June 1, 1965 W. W. FARRAR ETAL 3,186,489

RETRIEVABLE PLUGS AND PACKERS FOR DEEP WELLS

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Fig. 1

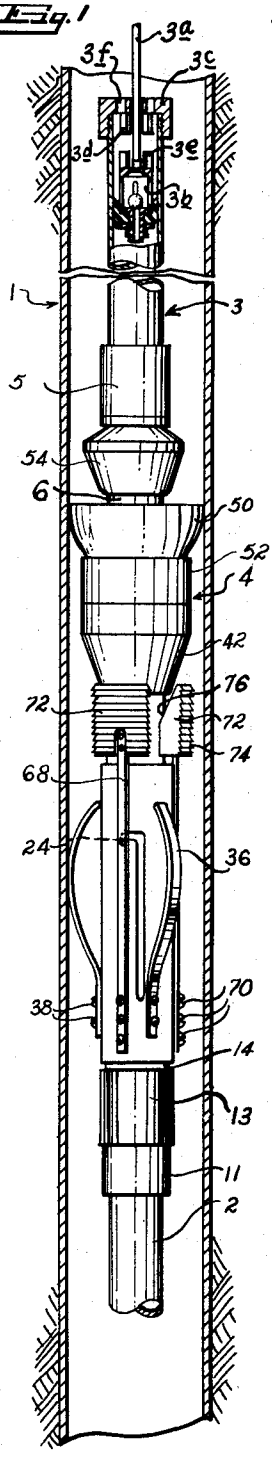


Fig. 2

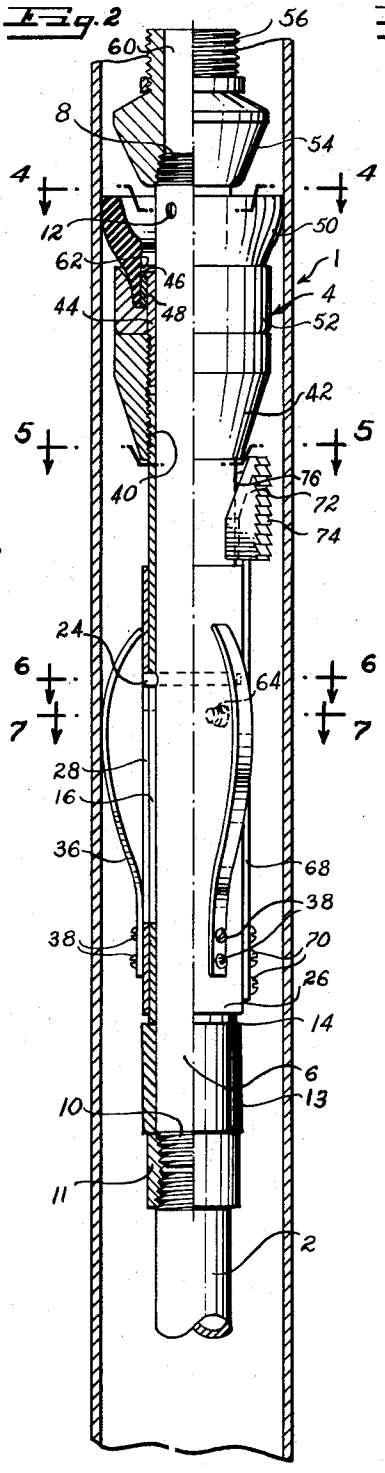
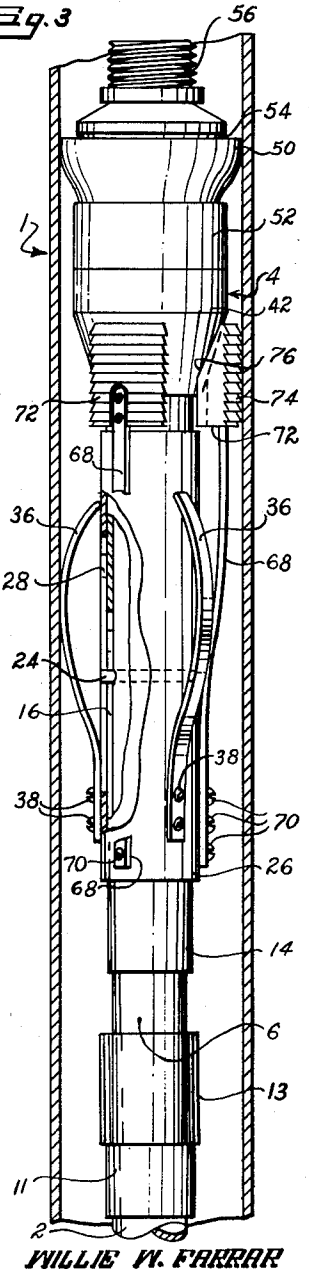


Fig. 3



WILLIE W. FARRAR
WILLIAM R. LEWIS
INVENTORS.

