May 12, 1959 R. C. BAKER 2,886,110

RELEASABLE CLUTCHES FOR SUBSURFACE WELL APPARATUS

Filed Sept. 26, 1955 2 Sheets-Sheet 1

FIG. 1.

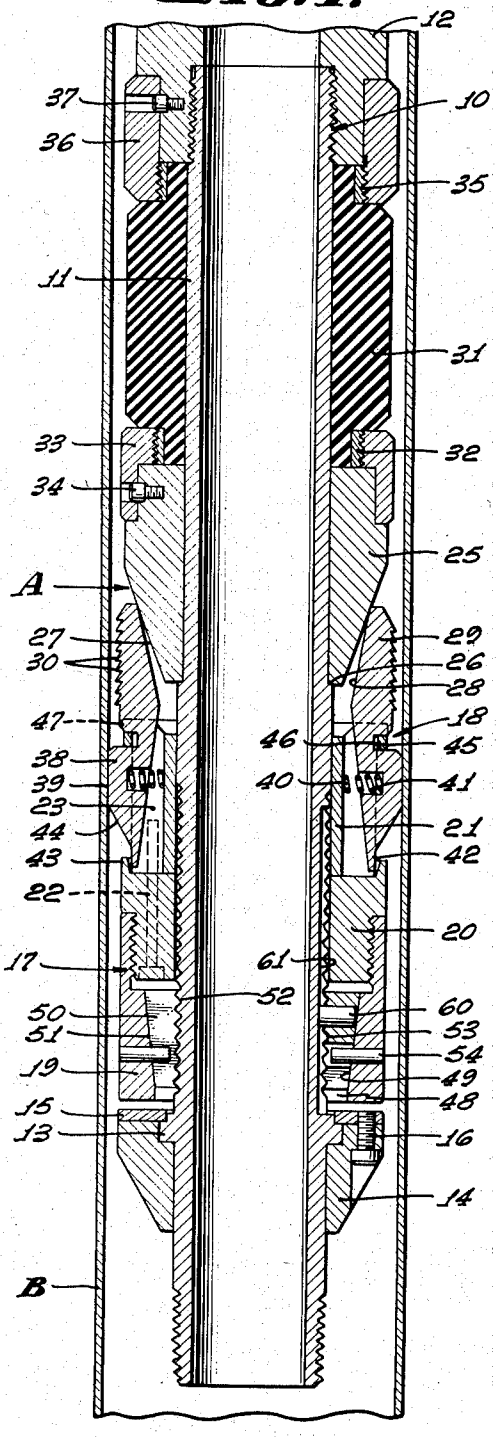
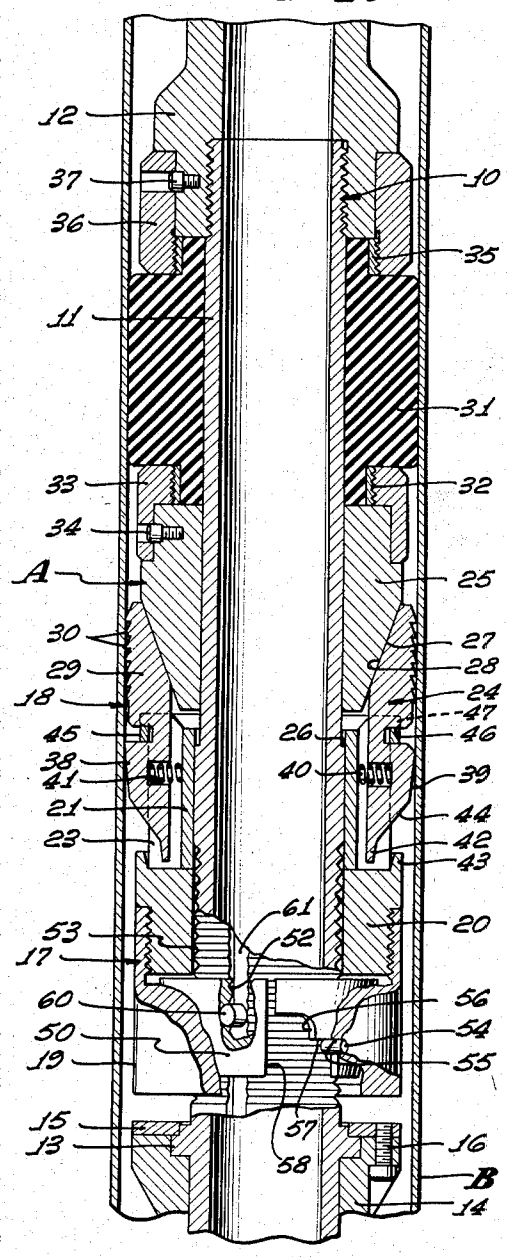



FIG. 2.




INVENTOR.
REUBEN C. BAKER
BY
Mellin and Hanscom
ATTORNEYS

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Filed Sept. 26, 1955 2 Sheets-Sheet 2

FIG. 4.

