Aug. 27, 1963 H. H. FISHER, JR., ETAL 3,101,783

WELL PACKER

Filed Oct. 28, 1960 3 Sheets-Sheet 1

FIG. 1.

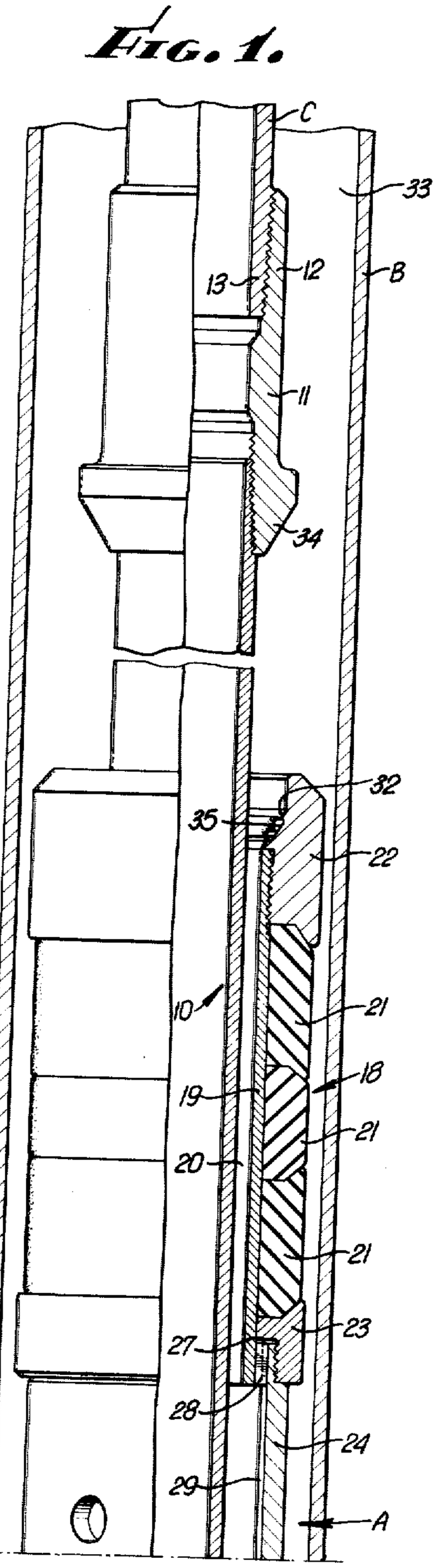

FIG. 1a.

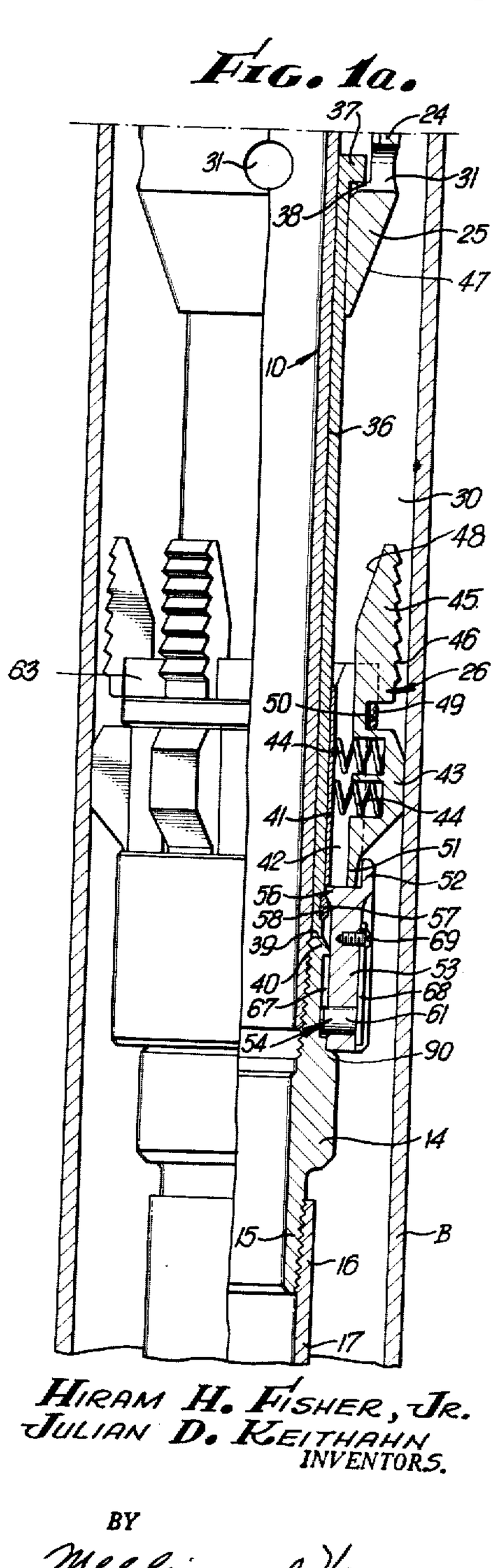

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FIG. 2.

