

Nov. 30, 1954

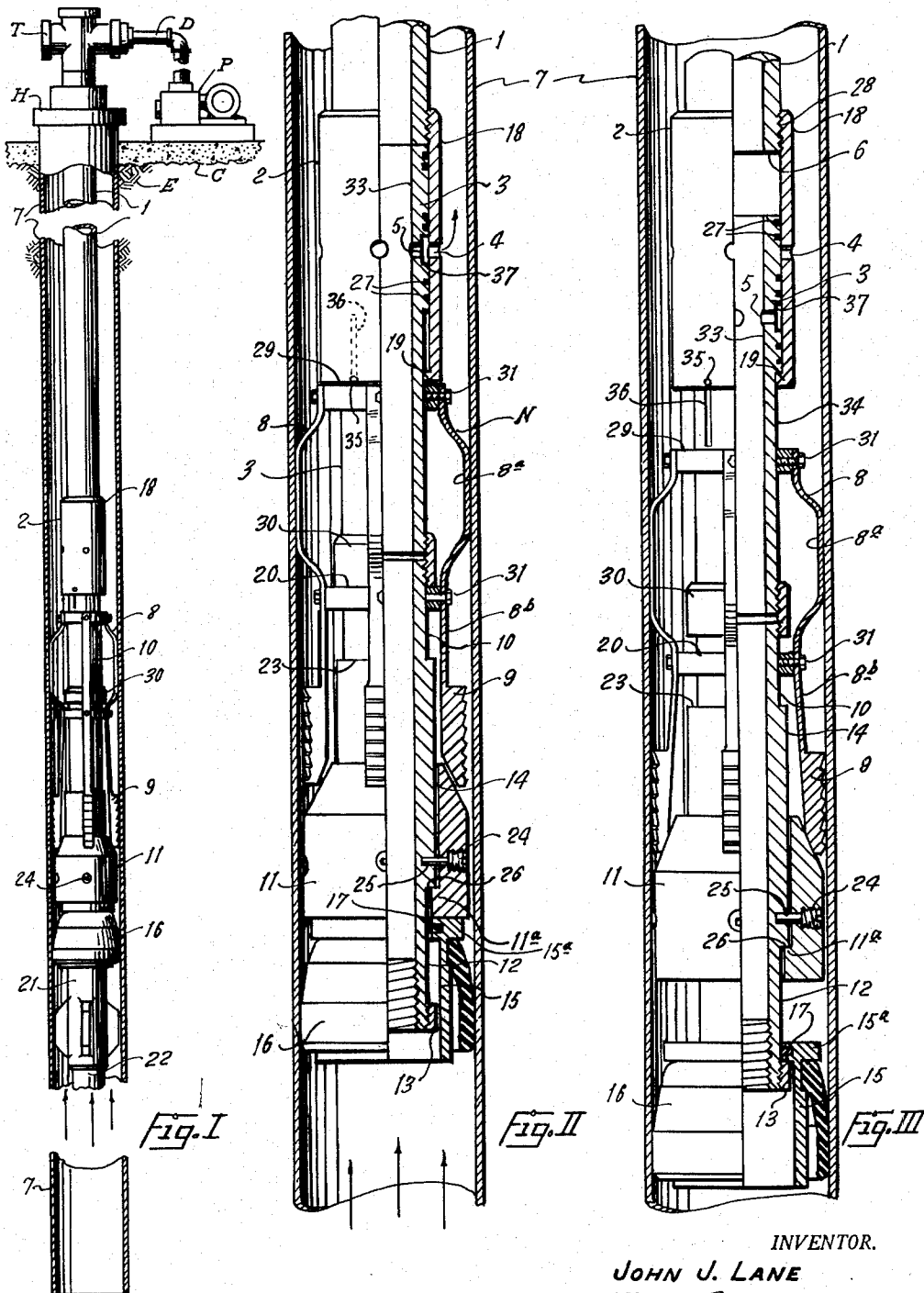
J. J. LANE

2,695,672

DROP HEAD RELEASE ANCHOR TOOL

Filed March 2, 1951

3 Sheets-Sheet 1



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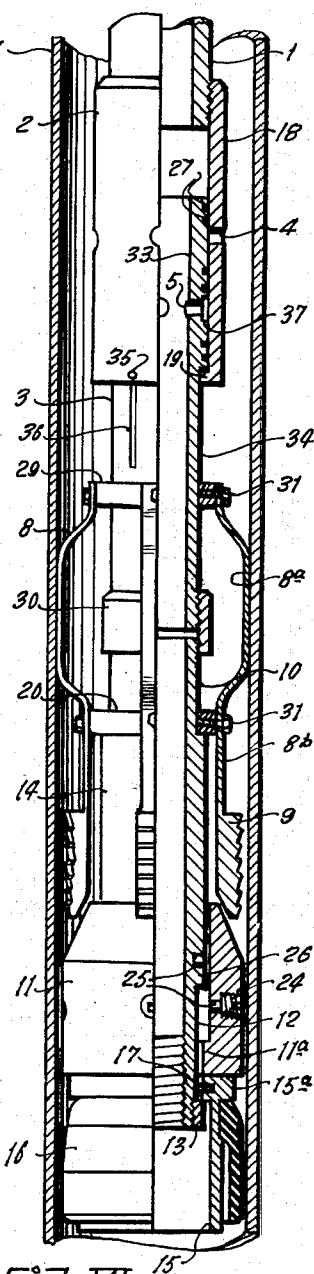
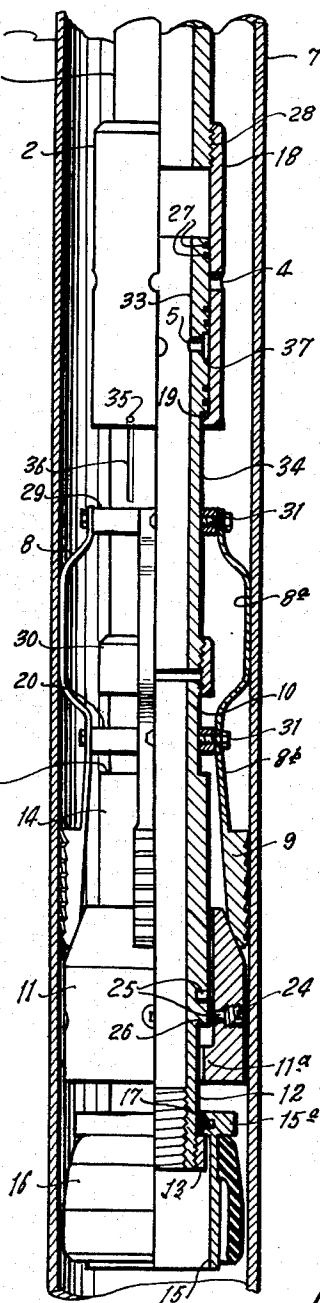
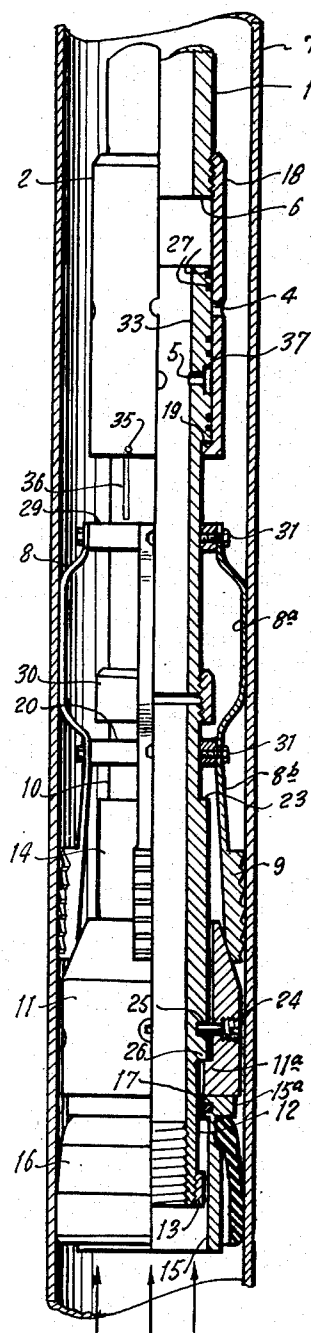
