Nov. 14, 1967 M. P. LEBOURG 3,352,362

WELL PACKER APPARATUS

Filed Dec. 21, 1964 2 Sheets-Sheet 1

Fig. 1

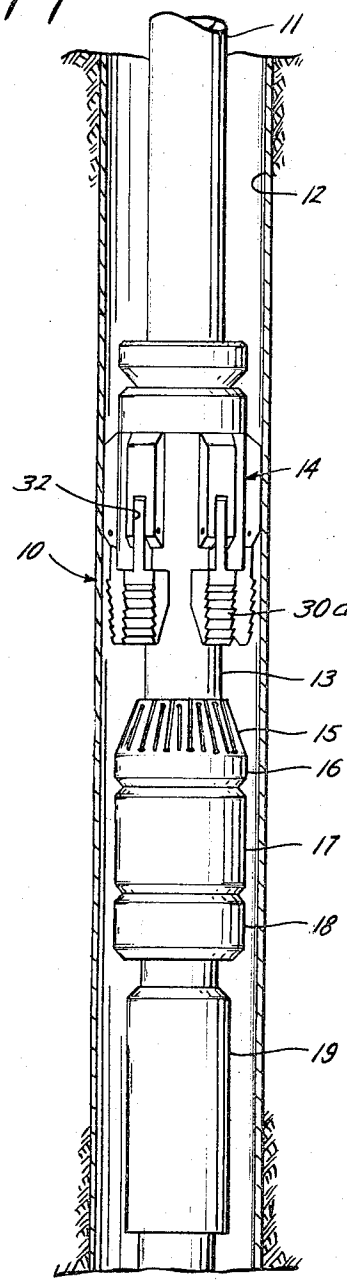


Fig. 2

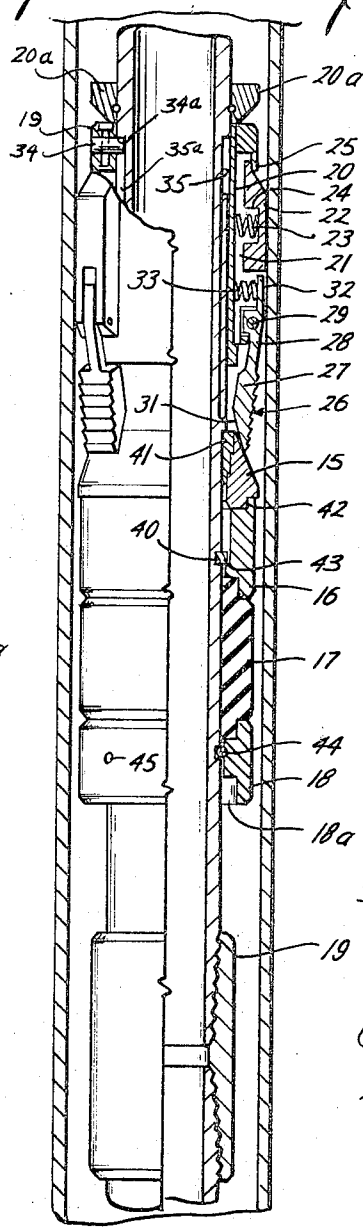
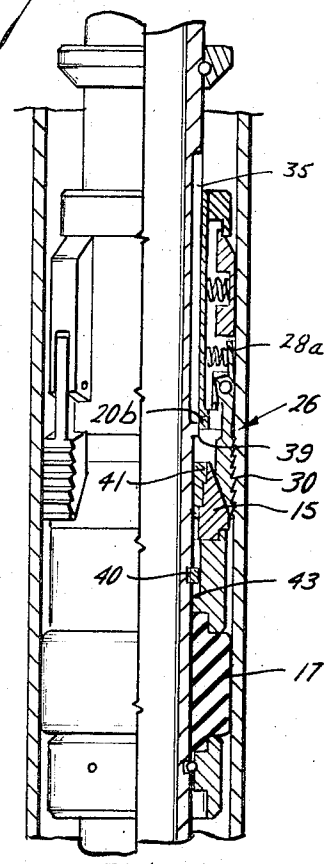


Fig. 3



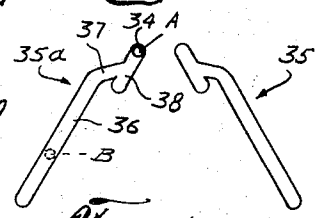


Fig. 4

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Nov. 14, 1967 M. P. LEBOURG 3,352,362