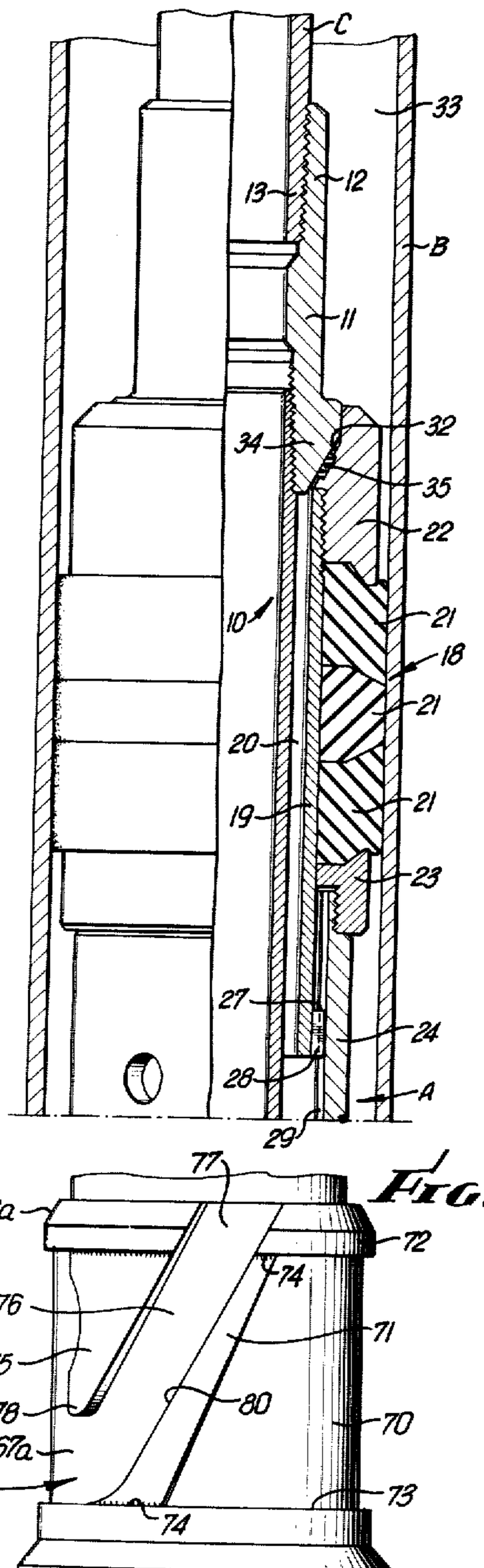

FIG. 2a.

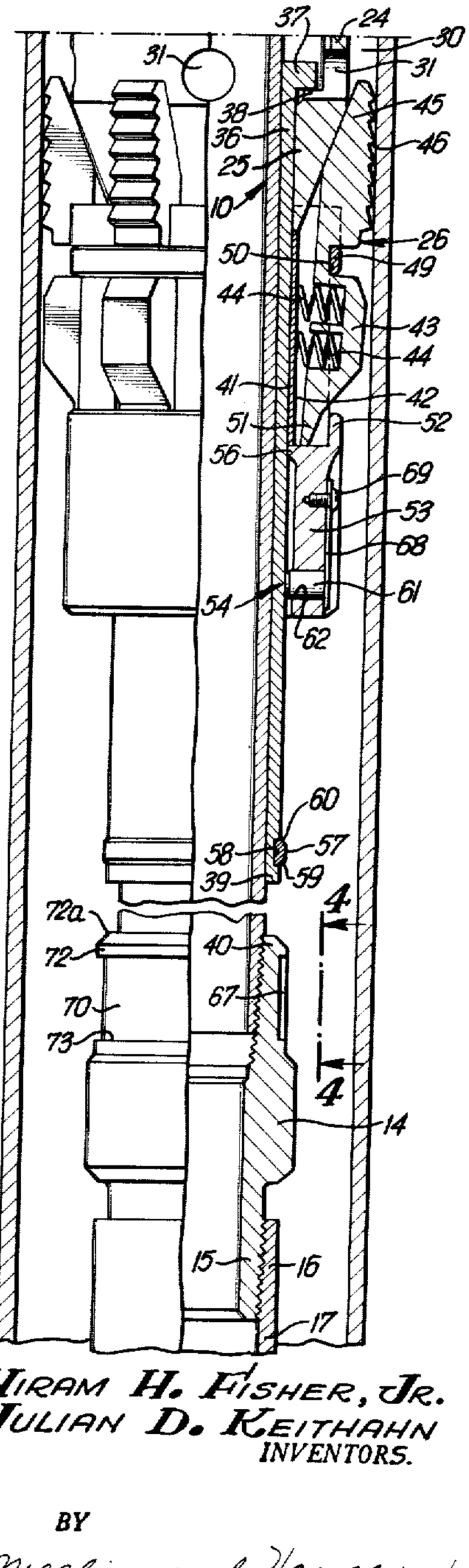

FIG. 4.

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FIG. 3.

