

Aug. 29, 1961

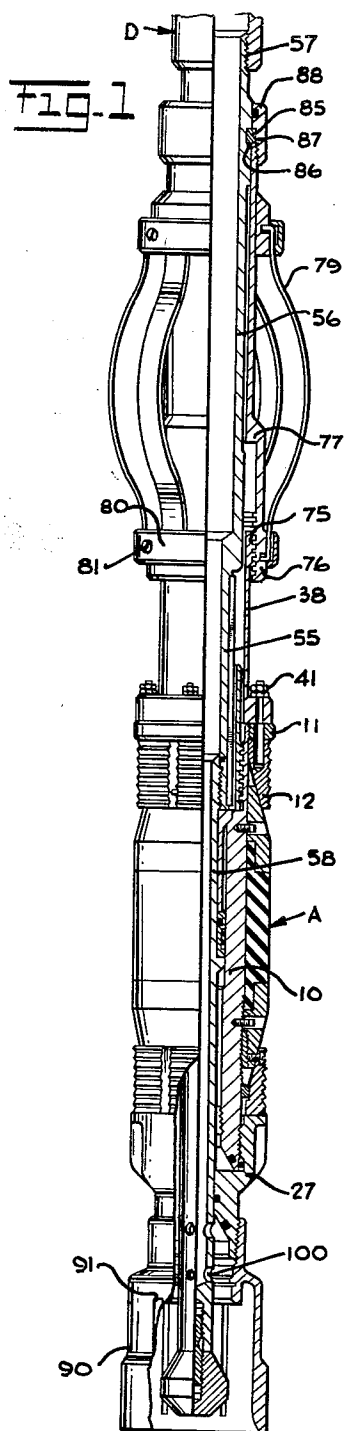
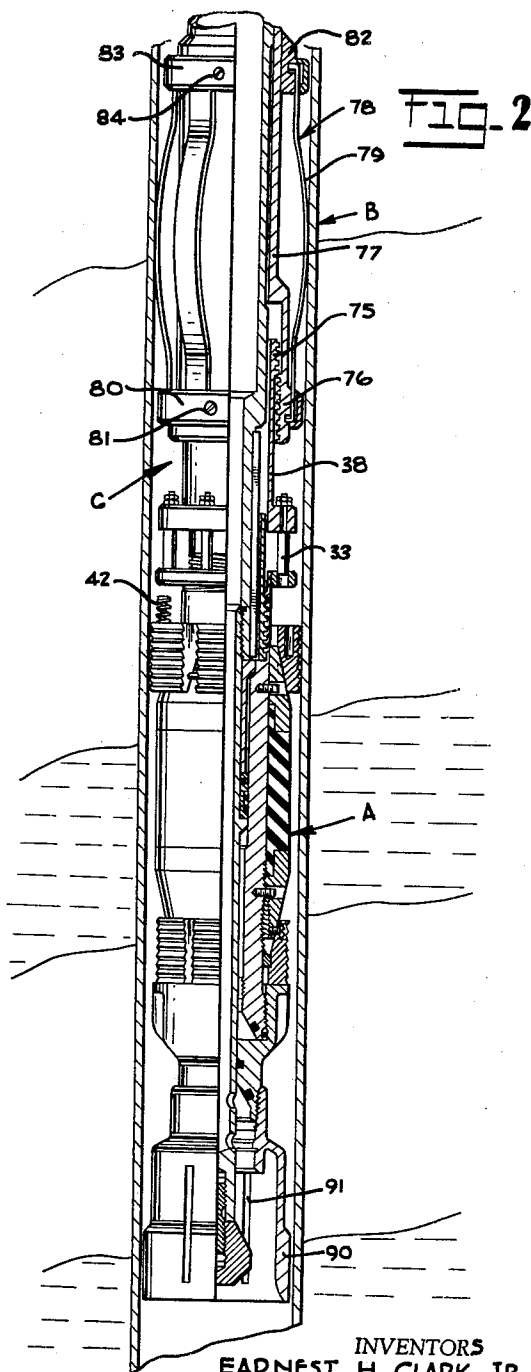
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2,998,073

