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PACKER HOLDDOWN AND RELEASE APPARATUS

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FIG. 1a.

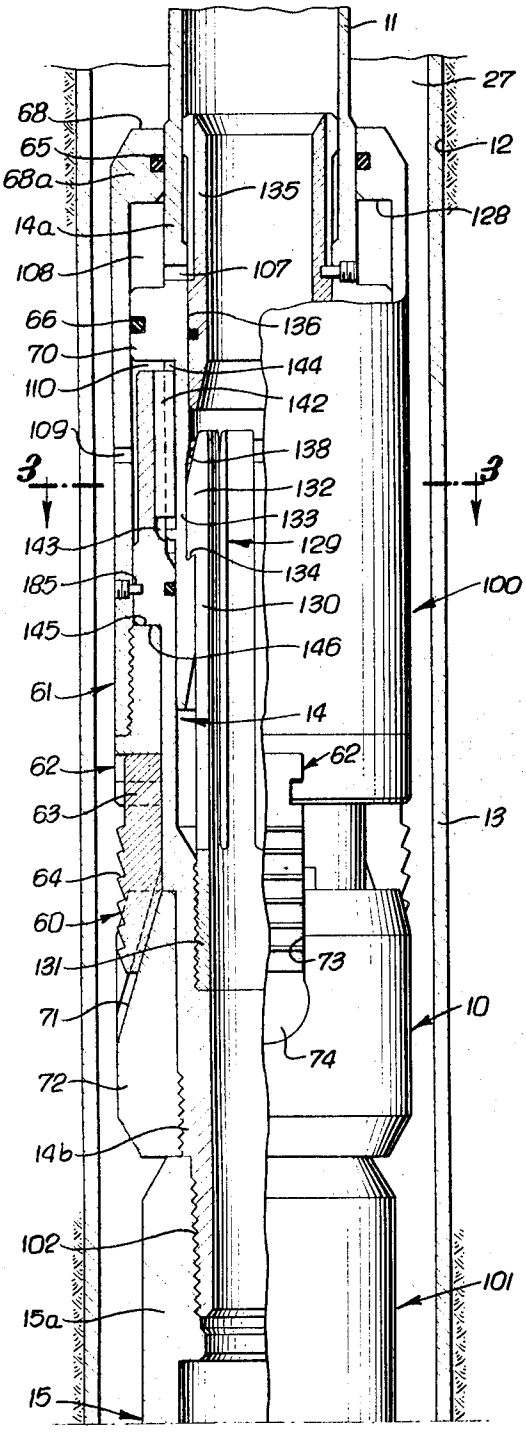
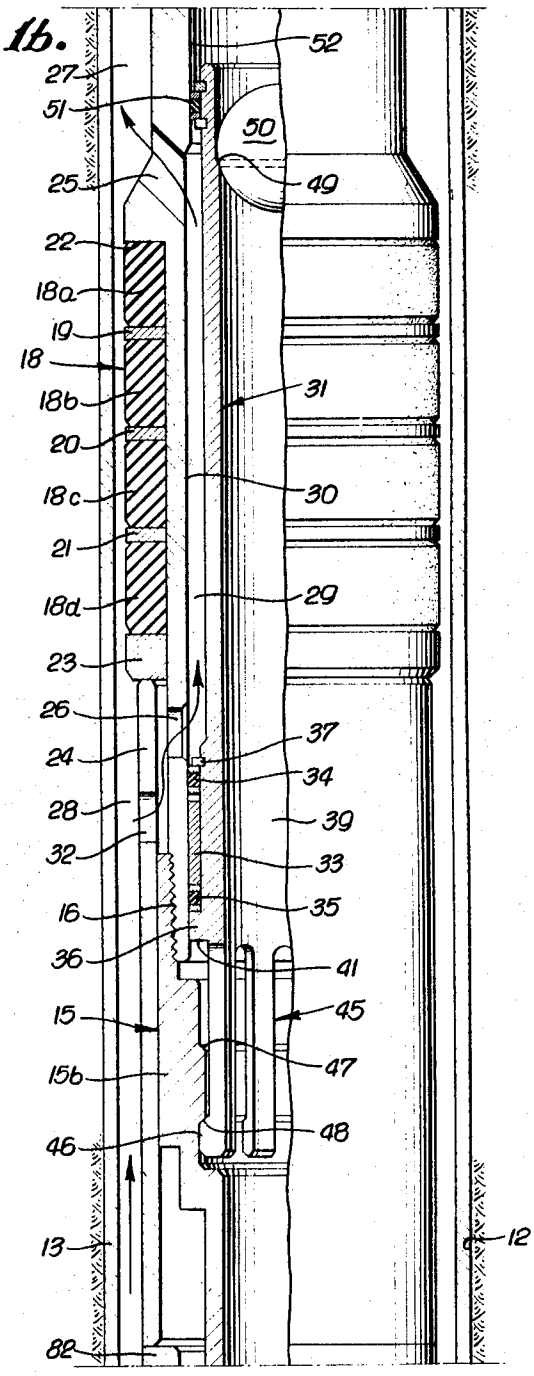


FIG. 1b.



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FIG. 2.

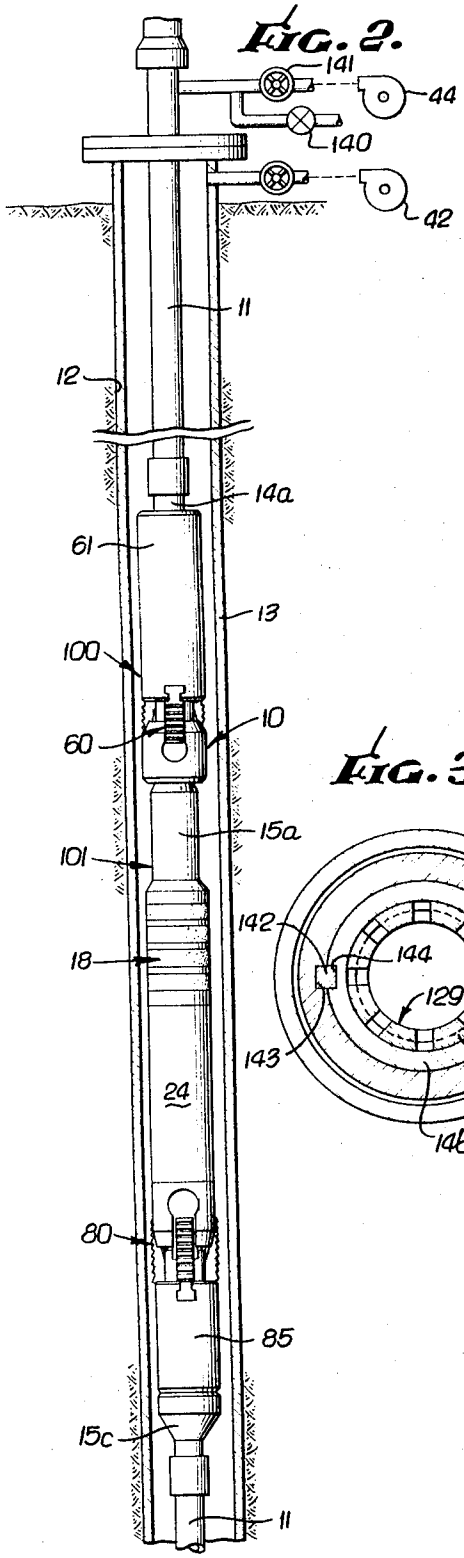
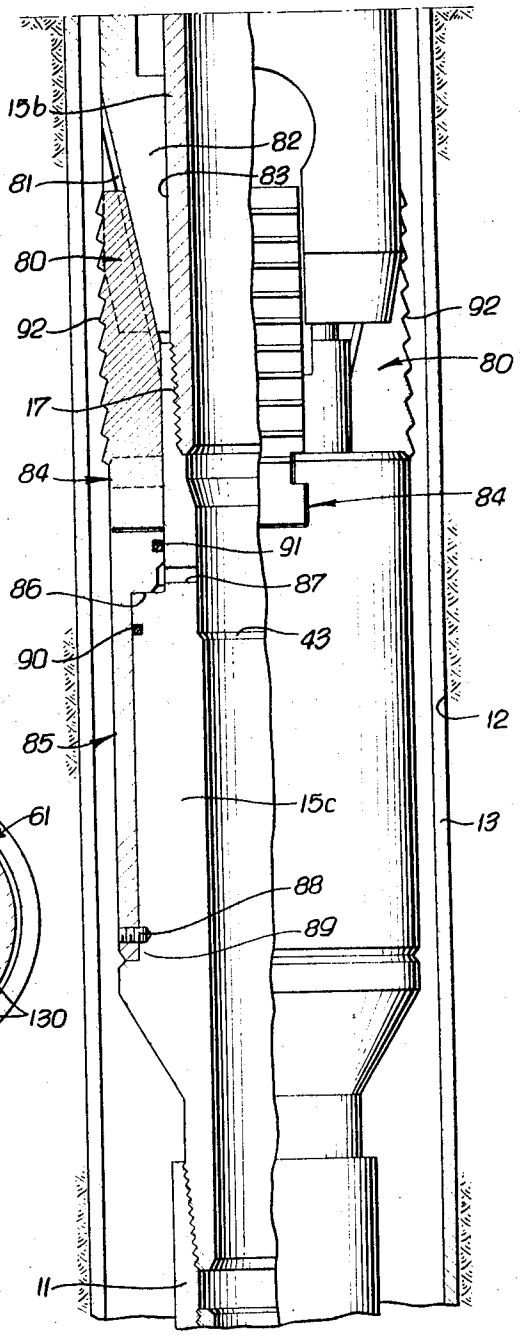


