June 18, 1963 W. D. MYERS 3,094,168

RETRIEVABLE PARALLEL STRING WELL PACKER

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FIG. 1.

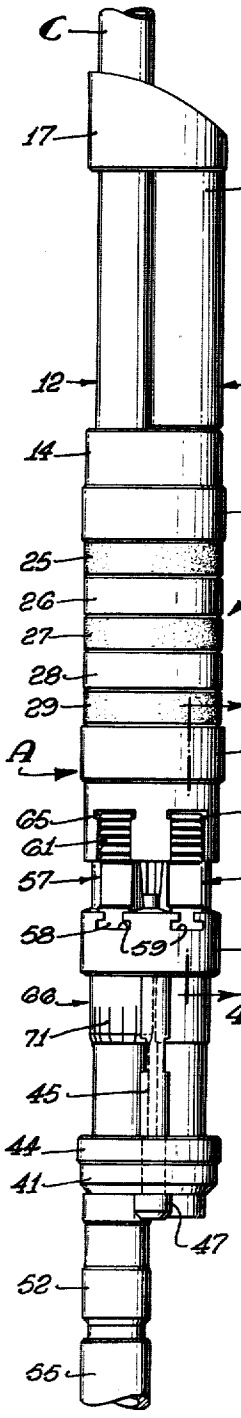


FIG. 2.

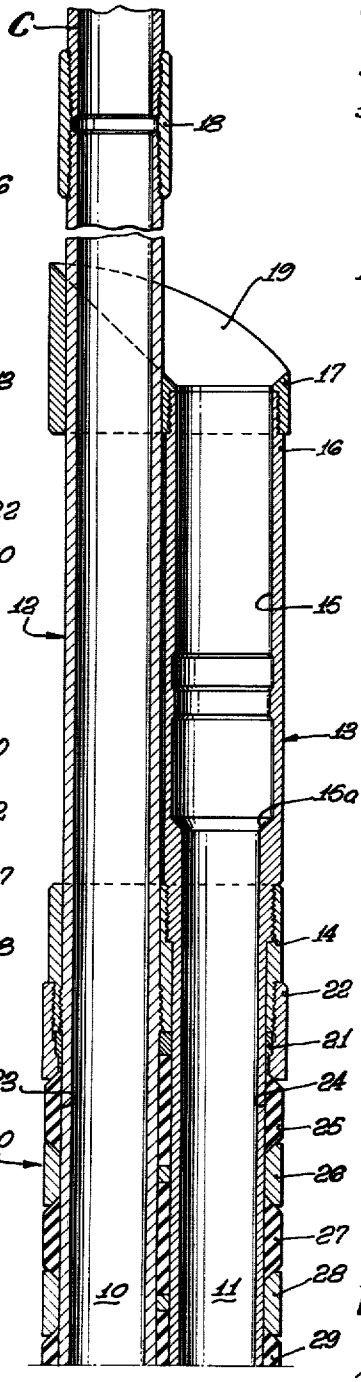
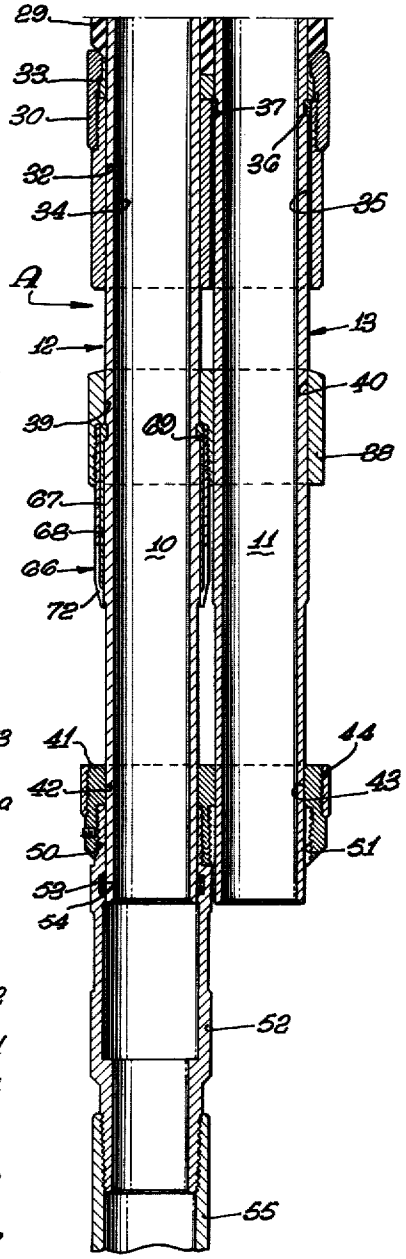


FIG. 2a.



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FIG. 3.

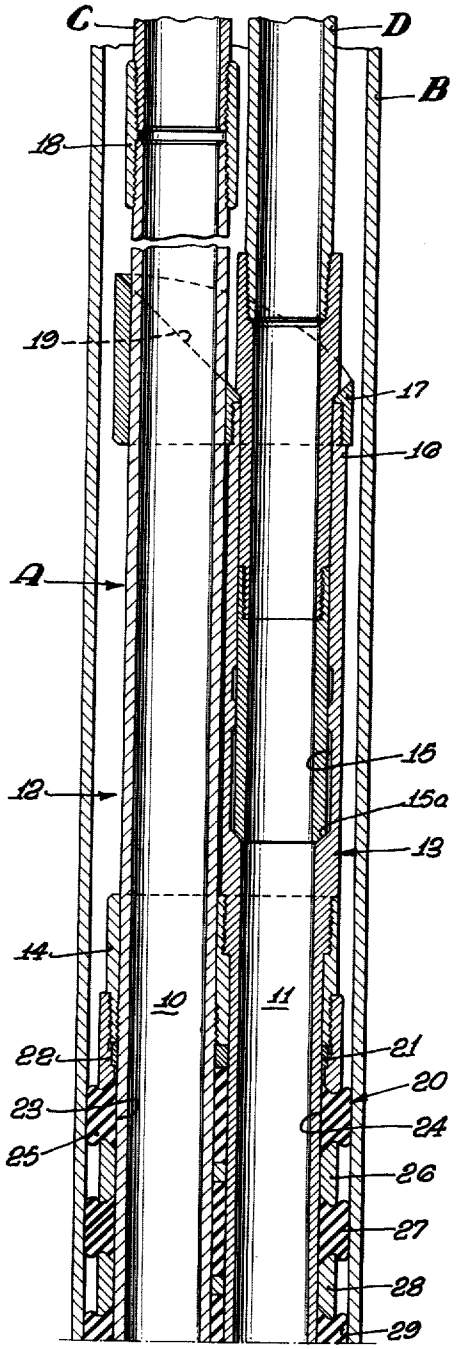
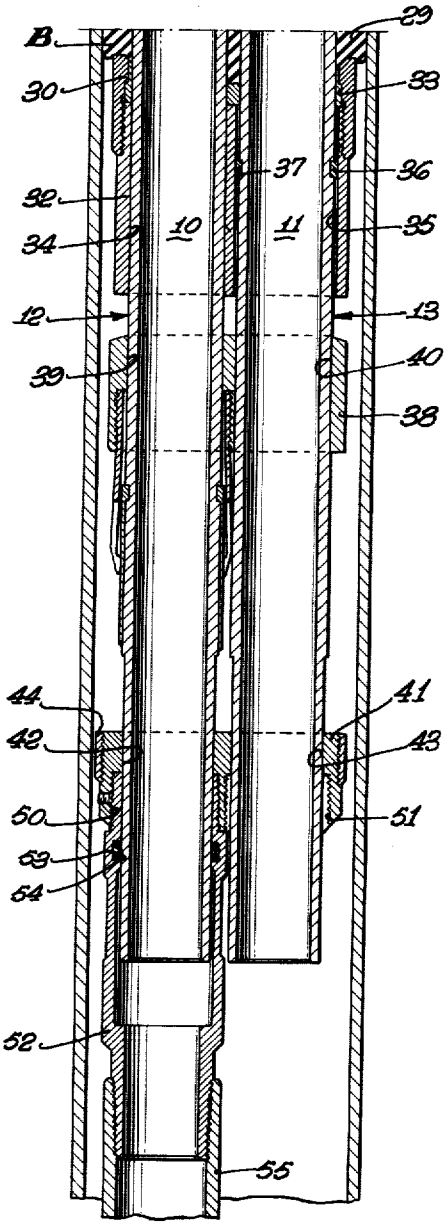


FIG. 3a.