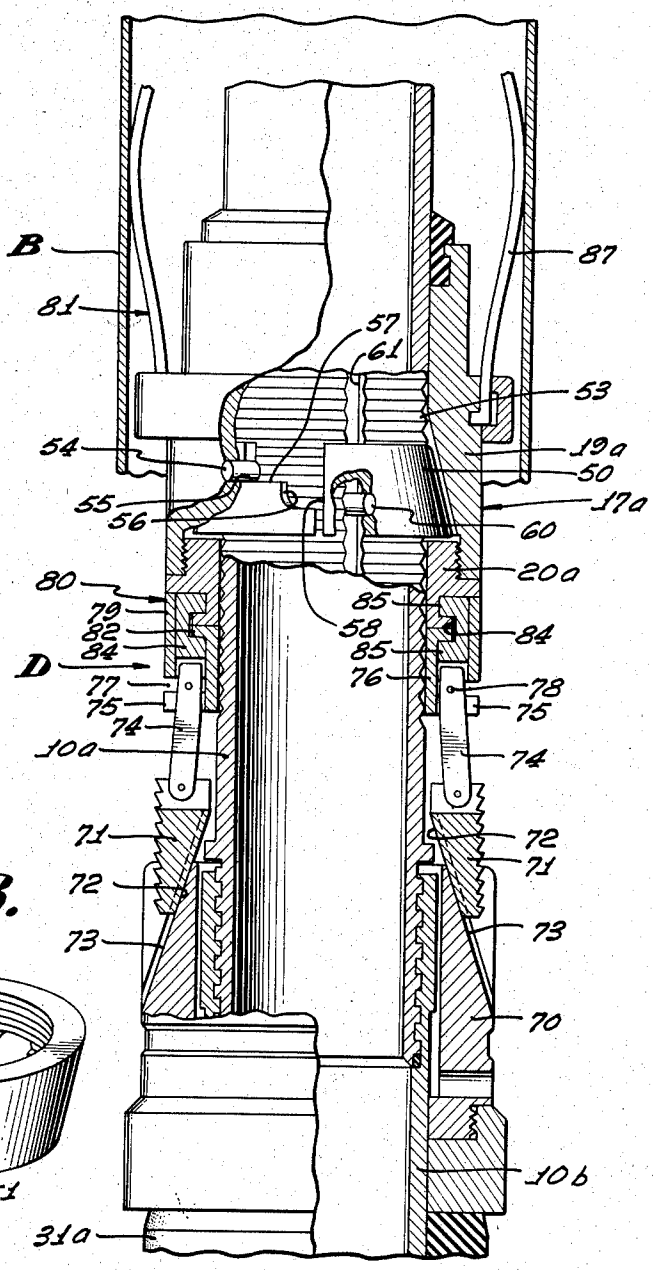
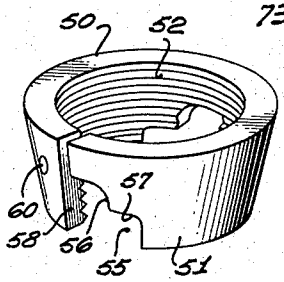



FIG. 3.




INVENTOR.
REUBEN C. BAKER
BY
Mellin and Hanscom
ATTORNEYS

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2,886,110

# RELEASABLE CLUTCHES FOR SUBSURFACE WELL APPARATUS

Reuben C. Baker, Coalinga, Calif., assignor to Baker Oil Tools, Inc., Los Angeles, Calif., a corporation of California

Application September 26, 1955, Serial No. 536,486

11 Claims. (Cl. 166—217)

The present invention relates to subsurface well apparatus, and more particularly to apparatus embodying parts capable of being releasably secured to one another while in the well bore.

This application is a continuation-in-part of my application for "Tubing Anchor and Valve Apparatus," Serial No. 464,356, filed October 25, 1954.

An object of the present invention is to provide a releasable clutch device for selectively permitting or preventing relative movement between parts of a subsurface well tool while disposed in a well bore, the device being operable between and maintained in clutching and unclutching conditions without the necessity for maintaining a torque on the running-in string to which the tool is secured, and by means of which it is moved longitudinally in the well bore.

Another object of the invention is to provide a releasable clutch device for selectively permitting or preventing relative movement between parts of subsurface well tools while disposed in a well bore, the device being simple in construction and much cheaper to manufacture than corresponding devices provided heretofore.

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, 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 longitudinal section through well apparatus embodying the invention, with the parts in condition for lowering the apparatus in a well casing;

Fig. 2 is a view similar to Fig. 1, disclosing the apparatus set in the well casing;

Fig. 3 is a perspective view of a part of the apparatus shown in Figs. 1 and 2;

Fig. 4 is a longitudinal section, partly in elevation, through another embodiment of the invention disposed in a well casing.

As disclosed in the drawings, it is desired to prevent or permit relative longitudinal movement between parts of a well tool that is to be disposed in a well bore. As shown by way of examples in the drawings, the invention has been applied to well packers, although it is to be understood that in its broader aspects it is applicable to other subsurface well tool equipment.

In the form of invention shown in Figs. 1 and 2, a well packer A is provided including a main body **10** having a central, generally cylindrical portion **11** threadedly secured to an upper body portion or sub **12** that is, in turn, adapted to be secured directly or indirectly to the lower end of a string of tubing (not shown) extending to the top of the well bore. The apparatus is lowered through



a string of well casing B to the location therein at which it is to be operated by means of the tubing string and is controlled by appropriate manipulation of the tubing string, in the manner hereinafter described.