BY

Wayland D. Keith
THEIR AGENT

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Fig. 4

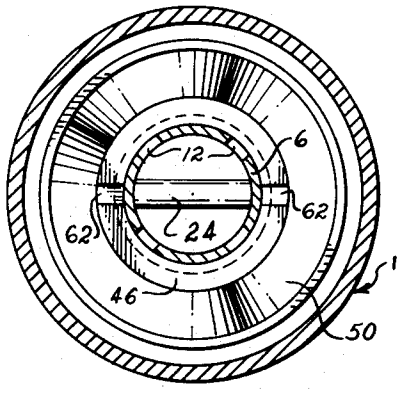


Fig. 7

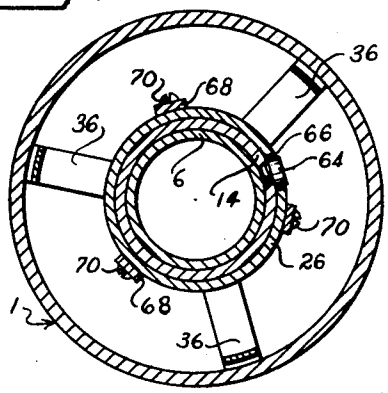


Fig. 5

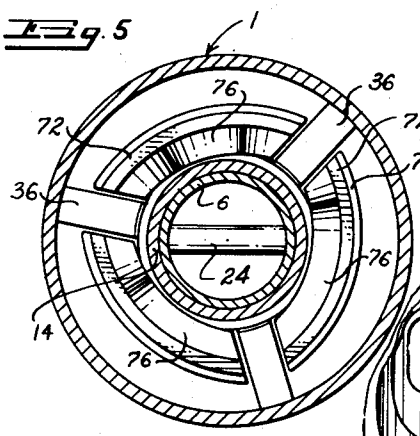


Fig. 8

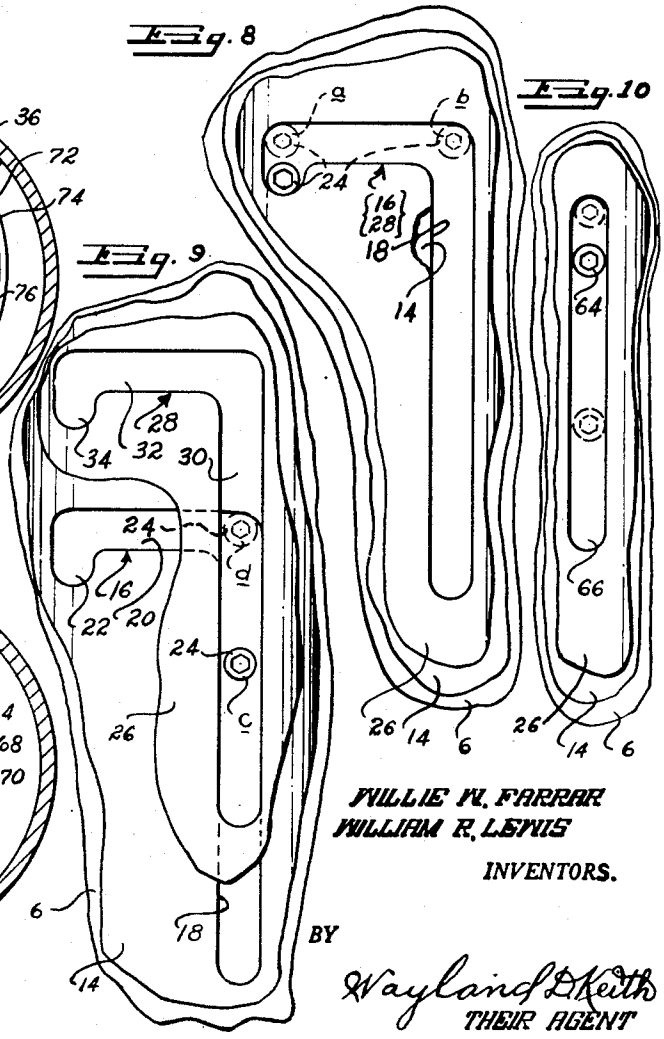
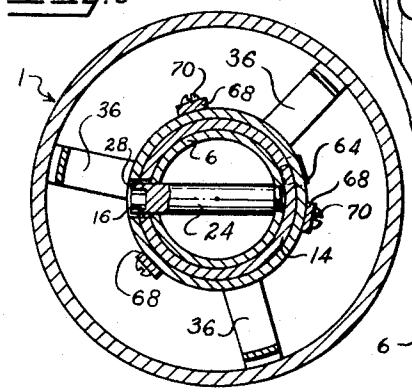


Fig. 10

Fig. 9

Fig. 6



WILLIE W. FARRAR
WILLIAM R. LEWIS
INVENTORS.

BY

Wayland D. Keith
THEIR AGENT

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RETRIEVABLE PLUGS AND PACKERS FOR DEEP WELLS

Willie W. Farrar and William R. Lewis, Wichita Falls, Tex., assignors to Totem Oil Tools, Inc., Wichita Falls, Tex., a corporation of Texas

Filed June 26, 1962, Ser. No. 205,301
3 Claims. (Cl. 166—138)

This invention relates to improvements in retrievable plugs and packers for deep wells and more particularly to packers and plugs which can be run into the well on tubing or rods and set at any desired depth within the length of the casing, without having an anchor member to engage the bottom of the well to cause the setting thereof.