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FIG. 4.

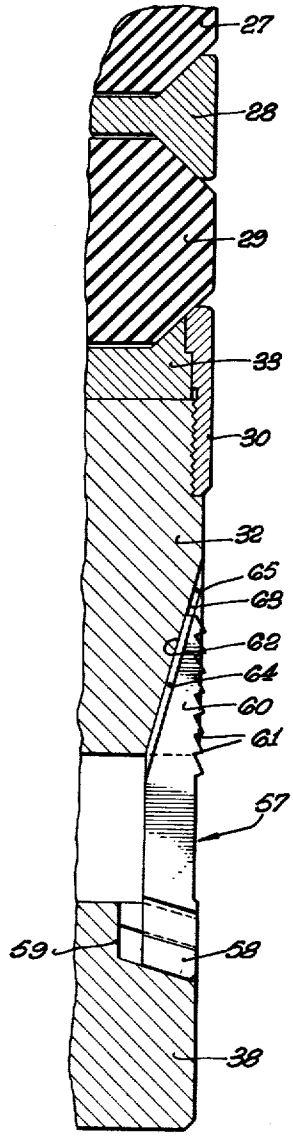


FIG. 5.

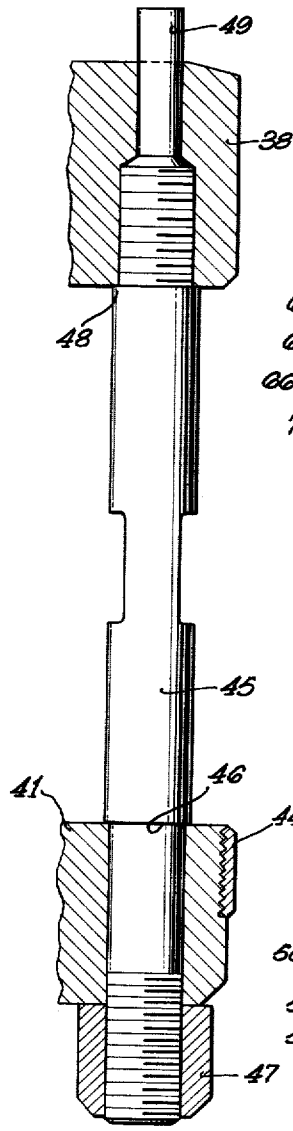
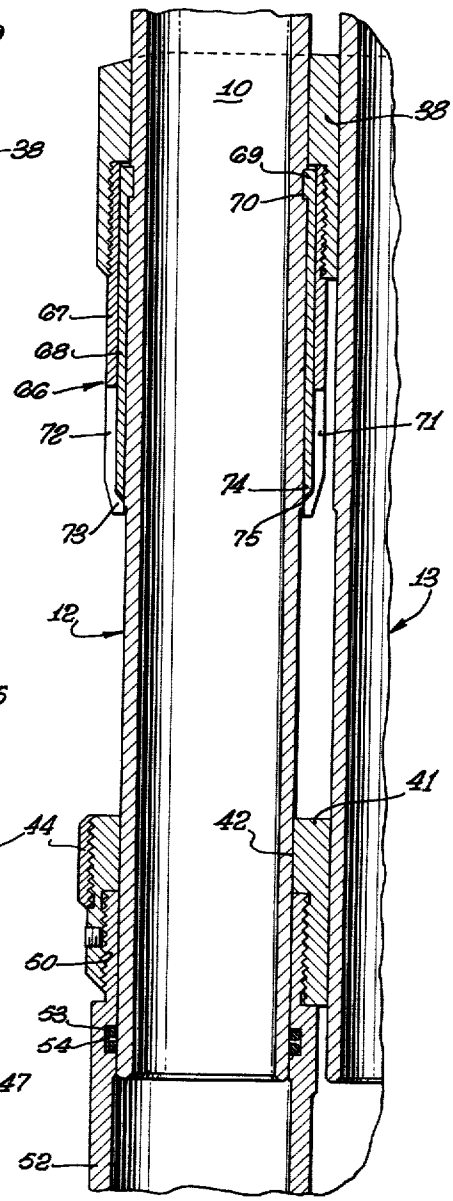


FIG. 6.



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FIG. 7.

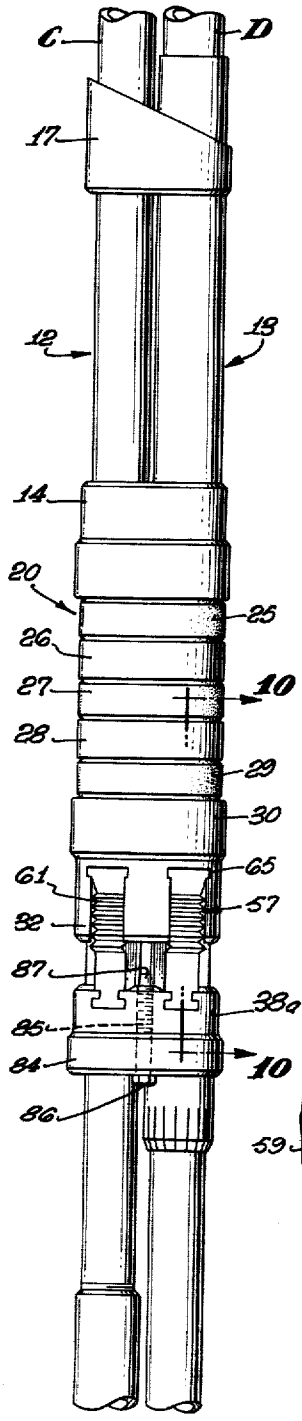


FIG. 10.

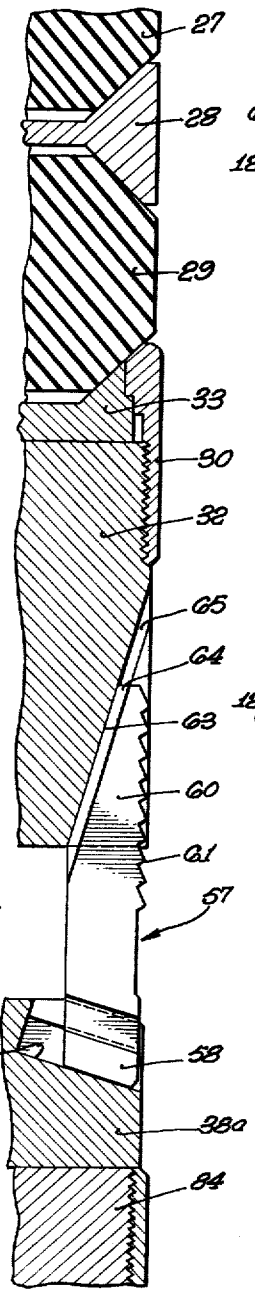


FIG. 11.

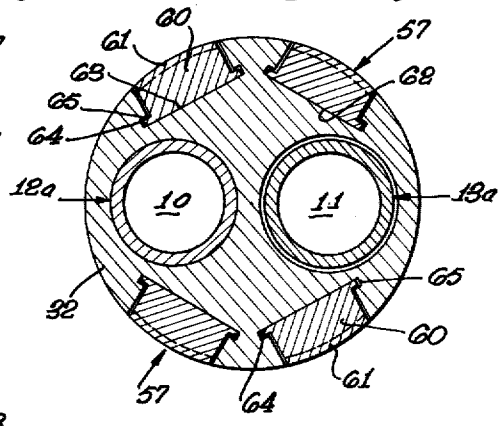
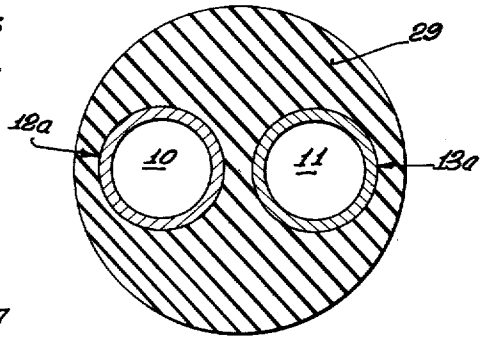


FIG. 12.