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DROP HEAD RELEASE ANCHOR TOOL

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3 Sheets-Sheet 2



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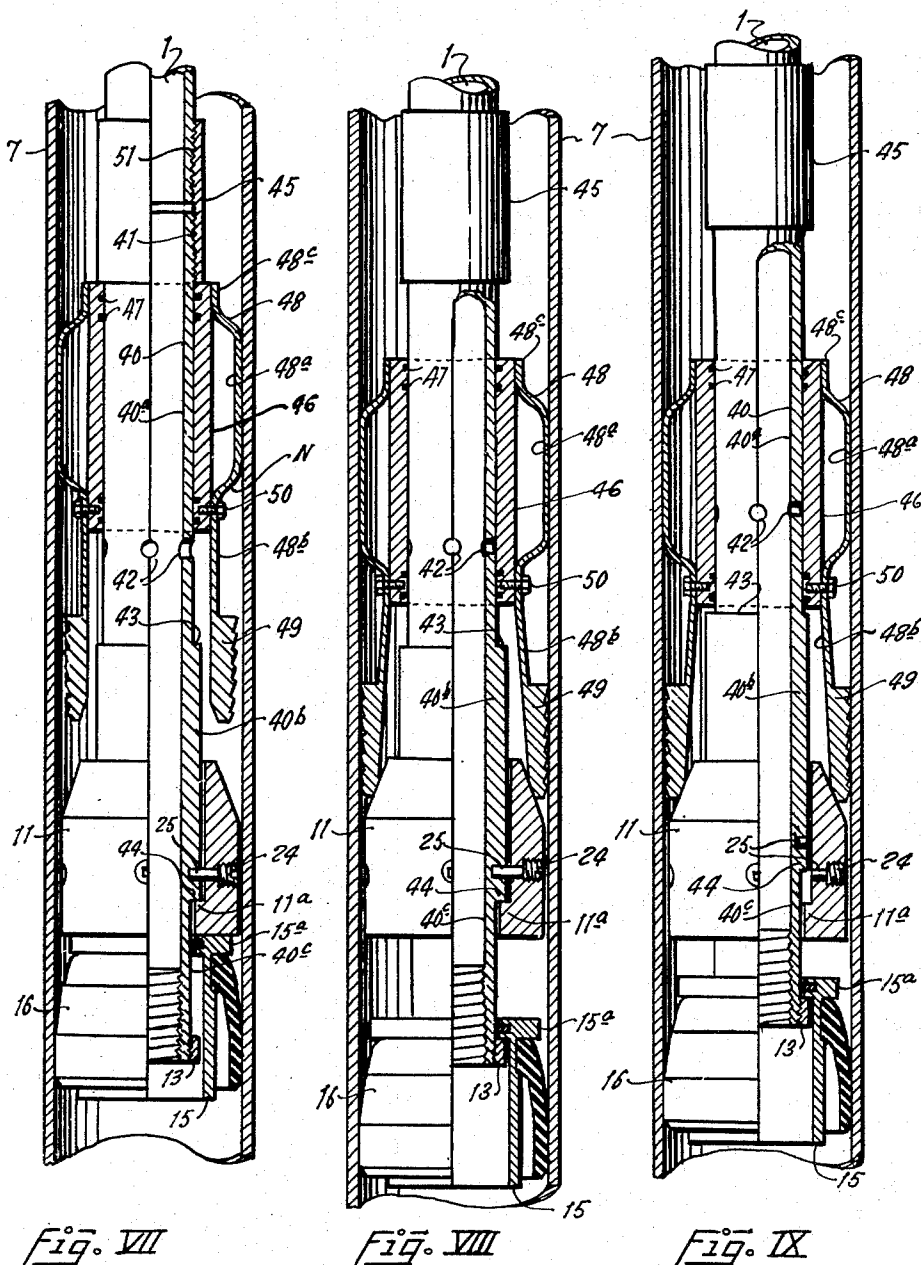
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DROP HEAD RELEASE ANCHOR TOOL