MECHANICALLY SET WELL PACKER

Filed Aug. 11, 1958

3 Sheets-Sheet 1



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3 Sheets-Sheet 2

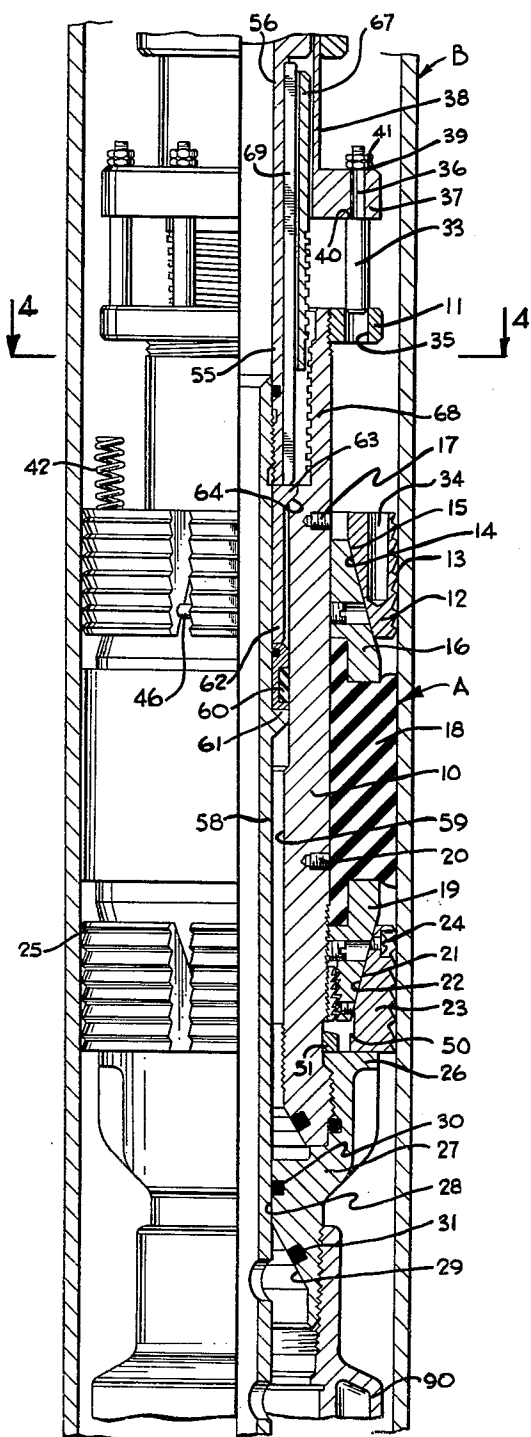


FIG. 3

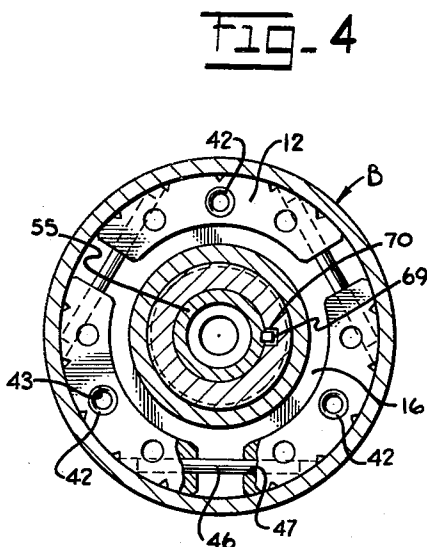


FIG. 4

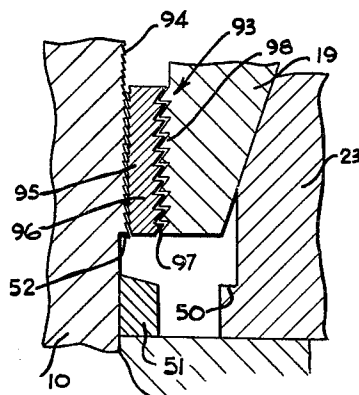


FIG. 5

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FIG. 7

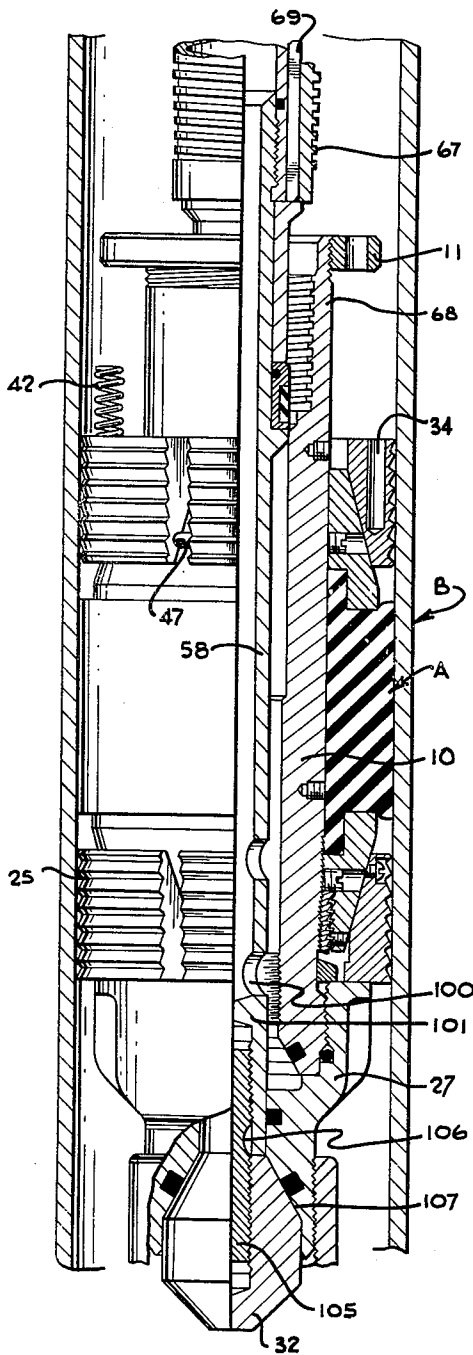
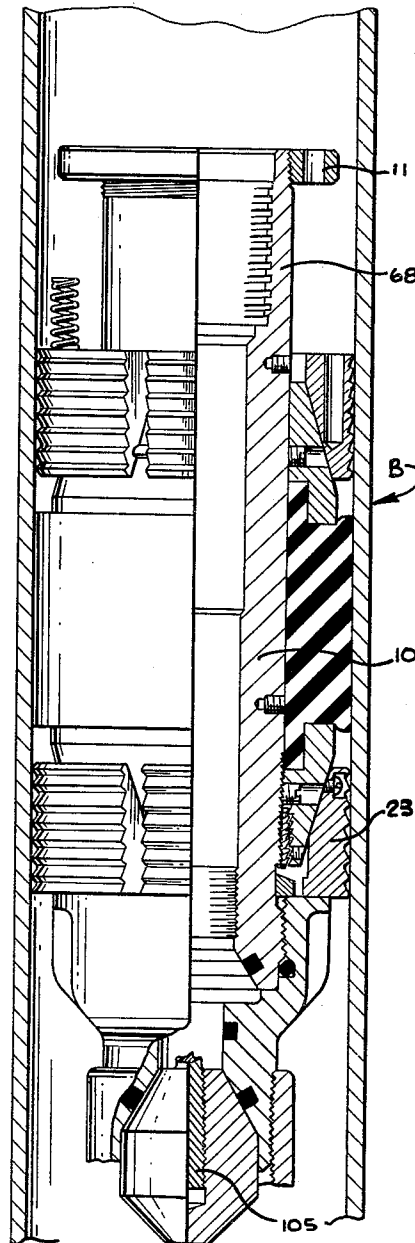


FIG. 6



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MECHANICALLY SET WELL PACKER

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14 Claims. (Cl. 166—134)

The present invention relates to subsurface well bore equipment, and more particularly to well packers adapted to be anchored in packed-off condition in well bores to perform certain desirable operations therein, such as cementing, acidizing, producing, formation fracturing, testing, or bridging.

An object of the invention is to provide a well packer having normally retracted slips and packing which can be retained more securely in retracted positions during running of the well packer in a well bore, assurance being had that the parts will not be released and expanded prematurely.

Another object of the invention is to provide a well packer having outwardly expandible parts normally retained in retracted position by the use of shear screws, or the like, in which the shear screws can be made stronger, and in which certain parts of the packer are not retained in retracted position by shear screws.