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RETRIEVABLE PARALLEL STRING WELL PACKER

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FIG. 8.

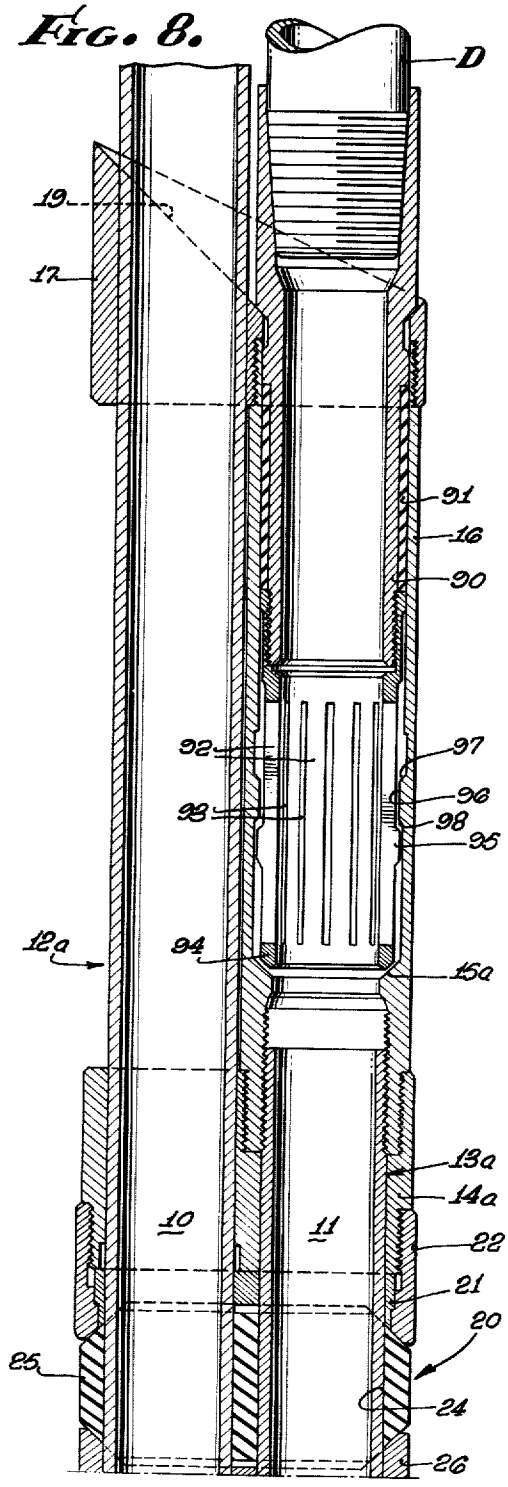
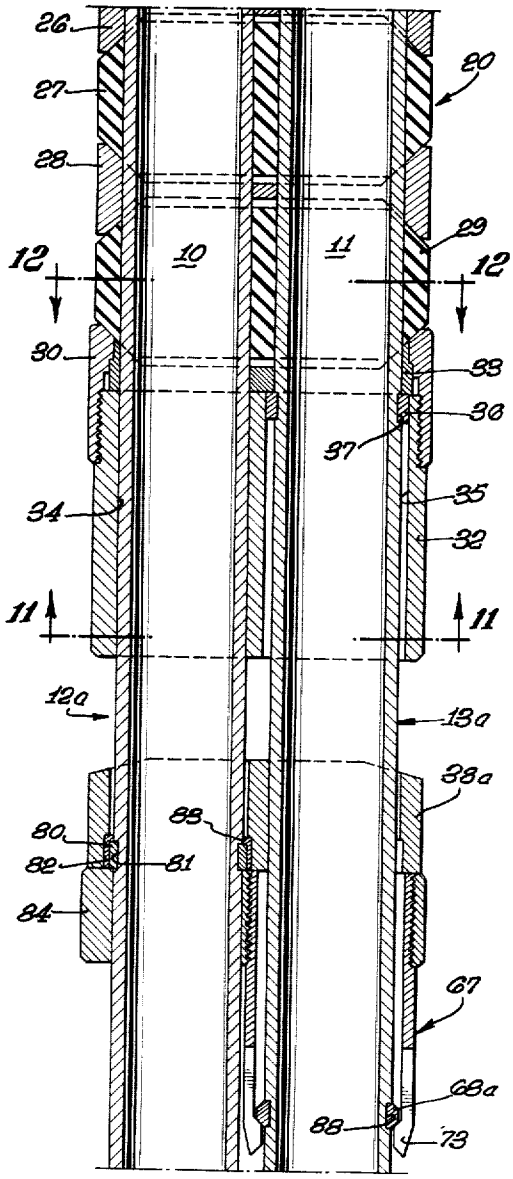


FIG. 8a.



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FIG. 9.

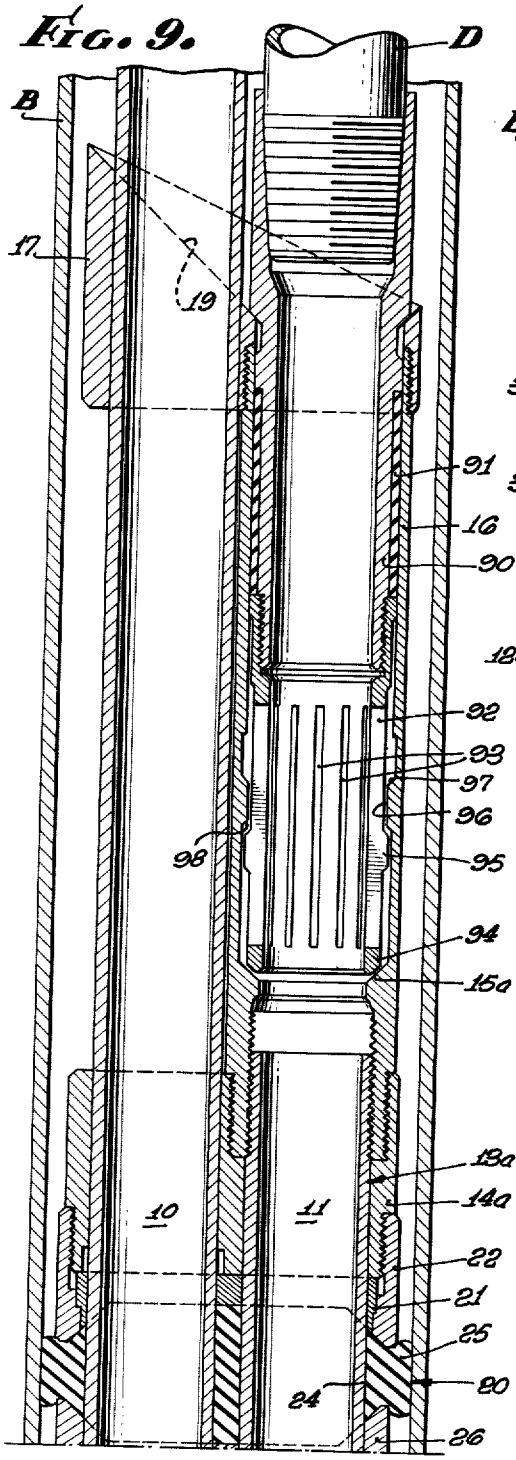
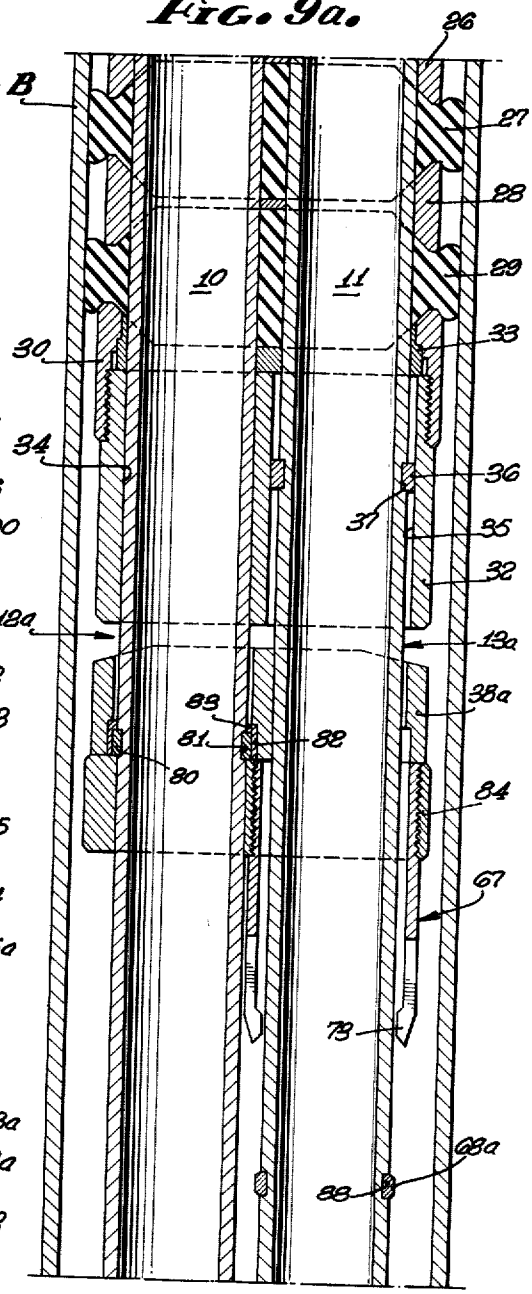