Various packers and plugs have been proposed heretofore but these, for the most part, had anchors or an extension on the lower end thereof to engage the bottom of the well, while others had friction memebrs or drag springs to enable the setting of the packer anywhere within the length of the casing. Many of these devices were not load bearing to the extent that they would support a string of tubing or the like thereabove, and others were of a character which did not permit the draining of the fluid above the packer when it was desired to remove the packer from the well.

The present invention embodies a packer which can be run into the casing of a cased well to cause the slips of the packer or plug to engage the casing at any desired level within the well and then, by further manipulation of the tool, the packer element may be sealed in fluid tight relation with respect to the tubing and casing, thereby preventing the intermixing of the fluids above and below the packer, yet enabling the release of the fluid above the packer prior to disengaging the slips when the packer or plug is to be removed from the well.

An object of this invention is to provide a packer or plug for well casing which will expand to provide a seal between the casing and the tubing to prevent passage of fluid into the annulus formed between the outer diameter of the tubing and the inner diameter of the casing.

Another object of the invention is to provide a packer or plug for a well casing which is easy to set and easy to retrieve without having to drill up the packer or plug, should the operator desire to remove the packer or plug from the casing to enable the serving of the well at a point below the packer.

Still another object of the invention is to provide a packer or plug which is simple in construction, easy to operate, and which may be readily removed from a well by simple manipulations.

A preferred embodiment of the invention is shown in the accompanying drawings in which like reference characters designate like parts in the several views thereof, in which:

FIG. 1 is a longitudinal sectional view through a well, showing the packer or plug in elevation within the well, with the slips being out of engagement with the well casing;

FIG. 2 is a view similar to FIG. 1 but with a quarter section of the packer or plug within the well casing being cut away;

FIG. 3 is a view similar to FIG. 1, but showing the slips in engaged position within the well casing, and showing an elastomer packer element in expanded condition against the inner wall of the casing to form a seal between the casing and the tubing;

FIG. 4 is an enlarged sectional view taken on the line 4—4 of FIG. 2, looking in the direction indicated by the arrows;

FIG. 5 is an enlarged sectional view taken on the line 5—5 of FIG. 2, looking in the direction indicated by the arrows;

FIG. 6 is an enlarged sectional view taken on the line 6—6 of FIG. 2, looking in the direction indicated by the arrows;

FIG. 7 is an enlarged sectional view taken on the line 7—7 of FIG. 2, looking in the direction indicated by the arrows;

FIG. 8 is an enlarged fragmentary view of the inverted J-slots and pin in position to maintain the slips in retracted position and the packer element in unexpanded condition while going into the well casing or coming out of the well casing;

FIG. 9 is a view similar to FIG. 8 but showing the inverted J-slots and complementary members as they appear when the slips are in engagement with the well casing and when the packer is in sealing relation between the tubing and the casing; and

FIG. 10 is an enlarged, fragmentary elevational view of a guide slot and pin within the packer sleeve to maintain the two outer sleeves against relative rotation with respect to each other.

With more detailed reference to the drawing, the numeral 1 designates generally a well casing having a casing pump therein, which is designated generally by the numeral 3. The lower end of casing pump 3 is connected by a coupling 5 to the upper end of a retrievable packer or bridge plug designated generally at 4. The lower end of the packer or bridge plug 4 has a tubing 2 extending downward therefrom to a point below the level of the fluid to be pumped.

The casing pump 3 has a pump rod 3*a* therein, which rod has a plunger and valve assembly 3*b* on the lower end thereof. The cylinder of the pump 3 is threaded at the top and has a cap 3*c* thereon, which cap has downwardly extending jaws 3*d*, which jaws are adapted to complementally engage jaws 3*e* on the upper end of plunger 3*b*, when the plunger 3*b* is at the uppermost point of travel within the cylinder of the pump 3. The coupling 5 has a conventional standing or check valve positioned therein in a manner well known in the art of pumps. The jaws 3*d* and the jaws 3*e* are interengageable to perform certain functions in setting and removing the packer from the well, as will be more fully brought out hereinafter.

The packer 4 has an inner tubular member 6 which is screw threaded, as indicated at 8 and 10, at the upper end and lower end thereof, respectively. A coupling 11 connects the lower end of the tubular member 6 to the upper end of the tubing 2 which is positioned below the packer 4. The upper end of the tubular member 6 has drain holes 12 formed therein, as will best be seen in FIGS. 2 and 4.