WELL PACKER APPARATUS

Filed Dec. 21, 1964 2 Sheets-Sheet 2

Fig. 6

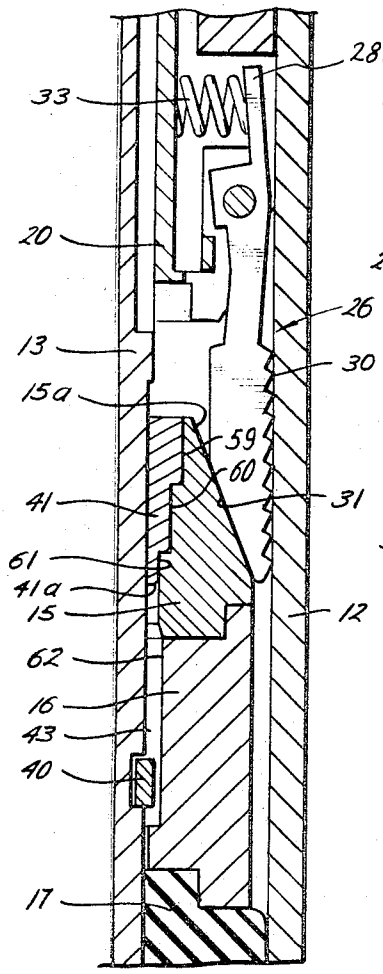


Fig. 7

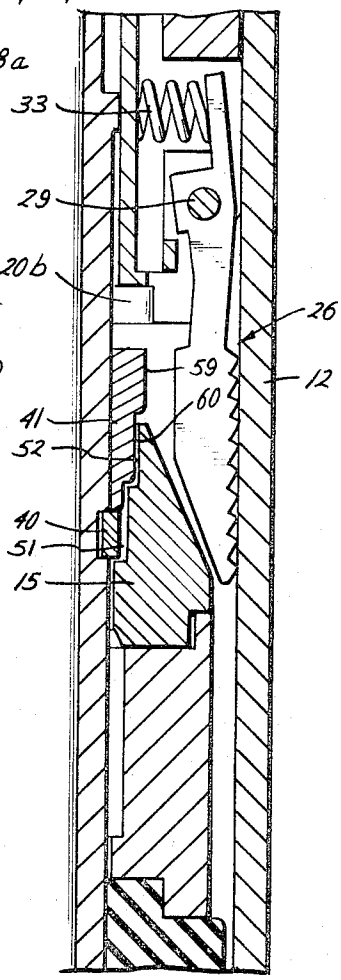


Fig. 8

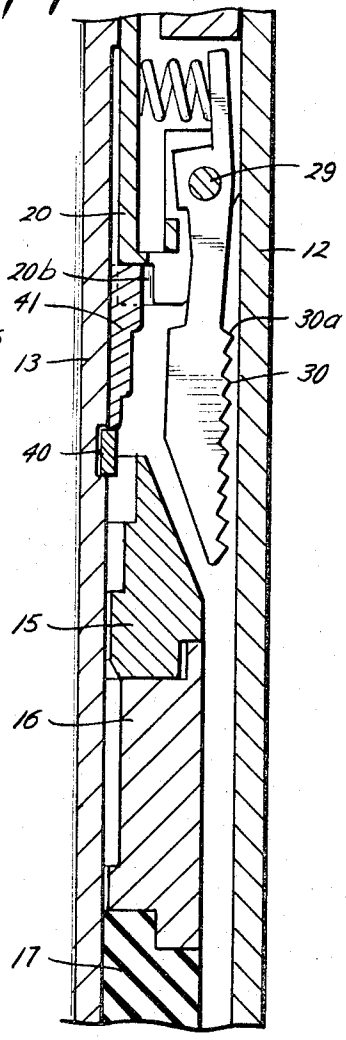
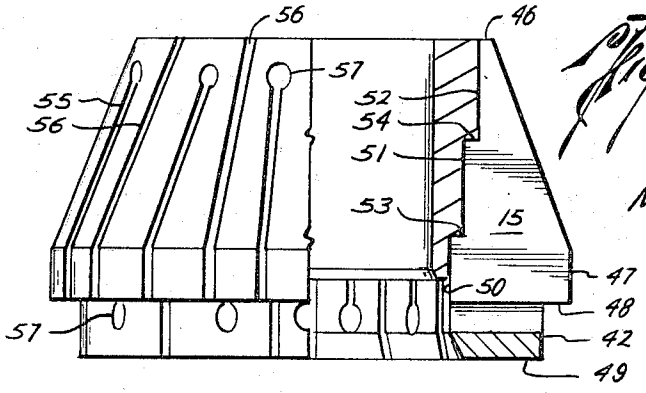


Fig. 5



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WELL PACKER APPARATUS

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15 Claims. (Cl. 166—140)

ABSTRACT OF THE DISCLOSURE

A well packer apparatus includes a body and anchor means for anchoring against movement in a well conduit. The anchor means includes slips shiftable outwardly of the body by an expander which is collapsible, the expander being supported by a support ring in expanded condition for actuating the slips. The slips can be shifted outwardly by the expander in response to movement of the body relative to the slips in one longitudinal direction and can further be released in response to relative movement of the body in the same one direction by a member on the body which engages the support ring to disable it, thereby permitting collapse of the expander and inward retraction of the slips.

This invention relates to well tools and is particularly concerned with tools such as well packers and bridge plugs which are adapted to be set in the well bore for a time and then retrieved.

Sometimes, after a retrievable well tool has been set in the well bore for a time one or more of the parts may malfunction when its retrieval is attempted. Such malfunction can occur for various reasons such as corrosion freezing or binding of moving parts.

Such well tools are exemplified by tubing-type retrievable packers adapted to be set in tension. This type of packer is comprised of an upper slip and drag block assembly in combination with a lower packer element. The packer is set by first unlocking a jaying mechanism and then applying tension to the tubing which operates a slip expanding mechanism to sequentially set the slips into the well casing and expand the packer element. The expanded packer element seals off an annulus between the casing and a mandrel of the packer. At some later time the packer can be retrieved by lowering the tubing which sequentially contracts the packer element and unlocks the slips from the casing. The packer is then locked in an inactive position by the jaying mechanism and retrieved.