The lower portion of the body has a flange **13** encompassed by a lower guide member **14** engaging the underside of the flange and being secured thereto by a clamp plate **15** engaging the upper side of the flange, the plate and guide being attached to one another by a plurality of screws **16**. Disposed above the guide portion **14** of the apparatus and surrounding the body **11** is a ratchet or clutch mechanism **17** and a slip device **18** for anchoring the tool to the wall of the well casing B. The clutch mechanism includes an outer ratchet or clutch housing **19** threadedly secured onto the lower portion of a stop ring **20** attached to a slip sleeve **21** in any suitable manner, as by means of a plurality of longitudinally extending screws **22**. This sleeve **21** is provided with a plurality of circumferentially spaced and longitudinally extending grooves **23** in which the lower portions of casing engaging slips **24** are contained. These slips extend upwardly from the sleeve **21** and are cooperable with an expander **25** slidably mounted on the cylindrical intermediate portion **11** of the packer body **10**. Downward movement of the expander **25** with respect to the body is determined and limited by engagement of the lower end of the expander with a laterally extending shoulder **26** on the body.

The expander **25** is adapted to expand the slips **24** outwardly into engagement with the wall of the well casing B by reason of the cooperation between the downward and inwardly tapering external surface **27** on the expander and the companion internally tapered surfaces **28** on the upper portion **29** of the slips. From the drawings, it is evident that downward movement of the expander **25** within the slips **24** will wedge the expander into the slips and urge the latter laterally outward to embed their external wickers **30** into the wall of the casing. In the form of device specifically illustrated, the slips **24** are designed to anchor the tool against downward movement in the well casing, for which reason the wickers **30** face in a downward direction.

The upper end of the expander **25** is coupled to the lower portion of a packing structure, which is predominantly in the form of a rubber or rubber-like packing sleeve **31** surrounding the body **11**. The lower portion of the packing sleeve is molded into a lower ring **32** that is threadedly secured within a gauge ring **33** surrounding and attached to the upper portion of the expander in any suitable manner, as by a plurality of cap screws **34**. The packing sleeve **31** extends upwardly from the expander along the body **11**, being engageable with the exterior of the body above the expander **25**, the upper end of the packing sleeve being molded within an upper ring **35** threadedly secured to an upper gauge ring **36** encompassing the upper portion **12** of the body and secured thereto in any suitable manner, as by means of a plurality of cap screws **37**.

The specific mode of anchoring the upper and lower ends of the packing structure to the upper body member **12** and the expander **25** forms no part of the present invention and may be varied considerably from the arrangement disclosed. This is also true of the construction of the packing unit itself, which may take various forms.

As described above, the slips **24** are set upon downward movement of the expander **25** relative thereto. To secure such relative downward movement, retarding means are provided tending to resist longitudinal movement of the slips **24** in the well casing B. In the present instance, the retarding device is incorporated on the lower portions of the slips themselves. As specifically shown, such re-

tarding devices include the formation of friction drag block portions 38 on the slips having outer faces 39 adapted to contact the wall of the well casing. The frictional contact between the drag block portions of the slips and the casing wall is secured by a plurality of helical compression springs 40 having their axes transverse of the axis of the body, each spring being disposed in one of the slip sleeve grooves 23. The outer portion of each spring is located in a socket 41 formed in the slip and adjacent its casing engaging face 39, the spring bearing against the base of the socket and also against the base of the longitudinal sleeve groove 23.

The extent of lateral outward movement of each slip 24 is limited, there being a lower finger or leg portion 42 on each slip adapted to engage the upwardly projecting rim 43 of the stop ring 20. Normally, when the tool is disposed within the well casing, these leg portions 42 are located inwardly by a substantial distance from the rim 43 of the stop ring. However, when the tool is out of the well casing and in an unconfined position, the springs 40 urge the lower portions of the slips outwardly to the extent limited by engagement of the leg portions 42 with the rim 43. When the tool is inserted in the well casing B, the upper end of the casing will engage the tapered surfaces 44 of the slips adjacent the foot portions 42, to urge the slips in an inward direction against the force of the springs.

Lateral outward movement of the slips 24 is also limited by a retaining ring 45 encompassing the sleeve and disposed in external circumferential grooves 46 formed in the intermediate portions of the slips below their wickered surfaces 30. The upper end of this ring 45 is engaged by a transverse shoulder 47 extending outwardly from the upper end of the slip sleeve 21, the lower end of the ring 45 being adapted to engage the lower side of the slip grooves 46, for the purpose of pulling the slips 24 in a downward direction with the sleeve 21 when the tool is being lowered in the well casing. The ring 45 also limits the extent of lateral outward movement of the slips under the influence of the springs 40, particularly when the tool is unconfined and out of the hole, the base portions of the slip grooves 46 engaging the inner surface of the retaining ring 45.