FIG. 9a.



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United States Patent Office 3,094,168 Patented June 18, 1963

3,094,168

RETRIEVABLE PARALLEL STRING WELL PACKER

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Filed Aug. 3, 1959, Ser. No. 831,137
21 Claims. (Cl. 166—118)

The present invention relates to subsurface well bore apparatus, and more particularly to well packers adapted to be set in well casings or similar conduit strings disposed in well bores.

A plurality of parallel tubular strings are mounted in a well bore in appropriate association with one or more well packers to conduct fluids through separate paths between the top of the well bore and different locations therewithin. The separate paths include individual passages through the well packers, which heretofore have been of a relatively restricted size, limiting the scope of application of the parallel tubular string apparatus.

An object of the present invention is to provide an improved well packer, or the like, adapted to be set in well casings, or similar conduit strings, and having separate parallel passages therethrough, each of which has a comparatively large diameter.

Another object of the invention is to provide a well packer having separate parallel fluid flow paths or passages therethrough of comparatively large size, the packer being adapted to be anchored in packed-off condition in a well casing, or similar well conduit, and of being readily retrieved therefrom.

A further object of the invention is to provide a well packer having separate parallel passages therethrough and adapted to be set in a well conduit and association with a lower packer in the well conduit, in which either of the passages may be selected to be placed in fluid communication with the passage through the lower packer.

An additional object of the invention is to provide a well packer having separate parallel passages therethrough and adapted to be set in packed-off condition in a well conduit string and retrieved therefrom when desired, the packer being relatively economical to manufacture.

This invention possesses many other advantages, and has other objects which may be made more clearly apparent from a consideration of several forms in which it may be embodied. Such forms are shown in the drawings accompanying and forming part of the present specification. These forms will now be described in detail for the purpose of illustrating the general principles of the invention; but it is to be understood that such detailed description is not to be taken in a limiting sense, since the scope of the invention is best defined by the appended claims.

Referring to the drawings:

FIGURE 1 is a side elevational view of an apparatus embodying the invention;

FIG. 2 and 2*a* together constitute an enlarged longitudinal section through the well packer disclosed in FIG. 1 with its parts in retracted position, FIG. 2a constituting a lower continuation of FIG. 2;

FIG. 3 and 3*a* are views corresponding to FIG. 2 and 2*a*, respectively, of the well packer anchored in packed-off condition in the well casing;

FIG. 4 is an enlarged vertical section taken along the line **4—4** on FIG. 1;

FIG. 5 is a section through a portion of the apparatus disclosing a tie bar interconnecting the slip ring with a lower connector;

FIG. 6 is an enlarged longitudinal section through a lower portion of the apparatus;

FIG. 7 is a side elevational view of another form of the invention;

FIGS. 8 and 8*a* together constitute an enlarged longitudinal section through the well packer disclosed in FIG. 7 with its parts in retracted position, FIG. 8*a* constituting a lower continuation of FIG. 8;

FIGS. 9 and 9*a* are views corresponding to FIGS. 8 and 8*a*, respectively, of the well packer anchored in packed-off condition in the well casing;

FIG. 10 is an enlarged vertical section taken along the line **10—10** on FIG. 7;

FIG. 11 is a cross-section taken along the line **11—11** on FIG. 8*a*;

FIG. 12 is a cross-section taken along the line **12—12** on FIG. 8*a*.

The well packer A disclosed in FIGS. 1 to 6 of the drawings is adapted to be lowered in a well casing B on a first tubular string C and may be placed in proper association with a lower well packer (not shown) previously set in the well casing. The well packer A has a plurality, such as a pair, of fluid passages **10**, **11** therethrough, one of which **10** communicates with the first tubular string C, by means of which the apparatus is lowered in the well casing, and the other of which **11** communicates with a second tubular string D extending to the top of the well bore. The fluid derived from the well bore below the lower packer (not shown) may be conducted through either one of the passages **10** or **11** and into either the first or second tubular strings C, D to be conducted from the well bore. Some other fluid, such as derived from a region in the well bore between the packer A illustrated and the lower packer (not shown) may flow through the other passage **10** or **11** and through the other tubular string C or D to the top of the well bore.

The well packer A includes a pair of parallel tubular body members or mandrels **12**, **13** movable as a unit in the well casing B. A first tubular body member or mandrel **12** passes through an upper connector **14**, to which it is threadedly attached. A second tubular body member or mandrel **13** also passes through the upper connector **14** and is threadedly attached thereto. This second mandrel member has a counterbore **15** in its upper portion forming a receptacle for the second tubing string D that is adapted to be lowered in the well casing B and inserted therewithin. The upper end **16** of the second tubular body member or mandrel **13** is threadely attached to a guide or head **17**, the first tubular body member **12** extending through this guide and being suitably secured to the first tubular string C, as by means of an intervening coupling **18**. The guide or head **17** has a tapered guide surface **19** which diverges in an upward direction from a low point at the tubing receptacle **15** to a high point adjacent the first tubular member **12**. More specifically, such tapered guide surface **19** may be conical in shape, being developed about an axis coinciding with the axis of the second body member **13**.

The first and second tubular body members or mandrels **12**, **13** extend downwardly from the upper connector **14** through a packing structure **20**. This packing structure includes an upper insert **21** engaging the lower end of the upper connector **14** and clamped thereagainst by an upper gage ring **22** which is threaded on the upper connector. The body members **12**, **13** extend through parallel bores **23**, **24** and an upper packing element **25** of a pliant, elastic material, such as rubber, the upper end of this packing element engaging the lower end of the upper gage ring **22** and its lower end engaging a spacer **26** through which the body members **12**, **13** also pass. These body members successively pass downwardly through an intermediate packing element **27**, of rubber or rubber-like material, a lower spacer ring **28**, and a lower packing element **29** of rubber or rubber-like material. This lower packing element engages a lower gage ring **30** threadedly attached to the upper end of a slip expander **32**, the packing element also contacting a lower insert **33** clamped

against the upper end of the expander **32** by the lower gage ring **30**. The lower insert **33** and expander **32** have parallel bores **34**, **35** therethrough through which the tubular body members **12**, **13** extend. The expander bore **35** through which the second tubular body member **13** extends is larger in diameter than the second tubular body member to enable a retracting ring **36** to slide therewithin which is mounted within a peripheral groove **37** in the second body member **13**, and which is adapted to engage the lower insert **33** for the purpose of elevating the expander **32** when the second body member **13** is elevated in the well casing B.