When malfunction does occur the normal lowering operation will not unset the slips or operate the jaying mechanism. Heretofore, unless the packer was specially equipped, it could not be retrieved when such malfunction occurred. In these situations it was necessary to remove the tubing and retrieve the packer by fishing operations. If the fishing operation did not work, the packer would then be drilled out.

Features intended to obviate or correct such malfunctions have been incorporated in various retrievable well tools. However, when these features are added to the tool it normally becomes undesirably larger, heavier and more complex. This of course means that the greater assurance of retrievability which inclusion of these features contributes to the commercial worth of the tool is offset in significant part by increased manufacturing and maintenance costs and reduced ease of operation.

The present invention, in one aspect, provides structure which gives assurance against binding of certain moving parts of a retrievable well tool and, in another aspect provides a means for overcoming freezing of other moving parts of such a tool without the offsetting disadvantage of significant increase in tool size, weight or complexity. More particularly, this invention provides improved jaying and slip expanding mechanisms for incorporation in retrievable well tools such as well packers and bridge plugs.

Retrievable well tools embodying this invention are provided with a jaying mechanism having helically oriented cam surfaces which may, for example be in the form of the inclined J-slot system shown in FIGURE 4 of the appended drawings. An expandable and contractible expander cone having a longitudinally stepped interior surface is normally supported in expanded condition by a support member which is longitudinally stepped across its exterior surface to matably receive the expander cone. The support member is carried by the tool body and adapted for slidable movement thereover. During routine setting and retrieving operations the cone and support will move together. However, if during a retrieval operation the cone should fail to move out of engagement with the slips, a striker is provided to move the support from behind the cone causing the normally expanded cone to contract. The length of the support is such that when moved from behind the cone it engages the slip cage to assist the slip springs in withdrawing the slips from the casing and maintain a space between the cone and the withdrawn slips thereby insuring against inadvertent resetting as the tool is withdrawn from the well bore.

Further understanding of this invention may be had by reference to the following description of the embodiment illustrated in the appended drawings.

In the drawings:

FIGURE 1 is an elevation view illustrating a packer incorporating the present invention in running-in position within a cased well bore.

FIGURE 2 is an enlarged view of the packer shown in FIGURE 1 partly in elevation and partly in section.

FIGURE 3 is a view similar to FIGURE 2 showing the packer in set condition and rotated to show the J-slot.

FIGURE 4 is a layout of the J-slot incorporated in the packer.

FIGURE 5 is an enlarged view of the expander cone of the packer, partly in elevation and partly in section.

FIGURE 6 is an enlarged section view detailing the slip and expander assemblies in set condition.

FIGURE 7 is an enlarged section view detailing the slip and expander assemblies as the cone support is being moved from behind the cone and the cone is collapsing.

FIGURE 8 is an enlarged section view detailing the slip and expander assemblies in fully disengaged condition.

Referring to FIGURE 1 of the drawings, a tension-type packer **10** is illustrated in a casing **12** at the lower end of a tubing string **11**. If desired, a safety joint, bypass and other accessories can be connected in the tubing string **11** above the packer. The packer **10** has a longitudinally extending tubular mandrel **13** on which an upper drag block and slip assembly **14** is slidably mounted. An inclined J-slot and J-pin which will hereinafter be described are used to control relative movement between assembly **14** and mandrel **13**. Below the assembly **14** is an expander cone **15**, an upper gauge ring **16**, an elastomer packing element **17** and a lower gauge ring **18**. The lower gauge ring **18** is releasably secured by shear means to the mandrel **13**. The cone moves with the mandrel to activate slips on the assembly whereupon the cone **15** is slidable relative to the mandrel to expand the packing element between the guage rings **16** and **18**. Below the lower gauge ring **18** is a collar **19**. Collar **19** is larger in diameter than mandrel **13** and serves as a stop for the guage ring **18** if it is shear released from the mandrel.

The control means for releasably connecting the cage housing **20** to the mandrel **13** includes an inwardly projecting lug **34** and J-slots **35** and **35***a* in the wall of the mandrel. The lug **34** is positioned within an opening **34***a*

formed in the retainer ring **19** and held in place by a bolt which screws into the tubular cage **20**. This bolt may be used for removing the lug from the opening and rotating the upper drag block and slip assembly **14** so that the lug may be selectively operated in one or the other of the slots **35** or **35***a*. As shown in FIGURE 4, the J-slot **35***a* has a relatively long lengthwise-extending helically oriented portion **36**. When the packer is in the position shown in FIGURE 1, that is, in condition for being run into a well, the lug **34** is disposed at a point "A" in the upper end of a short lengthwise-extending helically oriented portion **38** of the J-slot. The resistance caused by frictional engagement of the drag blocks with the casing allows the mandrel **13** to be moved relative to the upper drag block and slip assembly **14**. A helically oriented transverse portion **37** of the J-slot connects the portions **36** and **38** to permit movement of the lug **34** within the slot while rotation of the mandrel **13** is accompanied with vertical movement of the mandrel. When the lug **34** is disposed in the long portion **36** of the J-slot, the mandrel **13** can be further shifted vertically relative to the drag block assembly **14**.