A first sleeve 14, which has an inverted J-slot 16 formed in a side thereof, surrounds tubular member 6 on the lower end thereof in sliding relation therewith, as will best be seen in FIG. 3. A second sleeve 26, which has an inverted J-slot 28 formed in a side thereof, surrounds first sleeve 14. The J-slot 28 is complementary to the J-slot 16, formed in the tubular sleeve 14, when the sleeves are in one position. The second sleeve 26 has a longitudinal slot 65 formed in a side thereof, which second sleeve 26 is fitted on the first sleeve 14. A pin 64 is screw-threaded into the first sleeve 14 and projects into longitudinal slot 66 in second sleeve 26 so as to permit limited relative, longitudinal, sliding movement of the first sleeve 14 and second sleeve 26. The sleeves 14 and 26 are free to move through a limited arcuate movement about the axis of tubular member 6 when the respective J-slots 16 and 28 are in register and are laterally aligned with pin

24 as shown in positions as indicated in dashed outline at *a* and *b*, as indicated in FIG. 8, and are free to slide longitudinally when the pin 24 is in aligned relation with longitudinal portions 18 and 30 of the respective J-slots 16 and 18.

A tubular spacer member 13 is slid over tubular member 6 so as to be positioned intermediate lower ends of first and second sleeves 14 and 26 and the upper end of coupling 11. When going into or coming out of the casing 1 of a well, the first tubular sleeve 14 and the second tubular sleeve 26 are supported on tubular spacer member 13, when the pin 24 is within lateral portions 20 and 32 of the respective inverted J-slots 16 and 28, as shown at *a* and *b* in FIG. 8, so that the slotted portions 20 and 32 of inverted J-slots 16 and 28 respectively will be aligned with pin 24 so that the first tubular sleeve 14 and the second tubular sleeve 26 may be moved arcuately, as is best illustrated in FIGS. 2 and 8. With the pin 24 screw threaded into tubular member 6, the lateral portions 20 and 32 of the respective inverted J-slots will receive the pin 24 thereinto in guided relation. The pin 24 in tubular member 6 will prevent relative longitudinal movement between the tubular member 6 and the first and second tubular sleeves 14 and 26, until it is desired to release the mechanism, whereupon, by aligning the pin 24 and the tubular member 6 with longitudinal slots 18 and 30 in the first and second sleeves 14 and 26, respectively, the sleeves 14 and 26 will be released for longitudinal sliding movement with respect to tubular member 6, whereupon, as tubular member 6 moves downward, the drag springs 36 will retard the movement of second sleeve 26 on which toothed slips 72 are resiliently mounted, thereby causing the toothed slips to be held relative to casing 1 by the downward movement of the conical face of member 42, which will urge the toothed slips 72 outward into engagement with the inner diameter of casing 1, which will arrest and support tubular sleeve 26 therein. The coupling 11 will support the tubular spacer member 13 thereon which in turn will support first sleeve 14. When the packer is seated in the well casing, the tubular member 6 will be moved downward relative to first sleeve 14 to a position as shown in FIG. 3, and it will so remain as long as the packer is seated in the well casing. However, upon upward movement of the tubular member 6, preparatory to removing the packer from the well, the upper end of tubular spacer member 13 will engage the lower end of first sleeve 14 to enable the pull to be transmitted from the threaded member 56 directly to the tubular member 6, thereby relieving the pins 24 and 64 of strain and the possibility of shearing these pins if an excessive pull is necessary to remove the packer from the well.

A slot, designated generally at 16, is formed in sleeve 14 and is of the shape of an inverted J, with the elongated straight portion 18, the lateral portion 20 and a recessed lock portion 22. The tubular member 6 has a pin 24 screwthreaded thereinto, which pin 24 extends across tubular member 6 and out through inverted J-slot 16, in first sleeve 14 and is in sliding relation within slot 16.

A second sleeve 26 has an inverted J-slot, designated generally by the numeral 28, formed therein, which is similar in shape to J-slot 16, and is adapted to be in complementary relation with J-slot 16 when said sleeves are in one position with respect to each other. The J-slot 28 has an elongated portion 30, a lateral portion 32 and a recessed locking portion 34. The pin 24 extends through sleeves 26 and 14 and through the wall of tubular member 6, thence transversely across tubular member 6 to threadably engage the opposite wall of the tubular member 6 but does not extend outwardly therefrom, as will best be seen in FIGS. 2 and 6, so as to enable the first sleeve 14 to be received by the tubular member 6 for limited, longitudinal sliding movement with respect thereto, and for limited rotational movement with respect to tubular member 6. The second sleeve 26 is mounted on

first sleeve 14 in sliding relation with respect thereto and is connected with toothed slips 72 to engage the inner wall of casing 1 upon relative movement between the first sleeve 14 and the second sleeve 26.

When the J-slots 16 and 28 are in the position as shown in FIG. 8, the outwardly extending pin 24 extends from tubular member 6 outward therethrough and is in register with the slots 16 and 28, the purpose of which will be more fully explained hereinafter.

The sleeve 26 has resiliently pressed members 36 secured thereto at spaced intervals therearound by screws 38, which resilient members, in the present instance, are shown to be resilient leaf type springs which are curved inwardly toward each end from the point which is in contact relation with the well casing. There are preferably three of these resilient members secured to sleeve 26 so as to provide proper friction and to centralize the packer within the casing 1, the purpose of which drag springs will be more fully brought out hereinafter.