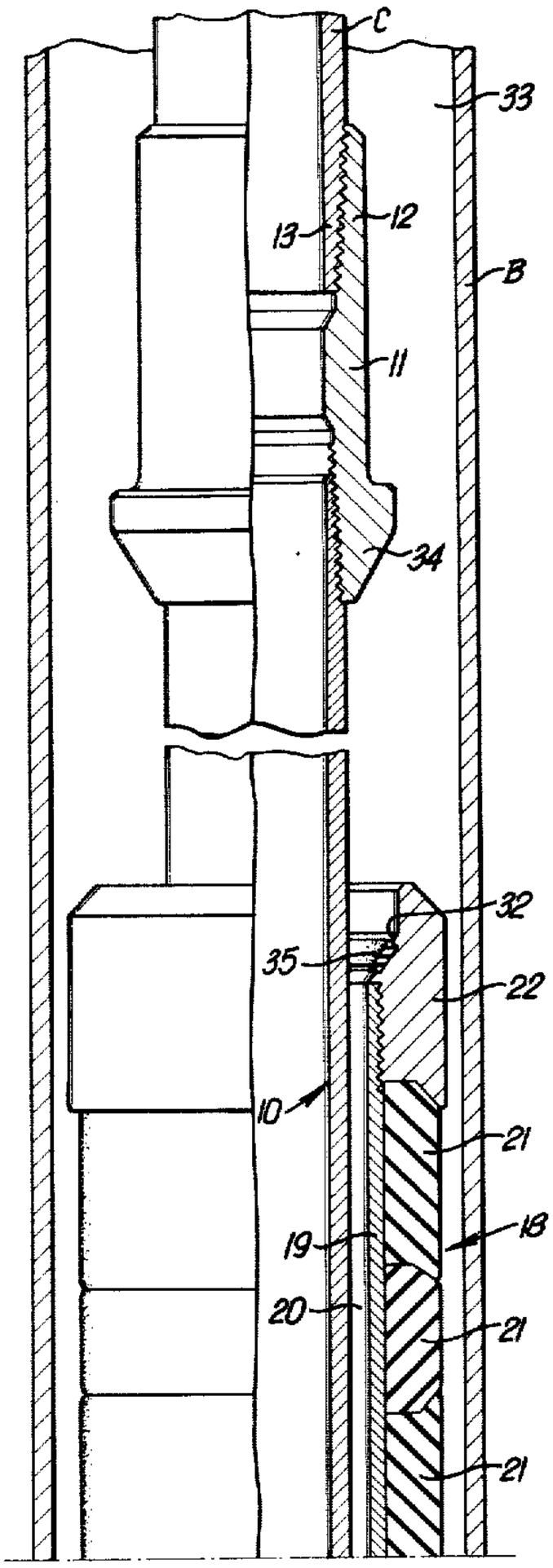
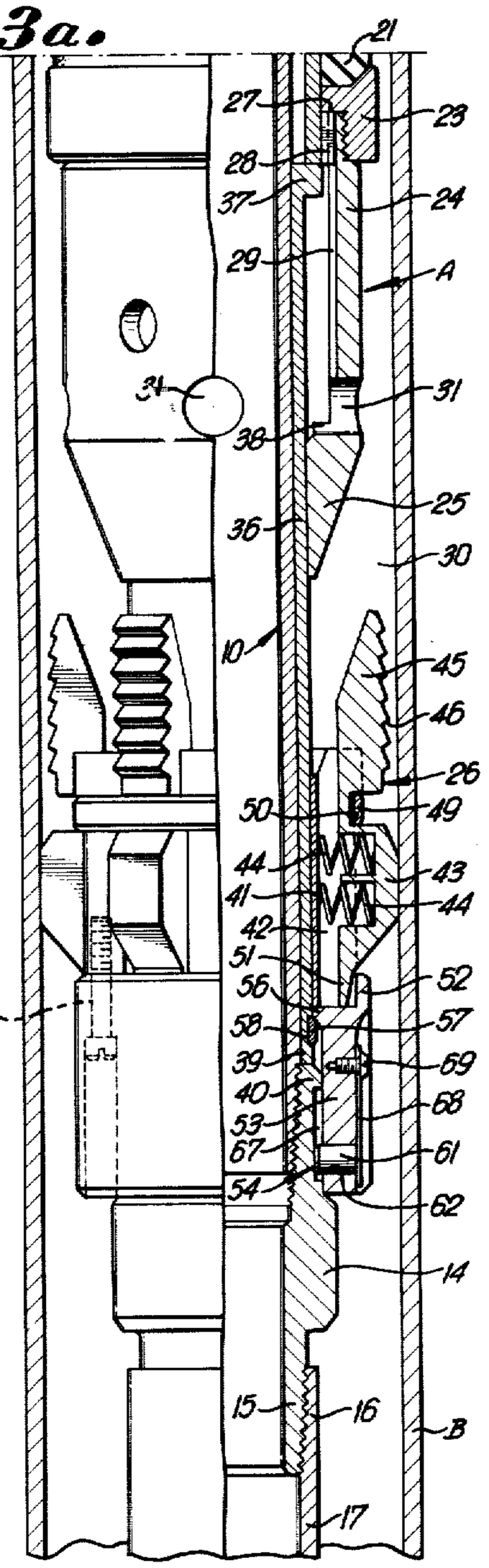


FIG. 3a.



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WELL PACKER

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14 Claims. (Cl. 166—130)

The present invention relates to subsurface well devices, and more particularly to well packers adapted to be run and set in well bores.

An object of the invention is to provide a well packer having a normally retracted expandible and retractable packing element or structure, which is prevented from inadvertently expanding outwardly during lowering of the well packer in the bore hole.

Another object of the invention is to provide a well packer having a normally retracted expandible and retractable packing element or structure, which is prevented from inadvertently expanding outwardly during elevating of the well packer in the bore hole, as in removing the well packer from the bore hole.

A further object of the invention is to provide a well packer having a normally retracted expandible and retractable packing element or structure, which is prevented from expanding outwardly after the well packer has been lowered in the bore hole, while fluid is being circulated through and around the packer prior to its setting in the bore hole or after the packer has been set and then released.

An additional object of the invention is to provide subsurface well apparatus, in which operation of the apparatus is determined by an improved control or releasable lock mechanism, which possesses a relatively small number of parts, and which can be placed readily in a locked or released condition by manipulation of a running-in string by which the apparatus is lowered in a bore hole.

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 and 1*a* together constitute a combined longitudinal section and side elevational view of a well packer apparatus located in a well casing disposed in a well bore, FIG. 1*a* constituting a lower continuation of FIG. 1;

FIGS. 2 and 2*a* are views corresponding to FIGS. 1 and 1*a* illustrating the packer anchored in packed-off condition in the well casing, FIG. 2*a* constituting a lower continuation of FIG. 2;

FIGS. 3 and 3*a* are views corresponding to FIGS. 1 and 1*a*, illustrating the packer following its release and during its elevation in the well casing, FIG. 3*a* constituting a lower continuation of FIG. 3;

FIG. 4 is an enlarged side elevational view taken along the lines **4—4** on FIG. 2*a*.

A well packer apparatus A is illustrated in the drawings, which is adapted to be lowered in a well casing B, or similar conduit string, by means of a tubular running-in string C extending to the top of the hole. The well packer includes a central body or mandrel **10** having an upper body sub **11** threadedly connected to the main portion of the body, this sub having an upward threaded box **12** for threaded attachment to the lower pin end **13** of the tubular running-in string C. The lower end of the body is constituted as a lower sub **14** threadedly secured to the lower end of the main portion of the body, this lower sub having a threaded pin **15** for threaded attachment of the body to the upper threaded box **16** of a depending tubular member **17**, which can extend downwardly in the well casing to a desired extent, or which may, if desired, be omitted.