A further object of the invention is to provide an improved mechanical device for effecting outward expansion of certain well packer parts, such as casing engaging slips, when the setting location of the packer in the well bore has been reached.

An additional object of the invention is to provide a well tool embodying improved means for retaining the normally retracted segmental slips of the tool in alignment while they are retracted and while they are being expanded outwardly.

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

Referring to the drawings:

FIGURE 1 is a combined side elevational view and longitudinal section through a well packer apparatus, with its parts in their initial or retracted position;

FIG. 2 is a view similar to FIG. 1 illustrating the well packer partially set in a well casing;

FIG. 3 is an enlarged view similar to FIGS. 1 and 2 showing the well packer fully set within the well casing;

FIG. 4 is a cross-section taken along the line 4—4 on FIG. 3;

FIG. 5 is an enlarged fragmentary section through the latch or locking portion of the well packer;

FIG. 6 is a view similar to FIG. 3 illustrating the central passage through the packer closed;

FIG. 7 is a view similar to FIG. 3 illustrating the central passage through the packer closed against upward flow of fluid therethrough and the setting mechanism of the apparatus removed therefrom.

The well packer A illustrated in the drawings is adapted to be anchored in packed-off condition in a well casing B. It is run in the well casing, or similar conduit string, by means of a setting tool C, the upper portion of which is attached to the lower end of a tubular running-in string D, such as tubing or drill pipe extending to the top of the hole.