The sleeve 14 has screw threads 40 on the end thereof, which threads complementally engage internal screw threads in the lower end of the axial opening in slip cone 42; the slip cone 42 is also internally screw threaded at the upper end to threadably receive a packer locking sleeve 44 which is externally screw threaded at the lower end thereof and has an outturned flange 46 at the upper end thereof to engage the metal ring 48 which is bonded to the elastomer packer element 50. Follower cup 52 surrounds packer locking sleeve 44 and is adapted to receive the lower end of elastomer packer element 50 therein, to which the metallic ring 48 is bonded, and is complementally contoured to retain the lower end of the packer element therein.

A packer expanding cone 54 is screw threaded to complementally engage the screw threaded end 8 of tubular member 6 and is positioned so, when the tubular member 6 is in one position with respect to sleeve 14 and packer locking sleeve 44, the packer engaging cone 54 will be a spaced distance away from elastomer packer element 50, which will place the drain holes 12 in tubular member 6 in communication with the casing 1 above the packer 4 to drain the fluid to a point therebelow. The upper end of the packer expanding cone 54 is screw threaded, as indicated at 56, to threadably receive the pipe coupling 5 to couple the casing pump 3 with the packer. The casing expanding cone 54 has an opening 60 formed therethrough so as to form a continuous conduit from casing pump 3 to tubular member 6 and thence to tubing 2 below the packer 4.

The packer locking sleeve 44, with the outturned flange 46 thereon, serves to hold the elastomer packer element 50 and the packer follower cup 52 in binding relation with the upper face of the slip expanding cone 42. Transverse slots 62 are formed in the upper face of outturned flange 46 to enable a special spanner wrench to fit thereinto to enable the assembly and disassembly of elastomer packer element 50 onto the upper end of the packer 4.

The first sleeve 14 and the second sleeve 26 are held against relative rotational movement by a screw threaded pin 64 which passes through a slot 66 in the second sleeve 26 and is screw threaded into a hole in the first sleeve 14, as will best be seen in FIGS. 2, 7, and 10.

The screw threaded pin 64 permits limited longitudinal sliding movement between first sleeve 14 and second sleeve 26 so as to maintain J-slots 16 and 28 in position to be in register when the pin 64 is moved to the uppermost point of travel, however, the pin 64 does not extend into binding relation with tubular member 6, therefore, sleeve 14 is freely slidable longitudinally with respect to tubular member 6.

The second sleeve 26 also has resilient slip arms 68 secured thereto which are spaced circumferentially therearound, and are in spaced, circumferential relation to resiliently pressed members 36. The slip arms 68 are secured to the second or outer sleeve 26 by screws 70, which

arms extend upward and have casing engaging slips 72 secured thereon, which slips 72 have teeth 74 on the respective arcuate peripheral sides thereof, with a tapered surface 76 on each inner face, which tapered surfaces 76 are adapted to engage the taper on slip expanding cone 42 to urge the slips 72 outward from the position as shown in FIGS. 1, 2, and 5, to that shown in FIG. 3 to engage the inner wall of casing 1.

Operation

The present packer or bridge plug 4 can be used on the lower end of a casing pump 3, which casing pump is lowered into the well on an elongated support member, such as a string of pump rods 3*a*.

To set the packer 4 within the well casing 1, at a predetermined elevation above the bottom thereof, and without an anchor pipe extending to and being in contact with the bottom of the well, a length of tubing 2, if desired, may be secured to coupling 11 on the lower end of inner tubular member 6 and with the casing pump 3 having the coupling 5 thereof threadably engaging the threads 56 of packer expander cone 54, and with the pump rods 3*a* extending through cap 3*c* of casing pump 3 and being connected with plunger 3*b* therein, the packer 4 is ready to be lowered into the well. Upon lowering the casing pump 3 downward into casing 1, the jaws 3*e* on the upper end of plunger 3*b* will move into engagement with jaws 3*d* on the lower side of cap 3*c* to lock the plunger 3*b* against relative rotation with respect to cap 3*c*, thereby enabling the casing pump 3 and the inner tubular member 6 of packer 4 to be rotated a limited amount.

When the packer 4 is lowered into the casing to the desired depth within the well, and with the pin 24 being in the position as indicated at *a* in FIG. 8, the pump rods 3*a* are rotated counter-clockwise until tubular member 6 rotates pin 24 from the position as shown at *a* to the position as shown at *b* therein, and since the drag springs 36, which are secured to outer sleeve 26, are in frictional engagement with the outer walls of casing 1, which outer sleeve 26, as well as sleeve 14 will be maintained against rotation, and since sleeves 14 and 26 are maintained against relative rotation by outwardly extending screw 64, which screw is threaded into sleeve 14 and extends out through slot 66 in sleeve 26, these sleeves are free to slide longitudinally relative to each other.