The upper drag block and slip assembly **14** includes a tubular cage **20** (FIGURE 2) slidably received on mandrel **13**. A stop collar **20***a* is connected to the mandrel to limit upward movement of the cage **20** relative to the mandrel. Cage **20** has circumferentially spaced, longitudinal slots **21** which receive rectangularly shaped friction drag blocks **22**. Between each drag block **22** and the cage is a coiled spring **23** to move the drag block radially outwardly into frictional engagement with the casing. Each block **22** has a bored recess **24** to receive the spring **23**. Each block **22** also has end portions or flanges **25** (only one end shown) to retain the block in the cage.

Associated with each drag block **22** is a slip element **26** which has a head **27** and stem **28**. To accommodate a slip element each drag block at its lower end has a slot **32** in which a stem **28** is received. A pin **29** pivotally interconnects the stem of a slip element to a block. Each slip head **27** is provided with external serrations or teeth **30** and an internal or inner tapered slip surface **31**. Teeth **30** are formed by transverse slots which provide edges and inclined surfaces **30***a* (FIGURE 1). Between slot **21** in the cage and a tang **28***a* on the end of the stem **28** of a slip element **26**, a spring **33** is inserted to urge the tang **28***a* outwardly thus pivoting the slip element **26** about pin **29** to urge the head **27** of the slip element **26** inwardly toward mandrel **13**.

When the packer is in the position shown in FIGURES 1 and 2, that is, in condition for being run into a well, the lug **34** is disposed at a point "A" in the upper end of a short helically extending portion **38** of the J-slot. The resistance caused by frictional engagement of the drag blocks with the casing allows the mandrel **13** to be moved relative to the upper drag block and slip assembly **14**. A transverse and helically oriented portion **37** of the J-slot connects the portions **36** and **38** to permit movement of the lug **34** between the long and short portions **36** and **38** while the mandrel **13** is rotated and vertically moved. When the lug **34** is disposed in the long helically extending portion **36** of the J-slot, the mandrel **13** can be further shifted vertically relative to the drag block assembly **14**.

Below the J-slot **35** in the mandrel **13** is a downwardly facing shoulder or stop **39** (seen more clearly in FIGURE 3). Spaced downwardly from shoulder **39** on the mandrel is a member **40**. Member **40**, for example, may be a rectangularly shaped snap-on ring received in a groove in the mandrel. Slidably mounted on the mandrel **13** between stop **39** and ring member **40** is an annular support ring **41**. An annular recessed portion **20***b* is formed on the lower end of cage **20** and is sized to receive therein the upper end of support ring **41**. Support ring **41** on mandrel **13** is coextensive with and supporting expander or cone **15** is an expanded condition. The construction and

function of expander **15** and ring **41** will hereinafter be more fully explained. For the present, it may be assumed that expander **15** and ring **41** move as a unit.

Expander **15** has an outer relieved portion **42** at its lower end which provides a seat for a complementarily shaped portion in the upper end of the gauge ring **16**. An annular recess **43** is formed within the bore of upper gauge ring **16** to permit movement of the ring member **40** relative to the gauge ring. Upward travel of the support ring **41**, cone **15**, and upper gauge ring **16** is limited by the downwardly facing shoulder **39** on the mandrel **13**.

The resilient elastomer packer element **17** is received about the mandrel and disposed between the upper and lower gauge rings **16** and **18**.

The lower gauge ring **18** is connected to the mandrel **13** by a ring-like shear member **44** disposed partly in each of annular, complementarily arranged slots respectively in the gauge ring **18** and mandrel **13**. Member **44** can be inserted through a tangential passageway **45**. An annular recess **18***a* is formed in the bottom or lower end of the gauge ring **18** sized to seat over collar **19** should the gauge ring **18** be released by shearing of ring **44**.

In operation of the apparatus thus far described, the packer **10** can be positioned in the casing. When the packer is in position for setting, the operator will first slack off on the running-in string and then pick up while torquing the pipe in a left-hand direction so as to align the lug **34** on the cage **20** with the long portion **36** of the J-slot **35***a* (see FIGURE 2). It may be seen from FIGURES 1 and 2 that the direction of torquing may be reversed by reversing the J-slot arrangement, that is, by rotating the upper drag block and slip assembly **14** such that when the pin **34** is inserted it will be aligned with the other J-slot **35** as shown in FIGURE 3. Such an arrangement will accommodate right-hand torquing to align the lug **34** with the long portion of slot **35**.

The longitudinal portions of the J-slots are angularly disposed relative to the center line of the mandrel as shown in FIGURE 4 to prevent the lug from binding with the slots. Binding can occur because torque applied to the slot tends to press the lug against the wall surface of the slot, which in turn presses the mandrel against the inner wall surface of the cage so that there is a possibility that the lug will not ride downwardly in the slots upon lifting of the mandrel. By slanting the longitudinal portions of the slot relative to the transverse portion as shown in FIGURE 4, a downward complement of movement is applied to the pin during torquing so that torquing action alone on the slot will tend to move the pin downwardly within the longitudinally extending slots.