A normally retracted packing device **18** surrounds the tubular body **10** and includes an inner support sleeve **19** spaced laterally from the body to provide an annular passage **20** therebetween through which fluid can pass. Surrounding the support sleeve **19** is a packing structure **21**, such as one or a plurality of rubber-like packing rings or members, which are normally retracted. The upper end of the packing structure is adapted to engage an upper abutment **22** threadedly attached to the upper end of the support sleeve **19**, whereas the lower end of the packing structure is engageable with a lower abutment comprising an abutment ring **23** slidable on the support sleeve **19** and an abutment sleeve **24** threadedly connected to the ring **23**, the abutment sleeve being integral with a lower expander **25**, of generally frustoconical shape, adapted to coact with a plurality of circumferentially spaced lower slips **26** for anchoring the apparatus in the well casing. When the packing structure **18** is in retracted position, the lower abutment **23**, **24** may engage an external lower flange **27** on the support sleeve **19**. The support sleeve **19** and the sleeve portion **24** may be non-rotatably secured to one another, while permitting their relative telescopic movement, by securing a key **28** on the flange portion of the support sleeve which is slidable in a longitudinal keyway or slot **29** in the interior of the sleeve **24**.

Fluid can pass through the annular space **30** surrounding the apparatus and the expander **25**, flowing inwardly through a plurality of circumferentially spaced ports or openings **31** in the sleeve portion **24** to its interior, and then flowing upwardly through the annular passage **20** between the sleeve portion and body **10** and between the support sleeve **19** and body, discharging through a valve seat **32** in the upper abutment **22** into the annulus **33** around the body **10** and the tubular string C. Of course, fluid could also pass in a reverse direction to that just described. When the tubular string C and body **10** are lowered relative to the members surrounding the body, a valve head **34** at the lower portion of the upper body sub **11** is movable downwardly into engagement with the valve seat **32** to close the annular passage **20** around the body. To prevent leakage between the valve head and seat, a suitable seal ring or gasket **35** may be provided in the seat for engagement with the exterior of the valve head **34**.

A connector sleeve **36** is slidably mounted on the exterior of the body **10** of the tool, its upper portion extending within the expander **25**. The connector sleeve ter-

minates in an upper stop or flange **37** that projects outwardly and is adapted to engage an upwardly facing shoulder **38** on the sleeve portion **34**. The lower end **39** of the connector sleeve may rest upon the upper end or stop portion **40** of the lower sub **14**. Surrounding the connector sleeve **36** is a slip sleeve **41** slidable thereon, and having a plurality of longitudinal extending circumferentially spaced grooves **42** in which the slips **26** are laterally removable. These slips each include a lower drag portion **43** adapted to frictionally engage the inner wall of the well casing **B**, being urged outwardly thereagainst by one or a plurality of compression springs **44** engaging the bases of the grooves **42** and the drag portions of the slips. The slips include upper anchor portions **45** having downwardly facing wickers or teeth **46** adapted to engage and embed themselves in the wall of the well casing to prevent downward movement of the slips **26** therealong when expanded outwardly by the expander **25**.

The expander **25** has a downward and inwardly inclined tapered surface **47** adapted to coact with companion inner tapered surfaces **48** on the anchor portions **45** of the slips. Outward expansion of the slips **26** under the influence of the springs **44** is limited by a retainer ring **49** encompassing the central portions of the slips and received within external grooves **50** therewithin. Outward movement is also limited by engagement of lower terminals **51** of the slips, below the drag portions, with an upper rim **52** of a stop and control sleeve or member **53** surrounding the body **10** of the tool and releasably connected thereto by a lock device **54**. The stop and control member or sleeve **53** and the slip sleeve **41** are secured together by a plurality of longitudinally extended screws **55** so that they move as a unit. When the stop and control member **53**, slip sleeve **41**, and slips **26** are disposed in a lower position on the body **10**, such as illustrated in FIG. 1*a*, an upper inner flange **56** on the stop and control member is engageable with a split snap ring **57** mounted in a peripheral groove **58** in the connector sleeve **36** to limit the upward position of the connector sleeve **36** relative to the stop and control member **53**, as well as relative to the slip sleeve **41**. This snap ring **57** has a lower beveled corner **59** inclined in a downward and inward direction and an upper beveled corner **60** inclined in an upward and inward direction. Such beveling is obtained in order that a laterally movable control pin **61** slidable radially in the companion bore **62** in the control member **53** can ride over the snap ring **57** during operation of the apparatus.

The slips **26** are prevented from having substantial longitudinal movement relative to the slip sleeve **41** by engagement of the lower ends **51** of the slips with the upper end of the control member **53** and also by engagement of the retainer ring **49** with an upper external flange **63** of the slip sleeve. When the slip sleeve **41** is moved downwardly, its upper flange **63** engages the retainer ring **49**, which engages the lower sides of the slip grooves **50** to pull the slips **26** downwardly in the well casing. When the slip sleeve **41** and the control member **53** are moved upwardly, the upper end of the control member engages the lower ends **51** of the slips **26** to shift them upwardly along the wall of the well casing. The slips themselves are of the rocker type, in that the anchor portions **45** are removed from engagement with the wall of the well casing when the springs **44** are permitted to force the drag portions **43** into full contact with the wall of the well casing. However, when the expander **25** moves downwardly within and behind the anchor portions **45** of the slips, the latter will rock outwardly about the upper parts of the drag portions as a fulcrum on the casing to shift the teeth **46** outwardly against the well casing B and embed them therewithin.