With the sleeves 26 and 14 in the relation as shown in FIG. 8, and with the pin 24 in the position as indicated at *b*, the rods 3*a* are lowered, whereupon, the inner tubular member 6 and pin 24 will move downward from the position as shown at *b*, FIG. 8, within slots 18 and 30 in the respective sleeves 14 and 26, to the position indicated at *c* in FIG. 9, and with the resilient spring members 36 maintaining sleeves 14 and 26 against downward movement, the taper of slip engaging cone 42 will move into engagement with the tapered surfaces 76 of slips 72 which will urge these outward from the position as shown in FIGS. 1 and 2 to the position as shown in FIG. 3, which will prevent further downward movement of sleeves 14 and 26. Whereupon, the rods 3*a*, casing pump 3, and packer expander cone 54 and inner tubular member 6 are lowered downward in sliding relation within sleeve 14, whereupon, the tapered surface of cone 54 will come into wedging engagement with the interior of elastomer packer element 50 which will urge the lips of packer element 50 outward into sealing relation with the wall af casing 1. In this manner, the weight of casing pump 3, packer 4 and tubing 2 is supported in fixed relation within the casing 1 without the necessity of an anchor pipe extending to the bottom of the well.

The plunger 3*b* of the casing pump 3 may then be lowered into the casing pump 3 and the rod 3*a* connected to a suitable actuating element (not shown) at the top of the well, to actuate the plunger 3*b* within the casing pump 3 to pump liquid from a point below the packer 4 upward therethrough and out through holes 3*f* in cap 3*c* into the casing 1 above elastomer packer sealing element 50, and as the casing 1 fills with liquid, the slips 72 prevent the movement of packer 4 downward, whereupon, when the casing 1 is filled with liquid, it will be pumped out at the upper end thereof in a manner well understood in the art of casing pumps.

To remove the casing pump 3, packer 4 and tubing 2 from the well, the rods 3*a* are moved upward until jaws 3*e* and jaws 3*d* interengage and the plunger 3*b* is in contact relation with cap 3*c*, whereupon, the rods are movel upward until packer expander cone 54 disengages from the elastomer packer element 50 which will cause holes 12, within inner tubular member 6, to move out of sliding engagement with sleeve 44, which will place these holes 12 in communication with the fluid above elastomer packer element 50. This will permit fluid, such as oil, water and the like, to pass through holes 12 into inner tubular member 6, thence downward until the inner tubular member and the casing 1, below the packer 4 are filled with fluid. Upon the filling of the casing 1 with fluid above and below the packer 4 the pressure within the casing 1 will become equalized, and continued pull on pump rod 3*a* will move pin 24 from the position as indicated at *c*, in full outline in FIG. 9, to the position as indicated in dashed outline at *d*, FIG. 9, whereupon, continued upward movement of the pump rod 3*a* will cause the sleeve 14, upon which slip expander cone 42 is mounted, to be lifted so the tapered portion of slip cone 42 will move out of engagement with the tapered surfaces 76 of slips 72, and with the friction spring elements 36 maintaining sleeve 26 against upward movement during this operation, the continued upward movement of the rods 3*a* will move the pin 24 and the sleeve 26 to the position indicated at *b* in dashed outline in FIG. 8, which will cause the release of the slips, so the slips will move into the position as shown in FIG. 2. Whereupon, the pump rods 3*a* are turned clockwise, which will rotate the tubular member 6, sleeve 14 and pin 24 so that the pin 24 will move from the position as indicated at *b*, FIG. 8, to that indicated at *a* in dashed outline in FIG. 8. As the pin 24 moves from the position as indicated at *d* in FIG. 9 to the position as indicated at *b* in FIG. 8, pin 64 will move from the lower-most position to the upper-most position, as shown in FIG. 10, and the pin will be in abutting relation with the top of slot 66 within sleeve 26 upon upward movement of rods 3*a*, pin 24 and pin 64 will be in contact relation with the upper-most portion of the respective slots.

Upon further upward pull being exerted on pump rod 3*a*, the pin 24 will move from the position as indicated at *a* in FIG. 8 to the position as indicated in full outline therein, within the recessed locking portions 22 and 34 of the respective J-slots 16 and 28, as these slots will be in register when the movements described have been completed. With the slips disengaged, and with the outwardly expanding pressure having been removed from elastomer packer element 50, the rods will be moved upward, which will cause the outer sleeve 26 on packer 4 to be moved in unison with tubular member 6 and sleeve 14, as well as with the packer elements and tubing 2 until the packer is removed from the well.

Having thus clearly shown and described the invention, what is claimed as new and desired to be secured by Letters Patent is:

1. A retrievable bridge plug adapted to be supported on an elongated support member for longitudinal and arcuate movement in the bore hole of a cased well, which bridge plug comprises:

(a) an inner tubular member adapted to be connected to said elongated support member for longitudinal and arcuate movement therewith upon longitudinal and arcuate movement of said elongated support member,

(b) a first sleeve fitted on and surrounding said inner tubular member for limited sliding relation and being rotatable, within limits, on said inner tubular member,

(1) said first sleeve having an inverted J-slot formed therein,

(c) a second sleeve fitted on and surrounding said first sleeve for limited longitudinal sliding movement relative thereto and for relative arcuate movement therewith about the axis of said inner tubular member and for relative independent longitudinal movement with respect to said inner tubular member,

(1) said second sleeve having an inverted J-slot formed therein which is complementary to said J-slot in said first sleeve, when said sleeves are in one position,