In order to prevent relative downward movement of the expander 25 within the slips 24, until the latter are to be anchored against the well casing B at the desired setting point therewithin, the releasable clutch device 17 is provided. As disclosed, the releasable clutch mechanism includes the outer housing 19 which has an annular groove 48 therein provided with an internal tapered surface 49 inclined in a downward and inward direction, the upper end of the groove 48 being defined by the lower end of the stop ring 20, which is threadedly secured to the clutch housing 19. Disposed within the clutch housing is a split, inherently contractible ratchet ring 50, which has an external tapered surface 51 inclined in a downward and inward direction, coacting with the internal tapered surface 49 in the ratchet housing for the purpose of urging the ring 50 inwardly to cause its internal circumferential clutch teeth 52 to engage companion external circumferential clutch teeth 53 provided on the central body portion 11. The clutch teeth 52, 53 may be formed as V-threads to permit the body 10 to ratchet freely in an upward direction within the ratchet or clutch ring 50, the body also being capable of ratcheting downwardly within the ratchet ring when permitted to do so, as hereinafter described.

When the ratchet ring 50 is held in its upper position with respect to the clutch housing 19, the body 10 can be moved downwardly with respect thereto. However, when the ratchet ring 50 is permitted to move downwardly of the housing, it will become wedged between this housing 19 and the body 11 of the tool, the tapered wall 49 of the housing engaging the ratchet ring 50, which prevents the teeth 53 on the body from shifting or camming the ratchet ring 50 laterally outward to disengage the clutch teeth 52, 53 from each other. When the ratchet ring 50 is held in its upper position within the housing 19, there is substantial clearance between its external tapered surface 51 and the companion internal tapered surface 49 in the housing, which will permit the body 11 to move downwardly within the ratchet ring 50, since the V-shaped teeth or threads 53 on the body can then cam the ratchet ring 50 laterally outward to disengage the clutch teeth 52, 53 from each other.

The ability of the ratchet ring 50 to move downwardly within the housing groove 48, so as to be wedged between the body 11 and the housing 19, depends upon the location of the ratchet ring 50 relative to one or a plurality of control elements, in the form of pins 54 welded or otherwise suitably secured to the ratchet sleeve or housing 19, these pins extending inwardly into the housing groove 48. The pins 54 can be selectively located in either the horizontal or vertical portions 55, 56 of generally L-shaped slots or recesses formed in the lower portion of the ratchet ring 50. When the pins 54 are disposed in the horizontal portions 55 of the slots, they engage lower shoulders 57 on the latter and prevent the ring from being moved downwardly with respect to the ratchet sleeve 19 into a wedged position. When the pins 54 are so disposed in the horizontal slot portions 55, there is substantial clearance between the tapered periphery 51 of the ring and the tapered wall 49 of the ratchet sleeve, allowing the split ring 50 to expand outwardly to disengage its teeth 52 from the body teeth 53. The ring 50 can be turned arcuately with respect to the pins 54 to dispose the latter in alignment with the longitudinal slots 56 in the ring. When this occurs, the ring 50, which inherently contracts into engagement with the body 11, can be carried downwardly with the body to a position in which it is wedged against the tapered side 49 of the ratchet housing 19, which will hold the ring inwardly with its teeth 52 fully engaged with the companion teeth 53 on the body.

Rotation of the ratchet ring 50 between the positions in which the pins 54 are disposed under the horizontal slot shoulders 57 or in alignment with the vertical slots 56 is determined by turning the tubular string and the tubular body 10 connected thereto. Assuming the pins 54 to be in engagement with the upper shoulders 57 of the horizontal slot portions, the tubular mandrel or body 10 is rotated to the left, or counter-clockwise, as seen from the top of the well bore. Such rotation will be imparted to the ratchet ring 50, since it is normally contracted in frictional engagement with the tubular mandrel 10, the extent of rotation being limited by engagement of the pins 54 with end walls 58 defining the vertical ring slots 56. Thereafter, it is only necessary to lower the tubular body 10 the slight distance necessary to carry the ratchet ring 50 downwardly with it, as permitted by the fact that the pins 54 are merely moving relatively within the vertical slots 56 of the ring, to wedge the ring 50 between the ratchet sleeve or housing 19 and the tubular body 10.

In the event it is desired to place the ring 50 in its ineffective position, insofar as its clutching or coupling action is concerned, then the body 10 need merely be elevated a slight distance, which will carry the ring 50 upwardly with it, whereupon the body and ring are turned a slight distance to the right to relocate the shoulders 57 of the horizontal slot portions of the ring above the pins 54. Thereafter, substantial downward movement of the body 10 with respect to the sleeve 19 can take place, since the ring 50 is prevented from being shifted downwardly to a wedged position between the ratchet housing 19 and the body 10, the latter merely ratcheting downward through the ring 50. Of course, the body is movable upwardly whenever desired merely by taking an upward pull on it, inasmuch as the shape of the coengaging clutch teeth 52, 53 and the direction of their

tapered surfaces are such as to permit free upward movement of the body **10** with respect to the ratchet housing **19** at all times.

Instead of relying upon the friction between the body **10** and the ratchet ring **50** to rotate the latter with respect to the housing **19** and pins **54**, for the purpose of placing the pins **54** in the horizontal slot portions **55** or in the vertical slot portions **56** of the ratchet ring, a positive connection between the body and the ratchet ring can be provided. As specifically shown, such positive rotary device includes a pin or key **60** secured to the ratchet sleeve **50** and extending inwardly into a longitudinal slot or keyway **61** in the body **11** of the apparatus. The key and keyway connection **60**, **61** permits relative longitudinal movement to take place between the body **10** and the ratchet ring **50**, but prevents relative rotary movement from taking place, since turning of the body **10** in either direction will be transmitted through the pin **60** directly to the ratchet ring **50**. Thus, a more positive drive connection between the body **10** and the ratchet ring **50** has been provided, to insure appropriate rotation of the ratchet ring **50** relative to the housing **19** and its control pins **54** whenever the ratchet ring is to be placed in an effective clutching position, or in a position in which the longitudinal clutching or coupling of the body **10** to the housing **19** is to be prevented.