FIG. 3.

FIG. 1c.



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FIG. 4a.

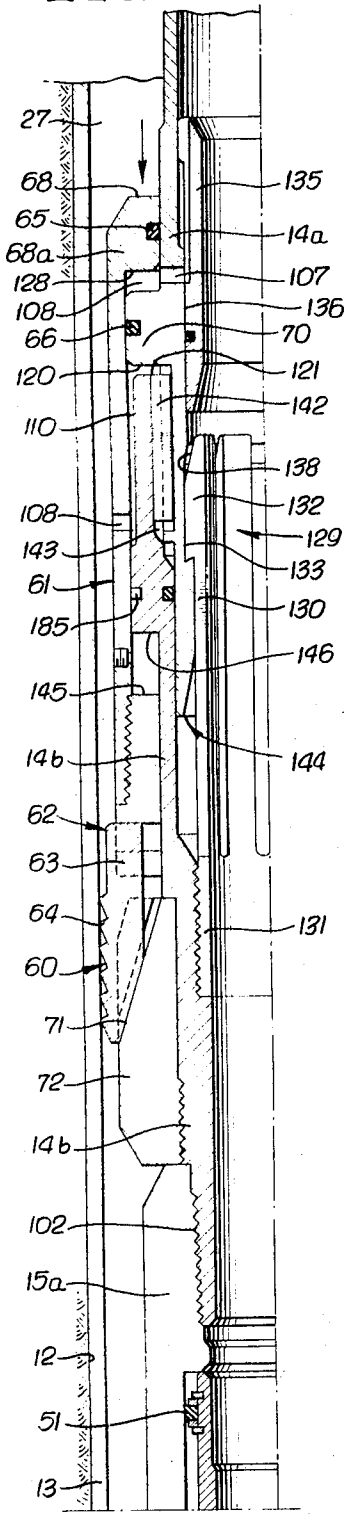


FIG. 4b.

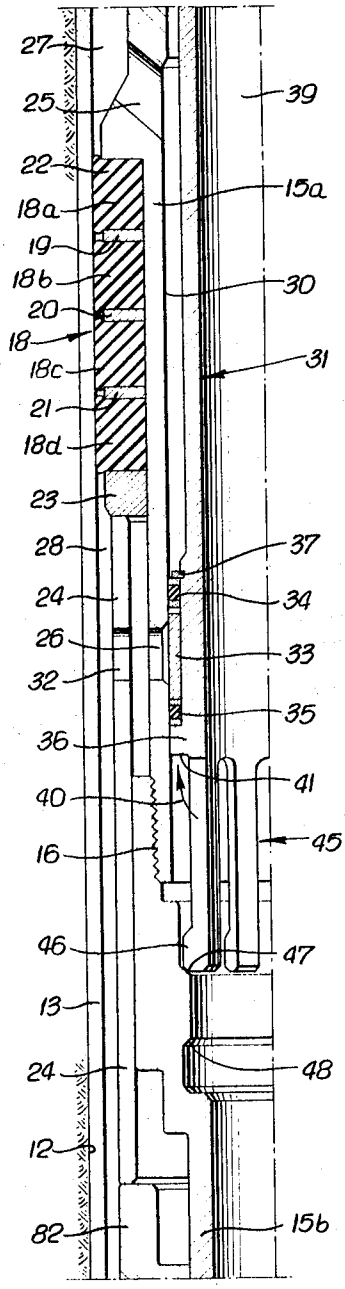
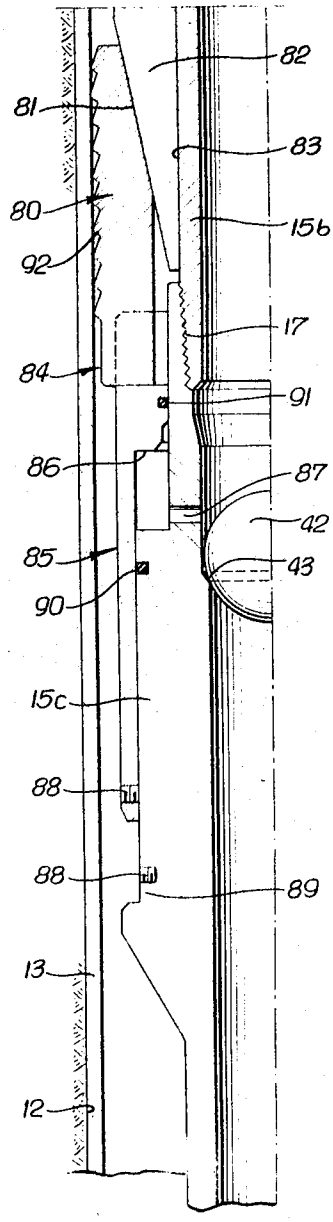


FIG. 4c.



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FIG. 5.