(2) said second sleeve having a longitudinal slot formed therein,

(d) a pin fixedly secured to said first sleeve and extending into said longitudinal slot in said second sleeve to limit the relative sliding movement between said first and said second sleeves and to permit relative arcuate movement therebetween,

(e) friction members mounted on said second sleeve exteriorly thereof to frictionally engage the inner wall of the casing of the cased well to retard movement of said second sleeve relative to said first sleeve when said bridge plug is moved longitudinally in the casing of the cased well,

(f) a slip expander cone mounted on and secured to the upper end of said first sleeve and having a downwardly and inwardly tapered face thereon,

(g) resilient arms mounted on said second sleeve exterior thereof and extending upward therefrom, and being spaced around the periphery of said second sleeve,

(h) a toothed slip member mounted on the upper end of each said arm and having an inwardly and downwardly tapered surface on the inner face thereof to complementally engage the tapered surface of said slip expander cone to move said slip members, upon relative movement of said tapered slip expander cone with respect to said slip members,

(i) a pin fixedly secured to said inner tubular member and extending out through said inverted J-slot in said first sleeve and into said inverted J-slot in said second sleeve to permit relative longitudinal sliding movement between said first sleeve, mounting said slip expander cone, and said second sleeve, mounting said toothed slip members thereon, when said pin is in one position relative to said inverted J-slots in said first and second sleeves,

(1) said pin, secured to said inner tubular member and extending through said inverted J-slots in said first and second sleeves, being adapted to retain said toothed slip members out of engagement with the inner wall of the casing of the cased well, when said pin is in another position in said inverted J-slots,

(2) said inner tubular member and said first sleeve being adapted to move downward relative to said second sleeve, which has said expander cone thereon, when said friction members are in engagement with the inner wall of the casing of the cased well, so said tapered surfaces of said slip members will be retained against downward movement relative to said slip expander cone, so said slip expander cone will engage the tapered face of each said slip member to urge said slip members outward into binding engagement with the inner wall of the casing of said cased well.

(j) an annular elastomer packer element secured to said first sleeve above said slip expander cone and being movable therewith,

(k) a downwardly and inwardly tapered packer expander cone mounted on the upper end of said inner tubular member and being movable therewith to engage said elastomer packer element when said packer expander cone is in one position,

(1) said packer expander cone, mounted on said inner tubular member, being adapted to move into engagement with said elastomer packer element, upon downward movement of said elongated support member, so as to form a seal between said inner tubular member and the inner wall of the casing of the cased well.

2. A retrievable bridge plug adapted to be supported on an elongated support member for longitudinal and arcuate movement in the bore hole of a cased well, which bridge plug comprises;

(a) an inner tubular member adapted to be connected to said elongated support member for longitudinal and arcuate movement therewith upon longitudinal and arcuate movement of said elongated support member,

(3) said inner tubular member having a transverse hole formed therethrough, a portion of which hole is screwthreaded,

(b) a first sleeve fitted on and surrounding said inner tubular member in limited sliding relation and being rotatable, within limits, on said inner tubular member,

(1) said first sleeve having an inverted J-slot formed therein, which inverted J-slot has interconnecting lateral and longitudinal portions.

(c) a second sleeve fitted on and surrounding said first sleeve for limited sliding movement relative thereto and for relative arcuate movement therewith about the axis of said inner tubular member and for relative independent longitudinal movement with respect to said inner tubular member,

(1) said second sleeve having an inverted J-slot formed therein which is complementary to said inverted J-slot in said first sleeve, when said sleeves are in one position,

(2) said second sleeve having a longitudinal slot formed therein.

(d) a pin fixedly secured to said first sleeve and extending into said longitudinal slot in said second sleeve to limit the relative sliding movement between said first and said second sleeves and to permit relative arcuate movement therebetween,

(e) friction members mounted on said second sleeve exteriorly thereof to frictionally engage the inner wall of the casing of the cased well to retard movement of said second sleeve relative to said first sleeve when said bridge plug is moved longitudinally in the casing of the cased well,

(f) a slip expander cone mounted on and secured to the upper end of said first sleeve and having a downwardly and inwardly tapered face thereon,

(g) resilient arms mounted on said second sleeve exterior thereof and extending upward therefrom, and being spaced around the periphery of said second sleeve,

(h) a toothed slip member mounted on the upper end of each said arm and having an inwardly and downwardly tapered surface on the inner face thereof to complementally engage the tapered surface of said slip expander cone to move said slip members, upon relative movement of said tapered slip expander cone with respect to said slip members,

(i) a screwthreaded pin extending through said transverse hole in said inner tubular member and threadably engaging the screwthreaded portion thereof, which pin extends out through said inverted J-slot in said first sleeve and into said inverted J-slot in said second sleeve to permit relative longitudinal sliding movement of said first sleeve, mounting said slip ex-

pander cone, and said second sleeve, mounting said toothed slip members thereon, when said pin is in aligned relation with the longitudinal portion of said inverted J-slots in said first and second sleeves,

(1) said pin, secured to said inner tubular member and extending through said inverted J-slots in said first and second sleeves, being adapted to retain said toothed slip members out of engagement with the inner wall of the casing of the cased well, when said pin is positioned within the lateral portions of said inverted J-slots in said first and second sleeves,