Filed March 2, 1951

3 Sheets-Sheet 3



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2,695,672

DROP HEAD RELEASE ANCHOR TOOL

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Application March 2, 1951, Serial No. 213,529

8 Claims. (Cl. 166—131)

This invention concerns well tool apparatus, whereby tubing pipe and/or packing devices may be releasably anchored to well casing; and such anchoring may be done swiftly, surely and dependably; and complete release may always be effected without the necessity of re-connecting, rotating, fishing or hooking-up of any tool parts or equipment; and the loss in the hole of any parts is precluded; and, even after long setting use, all apparatus and packers are certain to be withdrawn from the well together, and in one unailing operation; and, throughout all of the time of sustained anchorage, the tubing is relieved of undue stress and not required to be maintained under either downthrust force or up-pull tension.

This invention is usually employed as a packing tool. It may be used in any well which is walled with pipe, especially in oil and gas wells. It operates within a well casing, or outer string of pipe. It is carried by the well tubing, or inner pipe string.

Among the further objects and advantages of this invention will be found the provision of an anchor on the tubing string, so arranged and operated that such anchor will receive and hold all of the load that pushes up on the packing element.

The tool may be used, without the packing element, to so anchor the tubing as to render it unresponsive to the upthrust of a pump rod reciprocating within the tubing.

The tool, in its entirety, may be said to constitute a section of tubing, removably set in the tubing string, usually at or near the lower end of the string; but it may be placed at any other desired location within the tubing string.

In any event, the tubing string, of which this tool is a section, is so locked to the casing that all of the upthrust of fluid pressures below the packing element is transmitted to the casing and carried entirely thereby. This has the advantage of freeing all of the tubing above this tool from stresses ordinarily occasioned by upwardly thrusting forces arising from high fluid pressures below the packer.

The advantageous "locking arrangement" between tubing and casing is reversible, as will be hereinafter fully explained; and the entire tool may be easily released from engagement with the casing and readily removed from the casing by withdrawing the tubing.

Illustration forms of apparatus for employing this invention have been set out in the accompanying drawings, in which:

Fig. I presents a schematically arranged elevational view of a typical well tool anchor set in sectionalized casing, and also shows control apparatus schematically arranged above ground.

Fig. II is a partially sectionalized elevational view of a typical tool being lowered in well casing with head valve open allowing well fluid (arrows) to flow through the tool.

Fig. III is a sectionalized elevational view of the tool shown in Fig. II with valve closed, and setting head sufficiently elevated to force anchor teeth into casing wall, the packer cup being free of pressure and depending at base of tool.

Fig. IV is a sectionalized elevational view of the tool as shown in Fig. III except that fluid has been pumped through tubing to build strong pressure thrusting upwardly (arrows) lifting, spreading and setting packer cup so as to seal annulus between tubing and casing. This is the normal "set" or operating position of the tool.

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Fig. V is a sectionalized elevational view of the tool shown in Fig. IV after release of fluid pressure and after elevation of tool mandrel sufficiently to sever shear pins normally holding setting head.

Fig. VI is a sectionalized elevational view of the tool shown in Fig. V after slight downthrust of tubing and tool has effected disengagement of anchors and the dropping of the head. This is a position of the tool as it is removed from the well.

Fig. VII is a sectionalized elevational view of a modified form of tool, shortened and provided with simplified valve having exterior sliding sleeve. In this position the tool is lowered into the well.

Fig. VIII is a sectionalized elevational view of the modified tool shown in Fig. VII after anchors have been set into casing wall.

Fig. IX is a sectionalized elevational view of the modified tool shown in Fig. VIII as shear pins are severed preparatory to removing tool from well.

The construction, arrangement and operation of suitable apparatus for carrying out the invention may be understood by referring to the drawings, wherein the principal parts have been indicated by numerals, like numerals indicating like parts.