The well packer includes a tubular body 10 having an

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upper ring 11 threadedly secured thereto, against which a set of upper segmental slips 12 are retained initially. These segmental slips have upwardly facing wickers 13 adapted to embed themselves in the wall of the well casing B when the slips are expanded outwardly thereagainst. They also have inner surfaces 14 inclined in an upward and inward direction and engaging a companion externally tapered surface 15 on an upper expander 16 initially releasably retained to the body of the tool by one or more shear screws 17. Surrounding the body is a packing sleeve 18, of rubber or rubber-like material, which is disposed initially in a retracted position with its upper end engaging the upper expander 16 and its lower end a lower expander 19 secured initially to the body of the tool by one or more shear screws 20. This lower expander has an external expander surface 21 tapering downwardly and inwardly, which engages companion inner tapered surfaces 22 on a lower set of segmental slips 23 held initially in retracted position by shear screws 24 attaching them to the lower expander. These lower slips have downwardly facing wickers or teeth 25 adapted to engage the wall of the well casing B when expanded outwardly thereagainst by the lower expander 19. Initially the lower slips rest upon the upper abutment end 26 of a body extension 27 threadedly secured to the body 10 of the tool, this body extension having a cylindrical valve seat 28 therein and also a tapered valve seat 29 below the cylindrical valve seat. The cylindrical valve seat may contain a side seal ring 30, made of rubber or rubber-like material, whereas, the tapered valve seat 29 may also have a rubber or rubber-like sealing element 31 contained therein for sealing against a companion valve member 32.

The upper set of slips 12 is retained initially in a retracted position by a plurality of longitudinally extending retaining pins 33. As illustrated, a pair of such retaining pins are slidably disposed in companion longitudinal bores 34 in each slip segment 12, the retaining pins extending through aligned longitudinal holes 35 in the body ring 11. The retaining pins have reduced diameter shank portions 36 extending through the lower head 37 of a release sleeve 38, the pins being clamped to this head by nuts 39 threaded on their upper ends that bear against the upper side of the head, pulling the pin shoulders 40 against the lower side of the head. Inadvertent loosening of the nuts 39 is prevented by a lock nut 41 threaded on the stem of each retaining pin 33. When the pins are pulled upwardly out of the sockets or bores 34 in the slip segments 12, compression springs 42 can shift the slips downwardly along the upper expander 16 and radially outwardly into engagement with the wall of the well casing B. Each of said springs is disposed in a longitudinal socket 43 in the mid-portion of each slip segment, the upper end of the spring bearing against the lower surface of the body ring 11.

When the retaining pins 33 are disposed in the upper slip segments 12, the latter are held in their upward position against the body ring 11, and also retracted inwardly against the periphery of the body 10, the springs 42 then being in a highly compressed state. Upon pulling of the pins 33 upwardly from the sockets 34, the springs can propel segmental slips 12 downwardly along the expander 16 and outwardly into engagement with the wall of the well casing.

Assurance is had that the upper segmental slips 12 will shift downwardly, while remaining in transverse alignment with respect to one another, by providing transverse aligning pins 46 within and between the slip segments. Thus, each slip segment 12 has a hole 47 therein at each of its side portions in which an aligning pin 46 is disposed, this pin bridging the gap between adjacent segments and being received within an aligned hole 47 in an adjacent

slip segment, as shown most clearly in FIG. 4. The aligning pin 46 may have a press fit in the bore 47 in one section and a slidable fit in the bore 47 of the adjacent segment, or it may be slidable in the bores of both segments. The aligning pins 46 retain all of the slip segments 12 in the same transverse plane, while permitting them to slide along the aligning pins 47 when they are shifted radially outwardly by the action of the springs 42 forcing the slips 12 downwardly along the tapered surface 15 of the upper expander 16. The aligning pins 46 insure the retention of the slips 12 in alignment when in retracted position, and during their entire movement to their fully expanded position in anchoring engagement with the wall of the well casing B.

The retaining pins 33 not only hold the slips 12 in retracted position, but they prevent such slips from being shifted inadvertently down along the expander 16. The lower set of segmental slips 23 is also prevented from being prematurely tripped and expanded by providing an inner shoulder 50 on each segment 23 engaging the lower side of a split, contractile retainer ring 51, the upper end of which bears against a downwardly facing shoulder 52 on the body 10. During lowering of the apparatus in the well casing, any foreign matter that might tend to become wedged between the lower slips 23 and the wall of the well casing B is prevented from shearing the screws 24 attaching the lower slips to the expander 19, by virtue of the fact that the upward force on the slips is transferred through the segmental ring 51 to the body 10 of the tool. The segmental ring, however, does not interfere with upward shifting of the lower slips 23 along the lower expander 19 to secure their outward expansion into engagement with the wall of the well casing, as described hereinbelow.