As the mandrel **13** moves upwardly relative to the drag block assembly (which is frictionally held relative to the casing), the gauge rings **16**, **18**, packer element **17** and expander cone **15** move upwardly relative to the drag block assembly. The outer tapered surface of cone **15** engages the tapered sloping surface **31** on the slip heads **27** so as to pivot the heads outwardly into gripping engagement with the well casing. When the upwardly holding teeth **30** on the slips grip the casing, further upward movement of the expander cone is not possible so that further upward travel of the mandrel and gauge ring **18** will expand the resilient packer element **17** into sealing engagement with the inner wall of the casing. Packer element **17** when expanded provides an effective seal between the mandrel and the casing so long as the tension is maintained on the tubing **11**. Lug **34**, for example, can be in a position "B" as shown in FIGURE 4.

Normally, to recover the packer from the well, it is only necessary to relieve the upward tension on the tubing string **11** and lower the tubing string so that the gauge ring **18** releases the compression of the packer element **17**. Subsequently, shoulder **39** engages support ring **41** to move the gauge ring **17** and cone **15** downwardly. Cone **15**, when moved from below slips **26**, permits the

slips to retract inwardly. Lug 34 moves from position "B" to the going-in position "A."

As stated heretofore, the present invention concerns apparatus to permit retrieval of the entire packer should the packer fail to release in the normal manner described above. The apparatus includes the support ring 41 and expander cone 15.

As illustrated in FIGURE 5, expander cone 15 has an outer tapered surface 15*a* inclined outwardly from an upper end surface 46 to a cylindrical outer surface 47 of larger diameter. The outer surface 47 is relieved at 42 to form a downwardly facing shoulder 48. The upper end of the gauge ring 16 fits over the relieved portion 42 and abuts the shoulder 48 and a lower end surface 49. A bore 50 extending inwardly from end surface 49 has first and second counterbores 51 and 52, respectively, forming upwardly facing shoulders 53 and 54. Sets of alternating longitudinal slots 55 and 56 are respectively cut through the respective ends of cone 15 and terminate at transverse bores 57 near an opposite end. The effect of the slots is to make the cone 15 capable of radial expansion and contraction. The cone 15 may be made of ductile iron or other material having similar properties.

Referring to FIGURE 6, a portion of the cone 15, support ring 41, slip 26, cage 20, mandrel 13, gauge ring 16, packer element 17, and casing 12 are shown in enlarged cross-section where the slips 26 are set into gripping engagement with the casing 12 and packer element 17 is expanded. In this position, tapered surfaces 15*a* and 31 of the slip 26 and cone 15 are complementary and the entire serrated face of the slip 26 is in gripping contact with the casing.

The support ring 41 is disposed between the mandrel 13 and cone 15. The internal diameters of the bore portions 50, 51, 52 (FIGURE 5) of cone 15 normally are smaller than complementary stepped portions 59, 60, 61 on the support ring 41. Hence, when ring 41 is inserted into cone 15, the cone 15 is expanded radially. A rounded or chamfered edge 41*a* is formed on the edge of stepped portions 59, 60, 61 to facilitate insertion of the support ring 41 into the cone 15. The internal diameter of bore 50 of cone 15 is larger than the outer diameter of ring member 40 so that ring 40 can pass through bore 50 and contact the lower end of support ring 41. Similarly, a bore 62 in gauge ring 16 is larger in diameter than the diameter of ring 40. In the support 41, the portions 59 and 60 have equal lengths and the lengths of the complementary bores 52 and 51 have equal lengths. Portion 61 of support ring 41 is shorter than the length of portions 59 and 60 for reasons which will hereinafter become more apparent.

The operation of the cone 15 and support ring 41 of the present invention occurs when the packer fails to release when the tubing 11 is lowered. Failure to release may be due to such various factors as jamming of the slips, bonding of the rubber to the casing, debris in the J-slot, etc. In any event, it will be immediately obvious to the operator that the packer has failed to release. Upon this event, the operator applies tension to the tubing string 11 in an amount sufficient to overcome the shear strength of the shear ring 44 between the lower gauge ring 18 and mandrel 13. The shear strength can be predetermined, of course, by selection of the size and material of ring 44 so that, say, 35 to 50 thousand pounds can be required to shear the ring 44.

Once ring 44 shears, the mandrel 13 moves quickly in an upward direction, and, as shown in FIGURE 7, ring 40 will engage the end of support ring 41 and displace ring 41 upwardly relative to cone 15.

Cone 15 is supported in an expanded condition by ring 41 until stepped portions 59 and 60 of the ring simultaneously move from bores 52 and 51 of the cone. The upward motion of ring 41 relative to cone 15 is continued for a purpose hereinafter described but at this moment in time, the ring 41 no longer supports cone 15. As a result, cone 15 contracts inwardly due to its natural tendency to return to its non-expanded condition (see FIGURE 7). When cone 15 contracts, slips 26 are no longer supported. Thus, the slips can be urged inwardly to a non-gripping position by virtue of springs 33. However, in addition to release of the slips by contraction of the cone, the further continued upward motion of the ring 41 transmits motion to cage 20 by virtue of the upper end of the support ring 41 engaging the recessed end portion 20*b* of the cage 20. Thus, a lifting force will be transmitted from the mandrel 13 to the cage 20 and an upward force will be applied to the slips 26 through the pins 29 holding the slips to the cage 20. Because of the inclination of surfaces of the teeth 30 of the slips, this upward force causes the slips to be cammed inwardly by the upper sloping edges 30*a* formed on each of the teeth. After the cone 15 contracts and slips 26 are released, the entire packer can be retrieved from the well.