Certain conventional parts and apparatus incident to the customary employment of this invention have been indicated schematically at the top of Fig. I, and these include: Earth formations E, through which the well is drilled; concrete or cement C, ordinarily employed in cementing in place the first length of well casing; casing head apparatus H, employed to close the casing and especially the annulus between tubing and casing; tubing control apparatus T, arranged for the introduction to the tubing of fluid under pressure, and the relief of such fluid and pressure therein, and for other purposes; high pressure pump apparatus P, for delivering fluid through the tubing and into the lower parts of the well at great pressures; and delivery conduit, tubing or piping D, for transmitting high pressure fluids from pump to tubing.

In the drawings the mandrel 1 indicates the tubing, or inner pipe string, in which the tool which is the subject of this invention is placed as a section of the tubing string.

Preferably arranged as the uppermost part of the assembled tool (but placeable elsewhere as indicated in modified forms disclosed in Figs. VII et seq.) may be seen the sleeve valve which is shown as a telescoping valve 2 in Figs. II through VI. The sleeve valve is arranged to so operate that fluid may ordinarily flow through it in one direction only, which is upwardly and outwardly, while this well tool is being lowered into the casing. During the period of setting and anchoring this tool and of expanding and operating the packing element, the sleeve valve is closed.

Inner sleeve 3 of the sliding sleeve valve 2 may be considered as the head part of mandrel 10; and it is carried in valve housing 18, in slidable relation thereto. The inner sleeve member may be arranged for removable attachment to the mandrel body in any suitable fashion. Collar 30 may be employed to unite sleeve 3 with body 10 to form a continuous hollow mandrel.

Suitable discharge ports 4, appropriate in number and size to discharge the volume of fluid flowing upwardly through the tool into the well annulus is lowered into the hole, are provided through the wall of housing 18. Companion ports 5 are provided through the upper and preferably enlarged wall of sleeve 3. Ports 5 are made to complement ports 4, and must be in number, size and location suitable for this purpose, and be substantially alignable with ports 4.

Valve 2 may be attached to tubing 1 by the use of threads 28 arranged within the upper end of housing 18, companion threads being suitably arranged on the lower end of tubing 1. Valve housing 18 is therefore fixedly hung upon tubing 1, and moves with it.

In order to secure appropriate alignment between discharge ports 4 and 5 there should be provided means for stopping the upward movement of inner sleeve 3, when the valve is collapsing, so that the ports will be opened for discharge of fluid therethrough. A satisfactory form of stop 6 may be afforded by the lower end face of the

joint of tubing shown as at 1 in the uppermost part of the drawings. Other and suitable forms of valve stops may be arranged, as for instance, one or more screws or lugs may be set to inwardly project from the upper wall of housing 18. Or a circular and inwardly projecting shelf or ring may be disposed in the top of the valve housing. Such ring (not shown) may be externally threaded and fixed with exactness (in internal companion threads provided in the housing) at the proper location found suitable to limit the upward movement of sleeve 3.

This tool is arranged to operate within a well casing 7, and be slidably related thereto except when anchored and locked thereto.

Slidably mounted along the midsection of the mandrel is a spring assembly or nest, N, employing a number of leaf spring members 8. These leaf members should number 3 or more. In the drawings four such members are placed in the assembly. Each leaf or spring strip has a double purpose and function. The upper part of each leaf 8 is so arranged as to extend outwardly from its carriage 20 and provide a bow spring 8a. These bow springs serve as drag springs or friction shoes, slidably engaging the wall of the surrounding casing as the tool is lowered into the hole and when it is being removed from the well.

At all other times when in use the drag springs act, by means of frictional engagement with the casing, to suspend themselves in whatever position they may be placed in the casing, until their frictional resistance has been overcome by such force as will move them further up or down the casing. At certain times, spring bows 8a operate by friction to hang and suspend the entire spring assembly or nest within the casing; and such assembly may be so supported independently of any support afforded by the mandrel of the tool at other times.

The spring leaves 8 are extended downwardly to form the free and depending spring fingers 8b; and these fingers carry anchors 9 at their lower ends. This depending spring arrangement is such that the anchors are normally urged inwardly of the casing. They are thus normally held vertically and out of engagement with the casing. Therefore, unless some force intervenes to move the anchors into contact with the casing, there is no such contact. During the entire time the well tool is lowered in the casing there is no contact between the anchors and the casing wall. However continuous contact with the casing is maintained at all times by bow springs 8a.

Anchors 9, sometimes called engaging slips, or locks, are preferably curved or beveled on their inner walls or faces; and their outer faces are provided with strong sharp teeth, preferably turned upwardly. The hardness of the metal in these anchor teeth should be sufficient to insure the entry of the teeth into the side wall of the casing when sufficient force drives the anchors outwardly.

There is provided centrally of the tool the hollow mandrel 10, which constitutes the central body of the tool. As indicated above, this mandrel may be continued upwardly to form and provide a head section to serve as inner sleeve 3, of the telescoping valve 2. Such construction may well be employed because the two members (head 3 and body 10) operate as one. However, two members may be used; and two such members are shown in the drawings, as at 3 (the sleeve) and 10 (the mandrel body), joined together by the internally threaded collar 30, the conjoined ends of the two members being externally threaded for the purpose of removable connection.

Carried by the mandrel body 10 are two members (the drop head 11 and the inverted packer cup 16) cooperatively related to the spring assembly with its depending anchors.