In the operation of the apparatus disclosed in Figs. 1 and 2, the ratchet ring **50** is normally in a position in which the control pins **54** are disposed in the vertical slot portions **56** of the ratchet ring or sleeve **50**. The slips **24** and the packing structure **31** are in retracted positions. The apparatus can be inserted in the well casing B, the downward movement of the body **10** carrying the ratchet sleeve **50** the slight distance downwardly with it within the housing **19** necessary to wedge the sleeve or ring between the body **10** and the housing **19**, which precludes further relative motion between the parts. The apparatus can thus be lowered on the string of tubing through the well casing without relative longitudinal movement between the slips **24** and expander **25** occurring, insuring that the wickered portions **30** of the slips will remain in their retracted positions, which is also true of the packing structure **31**.

When the region in the well casing is reached at which anchoring of the well packer in packed-off condition is desired, it is only necessary to elevate the body **10** a slight distance, which will carry the ratchet ring **50** upwardly with it within the clutch housing **19**, the drag block portions **38** of the slips resisting upward movement of the housing **19**. A partial turn to the right is then taken on the tubing string and the body **10** of the apparatus, which will carry the horizontal shoulders **57** of the ratchet ring or sleeve above the locating pins **54**, to hold the ratchet sleeve **50** in its upper position within the housing **19**, in which there is clearance between the tapered surface **51** of the ratchet sleeve and the internally tapered cam surface **49** on the clutch housing. The tubular string and body **10** are then lowered, such lowering action camming the ratchet sleeve **50** laterally outward and permitting the body **10** to move or ratchet therethrough. During the initial downward movement of the body, the packing structure **31** and expander **25** are carried downward with it, the expander moving within the slips **24** and shifting the latter outwardly into anchoring engagement with the well casing B. When full anchoring of the slips **24** occurs, the expander **25** cannot move downwardly to any further extent, whereupon additional downward movement of the body **10** of the apparatus moves the upper body member **12** toward the expander **25** to foreshorten and compress the packing sleeve **31**, causing its outward expansion into sealing engagement with the wall of the well casing B, as well as with the periphery of the body portion **11**.

When it is desired to release the well packer A from the well casing B, it is merely necessary to move the tubing string and the body **10** upwardly, the body being permitted to ratchet freely through the ratchet ring **50**, the parts then returning to their retracted positions disclosed in Fig. 1. It is unnecessary to effect any turning action of the body in the event it is desired to elevate the apparatus in the well casing. However, if it is to be lowered in the well casing to a point below its setting location, then the tubing string and body **10** are turned to the left, to dispose the vertical slot portions **56** of the ratchet sleeve **50** in alignment with the control pin **54**, which will then insure the coupling of the body **10** to the housing **19** of the apparatus, in view of the wedging of the ratchet ring **50** between the housing **19** and the body **10** of the tool, in the manner described above. Following the placing of the apparatus in the appropriate lower location in the well casing, the body **10** and the tubular string attached thereto are elevated slightly and turned to the right once again, to relocate the pins **54** under the horizontal shoulders **57** of the ratchet sleeve **50**, which will hold the ratchet sleeve **50** in its ineffective position, to permit the body **10** to ratchet downwardly therethrough and with respect to the housing **19**, achieving a reengagement of the slips **24** and the packing sleeve **31** with the wall of the well casing B.

With the releasable one-way type of clutch **17** described, it is only necessary to place the clutch parts in the released or clutch engaging position by appropriate turning of the tubing string and the body **10**. The parts will stay in the relative position at which the clutch is released, or in which it is effective to be engaged. It is unnecessary to maintain any torque or turning effort on the tubing string and body **10**, as in prior art devices. Once the ratchet ring **50** has been shifted, to place its vertical slots **56** in alignment with the control pins **54** or to place its horizontal shoulders **57** above the control pins, the clutch ring **50** will remain in this position. It is only necessary, thereafter, to appropriately move the tubing string and the body **10** attached thereto in a vertical direction to achieve the anchoring of the well tool in packed-off condition within the well casing, or to lower the apparatus downwardly through the well casing, with the slips **24** and packing structure **31** remaining in their retracted positions. The clutch arrangement is relatively inexpensive to manufacture, in view of its simplicity. As a matter of fact, it is substantially cheaper than clutching devices heretofore devised for accomplishing the same purpose in subsurface well apparatus.

In the form of invention disclosed in Fig. 3, the clutching apparatus **17*a*** is essentially the same as the one disclosed in Figs. 1 and 2, except that it is illustrated in conjunction with a well packer D adapted to be anchored in packed-off condition within a well casing against upward movement therewithin. In other words, the body or mandrel **10*a*** of the tool is either permitted or prevented from moving upwardly with respect to the ratchet housing **19*a***, rather than being permitted or prevented from moving downwardly with respect to the ratchet housing, as in the form of invention described above. Accordingly, the clutch mechanism **17*a*** is disposed in an inverted position relative to the position shown in Figs. 1 and 2. However, the parts are the same and function in essentially the same manner.