Referring to FIGURES 7 and 8, it will be seen that, by reason of its length, ring 41 will, after engaging cage 20 lift cage 20 and slips 26 until there is sufficient longitudinal spacing between slips 26 and cone 15 to prevent them from inadvertently engaging and accidentally resetting the tool during its retrieval from the well.

It should be appreciated that the entire length of cone 15 is supported until it is released by virtue of the stepped shoulders. Other step arrangements can be employed to achieve the same function and purpose. With the disclosed stepped arrangement the travel of support ring 41 is relatively short thereby enhancing the compactness of the packer and permitting utilization of the disclosed arrangement with packers presently in service.

While the cone 15 herein is disclosed as self-contracting to accomplish its intended purpose, cone 15 can be made to collapse by radial forces exerted by the slips. In this sense, the terms "contract" and "collapse" are intended to encompass radial inward displacement of any cone upon removal of a supporting ring member.

It will be appreciated that while the present invention is disclosed with a packer element, the invention is applicable to other tools such as a tubing anchor. In such a case the expander means could be connected by a shear pin to the mandrel so that upon shear release the disabling means are removed from beneath the expander element.

While a particular embodiment of the present invention has been shown and described, it is apparent that changes and modifications may be made without departing from this invention in its broader aspects and, therefore, the aim in the appended claims is to cover all such changes and modifications as fall within the true spirit and scope of this invention.

What is claimed is:

1. In a well packer for use in a cased well, the combination comprising: mandrel, slip and drag block means, expander means including an expandable and contractible outer cone and a rigid inner ring normally supporting said cone in expanded condition so that said cone can actuate said slip means,

said inner ring surrounding said mandrel for longitudinal movement thereover and having upper and lower transverse end surfaces and a stepped exterior surface which progresses from one outside diameter at end end to a smaller outside diameter at the other end to thereby define a plurality of commonly oriented intermediate transverse surfaces,

said outer cone having a stepped interior surface companion to and normally matable with the stepped exterior surface of said inner ring,

a gauge ring coaxial with and abutting an end of said cone adjacent the smaller diameter end of said inner ring for jointly moving said inner ring and said cone in one direction relative to said slip means, said gauge ring being formed in spaced relation to said mandrel to define a recess therebetween,

and, movable means in said recess for moving said inner ring in said one direction relative to said cone to a position where said inner ring no longer supports said cone in expanded condition.

2. A well packer for use in a cased well comprising:
a mandrel;
packing means on said mandrel including an elastomer packing element disposed between upper and lower gauge rings;
means for releasably attaching said lower gauge ring to said mandrel;
expander means slidably mounted on said mandrel above said upper gauge ring, said expander means comprising an expandable and contractible outer cone and a rigid inner ring normally supporting said cone in an expanded condition, said inner ring surrounding said mandrel for longitudinal movement thereover and having upper and lower transverse end surfaces and a stepped exterior surface which progresses from one outside diameter at one end to a smaller outside diameter at the other end to thereby define a plurality of commonly oriented intermediate transverse surfaces;
said outer cone having a stepped interior surface companion to and normally matable with the stepped exterior surface of said inner ring;
said upper gauge ring abutting the end of said cone adjacent the smaller diameter end of said inner ring for jointly moving said inner ring and said cone, said upper gauge ring being formed in spaced relation to said mandrel to define a recess therebetween;
abutment means on said mandrel and disposed in said recess for selective engagement with said inner ring;
slip and wall friction means slidably mounted on said mandrel above said expander means;
and, means permitting selective movement of said mandrel relative to said slip and wall friction means to permit said expander to radially extend said slip means, said slip means having transverse serrations formed to bite into a casing with upwardly facing surface arranged with an upward inclination sufficient to assist in urging said slips inwardly when said cone releases said slips and said slips are subjected to an upward pull.

3. A well packer for use in a cased well comprising:
a mandrel;
packing means on said mandrel including an elastomer packing element disposed between upper and lower gauge rings;
means for releasably attaching said lower gauge ring to said mandrel;
expander means slidably mounted on said mandrel above said upper gauge ring, said expander means comprising an expandable and contractible outer cone and a rigid inner ring normally supporting said cone in an expanded condition, said inner ring surrounding said mandrel for longitudinal movement thereover and having upper and lower transverse end surfaces and a stepped exterior surface which progresses from one outside diameter at one end to a smaller outside diameter at the other end to thereby define a plurality of commonly oriented intermediate transverse surfaces;
said outer cone having a stepped interior surface companion to and normally matable with the stepped exterior surface of said inner ring;
said upper gauge ring abutting the end of said cone adjacent the smaller diameter end of said inner ring for jointly moving said inner ring and said cone, said upper gauge ring being formed in spaced relation to said mandrel to define a recess therebetween;
abutment means on said mandrel and disposed in said recess for selective engagement with said inner ring;
slip and wall friction means slidably mounted on said mandrel above said expander means;

and, means permitting selective movement of said mandrel relative to said slip and wall friction means to permit said expander to radially extend said slip means.