The drop head member 11 is preferably formed as a beveled or plug-like head, substantially conical at its upper end, where it has the form of the frustum of a cone.

In the course of performing its functions, the drop head 11 becomes a slidable member, moving along the lower part of mandrel body 10. It may so move in relation to this body, however, only after the breaking of connecting means normally existing between these members. The drop head is normally carried by and in fixed relation to the mandrel, and remains in such relation throughout the entire time that the packing element 16 is expanded and maintained as a seal to close and block the annulus between tubing 1 and casing 7.

Drop head 11 (which is first used as an anchor set-

ting head) is provided with a base shelf 11a, extending inwardly of the main body of the head. Shelf 11a is a ring-like projection of substantial character. It is so arranged that it may be caused to slidably operate in slip-joint relation to the reduced tail section 12 of mandrel body 10. This comes about whenever the drop head is disconnected from the upper wall of the mandrel body. After completing its term of use as an anchor retaining head, the drop head 11 drops down the slip-joint space provided by the reduced tail section 12, until it falls upon the cup thimble member 15a (when packing cup 16 is employed), and the relaxed cup also falls downwardly until supported by recovery shoe 13. In any event the dropped head 11 is retained and supported by shoe 13 while the tool makes its return journey out of the well.

Reduced tail section 12 of mandrel body 10 provides the slip joint at the base of packing tool. This upper limit of the slip joint is defined by shoulder 13, which is the lower end of the enlarged midsection 14 of mandrel body 10. Against this shoulder the base shelf 11a of drop head 11 is tightly carried during the time this head is pinned to the mandrel. The lowermost reach of this slip joint is defined by the recovery shoe 13.

Shoe 13 may be made of an outwardly disposed shelf or shoulder affixed to the tail section of the mandrel in any desired manner. It is conveniently made of an internally threaded ring, laterally mounted on the tail section near its lower end. The recovery shoe is an "insurance shoe," and should be made quite strong and be firmly attached to the mandrel so that it cannot be accidentally dislodged or sheared or otherwise lost from the mandrel.

Enlarged midsection 14 of the mandrel body 10 provides a stout steel tubular element suitably arranged to stoutly carry drop head 11 which is normally (and severably) pinned to this section.

Midsection 14 also provides stop shoulder 23, against which the middle band or spring carriage 20 of the spring assembly comes to rest when such assembly is moved downwardly about the mandrel, or when the mandrel is moved upwardly within such carriage and assembly.

Slidable thimble 15 provides a frame work or skeleton to which the resilient and inverted cup 16 may be firmly attached, as being bonded thereto in manufacture or otherwise suitably and safely secured. Thimble head 15a is a circular member surrounding tail section 12 of mandrel body 10, and it provides a stout cap piece, against which the upturned bottom of resilient cup 16 may be rested, held and expansibly thrust. The thimble head will receive and carry upthrusting fluid pressure when the resilient element of the cup 16 is sealably pressed against the casing wall so as to block and close the annulus between the tubing and casing.

Thimble packing ring 17 is arranged between the inner face of thimble head 15a and the outer face of tail section 12 of the mandrel. This packing is so arranged, placed and constructed as to allow the thimble (carrying the cup) to slide up and down in the slip-joint space provided along tail section 12. This packing element may well be of the inverted chevron type, encircling the tail piece and pressing thereagainst when fluid pressure enters the inverted V of the packing ring so as to expand the side walls of this type of packing against the tail piece and the thimble head. Such thimble packing is designed to prevent the loss of fluid and the escape of pressure when the packing cup is set and in actual use as a packer. Such packing ring, however, will not prevent the easy sliding of the loosened packing cup assembly when the latter no longer performs the function of a packer and is not under the stress of fluid pressure from below.

Valve housing 18 constitutes the outer shell of telescoping valve 2. Valve sleeve 3 constitutes a valve head slidably movable within housing 18, thereby providing inwardly projecting base 19 of housing 18. This base affords a supporting element on which valve head 33 may rest when the valve is in extended (closed) position.

Assembly 21 is a guide coupling, normally employed with the tool and, when so employed, constituting the lowermost element of the tool. It may be made of a coupling threaded on each end and attached by threads to tail section 12 of the mandrel. Lateral guide fins with smooth faces are so radially arranged on member

21 as to keep the tool located centrally of the casing without maintaining constant contact therewith.

Tail pipe 22 may be carried by and below guide 21, or by and below the mandrel if this guide is not used. The tail pipe may be a short nipple through which pressure fluid is forced into the casing or it may be a regular length of tubing pipe.

Enlarged midsection 14 of the mandrel body, providing upper shoulder 23 and lower shoulder 26, may be provided as indicated in Fig. II, et seq.; or an extended circular collar, of proper length, may be placed about and carried by a straight walled mandrel, to afford the shoulders. Such collar may be permanently or removably attached to the mandrel wall, as by welding, suitable threads, or by screws of sufficient number to bear the stresses required of this element.

Again, these shoulders may be provided by arranging a band about a straight sided mandrel in such position as to afford shoulder 23; and another band may be appropriately located to afford shoulder 26. Such construction is a matter of choice. The shoulders, or their equivalents, are necessary; and the thickened wall of the mandrel is recommended.

Shear pins 25 normally extend part way into the wall of the mandrel and into the wall of drop head 11; and they are kept in place by removable screw plug keepers 24.