Spaced below the expander **32** is a slip ring **38** having parallel bores **39**, **40** through which the body members **12**, **13** extend, and spaced below the slip ring **38** is a lower connector **41** having parallel bores **42**, **43** through which the body members **12**, **13** are slidable. This lower connector **41** has a guide ring **44** threaded thereon and is connected to the slip ring **38** by a pair of longitudinally extending tie rods or bars **45**. The lower portions of the tie rods extend through the lower connector **41**, a tie bar shoulder **46** engaging the upper end of this connector, a nut **47** being threaded on the lower end of the tie bar and tightened against the lower end of the connector to firmly secure the tie bar to the latter. The upper end of the tie bar **45** is threadedly secured to the slip ring **38**, there being an upper shoulder **48** engaging the lower end of the slip ring. The tie bar has an upper extension or pin **49** projecting upwardly from the slip ring **38**, this pin being adapted to be engaged by the lower end of the expander **32** to limit movement of the expander toward the slip ring. It is apparent that the tie bars interconnect the slip ring **38** and lower connector **41** as a rigid unit, so that they move together.

The lower connector **41** has a threaded counterbore **50** surrounding the first tubular body member **12** and another threaded counterbore **51** surrounding the second tubular body member **13**. A bottom sub or actuator **52** is adapted to be threadedly attached to the lower connector **41** in either of these counterbores **50**, **51**, as desired. When threaded in one of the counterbores, a suitable side seal **53**, such as one or more rubber or rubber-like O rings, mounted in a groove **54** in the bottom sub **52** slidably engages the periphery of one of the tubular body members **12** or **13**. A tail pipe **55** is threadedly attached to the bottom sub or actuator **52** and is adapted to coact with the lower packer (not shown) in the well casing B so as to bear thereagainst and prevent further downward movement of the lower connector **41** and slip ring **38** in the well casing, as well as to function as a conductor for the fluid from a region below the lower packer into the particular body member **12** or **13** with which the bottom sub **52** is related, the fluid then passing through one of the tubular strings C or D to the top of the well bore. The other tubular body member **12** or **13** terminates below the lower connector **41** and will receive fluid from a region below the well packer A and conduct such fluid through the body member and through the other tubular string to the top of the well bore.

Displaced from a plane including the axes of the two tubular body members **12**, **13**, and on opposite sides thereof, are slips **57** carried by the slip ring **38** and adapted to coact with the expander **32**. As shown, a pair of slips **57** is disposed on each side of the aforementioned central plane. Each slip is coupled to the slip ring **38** for longitudinal movement therewith, but the slips can move radially of the slip ring from a retracted position into engagement with the well casing B and back to a retracted position. Thus, the lower portions of the slips are formed as T-shaped heads **58** slidably mounted in companion generally T-shaped slots **59** in the slip ring. The upper portions of the slips are constituted as anchoring members **60**, having downwardly facing wickers or teeth **61** and inner tapered surfaces **62** inclined in a downward and inward direction, being slidable along companion tapered surfaces **63** in the expander **32**. As the expander **32** moves downwardly relative to the slip ring **38** and the slips **57**, the latter are shifted radially outwardly into engagement with the well casing B. Conversely, relative upward movement of the expander with respect to the slip ring and the slips will result in inward movement of the slips **57** from the well casing B. This occurs as a result of providing side tongues **64** on each slip parallel to its tapered surface **62** which ride in companion grooves **65** in the expander **32**, forming a slidable tongue and groove connection between the expander and each slip and insuring positive retraction of the slips **57** when the expander **32** moves away from the slip ring **38**.

Initially, the slips **57** and packing structure **20** are in their retracted positions, being retained in such positions during lowering of the packer apparatus A in the well casing by a releasable coupling or latch device **66**, which is disclosed as specifically interconnecting one of the tubular body members, such as the first body member **12**, with the slip ring **38**. The latch device is in the form of a control or latch sleeve **67** threadedly secured to the slip ring and disposed upon an actuating sleeve **68** mounted on the first tubular body member **12** and secured thereto. The actuating sleeve **68** may be made of two halves which are placed around the first body member **12** with an upper sleeve flange **69** mounted in a peripheral groove **70** in the first body member **12**. When the control sleeve **67** is threaded upwardly into the slip ring **38** it will hold the actuating sleeve **68** in coupled position on the first body member **12**.

The control sleeve **67** has a plurality of longitudinal slots **71** extending therethrough to form spring-like latch legs **72** that terminate in inwardly directed latch feet **73** disposed below the lower end **74** of the actuating sleeve **68**. Such lower end **74** and the upper surfaces of the latch feet **73** have companion tapered surfaces **75** that are inclined in an inward and downward direction, such that downward movement of the sleeve **67** with sufficient force will cam the latch feet **73** and legs **72** outwardly, to free the first body member **12** from the slip ring **38**. Initially, however, the latch feet **73** are disposed under the actuating sleeve **68** and couple the first body member **12** to the slip ring **38** and to the slips **57**.

The slips **57** are disposed initially in a retracted position, which is also true of the packing structure **20**, the latch feet **73** being under the lower end **74** of the actuating sleeve **68**. The second tubular string D is not in place, but the first tubular string C is threadedly attached to the upper end of the first tubular body member **12**. The entire apparatus A is lowered in the well casing with a suitable length of tail pipe **55** extending from the bottom sub or actuator **41**. During the lowering movement, the slips **57** remain in their retracted position since the latch or control mechanism **66** causes the slip ring **38** and slips **57** to move downwardly with the body members **12**, **13**. The expander **32** also moves downwardly with the body members **12**, **13**, since the ring **36** prevents it from dropping downwardly therealong.

When the lower end of the tail pipe **55** engages the lower packer (not shown) and becomes suitably related thereto in leakproof relation (in a known manner), further downward movement of the tail pipe, the bottom sub **52**, lower connector **41** and the slip ring **38** cannot occur. Accordingly, the imposition of a sufficient downward force on the first tubular string C will be transmitted through the first body member **12** and the actuating sleeve **68** onto the latch legs **73**, expanding such legs outwardly (which may occur with a downward force of 2,000 to 4,000 pounds, by way of example), thereby freeing the tubular body member **12** from the slip ring **38**. The first tubular body member **12** can now be shifted downardly, telescoping into the bottom sub **52** and carrying the upper connector **14** and the second body member **13** downwardly with it, since these parts are all securely attached to one another. This downward movement is accom-

panied by a downward movement of the entire packing structure **20** and of the expander **32**, the latter shifting down behind the slips **57** and expanding the slips outwardly into anchoring engagement with the wall of the well casing B.

When the slips **57** have been anchored against the well casing, further downward movement of the expander **32** cannot occur. Accordingly, a continuation of the downward movement of the first and second tubular body members **12, 13** moves the upper connector **14** and upper gage ring **22** toward the lower gage ring **30** (which is now prevented from moving downwardly by the expander **32**), foreshortening the packing elements **25, 27, 29** effecting their outward expansion into sealing engagement with the well casing B, as disclosed in FIGS. 3 and 3*a*. The well packer A is now anchored in packed-off condition in the well casing B against downward movement therewithin.

The second tubular string D is now lowered in the well casing alongside of the first tubular string C, and when its lower end engages the tapered guide surface **19** it will be directed toward and into the upper receptacle portion **15** of the second body member **13**, coming to rest upon a shoulder **15***a* therewithin.

The first passage **10** through the packer structure is in communication with the tail pipe **55** and the lower packer (not shown) and will direct the fluid from the well bore below the lower packer upwardly into the first tubular string C for conduction to the top of the well bore. The fluid in the well bore below the well packer A will pass upwardly through the second passage **11** in the second body member **13** and into the second tubing string D to be conducted thereby to the top of the well bore.