4. In a well tool for use in a well bore the combination of means for selectively controlling relative movement between telescoping members of the tool, which means comprises:
a slot system and follower lug means between said members, said slot system including lengthwise channel means and at least two connecting transverse channels respectively extending in opposite directions relative to said lengthwise channel means;
said transverse channels being inclined with respect to said lengthwise channel means;
said lengthwise channel means having a surface inclined in the same direction as each of said transverse channels;
said follower lug means being cooperable with said channel means and transverse channels;
and, means for orienting said lug means relative to said lengthwise channel means and transverse channels for selective cooperation with one of said transverse channels.

5. In a device for use in a well bore, the combination comprising a tubular body, a slip and drag block assembly arranged for movement with and relative to said body, a slip expander assembly including a slip expander cone and a cone support arranged for movement with and relative to said cone,
said support being carried by said body for longitudinal movement thereover and having upper and lower transverse surfaces and a stepped exterior surface which progresses from one outside diameter at one end to a smaller outside diameter at the other end to thereby define a plurality of commonly oriented intermediate transverse surfaces,
said expander cone being expandable and contractible and having a stepped interior surface companion to the stepped exterior surface of said support and normally held in expanded condition by said support,
means for selectively moving said support and said cone jointly and relative to one another,
a slot system including interconnecting helically oriented lengthwise and transverse slot portions on said body,
and, means on said slip and drag block assembly cooperable with said slot system for controlling relative movement between said body and said slip and drag block assembly.

6. In a device for use in a well bore, the combination comprising: a tubular body; slip means on said body arranged to anchor said body in a well conduit; an expander assembly adapted for setting and releasing said slip means, said expander assembly including an outer contractible expander portion having a lower transverse surface and stepped interior surfaces, and an inner support portion movable on said body and having a lower transverse surface and stepped exterior surfaces which are companion in shape to said inner surface on said expander portion, said support portion being normally located relative to said expander portion whereby said exterior surfaces engage said interior surfaces to support said expander portion and prevent contraction thereof so that said expander portion can function to set said slip means; a ring member on said body in abutting relation with said lower surface of said expander portion and sized to provide a recess between said body and an inner surface of said ring member; and means for contracting said expander portion to release said slip means including a member on said body movable in said recess and adapted to strike said lower transverse surface of said support portion and thereby move said support portion to a location with respect to said expander portion wherein said surfaces are out of engagement.

7. In a well tool for use in a well bore, the combination comprising: a mandrel; slip and drag means on said mandrel for anchoring against movement in a well conduit; expander means including an outer segmented portion which is laterally movable between expanded and contracted conditions and a rigid inner portion normally supporting said outer portion in expanded condition wherein said expander means can shift said slip means outwardly; means for moving said inner and outer portions jointly relative to said slip means to shift said slip means outwardly, said moving means including a ring adjacent said outer portion of said expander means, said ring being arranged in abutting relation with said outer portion and in spaced relation to said mandrel whereby said mandrel, inner portion and ring define an annulus; and abutment means on said mandrel disposed for movement within said annulus, said abutment means being movable by said mandrel into engagement with said inner portion to transmit force thereto, whereby said inner portion can be displaced from supporting relation with said outer portion and said outer portion can move inwardly to said contracted condition, whereby said slip means is free to shift inwardly toward said mandrel.

8. In a well tool for use in a well conduit, the combination comprising: a tubular body having slip and drag means thereon for anchoring against movement in the well conduit; an expander assembly including an expandable and collapsible cone and a rigid support member normally supporting said cone in expanded condition, said support member having a stepped exterior surface which progresses from one outside diameter at its one end to a smaller outside diameter at its other end whereby said surface defines a plurality of commonly oriented transverse surfaces, said cone having an apex end, a base end and a stepped interior surface complementary in shape to the exterior surface of said support member; and first and second annular members on said body, one of said annular members engaging said base end of said cone for jointly moving said cone and support member relative to said slip and drag means for shifting said slip means outwardly, the other of said annular members being normally located between said one annular member and said body and movable relative to both said cone and said support member, whereby said other member can engage said support member and move said support member relative to said cone to a position where said support member no longer functions to support said cone so that said cone can collapse to release said slip means.

9. In a device for use in a well bore, the combination comprising: a tubular body; slip and drag block means arranged for movement with and relative to said body; a slip expander assembly including a cone and a cone support arranged for movement with, and relative to, said cone; symmetrical cam means on said body, each of said cam means including helically oriented lengthwise and transverse portions; cam follower means on said slip and drag block assembly adapted to engage one of said cam means during relative movement between said expander cone and said slip and drag block assembly; said cone support being carried by said body for longitudinal movement thereover and having upper and lower transverse surfaces and a stepped exterior surface which progresses from one outside diameter at one end to a smaller outside diameter at the other end to thereby define a plurality of commonly oriented intermediate transverse surfaces; said expander cone being expandable and contractible and having a stepped interior surface companion to the stepped exterior surface of said support and being normally held in expanded condition by said support; means for selectively moving said support and said cone jointly relative to said slip means to activate said slip means; and shear means for securing said moving means to said body to cause said support and said cone to move jointly, said shear means being releasable to permit relative movement between said moving means and said body; and means operable upon release of said shear means for moving said support and said cone relative to one another to permit said cone to contract, thereby inactivating said slip means.