The apparatus is run in the well casing by means of a tubular mandrel 55, including an upper section 56 having an upper threaded pin 57 for threadedly securing the mandrel to the lower end of the tubular string D. This upper section is threadedly attached to a lower section 58 extending through the central passage 59 through the body 10 and also through the valve seats 28, 29 surrounding such passage. The mandrel carries a suitable side seal structure 60 held against a shoulder 61 on the lower mandrel section 58 by a retainer sleeve 62 held against the upper portion of the seal structure by the lower end of the upper mandrel section 56. This retainer sleeve has an outwardly directed stop flange 63 adapted to engage a companion upwardly facing shoulder 64 on the body 10 of the tool. Leakage of fluid between the mandrel 55 and the wall of the body passage 59 is prevented by the side seal 60 and also by the engagement of the cylindrical seat 28 and its seal ring 30 with the periphery of the lower mandrel section 58.

The mandrel 55 is releasably secured to the body 10 of the tool by a threaded nut 67 threadedly secured within the upper threaded box 68 in the body of the tool, the threads being left-hand. This nut is slidably splined to the mandrel 55 by securing an elongate longitudinally extending key 69 to the mandrel, which is slidably received within a companion keyway 70 extending lengthwise of the nut. When the nut 67 is threaded fully within the threaded body box 68, its lower end engages the shoulder 63 provided by the upper end of the retaining sleeve 62.

The setting tool includes the mandrel 55 and nut 67 arrangement and also the release sleeve 38 that carries the retaining pins 33. The upper end of this release sleeve has a threaded head portion 75 threadedly connected to the lower threaded portion 76 of the drag body 77 of a drag device 78 surrounding the mandrel 55. The threaded connection 75, 76 is left-hand in order that right-hand rotation of the release sleeve 38 will cause it to thread upwardly along the drag body 77 until it is completely unthreaded therefrom, as described hereinbelow.

The lower portion of the drag body 77 has the lower ends of circumferentially spaced, outwardly bowed drag springs 79 secured thereto, which are adapted to frictionally engage the wall of the well casing B, the lower ends being secured to the drag body by an encompassing retaining ring 80 attached to the body by screws 81. The upper ends of the outwardly bowed springs 79 are secured to an upper collar 82, slidable on the upper portion of the drag body 77, by an upper retaining ring 83 encompassing the springs and attached to the collar by a plurality of screws 84. The drag body 77 itself is movable longitudinally with the mandrel 55, the latter, however, being capable of rotation therewithin by providing a swivel connection therebetween. Thus, a split ring 85 is mounted in a peripheral groove 86 in the upper portion of the mandrel section 56, and is received within an opposed circumferentially continuous groove 87 defined between the upper end of the drag body 77 and a drag body nut 88 threadedly mounted thereon.

The apparatus is run in the well casing B with the parts disposed in the relative positions shown in FIG. 1, in which the upper and lower segmental slips 12, 23 and packing sleeve 18 are in retracted positions, the retaining pins 33 being disposed fully within the bores 34 of the upper segmental slips 12, with the springs 42 in their maximum compressed state. The release sleeve 38 is threaded within the drag body 77 of the drag device, the nut 67 being fully threaded within the body 10 of the apparatus. The apparatus is lowered in the well casing with the outwardly bowed springs 79 of the drag device 78 sliding frictionally along the wall of the well casing. During such downward movement, any debris in the well bore is pushed ahead of the apparatus by a junk catcher and feeler 90 having longitudinal slots 91 therethrough, which can be threadedly secured to the lower portion of the lower body member or extension 27.

When the location in the well bore is reached at which the well packer is to be anchored in packed-off condition, the tubing string D and mandrel 55 are rotated to the right, causing the entire packer structure A to rotate with it, as well as the release sleeve 38. However, the drag device 78 is prevented from rotating by the frictional engagement of its bowed springs 79 against the wall of the well casing. Accordingly, rotation of the entire apparatus, with exception of the drag device, will result in a relative upward feeding of the release sleeve 38 along the drag body 77 in view of their left-hand threaded interconnection 75, 76, the release sleeve moving upwardly and pulling the retaining pins 33 in an upward direction until they have been pulled completely from the bores 34 of the upper segmental slips 12. When this occurs, the slips 12 and the springs 42 are released, the springs shifting the slips downwardly along the upper expander 16 and radially outwardly into engagement with the wall of the well casing. As described above, the aligning pins 46 insure that the slip segments 12 will retain their alignment with respect to one another. When the slips 12 are released, they may shift circumferentially of the body during their outward expansion, but, if such shifting occurs, the pins 46 will still maintain their alignment.