Only the main portion of the well apparatus pertaining to the invention is shown in Fig. 3, inasmuch as the specific well packer by itself forms no part of the present invention. In general, the well packer is specifically shown and described in the patent to R. C. Baker et al., 2,633,917, to which attention is directed for details. It is adapted to be run in a well casing B on the end of a tubular running-in string (not shown) threadedly or otherwise attached to the upper end of the tubular mandrel or body portion **10*a*** of the packer. The lower end of this body portion is threaded onto the upper end of a

tubular packer body **10***b*, to which is attached a lower packing actuator in the form of a guide (not shown).

A tapered expander **70** is mounted on the body part **10***b* immediately above a packing sleeve **31***a* which extends downwardly to the guide (not shown) referred to above. When the tubular string and body **10***a*, **10***b* are elevated, the lower guide (not shown) is moved toward the exander **70** to compress the intervening packing sleeve **31***a* therebetween, forcing it outwardly into engagement with the wall of the well casing. Such actuation of the packing sleeve only occurs when the tapered expander **70** is prevented from moving upwardly, which results in shifting of the expander within a plurality of slips **71** and outward expansion of the latter against the wall of the casing.

The slips **71** have tapered cam surfaces **72** cooperating with companion tapered surfaces **73** on the expander, the inclination of such surfaces being such as to move the slips outwardly toward the casing when the expander is elevated. Conversely, lowering of the expander **70** with respect to the slips **71** permits the latter to release from the casing wall and move inwardly to retracted position.

It is, accordingly, apparent that elevation of the tubular string and packer body **10***a*, **10***b* can effect anchoring of the tool through engagement of the slips **71** with the casing B under the influence of the tapered expander **70**. Such elevation also effects compression and foreshortening of the rubber packing sleeve **31***a* between the expander **70** and the lower guide (not shown), to produce radial outward expansion of the packing structure into sealing engagement with the casing wall.

The slips **71** are held together for joint movement along the tapered expander **70** to and from engagement with the casing by pin-connecting them to the lower ends of links **74** whose upper ends extend between the fingers **75** of a slip ring **76**. This ring is also provided with a peripheral groove **77** into which pins **78** projecting in both directions from the sides of the links **74** may extend, for the purpose of coupling all of the links **74** and slips **71** for movement jointly with the slip ring **76**. Outward movement of the upper ends of the links **74** is prevented by a stop ring **79** encompassing the slip ring **76** and a swivel mechanism **80**, which connects the slip ring **76** to a drag and block device **81**. The main purpose of the drag device is to resist longitudinal movement of the slips **71** through the well casing B.

The drag device **81** includes the outer ratchet housing **19***a*, corresponding to the ratchet housing **19** of the other form of the invention, the lower end of this ratchet housing being threadedly secured to a lower stop ring or swivel ring **20***a*. This stop ring **20***a* and the slip ring **76** are provided with outwardly directed flanges **82** adjacent one another received within an internal circumferential groove **83** in a tie ring **84** having upper and lower inwardly directed flanges **85** disposed above and below the stop ring and slip ring flanges **82**. For convenience of assembly, the tie ring **84** may be made in two halves that are moved radially inward to dispose the flanges **85** above and below the stop ring and slip ring flanges **82**. This two-piece tie ring **84** is prevented from coming apart by the encompassing sleeve **79**, which may be suitably secured to one or both parts of the tie ring **84** by one or more screws (not shown) extending through the outer ring **79** and into the tie ring.

It is apparent that the tie ring **84** and the flanges **82** on the stop ring **20***a* and slip ring **76** form a swivel connection **80** between the drag device **81** and the slips **71**, permitting relative rotation therebetween to take place, at least to a limited extent, while coupling the two structures together against substantial relative longitudinal movement.

The drag device **81** includes the outer housing **19***a* which is slidable along the body or mandrel **10***a*, and to which the lower end of circumferentially spaced outwardly bowed friction drag springs **87** are secured. These springs frictionally engage the wall of the well casing B, their upper ends (not shown) being secured to another ring (not shown) slidable on the mandrel **10***a*. It is evident that the friction drag device **81** resists longitudinal movement of the slips **71** within the well casing B, enabling relative upward movement of the expander **70** to take place within the slips, to anchor the latter against the wall of the well casing, as well as to permit the expander **70** to move downward with respect to the slips, to release the latter from the well casing. The performance of these relative actions depends upon the ability of the mandrel or body **10***a*, **10***b* of the apparatus to shift longitudinally within the clutch housing **19***a*.

As stated above, the releasable clutch mechanism shown in Fig. 3 is identical with the one disclosed in Figs. 1 and 2, except that the parts are inverted. Accordingly, a detailed explanation of the clutch device shown in Fig. 3 is unnecessary. It is only evident that it is capable of coupling the body **10***a* against upward movement with respect to the housing **19***a* and drag device **81**, rather than against downward movement, as in the form of invention disclosed in Figs. 1 and 2.