The packer body **10** moves downwardly with respect to the parts that surround it in order to engage the valve head **34** with the valve seat **32**, to expand the packing

structure **18** against the wall of the well casing B, and to engage the expander **25** with the anchor portions **45** of the slips and expand the latter outwardly into anchoring engagement with the wall of the well casing. The ability of the body **10** of the tool to move in the manner just described is dependent upon the control mechanism **54** provided between the slip mounting portion of the apparatus and the body of the tool.

As specifically disclosed, the laterally or radially shiftable control pin **61** has its inner portion yieldably disposed within a control slot or groove **67** in the periphery of the lower body sub **14** by a leaf spring **68** engaging the outer end of the control pin and secured to the control member **53** in any suitable manner, as by means of a screw **69**. The control slot or groove **67** includes a circumferential groove portion **70** terminating at one end in a stop segment **71** that extends between an upper stop flange **72** of the sub and the lower side **73** of the circumferential groove, being secured thereto, as by welding material **74**. Another segment **75** is suitably secured to the sub **14**, as by welding, and this segment is spaced arcuately from the stop segment **71** to provide a longitudinal inclined slot **76** communicating with an extension of the slot or opening **77** through the stop flange **72** that extends completely through such stop flange. The lower end **78** of the segment **75** terminates above the lower side **73** of the circumferential groove to provide for communication **67***a* between the circumferential groove portion **70** and the longitudinal inclined slot or groove portion **76**, permitting the control pin **61** to pass from one portion into the other portion. It is to be noted that the segments **71**, **75** are so disposed that the longitudinal slot portion **76** defined therebetween is preferably inclined in an upward direction toward the right, as seen in FIG. 4.

The packer apparatus A can only be set in the well casing B upon removal of the control pin **61** from the circumferential groove portion **70**. Movement of the control pin **61** and of the outer control mechanism surrounding the body **10** of the tool and the connector sleeve **36**, as well as movement of the slips **26**, is resisted or prevented by the frictional engagement of the drag portions **43** of the slips against the wall of the well casing. As a result, the tubular string C and the body **10** of the tool can be moved upwardly to insure that the control pin **61** is in the lower portion of the circumferential groove **70**, which location can be provided without imposing a load on the control pin by causing the upwardly facing shoulder **40** on the lower body sub **14** to engage the lower end **39** of the connector sleeve **36**, such as shown in FIG. 1*a*. With this condition pertaining, the tubing string C and body **10** are rotated to the right, which will turn the lower body member **14** within the control pin until the latter passes relatively through the communicating passage **67***a* between the circumferential groove portion **70** and the inclined groove or slot portion **76** and engages the inclined wall **80** of the stop segment **71**. The body **10** of the tool can now be lowered, the control pin **61** passing relatively upwardly through the inclined slot portion **76** and through the opening **77** in the flange **72** to a position thereabove. The control pin **61** actually does not move longitudinally, but the body **10**, **14** and its groove **76** lower with respect thereto, the downward movement of the control pin being resisted by the friction drag portions **43** of the slips **26**. Downward movement of the body **10** can now continue to effect setting of the tool. The control pin **61** may engage the lower end **59** of the snap ring **57** and will, at first, prevent downward movement of the connector sleeve **36** with the body of the tool. However, upon engagement of the lower flange **27** on the support sleeve **19** with the upper end **37** of the connector sleeve, the snap ring **57** will force the control pin **61** outwardly so that the latter can, in effect, ride over the snap ring to a position thereabove, and thereby enable the setting of the well packer A to be completed. After the control pin **61** rides rel-

atively past the snap ring, the connector sleeve **36** may drop downwardly until its upper stop flange **37** again engages the expander shoulder **38**.

The apparatus A is run in the well casing with the control pin **61** in the locking or circumferential groove portion **70**, the parts being in the position disclosed in FIGS. 1 and 1*a*. During the lowering action, the upper side of the groove **70** will engage the pin **61** and result in pulling of the slip mechanism downwardly within the well casing and along the casing wall. The inner flange **56** of the control member engages the snap ring **57** and insures the downward pulling of the connector sleeve **36** with the body **10** and the control member **53**. The contact of the stop flange **37** with the shoulder **38** insures downward movement of the expander **25** and the sleeve portion **24**, which will cause the lower abutment ring **23** to engage the flange **27** of the support sleeve **19** and pull the latter downwardly in the well casing with it. At this time, the rubber or rubber-like or pliant, elastic structure **21** is in its retracted position, since the lower abutment ring **23** is disposed downwardly to its maximum extent with respect to the upper abutment **22**. Moreover, the upper abutment **22** is precluded from moving relatively upwardly along the body of the tool to prevent engagement of the valve head **34** with the valve seat **32**, thereby insuring that the annular passage **20** remains open. During such lowering movement, fluid in the well casing or well bore can pass upwardly through the tubular body member **10** and into the tubular string C thereabove. It can also pass relatively around the exterior of the lower portion of the apparatus and then through the ports **31** to the interior of the sleeve **24**, then continuing upwardly through the annular passage **20** and through the valve seat **32** into the annulus **33** between the tubular string C and casing B above the well packer apparatus. Fluid will also flow relatively around the outside of the packing structure **18** itself. The resistance or force offered by such fluid cannot expand the packing structure since the lower abutment ring **23** is prevented from moving upwardly along the support sleeve **19**, by virtue of the fact that it is tied to the body **10** through the abutment and connector sleeves **24**, **36**, the control member **53** and control pin **61**. The friction of the fluid flowing relatively past the exterior of the packing structure **18** and its upper abutment **22**, as well as interiorly of the support sleeve **19**, tends to maintain the support sleeve and upper abutment in the elevated position disclosed in FIG. 1. As the result of the construction described, the packing structure **18** cannot inadvertently expand into engagement with the well casing B during lowering of the apparatus A through the fluid therewithin.