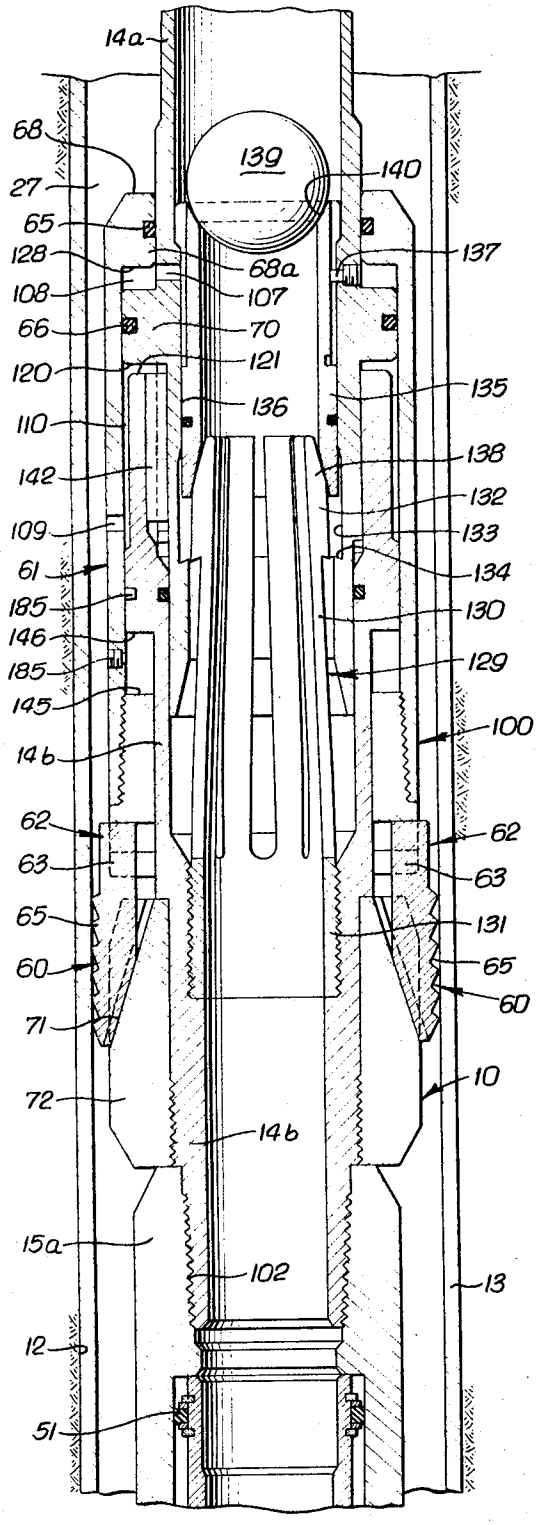
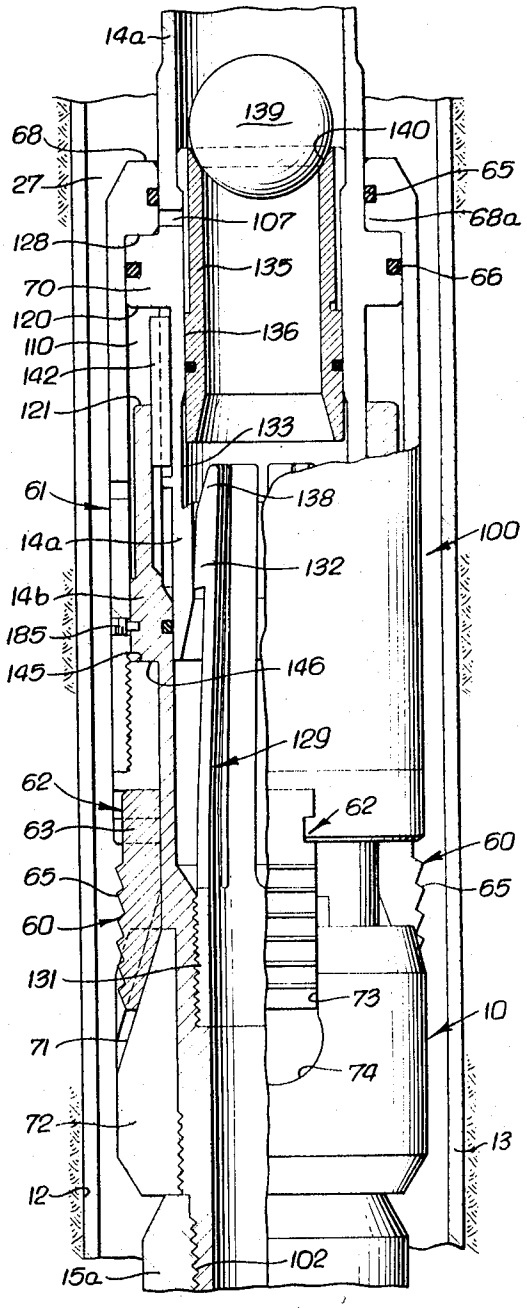


FIG. 6.



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FIG. 7.

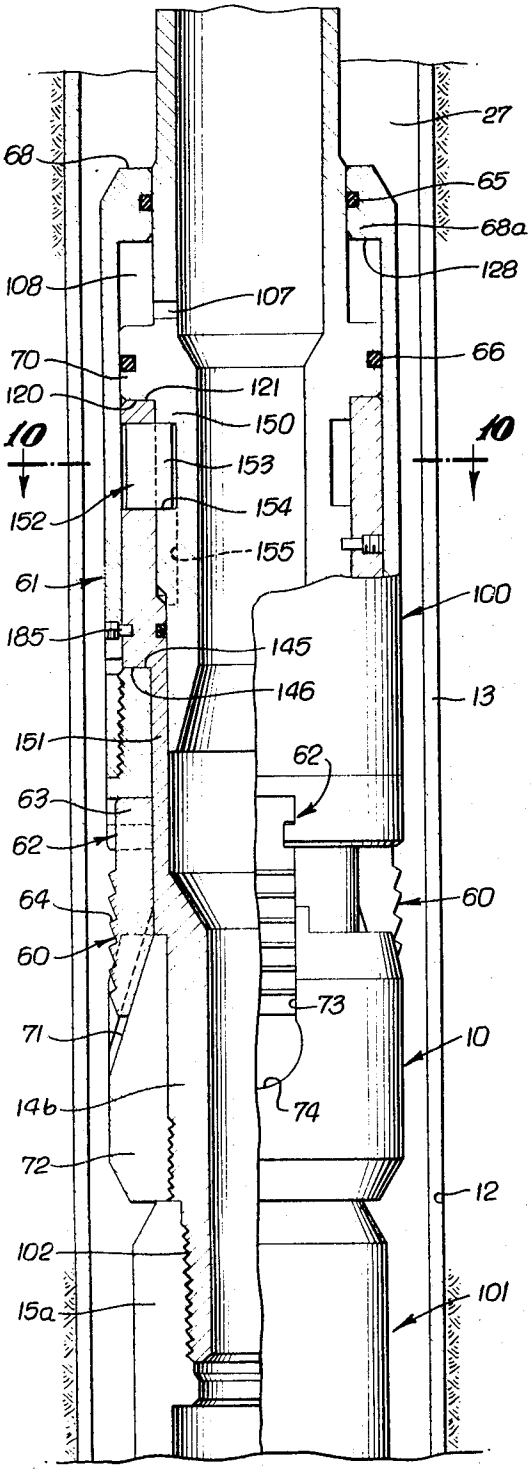
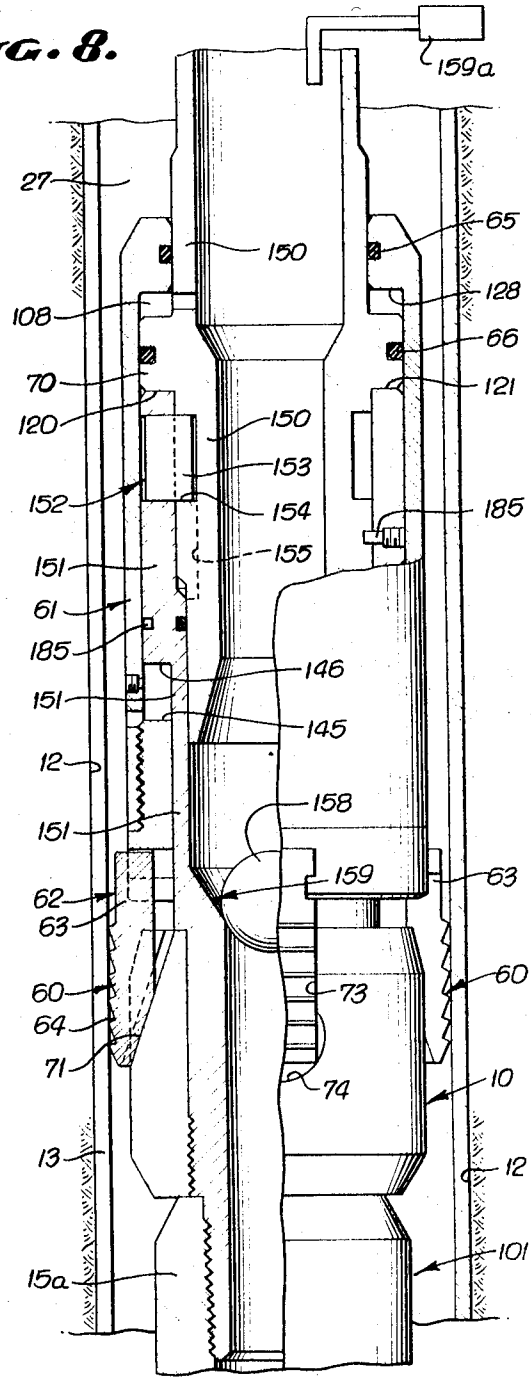


FIG. 8.