In the event the apparatus A is to be removed from the well bore the second tubular string D is first elevated in the well casing B and removed completely therefrom, whereupon the first tubular string C is elevated. Such elevating movement will first result in the upper connector **14** and upper gage ring **22** being moved upwardly away from the lower gage ring **30** and expander **32**, permitting the packing elements **25, 27, 29** to move inherently back to their initial or retracted positions. As the first tubular body member **12** moves upwardly, the second tubular body member **13** is moved upwardly with it, since they are both attached to the upper connector **14**, the retracting ring **36** on the second body member **13** engaging the lower insert **33** to lift the expander **32** relative to the slips **57**, causing the tongue and groove interconnection **64, 65** between the slips and the expander to retract the slips from the well casing B. At the same time, the upward movement of the first tubular body member **12** is moving the actuating sleeve **68** upwardly until it is again disposed above the latch feet **73**, the latter moving inwardly and again releasably recoupling the first body member **12** to the slip ring **38**. The entire packer apparatus A can now be elevated in the well casing, together with the tail pipe **55**, and removed therefrom, if desired.

In lieu of the tail pipe **55** being in communication with the first body member **12** and the first tubular string C, the apparatus can be made up at the top of the well bore with the bottom sub or actuator **52** threaded into the other threaded bore **51** of the lower connector **41** and with the side seal rings **53** in slidable sealing engagement with the periphery of the second body member **13**. The apparatus A is lowered in the well casing and is set in the same manner as before, the tail pipe **55** coming to rest upon the lower packer (not shown), but the anchoring of the packer A in packed-off condition being the same as previously described, since the tubular body members **12, 13** are connected to one another through the upper connector **14**. Thus, merely by changing the connection of the bottom sub or actuator **52**, it is possible to conduct the fluid from the location in the well bore below the lower packer through either the first tubular string C or through the second tubular string D to the top of the well bore.

By virtue of the making of the body portion of the well packer essentially as two parallel tubular body members **12, 13**, passages **10, 11** through such tubular members can be provided that are comparatively large in diameter. Space to one side of said body members is readily provided for the slips **57**, which can have a comparatively large range of expansion and yet possess adequate strength. The expander member **32** itself will also have adequate wall thickness to effectively wedge and hold the slips **57** in anchoring engagement with the well casing B. Such relatively heavy wall thickness need only be provided in the region of the slips **57** and not near the portion of the expander that is at the plane passing through the axes of both body members **12, 13**. The passages **10, 11** are of such diameter that other instruments or devices can be lowered therethrough. The packing elements **25, 27, 29** have a comparatively large volume of packing material and can be expanded outwardly to a substantial extent into sealing engagement with the wall of the surrounding well casing B. Despite the fact that a large volume of rubber or rubber-like material is available for packing off against the wall of the well casing, the effective area of the body portion of the apparatus, which are the two tubular members **12, 13**, is relatively small, so that there is a comparatively small area acting of the body tending to extrude the packing material around the gage rings **22, 30**. Accordingly, comparatively high pressures and temperatures can be imposed upon the apparatus while in the well bore without the packing material being dissipated through the clearance spaces that exist between the casing B and the upper and lower gage rings **22, 30**. The apparatus is comparatively economical to manufacture, is easy to set in packed-off condition in the well casing, merely by imposing a downward load on the first tubular member C, and is easily retrievable from the well casing without fear of inadvertently resetting it in the well casing, inasmuch as the latch device **66** automatically reconnects the slip ring **38** to the first body member **12** and precludes undesired expansion of the slips **57** and packing structure **20**.

In the form of invention illustrated in FIGS. 7 to 12 inclusive, the retrievable well packer is essentially the same as the form hereinbefore described. However, in setting the packer it is unnecessary for there to be a tail pipe which rests upon a lower barrier or packer (not shown). Such tail pipe may be used, but it may only be slidable through the well packer. In the present case, the packer is set by holding one of the tubular strings C and then setting down on the other tubular string D.

The second body member or mandrel **13***a* is threadedly attached to the upper connector **14***a*, as in the other form of the invention. However, the first body member or mandrel **12***a* is relatively slidable through the upper connector **14***a*, as well as through the packing structure **20** and expander **32**. It is connected to the slip ring **38***a* as by means of a coupling ring **80** disposed in its peripheral groove **81**, which is encompassed by a shear sleeve **82** fitting within the slip ring. This shear sleeve **82** has an upper, inwardly directed shear flange **83** engaging the upper end of the coupling ring **80**. Any upstrain on the first body member **12***a* is transmitted through its coupling ring **80** and shear flange **83** to the slip ring **38***a*. The slip ring itself is attached to a slip ring retainer **84** by means of a plurality of longitudinally extending limit pins or screws **85**, the lower head **86** of which engages the underside of the slip ring retainer **84** and the shank portion of which is threaded into the slip ring **38***a*. Each pin or screw **85** has an upper limit pin **87** projecting thereabove to engage the expander **32** and limit its relative approach to the slip ring **38***a*.

The control or latch sleeve **67** is threadedly secured to the slip ring retainer **84** and is disposed around the second body or mandrel **13***a*. Its inwardly directed latch

feet **73** are releasably located under a tapered actuator ring **68***a* mounted in a peripheral groove **88** in the second body member **13***a*. When the actuator ring **68***a* is disposed above the latch feet **73**, the second body member **13***a* is prevented from moving downwardly reative to the first body member **12***a*. However, when the first body member is held from moving downwardly by the first tubular string C extending to the top of the well bore, the exertion of a sufficient downward force on the second body member **13***a* will cause its actuator ring **68***a* to expand the latch feet **73** out of the way, whereupon the second body member can move downwardly to set the well packer, as described hereinbelow.

The second tubular string D is releasably latched in the upper portion **16** of the second body or mandrel **13***a*. Thus, the lower portion **90** of the second tubular string D can extend into the tubing receptacle or mandrel **15** and has an annular rubber or rubber-like seal **91** thereon for sealing engagement with the wall of the receptacle. The lower portion of the second tubular string D is constituted as a releasable latch device, including a plurality of arms **92** formed by circumferentially spaced longitudinal slots **93**. The lower ends of these arms **92** are integral with an annular portion **94** adapted to seat against the receptacle shoulder **15***a*. The intermediate portions of the arms have outwardly directed fingers **95** adapted to engage under an inwardly directed shoulder **96** of the receptacle. When the lower portion **90** of the second tubular string D is inserted in the receptacle **15**, the fingers **95** will engage the upper tapered surface **97** of the shoulder which will deflect the arms inwardly until the fingers ride past the shoulder and snap into the receptacle therebelow (FIG. 8). Similarly, the taking of an upward strain on the second tubular string D of sufficient force will cause the lower tapered surface **98** of the shoulder to engage the fingers **95** and deflect the arms **92** inwardly until the fingers ride past the shoulder, thereby permitting the withdrawal of the second tubular string from the receptacle.

The apparatus is run in the well casing by means of the first tubular string C, which is suitably connected to the first body member **12***a*. At this time, the latch feet **73** are under the actuator ring **68***a* to insure that the packing structure **20** is in retracted position and the slips **57** are retracted on the expander **32**. At this time, the second tubular string D is not disposed in the receptacle **15**. When the location in the well bore is reached at which the packer is to be set, the second tubular string D is lowered in the well casing alongside the first tubular string C. Its lower end will engage the guide surface **19** at the upper end of the head **17**, which will steer it into the second receptacle **15**. A sufficient downward force is imposed on the second tubular string D to force its fingers **95** past the shoulder **96**, whereupon the arms **92** will inherently expand outwardly to place the fingers below the shoulder.

The first tubular string C is now held in a fixed position and a downward force exerted on the second tubular string D which is transferred through the shoulder **15***a* to the second body member **13***a* and the upper connector **14***a*. The force is also transmitted from the actuator ring **68***a* to the latch feet **23**, expanding them outwardly and allowing the second body member **13***a* to move downwardly relative to the first body member **12***a*. The slip ring **38***a* is prevented from moving downwardly by the coupling ring **80** on the first tubular string **12***a*, which then permits the downward movement of the released second tubular string D to be transferred through the upper connector **14***a* and the entire packing structure **20** to the expander **32**, moving the expander downwardly relative to the slips **57** and forcing the latter outwardly into anchoring engagement with the wall of the well casing B. A continuation of the movement of the upper connector **14***a* towards the expander **32** will then foreshorten the packing structure **20** and expand the rubber or rubber-like packing elements **25**, **27**, **29** outwardly into sealing engagement with the wall of the well casing.

