinder; inflatable packing means on said body structure; a fluid pressure accumulator communicating with said cylinder and packing means; means for conducting fluid under pressure to said accumulator, cylinder, the interior of said packing means, and the end portions of said packing means to store fluid pressure energy in said accumulator, to expand said gripping member against the well bore, and to inflate said packing means against the well bore and shift said end portions toward each other, means for trapping said fluid under pressure applied to said gripping member, packing means and accumulator to prevent release of said gripping member and packing means from the well bore; means providing communication between said conducting means and the well bore externally of said body structure; and shiftable valve means for selectively preventing or permitting such communication.

17. In a well tool adapted to be set in a well bore: a body structure; inflatable packing means on said body structure; said body structure having generally radial upper cylinders and lower cylinders on opposite sides of said packing means; upper and lower gripping members movable in said upper and lower cylinders, respectively; means for conducting fluid under pressure to said cylinders and the interior of said packing means to expand said gripping members and packing means against the well bore; and means for trapping said fluid under pressure applied to said gripping members and packing means to prevent release of said gripping members and packing means from the well bore.

18. In a well tool adapted to be set in a well bore: a body structure; inflatable packing means on said body structure; said body structure having generally radial upper and lower cylinders therein on opposite sides of said packing means; upper and lower gripping members

movable in said upper and lower cylinders, respectively; a fluid pressure accumulator communicating with said packing means and cylinders; means for conducting fluid under pressure to said accumulator; cylinders, the interior of said packing means, and the end portions of said packing means to store fluid pressure energy in said accumulator, to expand said gripping members and packings means against the well bore, and to shift the end portions of said packing means toward each other; and means for trapping said fluid under pressure in said accumulator, cylinders and packing means to prevent release of said gripping members and packing means from the well bore.

19. In a well tool adapted to be set in a well bore: a body structure; inflatable packing means on said body structure; said body structure having generally radial upper and lower cylinders therein on opposite sides of said packing means; upper and lower gripping members movable in said upper and lower cylinders, respectively; a fluid pressure accumulator communicating with said packing means and cylinders; means for conducting fluid under pressure to said accumulator, cylinders, the interior of said packing means, and the end portions of said packing means to store fluid pressure energy in said accumulator, to expand said gripping members and packing means against the well bore, and to shift the end portions of said packing means toward each other; means for trapping said fluid under pressure in said accumulator, cylinders and packing means to prevent release of said gripping members and packing means from the well bore; means providing communication between said conducting means and the well bore externally of said body structure; and shiftable valve means for selectively preventing or permitting such communication.

20. In apparatus adapted to be lowered in a well bore on a tubular running-in string: a body structure; fluid actuated gripping means on said body structure expandible outwardly thereof; said body structure embodying passage means for conducting fluid under pressure to said gripping means to expand said gripping means outwardly against the well bore to anchor said body structure in the well bore; setting means adapted to be secured to the running-in string and communicating with said body structure for conducting fluid under pressure from the tubular running-in string to said passage means; means releasably connecting said setting means to said body structure to allow disconnection of said setting means from said body structure; and one-way valve means in said passage means through which the conducted fluid must pass in expanding said gripping means for trapping said fluid under pressure applied to said gripping means to prevent release of said gripping means from the well bore.

21. In apparatus adapted to be lowered in a well bore on a tubular running-in string: a body structure; fluid actuated normally retracted means on said body structure expandible outwardly thereof; said body structure embodying passage means for conducting fluid under pressure to said normally retracted means to expand said normally retracted means outwardly against the well bore; setting means adapted to be secured to the running-in string and communicating with said body structure for conducting fluid under pressure from the tubular running-in string to said passage means; means releasably connecting said setting means to said body structure to allow disconnection of said setting means from said body structure; and one-way valve means in said passage means through which the conducted fluid must pass in expanding said normally retracted means for trapping said fluid under pressure applied to said normally retracted means to prevent release of said normally retracted means from the well bore.

22. In apparatus adapted to be lowered in a well bore on a tubular running-in string; a body structure; fluid actuated gripping means on said body structure expandible outwardly thereof; said body structure embodying passage means for conducting fluid under pressure to said gripping means to expand said gripping means outwardly against the well bore to anchor said body structure in the well bore; setting means adapted to be secured to the running-in string and communicating with said body structure for conducting fluid under pressure from the tubular running-in string to said passage means; means releasably connecting said setting means to said body structure to allow disconnection of said setting means from said body structure; one-way valve means in said passage means through which the conducted fluid must pass in expanding said gripping means for trapping said fluid under pressure applied to said gripping means to prevent release of said gripping means from the well bore; valve means controlling flow of fluid from said passage means to the well bore externally of said body structure; and means connecting said setting means to said valve means whereby said valve means is shifted between open and closed conditions by said setting means.

23. In apparatus adapted to be lowered in a well bore on a tubular running-in string: a body structure having a generally radial cylinder therein; a gripping member movable in said cylinder; inflatable packing means on said body structure; said body structure embodying passage means for conducting fluid under pressure to said cylinder and packing means to shift said gripping member outwardly against the well bore and to expand said packing means outwardly against the well bore; setting means adapted to be secured to the running-in string and releasably connected to said body structure for conducting fluid under pressure from the tubular running-in string to said passage means; and means for trapping said fluid under pressure applied to said cylinder and packing means to prevent release of said gripping member and packing means from the well bore.