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FIG. 9.

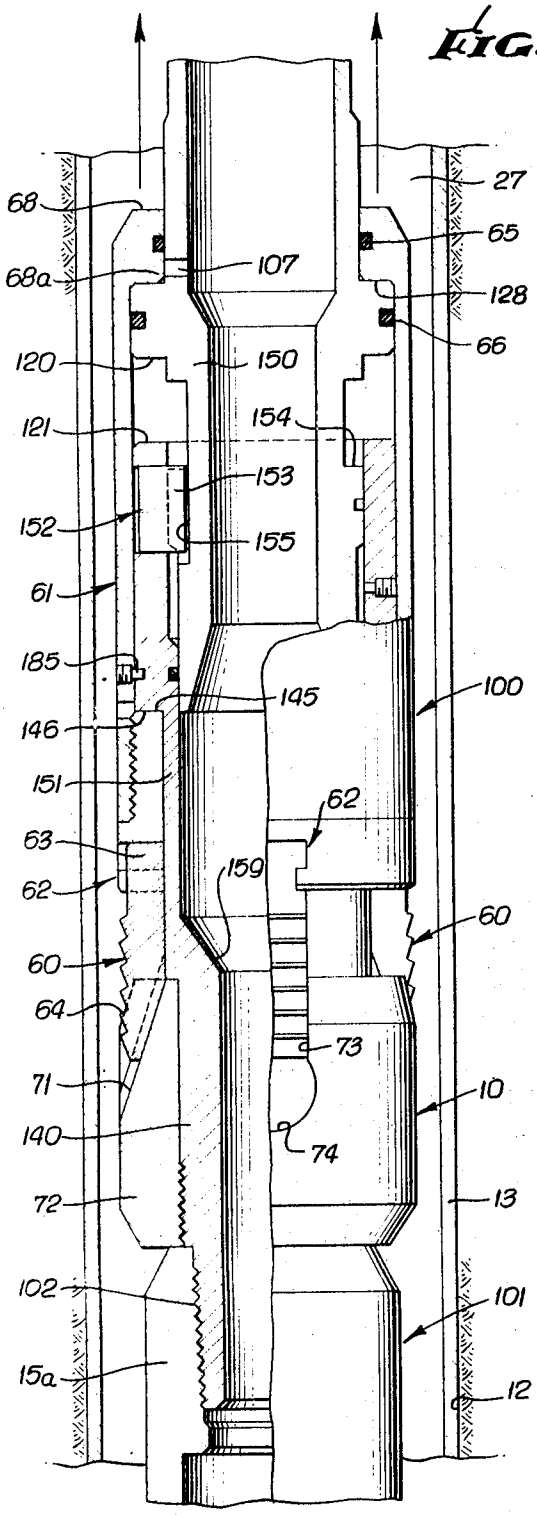


FIG. 10.

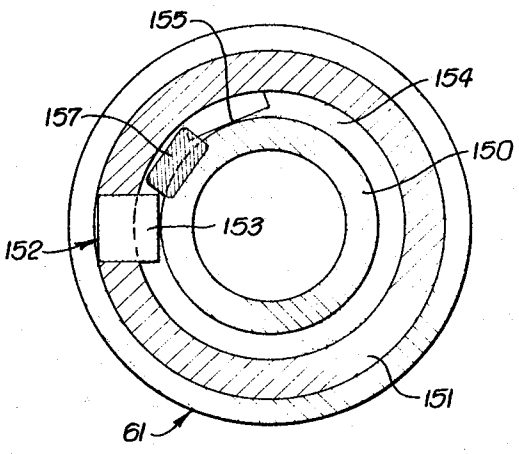
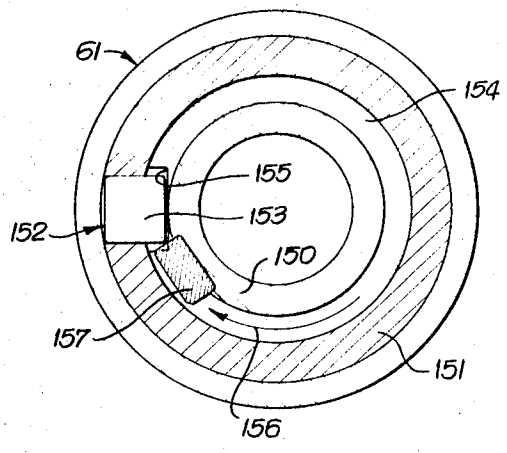


FIG. 11.



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FIG. 12.

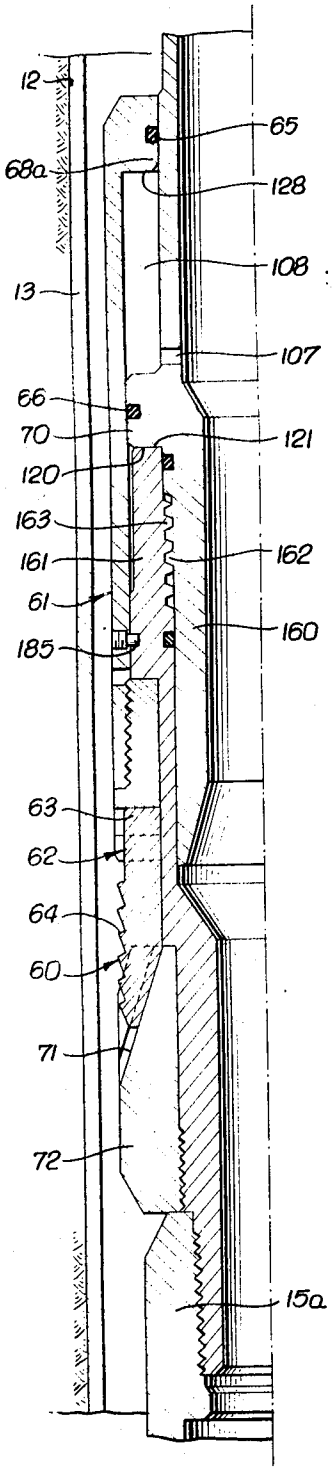


FIG. 13.

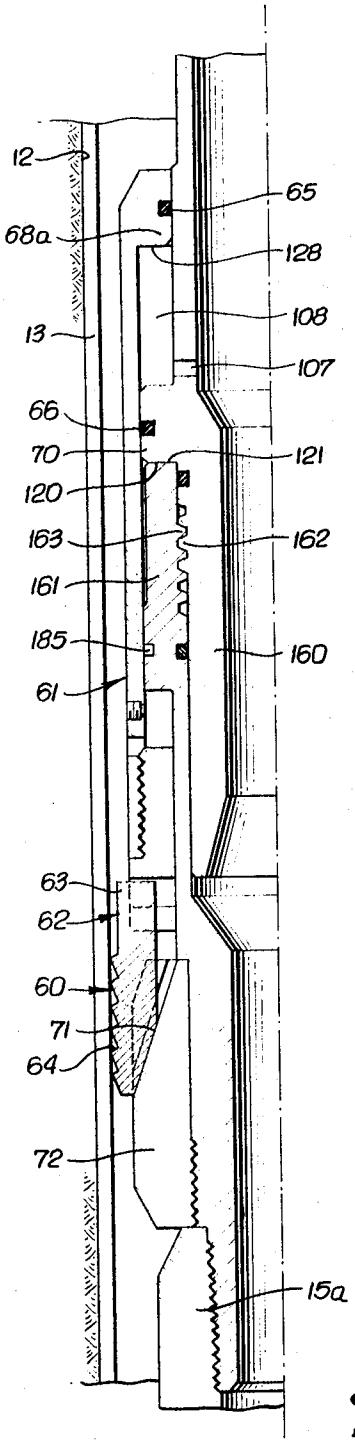
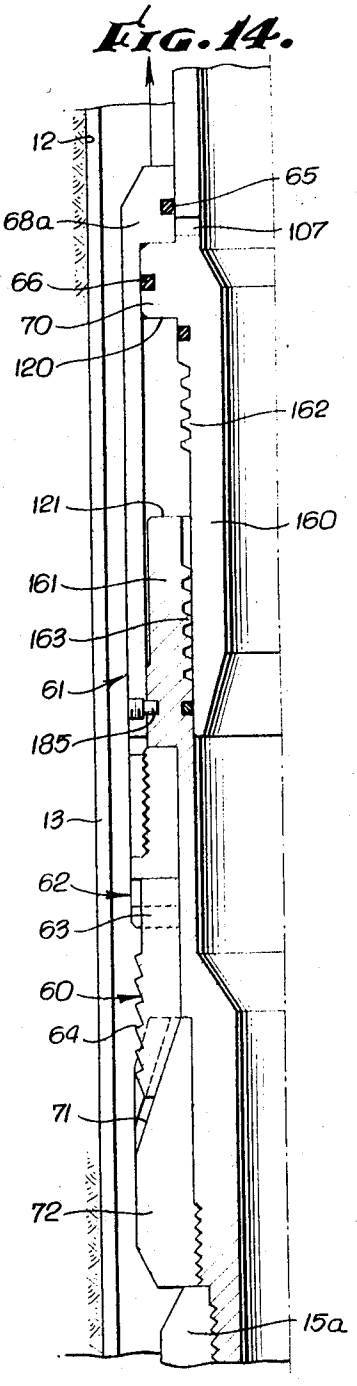