Usually, the tubular string D, the mandrel 55 and the packer apparatus as a whole are rotated to the extent at which the head 75 of the release sleeve 38 is unthreaded completely from the drag body 77, being disposed in the unthreaded portion of the latter above its internal threads 76. Following engagement of the upper slips 12 with the well casing, an upward pull is taken on the tubing string D and mandrel 55, which will be transmitted through the retaining sleeve 62 to the nut 67, and from the nut to the body 10 of the tool by virtue of their threaded interconnection. When the upward pull on the body exceeds the strength of the shear screws 17, 20, 24 attaching the expanders 16, 19 to the body and the lower slips 23 to the expander 19, such screws are disrupted, which will permit

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the body 10 to move upwardly, carrying the lower slips 23 upwardly along the lower expander 19 and shifting them radially outwardly into engagement with the well casing, and also shifting the lower expander 19 and lower slips 23 upwardly toward the upper expander 16, foreshortening the packing sleeve 18 and expanding it outwardly into firm sealing engagement with the wall of the well casing B and the packer body 10. A sufficient upward strain is taken on the tubing string D, mandrel 55, and the body 10 of the tool to insure the firm anchoring of the wickers 13, 25 of the upper and lower segmental slips 12, 23 against the well casing B and the leakproof sealing of the packing sleeve 18 against the wall of the well casing and the body of the tool.

The upward strain on the body 10 of the tool can now be relieved, the parts externally of the body remaining anchored in packed-off condition against the well casing by virtue of a one-way lock device 93 that precludes separation between the parts. As disclosed, the lower portion of the body has a plurality of ratchet teeth 94 extending circumferentially therearound and facing in a downward direction, which are adapted to engage companion upwardly facing ratchet teeth 95 formed internally on a split ratchet sleeve 96 disposed within the lower expander 19. The outer surface of the ratchet sleeve 96 consists of cam teeth 97 tapering in a downward and inward direction and engageable with companion tapered cam teeth 98 formed in the expander 19. The ratchet device 93 will permit the body 10 to move upwardly through the lower expander 19, since the body ratchet teeth 94 will merely ratchet freely over the companion teeth 95 on the lock sleeve 96. However, should the body 10 tend to shift downwardly, the ratchet teeth 94, 95 will co-engage, and any tendency for the ratchet ring to move downwardly will cause the cam teeth 97, 98 to engage and urge the split ratchet sleeve inwardly, thereby preventing downward movement of the body with respect to the lower expander, the latter being prevented from moving downwardly since it is wedged within the lower slips 23 that are anchored against the wall of the well casing.

As a result of the unthreading of the head 75 of the release sleeve from the drag body 77, the retaining pins 33 will have been elevated above the holes 35 in the body ring 11. The mandrel 55 can now be disconnected from the body 10 of the tool, which is prevented from rotating by the anchoring action of the slips 12, 23 against the well casing. The tubing string D and mandrel 55 are rotated to the right which will cause the nut 67 to rotate to the right within the threaded box 68 of the body 10. In view of the left-hand threaded connection between the nut and body, the nut will unscrew from the body, shifting upwardly along the mandrel 55. During its unthreading action, the rotatable driving connection between the mandrel 55 and nut 67 is retained in view of the spline connection provided between the mandrel key 69 and the keyway 70 in the threaded nut.

With the well packer anchored in packed-off condition in the well casing, the desired operation may be performed in the well bore. For example, a suitable charge of cement slurry may be pumped down the tubing string D, passing downwardly through the mandrel 55 and out through the ports 100 in its lower portion below the valve seat 28, flowing down into the well casing B below the packer and out from the casing into the well formation. Such pumping action can occur with or without the nut 67 threadedly secured to the body 10.

When the nut 67 has been unthreaded from the body, the tubing string D and mandrel 55 can be elevated, to pull the mandrel upwardly within the body and shifting the ports 100 in the mandrel above the lower seal ring 30 and cylindrical seat 28 in the lower body member. The mandrel section below the ports 100 has an end wall 101 closing the mandrel, the uninterrupted periphery of the mandrel below its ports sealing against the cylindrical

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seat 28 and seal ring 30 to prevent fluid from being pumped downwardly through the apparatus to any further extent, as well as preventing such fluid from flowing back into the tool through the ports 100, which are now in closed position, such as illustrated in FIG. 6.

The mandrel may be provided with a lower valve head 32 threaded onto the lower end of a release stud 105, which is, in turn, threaded into the lower portion of the mandrel section 58. This release stud 105 has an intermediate weakened section 106 at which it will part when subjected to a sufficient tensile strain. The head 32 has a tapered surface 107 conforming to the tapered surface of the lower valve seat 29, so that upward movement of the mandrel 55 to a sufficient extent will not only bring its cylindrical surface below the ports 100 in engagement with the upper cylindrical valve seat 28 and ring 30, but will also shift the lower head 32 into engagement with the tapered valve seat 29 and gasket, thereby providing two valve seats to insure against leakage of fluid through the apparatus both in upward and downward direction. At any time, the mandrel 55 can be relowered to the position determined by engagement of the flange 63 on the retaining sleeve 62 with the shoulder 64 on the body 10 to again remove the valve head 32 from its seat 29 and shift the ports 100 below the cylindrical seat 28, whereupon fluid can be pumped down the tubing string D and mandrel 55 for discharge through the ports 100. These ports can then be closed by pulling upwardly on the tubing string D and mandrel 55 to a position determined by engagement of the lower head 32 with the lower valve seat 29.