The shear pin hole in the mandrel does not pass through its wall. However the shear pin hole in the drop head continues through the wall of the head.

This last indicated hole may be enlarged where it passes through the outermost section of the drop head wall; and this enlargement may be threaded to receive the keeper 24.

With this construction, pin 25 may be sheared without placing any stress on the threads of the screw plug keeper. Therefore, this keeper may be used over and over again; and the tool, when reconditioned after it has once served its purpose and has been removed from the well, after the pins have been sheared, may be supplied with new pins. The severed parts of the old pins will simply drop out of their respective holes when the drop head has been slipped off of the lowermost end of the tail section 12 of the mandrel preparatory to restoring it to normal position and pinning it there with new pins.

Seal rings 27, which may be steel snap rings or piston rings or composition rings, are arranged between the slidable members of the sleeve valve. Plural numbers of these seal rings should be arranged in grooves or recesses provided around the outer face of the enlarged upper end of the mandrel; and they should be so disposed as to seal between the slidable members constituting the sleeve valve 2, both when the valve is open, as when going in the hole (see Fig. II) and when the valve is closed, as when the anchor is set (see Fig. III), and especially when the packer is set and expanded (see Fig. IV). It is recommended that the seal rings be in such number and so placed that a pair of such rings will always be on each side of the discharge ports, both when these ports are in alignment (valve open and in collapsed position) and when these ports are not in alignment (valve closed and in extended position).

The collar 30, or its equivalent, should be provided whether the mandrel is made of two parts or not. When two parts are employed to form the mandrel, the head section 3 has a reduced lower end 34 provided with threads to receive the collar, and a reduced upper section of mandrel body 10 is provided with like threads for the same purpose. Collar 30 may then be squared and so positioned as to be contacted by spring carriage 20 when the latter is held suspended in the casing by drag shoes 8a, and the tool is descending the well. Such contact will force the mandrel upwardly (as in Fig. II) and cause the opening of valve ports.

The spring retaining band, shown as at 29, may be employed to secure the upper ends of spring leaves 8; and machine screws 31 may be used to connect the band with the leaves. However, such a band and such attachment is not a necessity. See Fig. VII, showing a modified form of apparatus. A band may be carried outside the upper ends of leaves 8, and loose attachment provided between such outside band and the leaves, if desired.

To prevent relative rotation by the mandrel and hous-

ing 18, the former may be provided with keyway 36, cut vertically into its face; and key 35 may be set through the wall or base of housing 18 and introduced into the keyway for slidable operation therein.

Annular supply channel 37 may be cut into the outer face of valve face 33, so as to communicate with all of the ports 5. This channel will allow the valve to be opened even if the sleeve is rotated therein. Such rotation may come about if key 35 is not employed to prevent it. The channel should be made wider than the diameter of ports 5, so that the valve may be opened, even if vertical alignment between ports 4 and 5 is not accurately accomplished. The provision of channel 37 would make unnecessary the key 35 and keyway 36.

In this invention the tool can be moved into place in the casing and securely anchored thereto and the packing expanded and set without any undue stress upon the tubing string at any time and without requiring sustained thrust or tension in the tubing. Moreover, the shearable pins 25 which normally hold the drop head 11 in elevated position on the mandrel are never subjected to any undue stress during the entire time in which the tool is lowered in the well and anchored in place or during the time that the packing element is maintained and operated in fully expanded position. The upthrust of high pressure fluid maintained below the packer is transmitted directly from the metal frame or thimble 15 of the packing cup 16 directly to and through the steel drop head, and finally to the toothed anchors which have been set into the casing wall, so that the casing carries this upthrust; and such upthrust places no undue strain upon the shearable pins.

Furthermore, any upthrust which may be transmitted through the drop head 11 to the mandrel on which it is carried is transmitted through a shoulder-to-shoulder contact between head and mandrel; and such upthrust is not carried by the shearable pins.

Therefore, it will be observed that in the design construction and operation of this tool protective mechanism has been built up and arranged about the shear pins to preserve them for their ultimate function. This function is to allow the head to be severed, released and dropped from its normal position on the mandrel. Such result can be accomplished in only one way, and that is by lifting up on the tubing and mandrel while the head is immovably held by and between the set anchors. Then, and only then do the pins suffer such stress as to shear them. Thereafter the head may drop away, and free the anchors.

In operation, the tool descends the casing, being carried downward by the weight of the tubing, in which this tool is a removable section.

The bottom of the tool below the packer is open to allow fluid in the casing to flow upwardly through the central passageway of tool and be discharged through valve ports arranged through the walls of the sleeve valve located above the packer.

Pressure in the casing below the cup is therefore equalized with the pressure in the annulus between tubing and casing above the cup during the entire time of descent; and therefore the cup is not unduly expanded and does not suffer damaging abrasion from the side walls of the casing, friction therebetween being minimum.

Head 11 has a dual function. First, it causes the hold-down anchors to force their toothed outermost faces into the side wall of the casing, when the head is drawn upwardly within the slips. This head is attached to the body of the tool by a shearable pin, or a plurality thereof. The pins are not affected in setting anchor.