FIG. 14.



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FIG. 15.

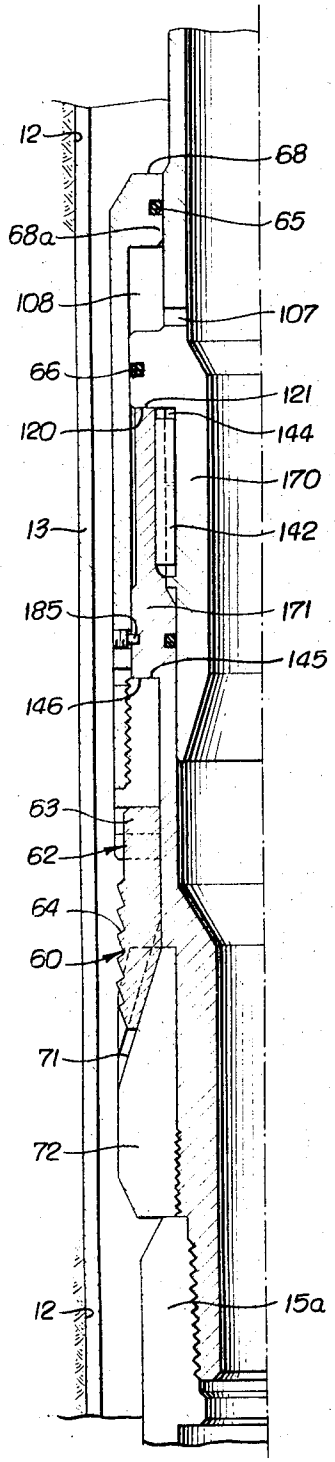


FIG. 16.

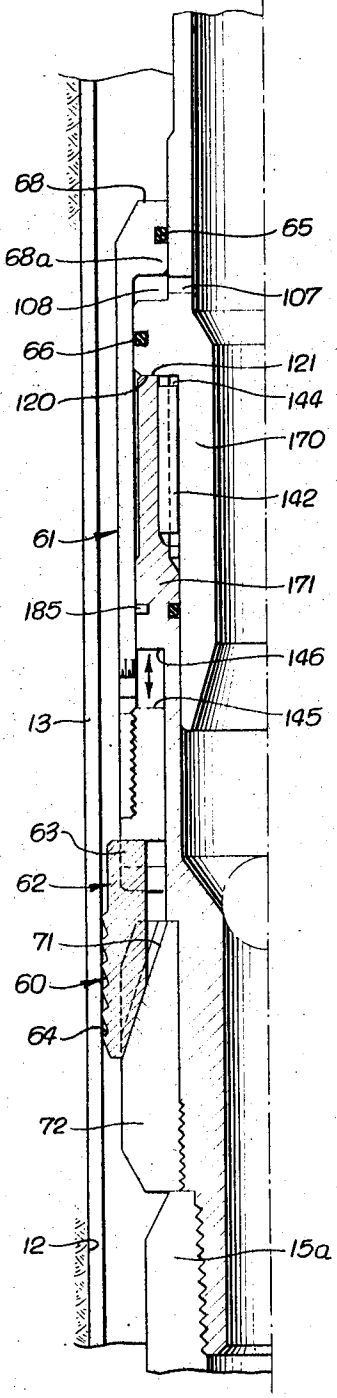
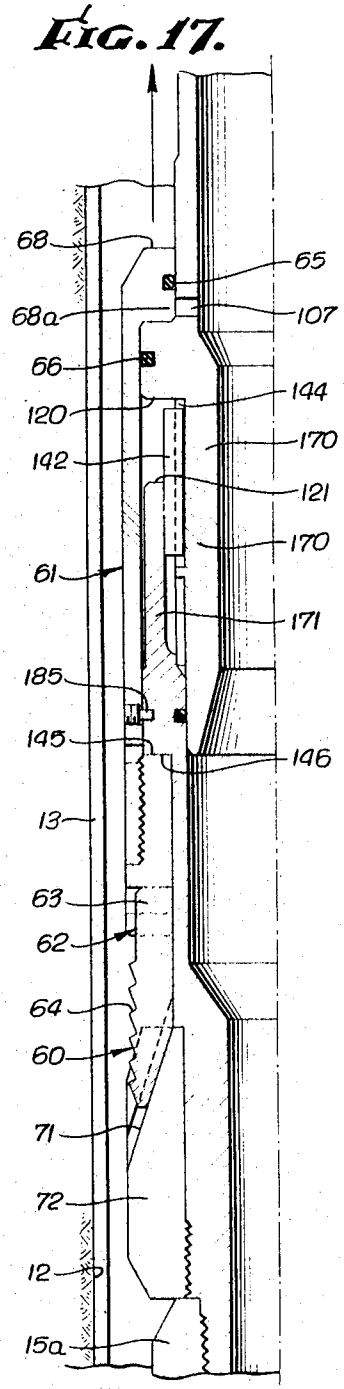


FIG. 17.



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United States Patent Office 3,455,381 Patented July 15, 1969

3,455,381

PACKER HOLDDOWN AND RELEASE APPARATUS

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Int. Cl. E21b 23/06, 33/128
U.S. Cl. 166—121 15 Claims

ABSTRACT OF THE DISCLOSURE

A releasable holddown or anchor device for a well packer carried on a well tubing and adapted for expansion into sealing contact with a well casing employs a tubular body on which the packer is mounted, together with a first set of slips hydraulically operated by pressure in the annulus between the casing and tubing for preventing upward movement of the body, and a second set of slips hydraulically operated by pressure within the tubing string for preventing downward movement of the body. The body includes two telescoping parts held against movement by means of a releasable latch device. The holddown or anchor device may be set hydraulically and locked mechanically, and also released both hydraulically and mechanically. A sleeve valve within the body is hydraulically operable to control bypass ports around the packer.

This invention relates generally to sub-surface oil tool holddown equipment, and more particularly concerns improvements in packer holddown apparatus.

There is a need for a simple, effective device capable of causing a well packer to hold pressure applied from above or below, and without tubing weight. The present invention has for its major object the provision of such a holddown device that can be run in a well in conjunction with the packer, and that may be set hydraulically and locked mechanically, and also can be released both hydraulically and mechanically to assure retrievability.

Among the further objects of the invention are the provision of sub-surface oil tool equipment capable of holding down or anchoring a well packer by means of a first or upper connection to the well bore effected in response to predetermined change in fluid pressures within the upper annulus, and wherein one or more of the following features or functions is provided; a second or lower conection to the well bore is made preliminarily so as to resist downward displacement of the packer; upper string weight may be applied to expand the packer into engagement with the well bore; the string above the tool may be tensioned without effecting release of the upper conection to the well bore, prior to release of a latch; the string above the tool may be elevated to effect release of the upper connection, following release of the latch, the latter being effected in a simple and effective manner; and fluid transfer between well annulus regions above and below the packer may be controlled by means of valving having advantageous association with the tool. The above features separately and cumulatively provide for an unusually advantageous holddown tool, as will appear.