It is apparent that the packer has been anchored in packed-off condition without the necessity for resting a tail pipe on a lower packer (not shown). Of course, a tail pipe can still be used in association with either of the body members **12***a*, **13***a*, as in the other form of the invention, or for that matter, two tail pipes can be used. If only one tail pipe is used it may be placed in appropriate position within a lower packer (not shown), but need not necessarily rest thereon.

In the event it is desired to retrieve the tubular strings C, D and the well packer, an upward pull is taken on the second tubular string D which will be exerted through the latch fingers **95** and shoulder **96** on the second body member **13***a*, elevating the upper connector **14***a* from the expander to permit the packing structure **20** to shift inherently to its retracted position. The retracting ring **36** on the second body member will then engage the insert **33** to elevate the expander **32** relative to the slips **57** and slip ring **38***a*, causing the slips to be shifted to their retracted positions. When the second body member **13***a* has moved upwardly sufficiently in which both the packing structure **20** and the slips **57** are in their retracted positions, the actuator ring **68***a* will be shifted back upwardly within the latch feet **73** and thereabove, so as to releasably hold the parts in their retracted positions.

A sufficient upward pull is taken on the second tubular string D to cause its fingers **95** to ride past the receptacle shoulder **96**, thereby releasing it from the second body member **13***a*. This tubular string D can now be removed from the well bore, after which the first tubular string C can be elevated in the well bore or casing B, to remove the well packer therefrom, if desired.

Another manner of releasing the packer from its set condition in the well casing is to take an upstrain on the second tubular string D while its fingers **95** are disposed under the shoulder **96** and impose a downward force on the first tubular string C and the first body **12***a*. This downward force will be transferred through the coupling ring **80** to the slip ring retainer **84** and the slip ring **38***a*, pulling the slips downwardly of the expander **32** and to a retracted position.

In the event that difficulty is encountered in releasing the packer apparatus, a sufficient pull should be taken on the second tubular string D to unlatch it from the receptacle **15** and this string removed to the top of the hole. A sufficient upstrain is then taken on the first tubular string C, and when this strain exceeds the shear strain of the shear flange **83** (which, for example, may be of the order of 20,000 pounds) the flange is disrupted from the remainder of the shear sleeve **82** which will allow the first body member **12***a* to move upwardly through the packer, until the coupling ring **80** engages the insert **33** disposed within the lower gage ring **30** that is secured to the expander **32**. A continuation of the upward movement on the first tubular string C and the first body member **12***a* will then move the expander **32** upwardly of the slips **57**, thereby releasing the latter from the casing B. The packer apparatus can now be removed from the well bore by elevating the first tubular string C.

The inventor claims:

1. In a well tool adapted to be disposed in a well bore: generally parallel tubular body members; an expander on said body members; slip means engageable with and movable with respect to said expander to be expanded laterally outwardly upon relative movement between said expander and slip means in one direction; and co-engageable, releasable and reengageable latch means on said slip means and one of said body members for preventing such relative movement, said latch means being releasable to permit such relative movement.

2. In a well tool adapted to be disposed in a well bore: a pair of parallel tubular body members; an expander on said body members through which said body members

pass; a slip ring movable relative to said expander; slips coupled to said ring for longitudinal movement therewith and lateral movement with respect thereto, said slips engaging said expander to be expanded laterally outwardly upon relative longitudinal movement between said expander and slips in one direction; coengaging means on said slips and expander for retracting said slips upon their relative longitudinal movement in the opposite direction; and releasable and reengageable means engaging one of said body members and slip ring for preventing relative longitudinal movement between said expander and slips in said one direction.

3. In a well tool adapted to be disposed in a well bore: a pair of parallel tubular body members; means securing said body members together; an expander through which said body members pass; a slip ring movable relative to said expander and through which said body members pass; slips coupled to said ring for longitudinal movement therewith and lateral movement with respect thereto, such slips engaging said expander to be expanded laterally outwardly upon relative longitudinal movement between said expander and slips in one direction; coengaging means on said slips and expander for retracting said slips upon their relative longitudinal movement in the opposite direction; means for preventing longitudinal movement of said slip ring and slips; means for transmitting the motion of said body members to said expander to expand said slips laterally outwardly; and releasable means engaging one of said body members and slip ring for preventing relative longitudinal movement between said expander and slips in said one direction.

4. In a well tool adapted to be disposed in a well bore: a pair of parallel tubular body members; means securing said body members together; an expander through which said body members pass; a slip ring movable relative to said expander and through which said body members pass; slips coupled to said ring for longitudinal movement therewith and lateral movement with respect thereto, such slips engaging said expander to be expanded laterally outwardly upon relative longitudinal movement between said expander and slips in one direction; coengaging means on said slips and expander for retracting said slips upon their relative longitudinal movement in the opposite direction; means for preventing longitudinal movement of said slip ring and slips; normally retracted packing means through which said tubular members pass disposed between said securing means and expander for transmitting the joint motion of said securing means and body members to said expander to expand said slips laterally outwardly, movement of said securing means with said body members toward said expander expanding said packing means laterally outwardly; and releasable means engaging one of said body members and slip ring for preventing relative longitudinal movement between said expander and slips in said one direction.

5. In a well tool adapted to be disposed in a well bore: generally parallel tubular members; means securing said members together; an expander through which said body members pass; slip means engageable with and movable with respect to said expander to be expanded laterally outwardly upon relative longitudinal movement between said expander and slip means in one direction; normally retracted packing means through which said tubular members pass disposed between said securing means and expander for transmitting the joint motion of said securing means and body members to said expander to expand said slip means laterally outwardly, movement of said securing means with said body members toward said expander expanding said packing means laterally outwardly; and co-engageable, releasable means on said slip means and one of said body members for preventing such relative movement, release of said releasable means permitting such relative movement.

6. In a well tool adapted to be disposed in a well bore: a pair of parallel tubular body members; an expander on said body members through which said body members pass; a slip ring below and movable relative to said expander; slips coupled to said ring for longitudinal movement therewith and lateral movement with respect thereto, said slips engaging said expander to be expanded laterally outwardly upon downward movement of said expander with respect to said slips; co-engaging means on said slips and expander for retracting said slips upon upward movement of said expander with respect to said slips; and releasable and reengageable means engaging one of said body members and slip ring for preventing downward movement of said expander relative to said slips.

7. In a well tool adapted to be disposed in a well bore: a pair of parallel tubular body members; means securing said body members together; an expander through which said body members pass; a slip ring movable relative to said expander and through which said body members pass; slips coupled to said ring for longitudinal movement therewith and lateral movement with respect thereto, such slips engaging said expander to be expanded laterally outwardly upon downward movement of said expander relative to said slips; co-engaging means on said slips and expander for retracting said slips upon upward movement of said expander relative to said slips; means for preventing downward movement of said slip ring and slips; means for transmitting the downward motion of said body members to said expander to expand said slips laterally outwardly; and releasable means engaging one of said body members and slip ring for preventing downward movement of said expander relative to said slips.

8. In a well tool adapted to be disposed in a well bore: a pair of parallel tubular body members; means securing said body members together; an expander through which said body members pass; a slip ring movable relative to said expander and through which said body members pass; slips coupled to said ring for longitudinal movement therewith and lateral movement with respect thereto, such slips engaging said expander to be expanded laterally outwardly upon downward movement of said expander relative to said slips; co-engaging means on said slips and expander for retracting said slips upon upward movement of said expander relative to said slips; means for preventing downward movement of said slip ring and slips; normally retracted packing means through which said tubular members pass disposed between said securing means and expander for transmitting joint downward motion of said securing means and body members to said expander to expand said slips laterally outwardly, downward movement of said securing means with said body members toward said expander expanding said packing means laterally outwardly; and releasable means engaging one of said body members and slip ring for preventing downward movement of said expander relative to said slips.