After the setting location of the well packer A in the casing has been reached, the tool is lowered a short additional distance in the well casing and is then elevated so that the body **10** of the tool is moved upwardly with respect to the control member **53** and pin **61**, the control pin then being disposed adjacent to the lower side **73** of the circumferential groove **70**. The tubular running-in string C and body **10** are now turned to the right to rotate the body sub **14** and its groove **67** relative to the pin, whereby the pin **61** passes relatively into the lower end of the inclined slot portion **76**. Thereafter, the tubular string C and body **10** of the tool are lowered. Downward movement of the body **10** of the tool can continue relative to the control member **53** and its pin **61**, since the latter then passes relatively upwardly through the entire inclined slot portion **76**, **77** to a position above the upper stop flange **72** of the sub **14**. As described above, downward movement of the control member and pin is resisted by the drag portions **43** of the slips **26**.

Downward movement of the body **10** now continues, the valve head **34** moving downwardly into engagement with the valve seat **32** to close the passage **20**, the downward movement of the body then moving the upper

abutment **22** and support sleeve **19**, the packing structure **18** and the lower abutment ring **23** downwardly, to shift the sleeve portion **24** and the expander **25** downwardly with the body, accompanied by the connector sleeve **36**. The expander **25** moves down toward the slips **26**, which are prevented from moving downwardly by the engagement of their drag portions **43** with the wall of the well casing. The connector sleeve moves downwardly with the expander **25** and the body **10**, and within the slip structure, the snap ring **57** camming the control pin **61** out of the way and allowing the snap ring to move past the control pin, which will now slide upon the periphery of the connector sleeve. The downward movement of the body **10** and the parts surrounding it, with the exception of the slip structure **41**, **26**, **44**, **49**, **53** surrounding the connector sleeve **36**, will now continue until the expander **25** moves within and behind the anchor portions **45** of the slips, shifting the latter outwardly into engagement with the wall of the well casing. When this occurs, the expander **25** cannot move downwardly any further. Accordingly, continued downward movement of the body **10** of the tool causes the upper abutment **22** to move toward the lower abutment ring **23**, which is prevented from moving downwardly by being connected to the expander **25**, compressing or shortening the packing structure **18** and expanding it outwardly into sealing engagement with the wall of the well casing. The parts are now in the condition illustrated in FIGS. 2 and 2*a*.

A suitable operation can now be performed with the set packer A. Following the completion of the operation, the tool can be released from the well casing and removed therefrom, if desired. Such release occurs simply as the result of elevating the tubing string C and body **10** in the casing. At first, the body **10** will move upwardly to disengage the valve head **34** from its companion valve seat **32**, again opening the annular passage **20** to permit flow of fluid therethrough. During the initial phase of upward movement of the body **10**, the upper end **40** of the body sub **14** will engage the lower end **39** of the connector sleeve **36** to carry the latter upwardly with the body until its upper end **37** engages the lower end of the support sleeve **19**, whereupon the support sleeve is shifted upwardly with the body **10** to move the upper abutment **22** away from the lower abutment ring **23**, which will permit the packing structure **18** to retract to its initial position. The support sleeve **19** moves upwardly with the body **10** and the connector sleeve **36** until its lower flange **27** engages the lower abutment ring **23**, which will then elevate the sleeve portion **24** and the expander **25** from the anchor portions **45** of the slips **26**, allowing the springs **44** to rock the drag portions **43** of the slips back into full surface contact with the wall of the well casing, and pivot the anchor portions **45** inwardly from engagement with the wall of the well casing. The expander **25** can move upwardly of the slips **26** until the control member **53** engages an upwardly facing shoulder **90** on the lower body sub, or its flange **56** engages the snap ring **57**. The control pin **61** itself moves automatically into its locked circumferential groove portion **70**, inasmuch as it will merely ride upon the upper beveled end **60** of the snap ring and past the ring, then engaging the cam or inclined end **72***a* of the body sub to ride past the flange **72** and back into the circumferential groove portion. The control pin **61** can shift outwardly against the force of the leaf spring **68**, which will shift it inwardly into the groove **70** after it rides past the stop flange **72**.

The parts are now in the position they occupy during elevation of the apparatus in the well casing, which is illustrated in FIGS. 3 and 3*a*. During such elevating movement through the fluid in the well casing, the resistance of such fluid cannot inadvertently expand the packing structure **18** against the wall of the well casing, since the fluid force is prevented from acting on and moving the upper abutment **22** relatively downwardly to-

ward the lower abutment ring **23**, which would effect a shortening of the packing structure **18** and its outward expansion. The downward force imposed by the fluid on the upper abutment and the sleeve **19** is not transmitted to the packing elements **21** at all, but instead is bypassed completely to the connector sleeve **36**, the lower end of which is in engagement with the body shoulder **40**. In other words, the downward force is transmitted directly to the body **10** without being imposed on the packing elements **21**. During upward movement of the apparatus A in the well casing B, the fluid passing through the annular passage **20** and also around the packing structure **18** does not tend to move the lower abutment ring **23** upwardly toward the upper abutment **22**, but, instead, actually tends to hold the lower abutment **23**, **24** in its downward position, in which the packing sleeves **21** are fully retracted. The apparatus can be elevated in the well casing and removed entirely therefrom at the top of the hole.