Second, the head 11 also has the function of effecting release of the anchors from engagement with the casing. The operation of the head to effect such release requires that the entire string of tubing, which is carrying this tool as a section thereof, be pulled upwardly with such force as to shear all of the pins by which the head is temporarily held to the mandrel of the tool. During this operation, the head itself can move upward no further, it having been previously wedged within the anchors to the greatest extent possible, in the setting of the anchors. Therefore, the mandrel of the tool moves upwardly, shearing the pins, and leaving the head and the anchors exactly in the precise relation and position which they occupied before the shearing lift was performed. It must be remembered that the hold-down anchor is so mounted about the mandrel of the tool as

to allow the latter certain limited slidable movement within the anchor assembly.

The severed head 11 will fall (after its pins are sheared), upon a cessation of the up-pull of the tubing and more especially if there is a slight downthrust on the tubing.

Prior to the shearing operation all pressure has been released below the inverted packer cup, so that there is no upthrust thereon, and the packer assembly itself is allowed to fall downwardly.

The anchors disengage themselves immediately when the head 11 is removed from behind them. The normal setting of the spring-like strips on which they depend is such as to urge the anchors inwardly of the casing wall and away from it. Spring action therefore urges the slips inwardly as the entire tool is moved upwardly in taking it out of the casing.

It should be clearly understood that the conventional barrel-type packer is not suitable for use with this tool. An inverted cup-type resilient packing element capable of being expanded laterally by fluid pressure maintained below it is the correct type of packer to be used with this tool.

This tool is ideally suited for use in wells of any depth, and it works perfectly in shallow wells. It would even operate effectively at a depth of 100 feet or less. Exactly the reverse is true of the conventional barrel-type packer which requires weight above it to cause and maintain expansion, and it is not successful in shallow wells.

In the preferred form of this tool the mandrel or central body member is extensibly related to the length of tubing on which the tool is attached and from which it depends (see Fig. II et seq.). However, a shorter and non-extensible tool is disclosed in the modified form shown in Fig. VII.

In the modified form of this tool, shown in Figs. VII, VIII and IX, the central body or mandrel 40 is made as a single continuous tubular member, including head section 40a, midsection 40b and tail section 40c, firmly and rigidly attached to and depending from the lower end of a length of tubing 1, with respect to which tubing there is no operational movement executed by the mandrel. In such modified form, exterior valve sleeve 46 also the carriage for springs 48, is made to slide along the head section 40a of the mandrel, in response to the upward movement of the tubing, while the exterior valve sleeve 46 is statically held in the casing without movement by the spring drag shoes 48a, until ports 42 are covered by the exterior sleeve and the valve closed thereby. The valve is opened by reversing this operation and lowering the tubing.

In the modified form of this tool shown in Fig. VIII, the mandrel 40 supports and carries in slidable relation thereto several elements, including the external valve sleeve 46, spring drag shoes 48a, depending spring fingers 48b, anchor blocks 49, drop head 11, and the inverted expandible and releasable packing cup assembly. This packing cup assembly includes resilient packing cup member 16, as previously described.

The drop head 11 and the packing cup assembly are prevented from ultimate loss, after they have dropped downwardly along the mandrel, by the use of the recovery shoe 13, removably carried externally of the tail end of the mandrel, all as previously explained in discussing the preferred form of this tool.

Uniting mandrel 40 and tubing 1 is coupling 45, internally threaded to mate with tubing threads 51 and mandrel threads 41. The lower end of this coupling provides the up stop for slidable element 46. The lower stop for this element is provided by shoulder 43 on the mandrel. The slip joint accommodating the drop head and the packer cup is terminated upwardly by shoulder 44 on the mandrel.

The inner face of slidable element 46 is provided with sealing rings 47. The free ends 48c of spring leaves 48 need not be firmly fixed to element 46, preferably near the lower end of the latter.

It is not considered necessary to explain in detail the operation of the modified form of this tool, as such is believed obvious after considering the discussions of the preferred form. The modified tool is shorter, stronger and simpler to make and operate. Its construction represents a saving in labor and materials.

Summing up, this invention presents a well tool which

provides mechanism for securely but releasably anchoring tubing in casing and when so used it effects the securing of the varied appliances which may be carried by the tubing. The same element is employed to set the anchors and thereafter cause their release at will, this element being the severable setting head which may be dropped to release anchor. As an anchoring device, the tool may be employed with or without a valve, as desired. Rotation between elements of the tool may be permitted or prevented by employing suitable and removable fixing means between rotatable members. The tool is employed as a packing device when equipped with a particular type of packing element, to-wit: an inverted resilient packing cup constituting an automatically sealing lip type packing element.

Having described my invention, I claim:

1. In a well tool of the character described, an elongated hollow body; a plurality of spring members slidably mounted exteriorly of said body and adapted to frictionally engage the walls of well casing; a plurality of toothed anchors depending from free ends of the spring members, said toothed anchors being free of attachment to the setting head and being normally held out of engagement with the wall of the well casing by said spring members; and a setting head severably secured to the body and adapted to be elevated therewith within said anchors to force such anchors outwardly into engagement with the well casing.

2. In a device of the character described, an elongated hollow body; a plurality of spring members slidably mounted exteriorly of said body and adapted to frictionally engage the walls of well casing; a plurality of toothed anchors normally depending from free ends of the spring members and adapted to be set into the wall of a well casing; a setting head carried by, and slidable on, the body and adapted to be elevated therewith within said anchors to force such anchors outwardly; shearable means initially immovably connecting the head to the body; and a recovery shoe arranged about the body below the head and adapted to support the head when disconnected.