9. In a well tool adapted to be disposed in a well bore: generally parallel tubular body members; means securing said members together; an expander through which said body members pass; slip means below and movable relative to said expander and engageable therewith to be expanded laterally outwardly upon downward movement of said expander along said slip means; normally retracted packing means through which said tubular members pass disposed between said securing means and expander for transmitting joint downward motion of said securing means and body members to said expander to expand said slip means laterally outwardly, downward movement of said securing means with said body members toward said expander expanding said packing means laterally outwardly; and co-engageable releasable means on said slip means and one of said body members for preventing downward movement of said expander relative to said slip means.

10. In a well tool adapted to be disposed in a well

bore: generally parallel tubular body members; an expander on said body members; slip means engageable with and movable with respect to said expander to be expanded laterally outwardly upon downward movement of said expander relative to said slip means; and co-engageable releasable and reengageable latch means on said slip means and one of said body members for preventing downward movement of said expander relative to said slip means.

11. In a well tool adapted to be disposed in a well bore: a pair of parallel tubular body members; an expander on said body members through which said body members pass; a slip ring movable relative to said expander and through which said body members pass; a connector secured to said slip ring through which said tubular body members pass; a tubular member receiving one of said body members and secured to said connector; slips coupled to said ring for longitudinal movement therewith and lateral movement with respect thereto, said slips engaging said expander to be expanded laterally outwardly upon downward movement of said expander relative to said slips; co-engaging means on said slips and expander for retracting said slips upon upward movement of said expander relative to said slips; and releasable means engaging one of said body members and slip ring for preventing downward movement of said expander relative to said slips.

12. In a well tool adapted to be disposed in a well bore: a pair of parallel tubular body members; an expander on said body members through which said body members pass; a slip ring movable relative to said expander and through which said body members pass; a connector secured to said slip ring through which said tubular body members pass; said connector having a threaded bore surrounding each of said body members; a tubular member threadedly secured in one of said bores; slips coupled to said ring for longitudinal movement therewith and lateral movement with respect thereto, said slips engaging said expander to be expanded laterally outwardly upon downward movement of said expander relative to said slips; co-engaging means on said slips and expander for retracting said slips upon upward movement of said expander relative to said slips; and releasable means engaging one of said body members and slip ring for preventing downward movement of said expander relative to said slips.

13. In a well tool adapted to be disposed in a well bore: a pair of parallel tubular body members; means securing said body members together; an expander through which said body members pass; a slip ring movable relative to said expander and through which said body members pass; a connector secured to said slip ring through which said tubular members pass; a tubular member receiving one of said body members and secured to said connector; slips coupled to said ring for longitudinal movement therewith and lateral movement with respect thereto, said slips engaging said expander to be expanded laterally outwardly upon downward movement of said expander relative to said slips; co-engaging means on said slips and expander for retracting said slips upon upward movement of said expander relative to said slips; normally retracted packing means through which said tubular body members pass disposed between said securing means and expander for transmitting downward motion of said body members to said expander to expand said slips laterally outwardly, downward movement of said securing means toward said expander expanding said packing means laterally outwardly; and releasable means engaging one of said body members and slip ring for preventing downward movement of said expander relative to said slips.

14. In a well tool adapted to be disposed in a well bore: generally parallel tubular body members; an expander on said body members; slip means engageable with and movable with respect to said expander to be expanded laterally outwardly upon relative movement between said expander and slip means in one direction; co-engageable, releasable latch means on said slip means and one of said body members for preventing such relative movement, said latch means being releasable to permit such relative movement; and a guide secured to the upper end of one of said body members and through which the other body member extends.

15. In a well tool adapted to be disposed in a well bore: a pair of parallel tubular body members; means securing said body members together; an expander through which said body members pass; a slip ring movable relative to said expander and through which said body members pass; slips coupled to said ring for longitudinal movement therewith and lateral movement with respect thereto, such slips engaging said expander to be expanded laterally outwardly upon downward movement of said expander relative to said slips; co-engaging means on said slips and expander for retracting said slips upon upward movement of said expander relative to said slips; means for preventing downward movement of said slip ring and slips; means for transmitting the joint downward motion of said securing means and body members to said expander to expand said slips laterally outwardly; releasable means engaging one of said body members and slip ring for preventing downward movement of said expander relative to said slips; and a guide secured to the upper end of one of said body members and through which the other body member extends.

16. In a well tool adapted to be disposed in a well bore: a pair of parallel tubular body members; means securing said body members together; an expander through which said body members pass; a slip ring movable relative to said expander and through which said body members pass; a connector secured to said slip ring through which said tubular members pass; a tubular member receiving one of said body members and secured to said connector; slips coupled to said ring for longitudinal movement therewith and lateral movement with respect thereto, said slips engaging said expander to be expanded laterally outwardly upon downward movement of said expander relative to said slips; co-engaging means on said slips and expander for retracting said slips upon upward movement of said expander relative to said slips; normally retracted packing means through which said tubular body members pass disposed between said securing means and expander for transmitting downward motion of said body members to said expander to expand said slips laterally outwardly, downward movement of said securing means toward said expander expanding said packing means laterally outwardly; releasable means engaging one of said body members and slip ring for preventing downward movement of said expander relative to said slips; and a guide secured to the upper end of one of said body members and through which the other body member extends.

17. In a well tool adapted to be disposed in a well bore: generally parallel tubular body members; an expander on said body members; slip means engageable with and movable with respect to said expander to be expanded laterally outwardly upon relative movement between said expander and slip means; means on one of said body members for shifting said expander in one direction upon movement of said one body member in said one direction; means on the other of said body members for shifting said slip means relatively in the opposite direction; and coengageable, releasable latch means on one of said body members and slip means for preventing relative movement of said slip means and expander to prevent outward expansion of said slip means.

18. In a well tool adapted to be disposed in a well bore: a pair of parallel tubular body members movable longitudinally with respect to each other; an expander through which said body members pass; a slip ring movable relative to said expander and through which said body members pass; slips coupled to said ring for longitudinal movement therewith and lateral movement with respect thereto, said slips engaging said expander to be expanded later-

ally outwardly upon relative longitudinal movement between said expander and slips in one direction; means for transmitting the longitudinal movement of one of said body members in one direction to said expander; means for transmitting the longitudinal movement of the other of said body members in the opposite direction to said slip ring, whereby relative longitudinal motion of said body members in opposite directions expands said slips laterally outwardly; and releasable means engaging one of said body members and slip ring for preventing such relative longitudinal movement of said body members in opposite directions.

19. In a well tool adapted to be disposed in a well bore: generally parallel tubular body members movable longitudinally with respect to each other; an expander on said body members; slip means engageable with and movable with respect to said expander to be expanded laterally outwardly upon relative movement between said expander and slip means; means for transmitting the longitudinal motion of one of said body members in one direction to said expander; means for transmitting the longitudinal motion of the other of said body members in the opposite direction to said slips, whereby relative longitudinal movement of said body members in opposite directions expand said slips laterally outwardly; and releasable means engaging said one body member and slip means for preventing movement of said body members in opposite directions.

20. In a well tool adapted to be disposed in a well bore: a pair of parallel tubular body members movable longitudinally with respect to each other; an expander through which said body members pass; a slip ring movable relative to said expander and below said expander through which said body members pass; slips coupled to said ring for longitudinal movement therewith and lateral movement with respect thereto, said slips engaging said expander to be expanded laterally outwardly upon relative downward movement of said expander and upward movement of said slips; means for transmitting the downward motion of one of said body members to said expander; means for transmitting the upward motion of the other of said body members to said slip ring, whereby downward motion of said one body member relative to said other body member expands said slips laterally outwardly; and releasable means engaging said one body member and slip ring for preventing downward movement of said one body member relative to said other body member.

21. In a well tool adapted to be disposed in a well bore: generally parallel tubular body members; normally retracted packing means through which said members pass; an expander on said body members below said packing means; slip means below said expander engageable with and movable relative to said expander to be expanded thereby laterally outwardly upon downward movement of said expander relative to said slip means; means on said body members for relatively moving said normally retracted packing means and expander downwardly of said slip means to expand said packing means and slip means outwardly; and releasable latch means on said slip means and one of said body members for preventing such relative movement, said latch means being releasable to permit such relative movement.

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