10. A well tool comprising: a body adapted for connection to a running-in string; slip means on said body shiftable outwardly to engage a well conduit; expander means for exerting outward pressure on said slip means to shift said slip means outwardly in response to movement of said body relative to said slip means in one longitudinal direction, said expander means being segmented so as to be laterally movable relative to said body and said slip means between expanded and contracted positions; support means between said expander means and said body for normally supporting said expander means in said expanded position, whereby said expander means can exert pressure on said slip means; and means on said body movable by said body in said one direction into engagement with said support means for disabling said support means to permit said expander means to move inwardly to said contracted position, whereby said expander means positively releases the outward pressure on said slip means to permit said slip means to shift inwardly toward said body.

11. A well packer appartaus comprising: a mandrel; packing means mounted around said mandrel; abutment means releasably coupled to said mandrel and engaging one end of said packing means; expander means on said mandrel including an annular member engaging the other end of said packing means and an expander member supported by said annular member, said annular member having an inner peripheral surface spaced laterally away from an outer surface of said mandrel to provide a recess therebetween, said expander member being longitudinally slotted so as to be laterally movable between expanded and contracted positions relative to mandrel and said annular member; support means between said expander member and said mandrel for normally supporting said expander member in said expanded position; anchor means engageable with said expander member and arranged to be shifted outwardly by said expander member when said expander member is in said expanded position into anchoring engagement with the well conduit; and shoulder means on said mandrel movable in said recess upon release of the coupling between said abutment and said mandrel into engagement with said support means for disabling said support means to permit movement of said expander member to said contracted position, thereby releasing said anchor means.

12. A well packer apparatus comprising: a mandrel; packing means mounted around said mandrel; first means engaging one end of said packing means and being releasably coupled to said mandrel and normally capable of being moved by said mandrel in one longitudinal direction for exerting compressive force on said one end of said packing means to expand said packing means; second means for anchoring the other end of said packing means against movement in the well conduit in said one direction to permit compressive force to be exerted on said packing means including slip and expander means on said body, said slip means being shiftable outwardly by said expander means into gripping engagement with the well conduit, said expander means being longitudinally slotted in a manner whereby said expander means is radially expansible and contractible; support means between said expander means and said mandrel for normally supporting said expander means in expanded condition; means responsive to a predetermined force in said one direction for releasing said mandrel from its coupled relationship to said first means whereby said mandrel can be moved in said one direction relative to said first and second means; and shoulder means on said mandrel movable by said mandrel into engagement with said support means upon release of said releasing means for disabling said support means, thereby permitting con-

traction of said expander member and release of said slip means.

13. A well tool comprising: a mandrel; slip means on said mandrel shiftable outwardly to engage a well conduit wall and shiftable inwardly to disengage from a well conduit wall; an annular member releasably coupled for movement with said mandrel; expansible and contractible expander means carried by said annular member, said expander means being movable transversely relative to said mandrel and said annular member between expanded and contracted positions, said expander means being movable longitudinally in one direction relative to said slip means when in said expanded position for shifting said slip means outwardly and movable to said contracted position to permit inward shifting of said slip means; support means between said expander means and said mandrel for normally supporting said expander means in said expanded position; and means responsive to longitudinal movement of said mandrel in said one direction for disabling said support means, thereby enabling movement of said expander means to said contracted position and inward shifting of said slip means.

14. A well tool apparatus comprising: a body member; normally retracted slip means arranged about said body member and shiftable outwardly for anchoring against movement in one longitudinal direction in a well bore; an annular member carried by said body member; releasable means for coupling said annular member for movement with said body member; expansible and contractible expander means arranged about said body member; means for mounting said expander means on said annular member for transverse movement relative to said annular member and said body member between an outer expanded position wherein said expander means can be moved in said one direction in response to movement of said body member and said annular member and exert outward force on said slip means to effect outward shifting thereof, and an inner contracted position; support means between said expander means and said body member for normally supporting said expander means in said outer expanded position so that said expander means can effect outward shifting of said slip means; and means responsive to movement of said body member in said one direction relative to said annular member and said expander means for disabling said support means by moving said support means out from between said expander means and said body member, whereby said expander means can move to said inner contracted position and release the outward force on said slip means to permit inward retraction thereof.

15. A well tool comprising: a body adapted for connection to a running-in string; slips on said body shiftable outwardly thereof into anchoring engagement with a well conduit wall; means on said body movable relative to said slips for engaging said slips with a well conduit wall and for releasing said slips from the well conduit wall, said means including a segmented outer portion movable laterally between expanded and contracted positions relative to said body and a rigid inner portion on said body and normally positioned under said outer portion in expanded position whereby said outer portion can exert pressure on said slips to engage said slips with a well conduit wall; means for jointly moving said inner and outer portions relative to said slips in response to movement of said body in one longitudinal direction including an annular member engaging said outer portion; means on said annular member capable of engaging said outer portion in said expanded position for limiting outward expansion of said outer portion; and means on said body movable by said body in said one longitudinal direction relative to said outer portion and said slips for shifting said inner portion out from under said outer portion, whereby said outer portion can move inwardly and away from said slips to said contracted position and said slips can move inwardly to disengage from the well conduit wall.

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