From the foregoing description, it is evident that the packing structure **18** is prevented from inadvertently expanding during lowering of the apparatus through the fluid in the well casing, and also during its elevation through such fluid. The packing structure is also prevented from inadvertently expanding out against the well casing B prior to its purposeful setting and in the event that fluid is being circulated through the apparatus. Assuming that conditioning or circulating fluid is pumped down through the tubular string C, it will pass downwardly through the body and out through its lower end or the lower end of the tubing extension **17** secured thereto. At this time, the parts are in the position illustrated in FIGS. 1 and 1*a*, the fluid passing upwardly around the lower extension **17**, the body **10**, and the slip structure **26**, flowing upwardly and through the ports **31** in the sleeve **24** and through the annular passage **20** into the annulus **33** between the tubular string C and casing B above the apparatus A. The control member **53** is locked to the body **10** by means of the engagement of the control pin **61** with the upper stop flange **72**, and the connector sleeve **36** is prevented from moving upwardly by virtue of engagement of the inner flange **52** on the control member with the snap ring **57**. Any tendency for the upwardly moving fluid to shift the upper abutment **22** upwardly is prevented by the fact that the shoulder **38** on the sleeve **24** engages the stop flange **37** at the upper end of the connector sleeve **36**. As a result, the circulating fluid can do not more than tend to move the support sleeve **19** and upper abutment **22** upwardly away from the lower abutment ring **23**, the parts retaining the position illustrated in FIG. 1, in which the packing elements **21** cannot expand outwardly against the well casing. Accordingly, the circulation of fluid can occur through the full area provided around the tool which is the area between the retracted packing structure **18** and the wall of the well casing and the area of the annular passage **20**.

The control mechanism **54** is simple in construction and easy to operate. It is only necessary to turn the tubular string C and body **10** of the apparatus to the right to unlock or release the mechanism **54**. It is unnecessary to impose any torque on the tubular string and body of the tool when the parts are to be relocked, to hold the normally retracted packing structure **18** and the normally retracted slips **26** in their respective retracted positions.

We claim:

1. In well packer apparatus to be set in a well bore: a body; longitudinally spaced first and second abutments surrounding said body; a support sleeve around said body and secured to said first abutment and slidable along said second abutment; normally retracted packing means on said sleeve between said abutments; means on said body engageable with one of said abutments for effecting movement of said abutments toward each other to expand said packing means outwardly; and means operatively associated with said sleeve and body and movable by said body for shifting said sleeve in a direction to maintain said first abutment away from said second abutment to retain said packing means in its retracted position.

2. In well packer apparatus to be set in a well bore: a body; longitudinally spaced first and second abutments surrounding said body; a support sleeve around said body and secured to said first abutment and slidable along said second abutment; normally retracted packing means on said sleeve between said abutments; means on said body engageable with one of said abutments for effecting movement of said abutments toward each other to expand said packing means outwardly; and means operatively associated with and movable by said body and operatively connected to said second abutment to urge said second abutment in a direction away from said first abutment to retain said packing means in its retracted position; said means movable by said body also being engageable with said support sleeve to shift said sleeve and maintain said first abutment away from said second abutment to retain said packing means in its retracted position.

3. In well packer apparatus to be set in a well bore: a body; longitudinally spaced first and second abutments surrounding said body; a support sleeve around said body and secured to said first abutment and slidable along said second abutment; normally retracted packing means on said sleeve between said abutments; means on said body engageable with one of said abutments for effecting movement of said abutments toward each other to expand said packing means outwardly; and actuating means operatively associated with said body and sleeve and movable by said body in one longitudinal direction to shift said sleeve in said one direction to maintain said first abutment away from said second abutment to retain said packing means in its retracted position; said actuating means being movable by said body in the opposite longitudinal direction and operatively connected to said second abutment to urge said second abutment in said opposite direction and away from said first abutment to retain said packing means in its retracted condition.

4. In well packer apparatus to be set in a well bore: a body; longitudinally spaced first and second abutments surrounding said body; a support sleeve around said body and secured to said first abutment and slidable along said second abutment; normally retracted packing means on said sleeve between said abutments; means on said body engageable with one of said abutments for effecting movement of said abutments toward each other to expand said packing means outwardly; a connector sleeve operatively associated with said support sleeve surrounding said body and movable by said body in one direction to shift said support sleeve in the same direction and maintain said first abutment in a direction away from said second abutment to retain said packing means in its retracted condition; and means operatively connecting said connector sleeve to said body.

5. In well packer apparatus to be set in a well bore: a body; longitudinally spaced first and second abutments surrounding said body; a support sleeve around said body and secured to said first abutment and slidable along said second abutment; normally retracted packing means on said sleeve between said abutments; means on said body engageable with one of said abutments for effecting movement of said abutments toward each other to expand said packing means outwardly; a connector sleeve surrounding said body and operatively connected to second abutment and movable by said body to urge said second abutment in a direction away from said first abutment to retain said packing means in its retracted condition; and means operatively connecting said connector sleeve to said body.

6. In well packer apparatus to be set in a well bore: a body; longitudinally spaced first and second abutments surrounding said body; a support sleeve around said body and secured to said first abutment and slidable along said second abutment; normally retracted packing means on said sleeve between said abutments; means on said body engageable with one of said abutments for

effecting movement of said abutments toward each other to expand said packing means outwardly; a connector sleeve operatively associated with said support sleeve surrounding said body and movable by said body in one direction to shift said support sleeve in the same direction and maintain said first abutment in a direction away from said second abutment to retain said packing means in its retracted condition; and means operatively connecting said connector sleeve to said body; said conector sleeve being operatively connected to said second abutment and movable by said body into engagement with said second abutment to urge said second abutment in a direction away from said first abutment to retain said packing means in its retracted condition.

7. In well packer apparatus to be set in a well bore: a body; longitudinally spaced first and second abutments surrounding said body; a support sleeve around said body and secured to said first abutment and slidable along said second abutment; normally retracted packing means on said sleeve between said abutments; means on said body engageable with one of said abutments for effecting movement of said abutments toward each other to expand said packing means outwardly; a connector sleeve operatively associated with and surrounding said body and movable by said body into engagement with said support sleeve to maintain said first abutment in a direction away from said second abutment to retain said packing means in its retracted condition.

8. In well packer apparatus to be set in a well bore: a body; longitudinally spaced upper and lower abutments surrounding said body; a support sleeve secured to said upper abutment and slidable in said lower abutment; normally retracted packing means on said sleeve between said abutments; means on said body engageable with one of said abutments for effecting movement of said abutments toward each other to expand said packing means outwardly; a connector sleeve surrounding said body and movable upwardly by said body against said support sleeve to urge said upper abutment upwardly away from said lower abutment and retain said packing means in its retracted condition; and means connecting said connector sleeve to said body.