3. In a device of the character described, an elongated hollow body; a plurality of spring members slidably mounted exteriorly of said body and adapted to frictionally engage the walls of well casing; a plurality of toothed anchors normally depending from free ends of the spring members and adapted to be set into the wall of a well casing; a setting head carried by, and slidable on, the body and adapted to be elevated therewith within said anchors to force such anchors outwardly; shearable means initially immovably connecting the head to the body; a recovery shoe arranged about the body below the head and adapted to support the head when disconnected; and an inverted resilient cup-type packer slidably carried about the body below the head and above the recovery shoe.

4. In a device of the character described, an elongated hollow body; a plurality of spring members slidably mounted exteriorly of said body and adapted to frictionally engage the walls of well casing; a plurality of toothed anchors normally depending from free ends of the spring members and adapted to be set into the wall of a well casing; a setting head carried by, and slidable on, the body and adapted to be elevated therewith within said anchors to force such anchors outwardly; shearable means initially immovably connecting the head to the body; a recovery shoe arranged about the body below the head and adapted to support the head when disconnected; an inverted resilient cup type packer slidably carried about the body below the head and above the recovery shoe; a tubular valve provided with discharge ports, the valve including a pair of concentrically arranged and slidably related sleeves having discharge parts therein and being arranged to open and close the ports upon the sliding of one such sleeve, one of said sleeves being carried at the upper end of the elongated hollow body and the other said sleeve being adapted to be attached to a string of tubing extending into a well casing; the first named sleeve being engageable with the spring members whereby such sleeve may be urged upwardly to cause communication between the valve ports in the sleeves in response to frictional drag of such spring members on a well casing when the said device is being lowered therein.

5. In a well tool of the character described, a cylin-

drical mandrel; a setting head loosely arranged about the lower part of the mandrel and provided with a tapered upper end; shearable members normally attaching the head to the mandrel, each such member being set into aligned recesses provided in opposed faces of mandrel and head; a spring carrier slidably arranged about the mandrel and above the head; friction springs attached to such carrier, such springs being self-urged outwardly of such carrier and adapted to drag upon the walls of a well casing in which the tool may be placed; toothed anchors depending from free ends of the springs and disposed about the mandrel and positioned between the carrier and the head.

6. In a well tool of the character described, a cylindrical mandrel; a setting head loosely arranged about the lower part of the mandrel and provided with a tapered upper end; shearable members normally attaching the head to the mandrel, each such member being loosely set into aligned recesses provided in opposite faces of mandrel and head; a spring carrier slidably arranged about the mandrel and above the head; friction springs attached to such carrier; such springs being self-urged outwardly of such carrier and adapted to drag upon the walls of a well casing in which the tool may be placed; toothed anchors disposed about the mandrel and positioned between the carrier and the head; means for dependently attaching the anchors to the carrier; the mandrel being provided with an upwardly projecting sleeve-like element, such element having discharge ports through its walls, a valve housing telescopically arranged with relation to such sleeve and having ports through its walls initially out of communication with the ports in the sleeve; means carried by the mandrel engageable with the spring carrier upon sliding movement between carrier and mandrel, whereby the sleeve and housing are telescoped by frictional drag of the springs against a well casing to thereby bring the ports in the sleeve and housing into communication.

7. In a well tool of the character described, a hollow mandrel, having a head element adapted for use as the inner sleeve of a sleeve valve, the mandrel being provided with an upwardly facing shoulder intermediate its ends and a downwardly looking shoulder between the first named shoulder and the lowermost end of the mandrel; a plurality of fluid-passing ports provided in the said head element; an outer sleeve arranged to encase a part of said mandrel above said upward facing shoulder, the outer sleeve and the head element being arranged for relative slidable movement therebetween; outwardly urged drag springs arranged about the upper part of the

mandrel; toothed anchors dependently attached to the free lower ends of such springs; a spring carrier slidably mounted about the mandrel; means intermediate the ends of the springs for attaching them to the carrier; a conical head loosely surrounding the lower part of the mandrel; severable attachment means attaching the conical head to the mandrel; a recovery shoe attached to and laterally extending from the lower end of the mandrel, and adapted to support the conical head when it is severed from the mandrel; an annular supply channel recessed within the outer face of the head of the mandrel and arranged to communicate with said ports passing through the mandrel head; ports arranged in the external valve sleeve and adapted to communicate with the supply channel when the valve is opened by telescopic movement between the sleeves.

8. In a well tool of the character described, a hollow mandrel, having an upper head element adapted for use as the inner sleeve of a telescopic valve; a plurality of fluid-passing ports provided in the said head element; an outer sleeve arranged to encase said inner sleeve and allow relative slidable movement therebetween; outwardly urged drag springs slidably carried about the upper part of the mandrel below the telescopic valve; toothed anchors dependently attached to the free lower ends of such springs; a conical head loosely surrounding the lower part of the mandrel; severable attachment means attaching the head to the mandrel; a recovery shoe attached to and laterally extending from the lower end of the mandrel below the conical head; an annular supply channel recessed within the outer face of the head element of the mandrel and arranged to communicate with said ports passing through the head element when the valve sleeves are telescoped while the tool is being lowered in the well with the anchors in spaced relation to the conical head; ports arranged in the external valve sleeve and adapted to communicate with the supply channel when the valve is open; and key and keyway means between mandrel and outer sleeve whereby relative rotation between mandrel and outer sleeve is prevented and slidable relation therebetween is allowed.

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