(2) said inner tubular member and said first sleeve being adapted to move downward relative to said second sleeve, when said pin in said inner tubular member is in aligned relation with said longitudinal portions of said inverted J-slots in said first and second sleeves,

(3) said inner tubular member and said first sleeve adapted to move downward when said pin is in alignment with the longitudinal portions of said inverted J-slots to move said slip expander cone on said first sleeve into engagement with said tapered surfaces of said slip members when said friction members on said second sleeve are in engagement with the inner wall of the casing of the cased well, so that the tapered surfaces of said slip members will be moved into engagement with the inner wall of the casing of the cased well to prevent said slip moving downward upon engagement of said slip expander cone therewith,

(j) an annular elastomer packer element secured to said first sleeve above said slip expander cone and being movable therewith,

(k) a downwardly and inwardly tapered packer expander cone mounted on the upper end of said inner tubular member and being movable therewith to engage said elastomer packer element when said packer expander cone is in one position,

(1) said packer expander cone, mounted on said inner tubular member, being adapted to move into engagement with said elastomer packer element, upon downward movement of said elongated support member, so as to form a seal between said inner tubular member and the inner wall of the casing of the cased well.

3. A retrievable bridge plug adapted to be supported on an elongated support member for longitudinal and arcuate movement in the bore hole of a cased well, which bridge plug comprises;

(a) an inner tubular member adapted to be connected to said elongated support member for longitudinal and arcuate movement therewith upon longitudinal and arcuate movement of said elongated support member,

(b) a first sleeve slidably fitted on and surrounding said inner tubular member in limited sliding relation and being rotatable, within limits, on said inner tubular member,

(1) pin means on said inner tubular member,

(2) said first sleeve having an inverted J-slot formed therein, which slot receives said pin means therein to limit the relative longitudinal sliding and arcuate movement between said inner tubular member and said first sleeve,

(c) a second sleeve slidably fitted on and surrounding said first sleeve,

(1) said second sleeve having an inverted J-slot formed therein which is complementary to the inverted J-slot formed in said first sleeve, which J-slot in said second sleeve receives said pin means therein to limit the longitudinal sliding movement of said second sleeve relative to said first sleeve and for relative arcuate movement therewith about the axis of said inner tubular member for relative independent longitudinal movement with respect to said inner tubular member,

(2) said pin means on said inner tubular member, which is engageable with said first sleeve, also being engageable with the inverted J-slot in said second sleeve to limit the relative longitudinal and arcuate movement between the inner tubular member and said second sleeve,

(d) a further pin means on said first sleeve,

(1) said second sleeve having a longitudinal slot formed therein, which slot receives said further pin means therein to interconnect said second sleeve with said first sleeve to permit relative limited longitudinal movement therebetween and to prevent relative arcuate movement therebetween,

(e) friction members mounted on said second sleeve exteriorly thereof to frictionally engage the inner wall of the casing of the cased well to retard movement of said second sleeve relative to said first sleeve when said bridge plug is moved longitudinally within said casing of the cased well,

(f) a slip expander cone mounted on and secured to the upper end of said first sleeve and having a downwardly and inwardly tapered surface thereon,

(g) resilient arms mounted on said second sleeve exterior thereof and extending upward therefrom, and being spaced around the periphery of said second sleeve,

(h) a toothed slip member mounted on the upper end of each said arm and having an inwardly and downwardly tapered surface on the inner face thereof to complementally engage the tapered surface of said slip expander cone to move said slip members, upon relative movement of said tapered slip expander cone with respect to said slip members,

(1) said pin means on said inner tubular member and engageable in the inverted J-slots of said first and second sleeves, permitting relative longitudinal sliding movement of said toothed slip members into engagement with the inner wall of the casing of the cased well, when said pin means is in one position relative to said inverted J-slots, said pin means, mounted on said inner tubular member and engageable in the inverted J-slots of said first and second sleeves retaininig said toothed slip members associated with said second sleeve out of engagement with the inner wall of the casing of the cased well, when said pin means is in another position relative to said inverted J-slots,

(2) said inner tubular member and said first sleeve adapted to move downward relative to said second sleeve, which first sleeve has said slip expander cone thereon, when said friction members on said second sleeve are in engagement with the inner wall of the casing of the cased well so said tapered surfaces of said slip members will be retained against the downward movement relative to said slip expander cone, so said slip expander cone on said first sleeve will engage the tapered face of each said slip member to urge said slip members outward into binding engagement with the inner wall of the casing of the cased well,

(i) an annular elastomer packer element secured to said first sleeve above said slip expander cone and being movable therewith,

(j) a downwardly and inwardly tapered packer expander cone mounted on the upper end of said inner tubular member and being movable therewith to engage said elastomer packer element when said packer expander cone is in one position,

(1) said packer expander cone, mounted on said inner tubular member, being adapted to move into engagement with said elastomer packer element, upon downward movement of said elongated support member, so as to form a seal between the inner tubular member and the inner wall of the casing of the cased well.

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CHARLES E. O'CONNELL, *Primary Examiner.*