24. In apparatus adapted to be lowered in a well bore on a tubular running-in string: a body structure having a generally radial cylinder therein; a gripping member movable in said cylinder; inflatable packing means on said body structure; said body structure embodying passage means for conducting fluid under pressure to said cylinder and packing means to shift said gripping means outwardly against the well bore and to expand said packing means outwardly against the well bore; setting means adapted to be secured to the running-in string and releasably connected to said body structure for conducting fluid under pressure from the tubular running-in string to said passage means; means for trapping said fluid under pressure applied to said cylinder and packing means to prevent release of said gripping member and packing means from the well bore; valve means controlling flow of fluid from said passage means to the well bore externally of said body structure; and means connecting said setting means to said valve means whereby said valve means is shifted between open and closed conditions by said setting means.

25. In apparatus adapted to be lowered in a well bore on a tubular running-in string: a body structure having a generally radial cylinder therein; a gripping member movable in said cylinder; inflatable packing means on said body structure; a fluid pressure accumulator communicating with said cylinder and packing means; said body structure embodying passage means for conducting fluid under pressure to said accumulator, cylinder, the interior of said packing means, and the end portions of said packing means to store fluid pressure energy in said accumulator, to expand said gripping means against the well bore, and to inflate said packing means and shift the end portions of said packing means toward each other to expand said packing means against the well bore; setting means adapted to be secured to the running-in string and releasably connected to said body structure for conducting fluid under pressure from the tubular running-in string to said passage means; and

means for trapping said fluid under pressure applied to said accumulator, gripping member, and packing means to prevent release of said gripping member and packing means from the well bore.

26. In apparatus adapted to be lowered in a well bore on a tubular running-in string: a body structure having a generally radial cylinder therein; a gripping member movable in said cylinder; inflatable packing means on said body structure; a fluid pressure accumulator communicating with said cylinder and packing means; said body structure embodying passage means for conducting fluid under pressure to said accumulator, cylinder, the interior of said packing means, and the end portions of said packing means to store fluid pressure energy in said accumulator, to expand said gripping member against the well bore, and to inflate said packing means and shift the end portions of said packing means toward each other to expand said packing means against the well bore; setting means adapted to be secured to the running-in string and releasably connected to said body structure for conducting fluid under pressure from the tubular running-in string to said passage means; means for trapping said fluid under pressure applied to said accumulator, gripping member, and packing means to prevent release of said gripping member and packing means from the well bore; valve means controlling flow of fluid from said passage means to the well bore externally of said body structure; and means connecting said setting means to said valve means whereby said valve means is shifted between open and closed conditions by said setting means.

27. In a well tool adapted to be set in a well bore: a body structure; fluid actuated normally retracted means on said body structure expandible outwardly thereof; said body structure having fluid passage means for conducting fluid under pressure to said normally retracted means to expand said normally retracted means outwardly against the wall of the well bore, said fluid passage means also being adapted to conduct fluid from said normally retracted means to allow retraction of said normally retracted means from the wall of the well bore; and shiftable valve means on said body structure for controlling said passage means to prevent the pressure of the fluid below said normally retracted means from passing through said passage means to said normally retracted means and to permit the pressure of the fluid above said normally retracted means to pass through said passage means to said normally retracted means during lowering of the tool in the well bore, and to prevent the pressure of the fluid above said normally retracted means from passing through said passage means to said normally retracted means and to permit the pressure of fluid below said normally retracted means to pass through said passage means to said normally retracted means during elevation of the tool in the well bore.

28. In a well tool adapted to be set in a well bore: a body structure; fluid actuated packing means on said body structure expandible outwardly thereof; said body structure having fluid passage means for conducting fluid under pressure to said packing means to expand said packing means outwardly against the wall of the well bore, said fluid passage means also being adapted to conduct fluid from said packing means to allow retraction of said packing means from the wall of the well bore; and shiftable valve means on said body structure for controlling said passage means to prevent the pressure of the fluid below said packing means from passing through said passage means to said packing means and to permit the pressure of fluid above said packing means to pass through said passage means to said packing means during lowering of the tool in the well bore, and to prevent the pressure of the fluid above said packing means from passing through said passage means to said packing means and to permit the pressure of fluid below said packing means to pass through said passage means to said packing means during elevation of the tool in the well bore.

29. In a well tool adapted to be set in a well bore: a body structure; fluid actuated gripping means on said body structure expandible outwardly thereof; said body structure having fluid passage means for conducting fluid under pressure to said gripping means to expand said gripping means outwardly against the wall of the well bore, said fluid passage means also being adapted to conduct fluid from said gripping means to allow retraction of said gripping means from the wall of the well bore; and shiftable valve means on said body structure for controlling said passage means to prevent the pressure of the fluid below said gripping means from passing through said passage means to said gripping means and to permit the pressure of fluid above said gripping means to pass through said passage means to said gripping means during lowering of the tool in the well bore, and to prevent the pressure of the fluid above said gripping means from passing through said passage means to said gripping means and to permit the pressure of fluid below said gripping means to pass through said passage means to said gripping means during elevation of the tool in the well bore.

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