Basically, the well tool apparatus of the invention is connectible in a pipe string in a well, and comprises generally vertically elongated tubular body means, a packer on the body to be expanded for sealing off the annulus between the well bore and the body, and upper or first connection means having a piston exposed to fluid pressure in the annulus and carried by the body for establishing a connection to the well bore so as to resist movement of the expanded packer in at least one vertical direction,

as for example upwardly in the well. Typically, the piston is exposed to the exterior of the body above the packer for transmitting downwardly directed force to establish the upper connection. As will be seen, the body typically includes upper and lower sections adapted for relative vertical displacement, the lower section carrying the packer as well as lower connection means operable to connect the lower section to the well bore so as to resist body movement downwardly in the well. Further, the upper section is at times liftable to release the upper connection means, as for example following release of latching means normally holding the sections against relative separation so that the string above the tool may be tensioned prior to latch release.

Other objects and advantages of the invention include the provision of shoulders on the body upper and lower sections to transmit force acting to intercept downward movement of the upper section relative to the lower section, so that string weight may be transmitted from the upper to the lower section and to the packer for expanding the latter into engagement with the well bore; the provision of body section latching means of collet type adapted for release by a sleeve or other tool displaced downwardly within the body upper section; and the provision for removable plug travel and landing within the body to effect displacement of the latch releasing sleeve and to effect displacement of a sleeve valve that controls by-passing of well fluid around the packer; and the provisions for alternate latching means of screw thread type, of clutch type, as will be seen.

These and other objects and advantages of the invention, as well as the details of illustrative embodiments, will be more fully understood from the following detailed description of the drawnigs, in which:

FIGS. 1*a*, 1*b* and 1*c* are vertical elevations taken in section through one preferred form of a tool embodying the invention, the tool being in running-in configuration;

FIG. 2 is a vertical section showing a well tubing string in a well, with the FIG. 1 tool in the string;

FIG. 3 is a horizontal section taken on line **3—3** of FIG. 1*a*;

FIGS. 4*a*, 4*b*, and 4*c* are vertical elevations taken in section through the FIG. 1 tool shown as set or connected in the well bore;

FIG. 5 is a vertical section showing the manner of release of the latching connection of the tool body upper and lower sections;

FIG. 6 is a vertical section showing release of the upper connection to the well bore, following FIG. 5 release of the latching connection;

FIG. 7 is a vertical section showing a modified form of the holddown tool being run in a well;

FIG. 8 is a vertical section showing the FIG. 7 tool set as connected in the well bore;

FIG. 9 illustrates the FIG. 7 tool after disconnection from the well bore;

FIG. 10 is a horizontal section taken on line **10—10** of FIG. 7, showing the body upper and lower section latch connected to resist relative elevation of the upper section;

FIG. 11 is a horizontal section similar to FIG. 10 and showing the manner of release of the latching connection in response to relative rotation of the sections;

FIGS. 12–14 are vertical half sections showing another latching means for the body upper and lower sections, FIG. 12 illustrating running-in position, FIG. 13 set position and FIG. 14 release position of the tool; and

FIGS. 15–17 are vertical half sections showing still another modified holddown tool in running in, set and released positions.

Referring first to FIGS. 1–3, the illustrated well tool apparatus **10** is connected in a pipe or tubing string **11** run

in a well 12 cased at 13. The overall apparatus generally includes a holddown tool 100 and packer apparatus 101. Associated with tool 100 is a generally vertically extending elongated upper body 14 including upper and lower sections 14*a* and 14*b* adapted for relative vertical displacement, and associated with packer apparatus 101 is a generally vertically extending elongated lower body 15 including sections 15*a*, 15*b* and 15*c* having threaded interconnection at 16 and 17. Lower section 14*b* of the upper body 14 is adapted, via threading 102, to carry the lower body 15 as a lower extension of the section 14*b*, whereby the packer apparatus and hold down tool are connected in cooperative combination.

The tubular body 15 carries what may be referred to as packer means generally indicated at 18 in FIG. 1*b*, the packer including endwise compressible ring sections 18*a*, 18*b*, 18*c*, 18*d* separated by metal rings 19, 20 and 21. These elements are in turn mounted on the body section 15*a* between an upper shoulder 22 and a lower compression ring 23 which is also mounted on the body section 15*a*. It will be understood that the packer elastomer sections 18*a* through 18*d* may be subjected to expansion into sealing engagement with the casing bore in response to upward displacement of the ring 23 relative to the shoulder 22. In this regard, the actuator ring 23 may be urged upwardly by an actuator sleeve 24 slidably mounted upon the body section 15*b*. Reference to FIG. 4*b* will show the packer 18 expanded as described, and sealing off the annular zone between the casing bore and the tubular body 15.

The body section 15*a* is seen in FIG. 1*b* to have porting to pass fluid generally between the zone or annulus at one end at least of the packer and the body interior. More specifically, the body has upper and lower side porting indicated at 25 and 26 to by-pass fluid between upper and lower annular zones 27 and 28 around the packer, and via the body interior as for example the annular passage 29. The latter is formed between the bore 30 of the body section 15*a* and the periphery of a sleeve valve 31 received within the body.

The sleeve valve may be characterized as carried by the body for movement between a first position in which side porting is closed, and a second position in which the side porting is open. Thus, as seen in FIG. 1*b* the side porting is open, a suitable port 32 in the actuator sleeve 24 communicating between the zone 28 and the lower port 26 in the body section 15*a*. On the other hand, in FIG. 4*b* the lower side port 26 is closed, the valving being in its upper position. As there appears, the valving includes a cylindrical closure 33 and endwise spaced annular seals 34 and 35, all retained between the valve flange 36 and a retainer ring 37 so as to be movable endwise with the valve. The seals 34 and 35 engage the bore of the body section 15*a* as the valve moves endwise, whereby the cylindrical closure 33 blocks or closes the lower port 26 which is sealed off from the interior passage 29 as seen in FIG. 4*b*.

It will also be noted that the valving means 31 contains an opening generally indicated at 39 to pass well fluid endwise therethrough, and typically during production of the well under the conditions shown in FIG. 4*b*. In this regard, the bore 39 of the valve may be generally of the same dimension as the bore of the tubing string 16, whereby suitable tools may be run downwardly through the valve 31. It is also to be noted that the valving means is exposed for transmitting fluid created pressure acting to move it between its lower and upper positions, such fluid pressure exertion being generally indicated by the arrow 40 in FIG. 4*b*. As illustrated, the valve has a downwardly facing annular shoulder 41 for receiving upward pressure exertion acting to unbalance the valve from the position shown in FIG. 1*b*, driving it upwardly to the position shown in FIG. 4*b* at such time that closure of the valving means is desired. For this purpose a primary plug, as for example a ball 42 seen in FIG. 4*c*, may be dropped downwardly in the tubing string to engage the interior port forming seat 43 to block downward flow of well fluid. When sufficient pressure is then pumped downwardly through the string, as by operation of the pump 44 in FIG. 2, the valving means 31 will be displaced from its lower to its upper position.

FIGS. 1*b* and 4*b* also illustrate one form of latching mechanism for releasably holding the valving means in each of said upper and lower positions. Typically, the latching mechanism means includes inwardly flexible vertically elongated fingers 45 depending from the valve means and having outwardly facing terminal latch shoulders 46. The fingers are circularly spaced in such manner that the latch shoulders 46 are engageable with upper and lower annular shoulders 47 and 48 on the body section 15*b*. Accordingly, when sufficient upward fluid pressure is exerted on the valving means, the latch shoulders 46 on the fingers cam inwardly to disengage the lower shoulder 48, allowing the valve to move upwardly to the FIG. 4*b* position, at which time the latch shoulder 46 spring outwardly to engage the upwardly facing shoulders 47 on the body. The latter prevents downward movement of the closed valve until such time as sufficient downward force is exerted on the valve.