In the operation of the apparatus disclosed in Fig. 3, it is secured to the tubular string to be lowered through the well casing B to the desired point at which it is to be anchored in packed-off condition therewithin. During such downward movement, the body **10***a*, **10***b* can ratchet freely through the ratchet ring **50** to a limited extent, which will insure the retention of the slips **71** and packing structure **31***a* in their retracted positions. Such downward movement of the body **10***a*, **10***b* carries the ratchet ring **50** downwardly within the housing groove **48** to a position in which the ring can be expanded outwardly by the camming action of the body teeth **53** against the companion V-shaped threads or teeth **52** along the interior of the ratchet sleeve **50**.

When it is desired to anchor the apparatus D in packed-off condition within the well casing, the body **10***a*, **10***b* is to be permitted to shift upwardly relative to the ratchet housing **19***a*. Accordingly, the tubular string and body are moved slightly in a downward direction to locate the ratchet sleeve **50** in its lowermost position within the clutch housing **19***a*. The tubular string and body are then turned in a counter-clockwise direction to a slight extent to insure the disposition of the upwardly facing horizontal shoulders **57** on the ratchet sleeve **50** below the control pins **54** that are secured to the housing **19***a*. Thereafter, the tubular spring and body can be elevated, the control pins **54** preventing upward movement of the ratchet ring **50** into its wedging position within the clutch housing **19***a*, the teeth **53** on the body camming the ratchet sleeve **50** outwardly and ratcheting freely therethrough. The drag springs **87** are resisting upward movement of the slips **71**, which means that upward movement of the body **10***a*, **10***b* will carry the packing structure **31***a* and expander **70** upwardly, the expander moving within the slips **71** and urging them laterally outward into anchoring engagement with the wall of the well casing. Continued upward movement of the body will then cause foreshortening of the packing sleeve **31***a* and its outward expansion into sealing engagement with the wall of the well casing B.

When the apparatus D is to be released, the tubular string and body **10***a*, **10***b* need merely be lowered, the body ratcheting freely through the ratchet sleeve **50**, allowing the packing sleeve **31***a* to elongate and retract from the casing, the expander **70** shifting downward relative to the slips **71**, enabling the latter to move inwardly to their retracted positions. If it is then desired to elevate the apparatus in the well casing, the tubular string and body **10***a*, **10***b* are turned to the right, which will shift the ratchet ring **50** in the same direction with it, the housing **19***a* being prevented from rotating by the drag springs **87**. A partial revolution to the right of the

ratchet ring **50** will place the vertical slots **56** in alignment with the control pins **54**, whereupon upward movement of the body **10***a*, **10***b* of the tool will carry the ratchet ring upwardly with it and cause its external tapered surface **51** to engage the companion internal tapered surfaces **49** of the housing **19***a*, to wedge the ring **50** in an inward direction, maintaining its internal teeth **52** fully engaged with the external teeth **53** on the body. Accordingly, the body **10***a*, **10***b* of the tool is clutched or coupled to the clutch housing **19***a*, precluding relative movement between the slips **71** and expander **70**, as well as other parts of the apparatus. The entire apparatus D can be elevated in the well casing B, and withdrawn therefrom at the top of the hole if desired.

In the form of invention disclosed in Fig. 3, once the clutch mechanism **17***a* has been placed in its coupling or released position, it will remain in such position without the necessity of maintaining any torque or turning effort, either in the left-hand or right-hand direction, on the tubular string or the body **10***a*, **10***b* secured thereto.

The inventor claims:

1. In a well tool adapted for operation in a well bore: a body member connectible to a running-in string for moving the tool within the well bore; a clutch housing member surrounding said body member; an expansible and contractible clutch ring between said members; said clutch ring and one of said members having coengageable tapered surfaces for forcing said ring into clutching engagement with the other of said members upon longitudinal movement in one direction of said ring relative to said one member; and means on said one member engageable with said ring for preventing such longitudinal movement of said ring when disposed in one position with respect to said ring and permitting such longitudinal movement when disposed in another position with respect to said ring.

2. In a well tool adapted for operation in a well bore: a body member connectible to a running-in string for moving the tool within the well bore; a clutch housing member surrounding said body member; an expansible and contractible clutch ring between said members; said clutch ring and one of said members having coengageable tapered clutch teeth; said clutch ring and the other of said members having coengageable tapered surfaces for forcing said ring laterally toward said one member upon longitudinal movement in one direction of said ring relative to said other member to hold said clutch teeth coengaged; means on said other member engageable with said ring to prevent such longitudinal movement of said ring to permit said one member to move longitudinally in said one direction relative to said ring when said means is disposed in one position with respect to said ring and to permit such longitudinal movement when disposed in another position with respect to said ring.

3. In a well tool adapted for operation in a well bore: a body connectible to a running-in string for moving the tool within the well bore; a clutch housing surrounding said body; an expansible and contractible clutch ring between said body and housing; said clutch ring and housing having coengageable tapered surfaces for forcing said ring into clutching engagement with said body upon longitudinal movement in one direction of said ring relative to said housing; and means on said housing engageable with said ring for preventing such longitudinal movement of said ring when disposed in one position with respect to said ring and permitting such longitudinal movement when disposed in another position with respect to said ring.