When the mandrel 55 and the entire setting tool C are to be removed from the well casing, the tubing string D and mandrel 55 are moved upwardly until the valve head 32 engages its lower seat 29. A sufficient tensile pull is now taken on the tubing string and mandrel, which is transmitted through the release stud 105 to the head 32. When this pull exceeds the tensile strength of stud at its weakened section 106, the latter is parted at that point, allowing the entire mandrel 55 to be removed from the well packer A and the entire setting tool C to be elevated in the well casing by the tubing string D, and removed completely therefrom. The head 32 will remain seated against the tapered valve seat 29, as disclosed in FIG. 7, acting as a back pressure valve preventing upward flow of fluid back into the passage 59 through the apparatus.

It is, accordingly, apparent that a well packer has been provided in which the body 10 of the tool is imperforate. The upper slips 12 are retained positively in retracted position and cannot be moved from such retracted position until the retaining pins 33 are withdrawn from the bores 34. The shear screws 17, 20, 24 holding the upper and lower expanders 16, 19 to the body 10 and the lower slips 23 to the lower expander 19 may be made comparatively strong, resisting premature shearing or tripping of the screws and setting of the retainer in the well casing during its lowering therewithin to the desired setting point. The pins 33 are positively removed from the upper slip segments 12 as a result of rotation of the apparatus, the packer being firmly set by the taking of a substantial and sufficient upward strain on the tubing string D, mandrel 55 and body 10 of the packer. Fluid can be pumped downwardly through the set tool and the passage there-through can be closed whenever desired by exerting an upward force on the mandrel which will shift the lower head 32 into engagement with its seat 29. The sealing engagement between the head 32 and seat 29 and also between the lower portion of the mandrel and the cylindrical seat 28 will not only prevent upward return flow of fluid through the apparatus, but it will also prevent downward flow of fluid through the apparatus A, which will then function as a bridge plug. At any time the passage through the apparatus can be reopened merely by shifting the tubing string D and mandrel 55 downwardly. Finally, when the setting portion C of the apparatus is to be removed from the well casing, an upward pull of a sufficient

amount is taken on the apparatus to disrupt the release stud 105, disconnecting the mandrel 55 from the lower valve head 32, which remains engaged with its companion tapered seat 29 to prevent upward flow of fluid through the well packer.

The inventors claim:

1. In well apparatus adapted to be set in a well bore: a body adapted to be lowered in the well bore on a running-in string; normally retracted means on and shiftable with respect to said body and expandible laterally outwardly of said body; spring means for shifting said normally retracted means longitudinally of said body and laterally outwardly of said body; retainer means secured to said normally retracted means to prevent said spring means from expanding said normally retracted means; and means responsive to rotation of the running-in string to shift said retaining means longitudinally along said normally retracted means to a position in which said retaining means is released from said normally retracted means to permit said spring means to shift said normally retracted means.

2. In well apparatus adapted to be set in a well bore: a body adapted to be lowered in the well bore on a running-in string; an expander on said body; segmental slips engaging said expander; spring means for shifting said slips longitudinally of said expander to expand said slips laterally outwardly of said body; retaining means engaging said slips to prevent their outward expansion; and means responsive to rotation of the running-in string for shifting said retaining means longitudinally along said slips to a position in which said retaining means is released from said slips to permit said spring means to shift said slips.

3. In well apparatus adapted to be set in a well bore: a body adapted to be lowered in the well bore on a running-in string; an expander on said body; segmental slips engaging said expander; spring means for shifting said slips relative to said expander and laterally outwardly of said body; longitudinally movable retaining means engaging said slips to prevent their outward expansion; and means for moving said retaining means longitudinally along said slips to a position in which said retaining means is released from said slips to permit said spring means to shift said slips.

4. In well apparatus adapted to be set in a well bore: a body adapted to be lowered in the well bore on a running-in string; an expander on said body; segmental slips engaging said expander and having longitudinally extending bores therein; spring means for shifting said slips longitudinally of said expander to expand said slips laterally outwardly of said body; retaining means including pins disposed in said bores to prevent said spring means from shifting said slips outwardly; and means for moving said retaining means longitudinally to remove said pins from said bores to permit said spring means to shift said slips.

5. In well apparatus adapted to be set in a well bore: a body adapted to be set in the well bore on a running-in string and having an abutment thereon; an expander on said body; slips engaging said expander and having longitudinally extending bores therein; spring means engaging said slips and abutment for shifting said slips longitudinally of said expander to expand said slips laterally outwardly of said body; retaining means including pins extending through said abutment into said bores to prevent said spring means from shifting said slips outwardly; and means for moving said retaining means longitudinally to remove said pins from said bores to permit said spring means to shift said slips.