Such downward force application as referred to may be effected as by introducing a secondary plug into the string 11, and allowing the plug to drop and engage the interior port forming seat 49 for blocking downward flow of well fluid through the valving means. Typically, the plug may comprise a ball 50 as shown in FIG. 1*b*, and of larger diameter than the bore 39 of the valving means. Since the valve periphery is sealed off at 51 from the stepped or reduced bore 52 of the body section 15*a*, sufficient fluid pressure pumped into the string and exerted downwardly will be transmitted by the plug 50 to the valve and overcomes the resistance to downward displacement of the valve imposed by the latching means described above, with the result that the valve will move to its lower position in the sub-body, as seen in FIG. 1*b*. The ball plugs 42 and 50 referred to above may be pumped into the tubing string at times when opening of the valve is desired, and after the packer 18 has been set in the casing. The plugs may be removed by flowing them out of the tubing with well fluid.

The invention contemplates means for establishing a first or upper connection of the body to the well bore and expansion of the packer into sealing engagement therewith in order that the valve means may be operated in response to fluid pressure exertion, all without unsetting of the packer. Referring to FIGS. 1 and 4, the upper or first connection means operable to effect body supporting connection with the well bore typically includes outwardly spreadable upper slips above the packer, and as for example are shown generally at 60, the slips in FIG. 1*a* being retracted from engagement with the bore, whereas they have been spread into engagement with the bore in FIG. 4*a*. The slips are carried by a cylindrical actuator 61, by virtue of a conventional so-called T-slot connection 62 retaining the upper portions 63 of the slips while accommodating outward spreading of the lower portions carrying wickers or serrations 64 operable to grip the casing bore. ctuator 61 is carried by the body sections 14*a* and 14*b* having sealable sliding engagement with section 14*a* at the locations 65 and 66, and having shear pin connection with section 14*b* at 185. Furthermore, the actuator is exposable to fluid pressure within the annulus 27 at the body exterior and communicated to the actuator piston face 68 on piston head 68*a*. Accordingly, when sufficient fluid pressure is pumped into the annulus as by pump 42 in FIG. 2 (packer 18 being set and valve 31 closed), the piston face 68 is displaced downwardly relative to the stop flange 70 on the body 14*a*, shearing pin 185, thereby to displace the slips 60 downwardly. Outward spreading of the downward travel-

ing slips occurs by wedging action effected by the tapered surfaces **71** of the cone member **72** carried on the sub-body. As is clear, slots **73** are cut at intervals around the cone member to receive the circularly spaced slips, and slot clearance is provided at **74** to be taken up by the downward terminals of the slips as they travel downwardly and spread outwardly to the position shown in FIG. 4. When the slips firmly engage the casing, upward thrust transmitted by the sub body section **14***b* to the cone member **72** is then transmitted to the slips and to the casing, firmly anchoring the sub-body against upward removal as might otherwise occur during setting of the packer and anchoring of the lower slips. During such displacement of the actuator, fluid pressure in the pipe string communicates via port **107** with the chamber **108** directly beneath the piston head **68***a*. Also, fluid pressure in annulus **27** communicates via port **109** with chamber **110** beneath stop flange **70**.

Turning now to FIGS. 1*b*, 1*c*, 4*b* and 4*c*, second connection means is provided to effect outward spreading of the lower slips and expansion of the packer, as for example when downward flow of well fluid in the string is blocked by the primary plug **42**. Here again, slips **80** are formed to have wedge surface engagement at **81** with a cone member **82**; however, the latter member is vertically slidable at the interface **83** and on the sub-body section **15***b* in order to transmit upward thrust to the actuator sleeve **24** operable to compress the packer as described above. The slips have T-slot interconnection at **84** with the lower actuator **85**, the latter having a piston face **86** to which pressure fluid is transmitted via the duct **87** in the sub-body section wall. When sufficient pressure is thus communicated from the sub-bore to the piston face **86**, the actuator **85** travels upwardly after shearing the pin **88** interconnecting the actuator and the reaction flange **89** on the body section **15***c*. The actuator has sealing and sliding engagement with the periphery of the section **15***c* at the locations **90** and **91**. Upward travel of the slips **80** effects their outward spreading on the cone member and also compression of the packer by force transmission to the cone member and actuator sleeve **24**. As a result, the slip wickers or serrations **92** firmly grip and anchor against the casing bore as seen in FIG. 4*c*.

Release of the lower slips when upward withdrawal of the tool is desired occurs by virtue of such upward withdrawal carrying the cone member **82** out from under the slips **80**. On the other hand, upward withdrawal of the tubing string is prevented by the upper slips unless their release is otherwise effected. In this regard, it will be seen that the upper body sections **14***a* and **14***b* extend in telescoping relation and are adapted for relative vertical displacement. Typically, the sections have shoulders, as for example are seen at **120** and **121**, to transmit force or interengage for intercepting downward movement of the upper section **14***a* relative to the lower section **14***b*, so that string weight may be transmitted via these sections for mechanically assisting the hydraulic expansion of the packer into engagement with the well bore. Also, the upper section **14***a* is at times movable relative to the lower section to release the upper connection to the well bore. For this purpose, the upper section **14***a* may be lifted by the string to elevate the stop flange **70** as seen in FIG. 6 in order to intercept and elevate the piston head **68***a*, thereby upwardly retracting the upper slips **60** relative to the cone **72**. Hydraulic assist of such release is afforded by pressurization of the string interior and chamber **108** below the piston head **68***a*, to exert upward force on surface **128**.

In the form of the invention seen in FIGS. 1–6, release of the upper or first connection is possible only after prior release of releasable latch means acting to hold the sections **14***a* and **14***b* against relative separation. This enables upward tension to be exerted upon the string connected with upper section **14***a*, without effecting release of the upper slip connection to the well bore, prior to release of the latch means, i.e., while the packer is set in the well. Such tensioning of the string is desirable in order to relieve the weight on the assembly tending to drive it down the hole. The illustrated latch means comprises a collet **129** having spring fingers **130** carried by the lower section **14***b* at collet ring **131** to project upwardly for latching engagement with the upper section **14***a*. The fingers have lugs **132** urged outwardly into annular groove **133** to shoulder at **134**.

A sleeve **135** normally retained within the bore **136** of the upper section **14***a*, as by a shear pin **137**, is movable downwardly therein to engage the tapered terminals **138** of the collet fingers **130**, thereby urging them inwardly to effect release of the latch means. A plug, such as ball **139**, may be dropped within the tubing string to seat on the sleeve at **140**, as seen in FIG. 5, and pressure pumped into the string by pump **44** effects shearing of pin **137** and downward displacement of the sleeve to release the latch means. Ball plugs **139**, **50** and **42** may be removed from the well by flowing them upward in response to upward flow of fluid in the string, as controlled by surface valve **140**, valve **141** then being closed. Suitable apparatus may be provided at the well head to facilitate insertion and removal of the ball plugs into and from the tubing string **11**. A key **142** received in keyways **143** and **144** in the sections **14***a* and **14***b* blocks relative rotation thereof while accommodating their relative axial displacement. Relative vertical separation of the sections is limited by engagement of the shoulder **145** on actuator **61** with the downward facing stop shoulder **146** on the lower section **15***b*, as seen in FIG. 6.

Turning now to FIGS. 7–11, the construction of the modified tool there shown is the same as described above, excepting for the latch means, the same parts bearing the same numbers. The relatively movable upper and lower body sections are designated at **150** and **151**, and they have telescopic interfit. A lug **152** on one of the sections, as for example section **151**, blocks upward movement of the upper section **150** relative to the lower section **151**, as for example by engagement of an inwardly projecting portion **153** of the lug with annularly extending shoulder **154** on upper section **150**. The latter has a vertically extending groove **155**, better seen in FIGS. 9–11, for receiving the lug portion **153** to unblock relative elevation of the upper section in response to relative rotation of the sections bringing the lug portion **153** and groove **155** into vertical registration. For example, as the upper string is rotated in the direction of arrow **156** in FIG. 11, the groove is brought into vertical registration with the lug portion **153**, the latter dropping into the groove as the string and upper section **150** are elevated as seen in FIG. 9. Accordingly, the upper connection of slips **60** to the well bore is released. A stop lug **157** carried by the upper section **150** is engageable with lug **152** to limit such relative rotation of the sections, as in the FIGS. 10 and 11 configurations. Thus, reverse torque applied to the upper section **150** cannot cause release of the latch. Ball **158** may be dropped in the string to seat at **159** in order that fluid pressure may then be introduced into chamber **108** via port **107** to aid release of the upper slip connection to the well bore. The force caused by the pressure pushing down on the ball and on seat **159** is transmitted into the cone of the hold down, also aiding in the release of the slips. Surface pump **159***a* may develop such pressure.