4. In a well tool adapted for operation in a well bore: a body connectible to a running-in string for moving the tool within the well bore; a clutch housing surrounding said body; an expansible and contractible clutch ring between said body and housing; said clutch ring and body having coengageable tapered clutch teeth; said clutch ring and housing having coengageable tapered surfaces for forcing said ring laterally toward said body upon longitudinal movement in one direction of said ring relative to said housing to hold said clutch teeth coengaged; means on said housing engageable with said ring to prevent such longitudinal movement of said ring to permit said body to move longitudinally in said one direction relative to said ring when said means is disposed in one position with respect to said ring and to permit such longitudinal movement when disposed in another position with respect to said ring.

5. In a well tool adapted for operation in a well bore: a body member connectible to a running-in string for moving the tool within the well bore; a clutch housing member surrounding said body member; an expansible and contractible clutch ring between said members; said clutch ring and one of said members having coengageable tapered surfaces for forcing said ring into clutching engagement with the other of said members upon longitudinal movement in one direction of said ring relative to said one member; first means on said one member engaging second means on said ring for preventing such longitudinal movement of said ring; said ring being rotatable relative to said one member to disengage said first and second means from each other and to place said first means in a position of non-engagement with said ring to permit such longitudinal movement of said ring.

6. In a well tool adapted for operation in a well bore: a body member connectible to a running-in string for moving the tool within the well bore; a clutch housing member surrounding said body member; an expansible and contractible clutch ring between said members; said clutch ring and one of said members having coengageable tapered clutch teeth; said clutch ring and the other of said members having coengageable tapered surfaces for forcing said ring laterally toward said one member upon longitudinal movement in one direction of said ring relative to said other member to hold said clutch teeth coengaged; first means on said other member engageable with second means on said ring for preventing such longitudinal movement of said ring; said ring being rotatable relative to said other member to disengage said first and second means from each other and to place said first means in a position of non-engagement with said ring to permit such longitudinal movement of said ring.

7. In a well tool adapted for operation in a well bore: a body connectible to a running-in string for moving the tool within the well bore; a clutch housing surrounding said body; an expansible and contractible clutch ring between body and housing; said clutch ring and body having coengageable tapered clutch teeth; said clutch ring and housing having coengageable tapered surfaces for forcing said ring laterally toward said body upon longitudinal movement in one direction of said ring relative to said housing to hold said clutch teeth coengaged; first means on said housing engaging second means on said ring for preventing such longitudinal movement of said ring; said ring being rotatable by said body relative to said housing to disengage said first and second means from each other and to place said first means in a position of non-engagement with said ring to permit such longitudinal movement of said ring.

8. In a well tool adapted for operation in a well bore: a body member connectible to a running-in string for moving the tool within the well bore; a clutch housing member surrounding said body member; an expansible and contractible clutch ring between said members; said clutch ring and one of said members having coengageable tapered surfaces for forcing said ring into clutching engagement with the other of said members upon longitudinal movement in one direction of said ring relative to said one member; said ring having a transverse shoulder; a pin on said one member engageable with said shoulder to prevent such longitudinal movement of said ring, whereby said other member is movable longitudinally of said one member and ring in said one direction; and

means for removing said pin from said shoulder to a position of non-engagement with said ring to permit such longitudinal movement of said ring.

9. In a well tool adapted for operation in a well bore: a body connectible to a running-in string for moving the tool within the well bore; a clutch housing surrounding said body; an expansible and contractible clutch ring between said body and housing; said clutch ring and body having coengageable tapered clutch teeth; said clutch ring and housing having coengageable tapered surfaces for forcing said ring laterally toward said body upon longitudinal movement in one direction of said ring relative to said housing to hold said clutch teeth coengaged; said ring having a transverse shoulder; a pin on said housing engageable with said shoulder to prevent such longitudinal movement of said ring, whereby said body is movable longitudinally of said housing and ring in said one direction; and means for removing said pin from said shoulder to a position of non-engagement with said ring to permit such longitudinal movement of said ring.

10. In a well tool adapted for operation in a well bore: a body connectible to a running-in string for moving the tool within the well bore; a clutch housing surrounding said body; a split, inherently contractile clutch ring between said housing and body; said clutch ring and body having coengageable tapered clutch teeth; said clutch ring and housing having coengageable tapered surfaces for forcing said ring laterally inward toward said body upon longitudinal movement in one direction of said said ring relative to said housing to hold said clutch teeth coengaged; said ring having a transverse shoulder; a pin on said housing engageable with said shoulder to prevent such longitudinal movement of said ring, whereby said body is movable longitudinally of said housing and ring in said one direction; and means for removing said pin from said shoulder to a position of non-engagement with said ring to permit such longitudinal movement of said ring.



11. In a well tool adapted for operation in a well bore: a body connectible to a running-in string for moving the tool within the well bore; a clutch housing surrounding said body; a split, inherently contractile clutch ring between said housing and body; said clutch ring and body having coengageable tapered clutch teeth said clutch ring and housing having coengageable tapered surfaces for holding said ring laterally inward toward said body upon longitudinal movement in one direction of said ring relative to said housing to hold said clutch teeth coengaged; said ring having a transverse shoulder; and a pin on said housing engageable with said shoulder to prevent such longitudinal movement of said ring, whereby said body is movable longitudinally of said housing and ring in said one direction; said body having a longitudinally extending keyway; and an element on said ring extending into and slidable relatively along said keyway.

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