6. In well apparatus adapted to be set in a well bore: a body; normally retracted means on and shiftable with respect to said body and expandible laterally outwardly of said body; spring means for expanding said normally retracted means laterally outwardly of said body; a mandrel secured to said body; retaining means secured to

said normally retracted means to prevent said spring means from expanding said normally retracted means; and means responsive to rotation of said mandrel for shifting said retaining means longitudinally along said normally retracted means to a position in which said retaining means is released from said normally retracted means to permit said spring means to expand said normally retracted means.

7. In well apparatus adapted to be set in a well bore: a body; normally retracted means on and shiftable with respect to said body and expandible laterally outwardly of said body; spring means for expanding said normally retracted means laterally outwardly of said body; a friction drag device; retaining means threadedly connected to said drag device and secured to said normally retracted means to prevent said spring means from expanding said normally retracted means; and a mandrel secured to said body and adapted to rotate said retaining means relative to said drag device to release said retaining means from said normally retracted means to permit said spring means to expand said normally retracted means.

8. In well apparatus adapted to be set in a well bore: a body; an expander on said body; segmental slips engaging said expander and having longitudinally extending bores therein; spring means for shifting said slips longitudinally of said expander to expand said slips laterally outwardly of said body; a friction drag device; retaining means threadedly connected to said drag device and including pins disposed in said bores to prevent said spring means from shifting said slips outwardly; and a mandrel secured to said body and adapted to rotate said retaining means relative to said drag device to remove said pins from said bores to permit said spring means to shift said slips.

9. In well apparatus adapted to be set in a well bore: a body adapted to be lowered in the well bore on a running-in string and having an abutment thereon; an expander on said body; slips engaging said expander and having longitudinally extending bores therein; spring means engaging said slips and abutment for shifting said slips longitudinally of said expander to expand said slips laterally outwardly of said body; a friction drag device; retaining means threadedly connected to said drag device and including pins extending through said abutment into said bores to prevent said spring means from shifting said slips outwardly; and a mandrel secured to said body and adapted to rotate said retaining means relative to said drag device to move said retaining means longitudinally and to remove said pins from said bores to permit said spring means to shift said slips.

10. In well apparatus adapted to be set in a well bore: a body having an abutment thereon; an upper expander on said body, upper slips engaging said expander and having longitudinally extending bores thereon; a lower expander on said body; lower slips engaging said lower expander; spring means engaging said upper slips and abutment for shifting said upper slips downwardly of said upper expander to expand said upper slips laterally outwardly of said body; a friction drag device above said abutment; retaining means threadedly connected to said drag device and including pins extending through said abutment into said bores to prevent said spring means from shifting said upper slips outwardly; a mandrel secured to said body and adapted to rotate said retaining means relative to said drag device to elevate said retaining means and remove said pins from said bores to permit said spring means to shift said upper slips; and means on said body engageable with said lower slips to shift said lower slips upwardly along said lower expander and laterally outwardly in response to upward movement of said mandrel and body.

11. In well apparatus adapted to be set in a well bore: a body adapted to be lowered in the well bore on a running-in string; means for anchoring said body in the

well bore including a set of initially retracted segmental slips expandible outwardly and capable of moving circumferentially of said body during outward expansion; transverse aligning pins on said slips, said slips having transverse bores snugly and slidably receiving said pins to maintain said slips in transverse alignment with respect to each other during their outward expansion.

12. In well apparatus adapted to be set in a well bore: a body adapted to be lowered in the well bore on a running-in string; means for anchoring said body in the well bore including a set of initially retracted segmental slips expandible outwardly and capable of moving circumferentially of said body during outward expansion; adjacent slips having aligned transverse bores opening through the adjacent ends of said slips; and pins in said transverse bores, said pins being snugly slidable in at least some of said bores to enable said slips to expand outwardly while said pins maintain said slips in transverse alignment with respect to each other.

13. In well apparatus adapted to be set in a well bore: a body adapted to be lowered in the well bore on a running-in string; normally retracted means on and shiftable with respect to said body and expandible laterally outwardly of said body; spring means for shifting said normally retracted means laterally outwardly of said body; retainer means secured to said normally retracted means to prevent said spring means from expanding said

normally retracted means; and means responsive to rotation of the running-in string to shift said retaining means longitudinally along said normally retracted means to a position in which said retaining means is released from said normally retracted means to permit said spring means to shift said normally retracted means.

14. In well apparatus adapted to be set in a well bore: a body adapted to be lowered in the well bore on a running-in string; an expander on said body; segmental slips engaging said expander and having longitudinally extending bores therein; spring means for shifting said slips laterally outwardly of said body; retaining means including pins disposed in said bores to prevent said spring means from shifting said slips outwardly; and means for moving said retaining means longitudinally to remove said pins from said bores to permit said spring means to shift said slips.

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