Referring to the modification in FIGS. 12–14, the construction of the tool there shown is the same as described in connection with FIGS. 1 and 4, again excepting for the latching means, unchanged parts bearing the same numerals. The relatively movable upper and lower body sections are designated at **160** and **161**, and they have telescopic interfit. The latch means in this instance comprises a threaded interconnection between the sections, enabling rotation of the pipe string above the tool to release the threaded interconnection, thereby to facili-

tate disconnection of the upper connection of slip **60** to the well bore as described above. Thus, for example, the sections **160** and **161** have interfitting threads at **162** and **163**, and continued unscrewing of such threading results in release thereof followed by relative elevation of the upper section **160** with resultant upward jarring and lifting of the actuator piston head **68***a* by the flange **70**, as seen in FIG. 14. This action releases the upper slip connection, as is clear from FIGS. 13 and 14.

Finally, the modification seen in FIGS. 15–17 is the same as described in connection with FIGS. 1–4, excepting that no latching means is provided. Instead, the upper and lower body sections **170** and **171** remain relatively movable vertically. The elements in FIGS. 15–17 that are the same as elements of FIGS. 1–4 bear the same numerals.

I claim:

1. Well tool apparatus connectible in a pipe string in a well, comprising: a generally vertically elongated tubular body, a packer on the body to be expanded for sealing off the annulus between the well bore and the body, first connection means for establishing a connection to the well bore so as to resist movement of the expanded packer in at least one vertical direction in the well, said first connection means having a piston exposed to fluid pressure in the annulus above the packer for transmitting downwardly directed force to establish said connection, the first connection means including slips and actuator members movable relatively together to urge the slips outwardly into engagement with the well bore in response to downward displacement of said piston, and second connection means carried by the body and operable to effect a second connection with the well bore so as to resist movement of the expanded packer in the opposite vertical direction in the well, said body including upper and lower sections adapted for relative vertical displacement, the lower section carrying the packer and said connection means, and the upper section at times being movable relative to the lower section to release said first connection means, said sections having shoulders to transmit force acting to intercept downward movement of the upper section relative to the lower section so that string weight may be transmitted from the upper to the lower sections and to the packer for expanding the packer into engagement with the well bore.

2. Well tool apparatus connectible in a pipe string in a well, comprising: a generally vertically elongated tubular body, a packer on the body to be expanded for sealing off the annulus between the well bore and the body, first connection means for establishing a connection to the well bore so as to resist movement of the expanded packer in at least one vertical direction in the well, said first connection means having a piston exposed to fluid pressure in the annulus above the packer for transmitting downwardly directed force to establish said connection, the first connection means including slips and actuator members movable relatively together to urge the slips outwardly into engagement with the well bore in response to downward displacement of said piston, and second connection means carried by the body and operable to effect a second connection with the well bore so as to resist movement of the expanded packer in the opposite vertical direction in the well, said body including upper and lower sections adapted for relative vertical displacement, the lower section carrying the packer and said connection means, and the upper section at times being movable relative to the lower section to release said first connection means, and releasable latch means to hold the sections against relative separation so that upward tension may be exerted on the string connected with the upper section without effecting release of said first connection.

3. The combination of claim **2**, including sleeve means movable downwardly within said upper section to effect release of said latch means so that the upper section may be elevated to effect release of said first connection.

4. The combination of claim **3**, including a removable plug landed to transmit string fluid pressure acting downwardly to so move said sleeve means.

5. Well tool apparatus connectible in a pipe string in a well, comprising: a generally vertically elongated tubular body, a packer on the body to be expanded for sealing off the annulus between the well bore and the body, first connection means for establishing a connection to the well bore so as to resist movement of the expanded packer in at least one vertical direction in the well, said first connection means having a piston exposed to fluid pressure in the annulus above the packer for transmitting downwardly directed force to establish said connection, the first connection means including slips and actuator members movable relatively together to urge the slips outwardly into engagement with the well bore in response to downward displacement of said piston, and second connection means carried by the body and operable to effect a second connection with the well bore so as to resist movement of the expanded packer in the opposite vertical direction in the well, said body including upper and lower sections adapted for relative vertical displacement, the lower section carrying the packer and said connection means, and the upper section at times being movable relative to the lower section to release said first connection means, the piston having an interior surface exposable to receive the upward acting pressure of string fluid within said body tending to urge the piston in a direction to effect release of said first connection.

6. Well tool apparatus connectible in a pipe string in a well, comprising: a generally vertically elongated tubular body, a packer on the body to be expanded for sealing off the annulus between the well bore and the body, first connection means for establishing a connection to the well bore so as to resist movement of the expanded packer in at least one vertical direction in the well, said first connection means having a piston exposed to fluid pressure in the annulus above the packer for transmitting downwardly directed force to establish said connection, a sleeve valve contained by said body to pass string fluid upwardly therethrough, the body having side porting controlled by said sleeve valve, the side porting extending in by-passing relation to the packer and controlled by the sleeve valve to block and unblock fluid transfer between annulus regions above and below the packer.

7. The combination of claim **6**, in which the sleeve valve has differential piston surfaces to receive application of string interior fluid pressure for shifting the sleeve valve upwardly in controlling relation with said porting.

8. The combination of claim **7** including a removable plug landed to plug the sleeve valve above the locus of application of string interior fluid pressure communication to sleeve valve piston lower surfacing so that sufficient of said pressure communicated to sleeve valve piston upper surfacing is operable to shift the sleeve valve downwardly in controlling relation with said porting.

9. For combination with apparatus connectible in a pipe string in a well, the apparatus including a lower generally vertically elongated tubular body, a packer on the lower body to be expanded for sealing off the annulus between the well bore and the body, and lower connection means carried by the lower body and operable to effect connection with the well bore so as to block downward movement of the expanded packer in the well, an improved packer hold-down structure connectible in the string in operating relation with the packer, said structure comprising an upper generally vertically elongated tubular body and upper connection means having a piston responsive to fluid pressure in the annulus and carried by the upper body for establishing upper connection to the well bore so as to block upward movement of the expanded packer in the well, said upper body including upper and lower sections adapted for relative vertical displacement, the lower section adapted to carry said lower body as a lower extension of said lower section, said

upper section at times being movable relative to the lower section to release said upper connection means.

10. The combination of claim **9**, in which said sections have shoulders to transmit force acting to intercept downward movement of the upper section relative to the lower section so that string weight may be transmitted from the upper to the lower sections and to the packer for expanding the packer into engagement with the well bore.

11. The combination of claim **9**, including releasable latch means to hold the sections against relative separation so that upward tension may be exerted on the string connected with the upper section without effecting release of said upper connection.

12. The combination of claim **11**, including sleeve means movable downwardly within said upper section to effect release of said upper connection.

13. The combination of claim **11**, in which said latch means comprises spring fingers carried by the lower section to project upwardly for latching engagement with the upper section.

14. The combination of claim **11**, in which said upper and lower sections extend telescopically, and said latch

means comprises a lug on one of said sections blocking upward movement of the upper section relative to the lower section, the other section having a vertically extending groove for receiving said lug to unblock said relative upward movement of the upper section in response to relation rotation of said sections bringing said lug and groove into vertical registration.

15. The combination of claim **11**, in which said latch means comprises a threaded interconnection between said sections enabling rotation of the pipe string above said body to release said threaded interconnection.

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