9. In well packer apparatus to be set in a well bore: a body; longitudinally spaced upper and lower abutments surrounding said body; a support sleeve secured to said upper abutment and slidable in said lower abutment; normally retracted packing means on said sleeve between said abutments; means on said body engageable with one of said abutments for effecting movement of said abutments toward each other to expand said packing means outwardly; a connector sleeve surrounding said body and movable downwardly by said body into engagement with said lower abutment to urge said lower abutment downwardly away from said upper abutment to retain said packing means in its retracted condition; and means connecting said connector sleeve to said body.

10. In well packer apparatus to be set in a well bore: a body; longitudinally spaced upper and lower abutments surrounding said body; a support sleeve secured to said upper abutment and slidable in said lower abutment; normally retracted packing means on said sleeve between said abutments; means on said body engageable with one of said abutments for effecting movement of said abutments toward each other to expand said packing means outwardly; a connector sleeve surrounding said body and movable upwardly by said body against said support sleeve to urge said upper abutment upwardly away from said lower abutment and retain said packing means in its retracted condition; said connector sleeve having means thereon engageable with said lower abutment, whereby downward movement of said body moves said connector sleeve and lower abutment downwardly and urges said lower abutment downwardly away from said upper abutment to retain said packing means in its retracted condition; and means connecting said connector sleeve to said body.

11. In well packer apparatus to be set in a well bore: a body; laterally spaced upper and lower abutments surrounding said body; a support sleeve secured to said upper abutment and slidable in said lower abutment; normally retracted packing means on said sleeve between said abutments; an expander secured to said lower abutment; normally retracted slip means engageable by said expander to be expanded outwardly; means releasably locking said slip means to said body; a connector sleeve operatively associated with, surrounding and movable by said body and slidable relatively in said slip means; means on said body for moving said expander downwardly into engagement with said slip means to expand the same and for moving said upper abutment toward said lower abutment to expand said packing means; said connector sleeve being engageable with said support sleeve upon upward movement of said body to urge said upper abutment away from said lower abutment and retain said packing means in its retracted condition.

12. In well packer apparatus to be set in a well bore: a body; laterally spaced upper and lower abutments surrounding said body; a support sleeve secured to said upper abutment and slidable in said lower abutment; normally retracted packing means on said sleeve between said abutments; an expander secured to said lower abutment; normally retracted slip means engageable by said expander to be expanded outwardly; means releasably locking said slip means to said body; a connector sleeve operatively associated with, surrounding and movable by said body and slidable relatively in said slip means; means on said body for moving said expander downwardly into engagement with said slip means to expand the same and for moving said upper abutment toward said lower abutment to expand said packing means; said connector sleeve being engageable with said support sleeve upon upward movement of said body to urge said upper abutment away from said lower abutment and retain said packing means in its retracted condition; said connector sleeve having means thereon engageable with said expander upon downward movement of said body to urge said lower abutment downwardly away from said upper abutment to retain said packing means in its retracted position.

13. In a well tool adapted to be lowered and operated in a well bore on a running-in string: first and second members adapted to be moved relatively to each other; one of said members being adapted to be connected to the running-in string to be manipulated thereby relatively to said other member; said first member having a circumferential groove bounded by upper and lower sides and a longitudinal groove communicating with said circumferential groove and opening through one of said sides; a lock element movable laterally on said second member and adapted to be disposed in said circumferential groove to limit the extent of relative longitudinal movement between said members and adapted to be disposed in said longitudinal groove so as not to limit the extent of relative longitudinal movement between said members in one direction; yieldable means engaging said element to hold said element in said grooves; and said first member having cam means thereon to one side of said circumferential groove engageable with said element when said element is out of said circumferential groove to shift said element laterally of said first member and permit entry of said element into said circumferential groove without requiring said element to move through said longitudinal groove.

14. In a well tool adapted to be lowered and operated in a well bore on a running-in string: first and second members adapted to be moved relatively to each other; one of said members being adapted to be connected to the running-in string to be manipulated thereby relatively to said other member; said first member having a circumferential groove bounded by upper and lower sides and a longitudinal groove communicating with said cir-

cumferential groove and opening through one of said sides; said first member at one side of said groove having a beveled surface outside of said circumferential groove; a lock element movable laterally on said second member and adapted to be disposed in said circumferential groove to limit the extent of relative longitudinal movement between said members and adapted to be disposed in said longitudinal groove so as not to limit the extent of relative longitudinal movement between said members in one direction; yieldable means engaging said element to hold said element in said grooves; said lock element being engageable with said beveled surface to be shifted laterally of said first member, upon relative longitudinal movement between said members, for movement into said circumferential groove.

References Cited in the file of this patent

UNITED STATES PATENTS

1,514,978	McLean	Nov. 18, 1924
1,799,317	Reed	Apr. 7, 1931
2,252,912	Armentrout	Aug. 19, 1941
2,633,918	Le Rouax	Apr. 7, 1953
2,871,949	Baker	Feb. 3, 1959
2,878,878	Baker	Mar. 24, 1959
2,888,278	Torres et al.	May 26, 1959
2,893,492	Brown	July 7, 1959
2,988,149	Conrad	June 13, 1961
3,008,523	Clark et al.	Nov. 14, 1961

FOREIGN PATENTS

1,228,578	France	Mar. 14, 1960

Disclaimer

3,101,783.—*Hiram H. Fisher, Jr.*, and *Julian D. Keithahn*, Houston, Tex. WELL PACKER. Patent dated Aug. 27, 1963. Disclaimer filed Feb. 27, 1970, by the assignee, *Baker Oil Tools, Inc.*

Hereby enters this disclaimer to claims 1, 4, 7, 8 and 11 of said patent.

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