

July 9, 1957

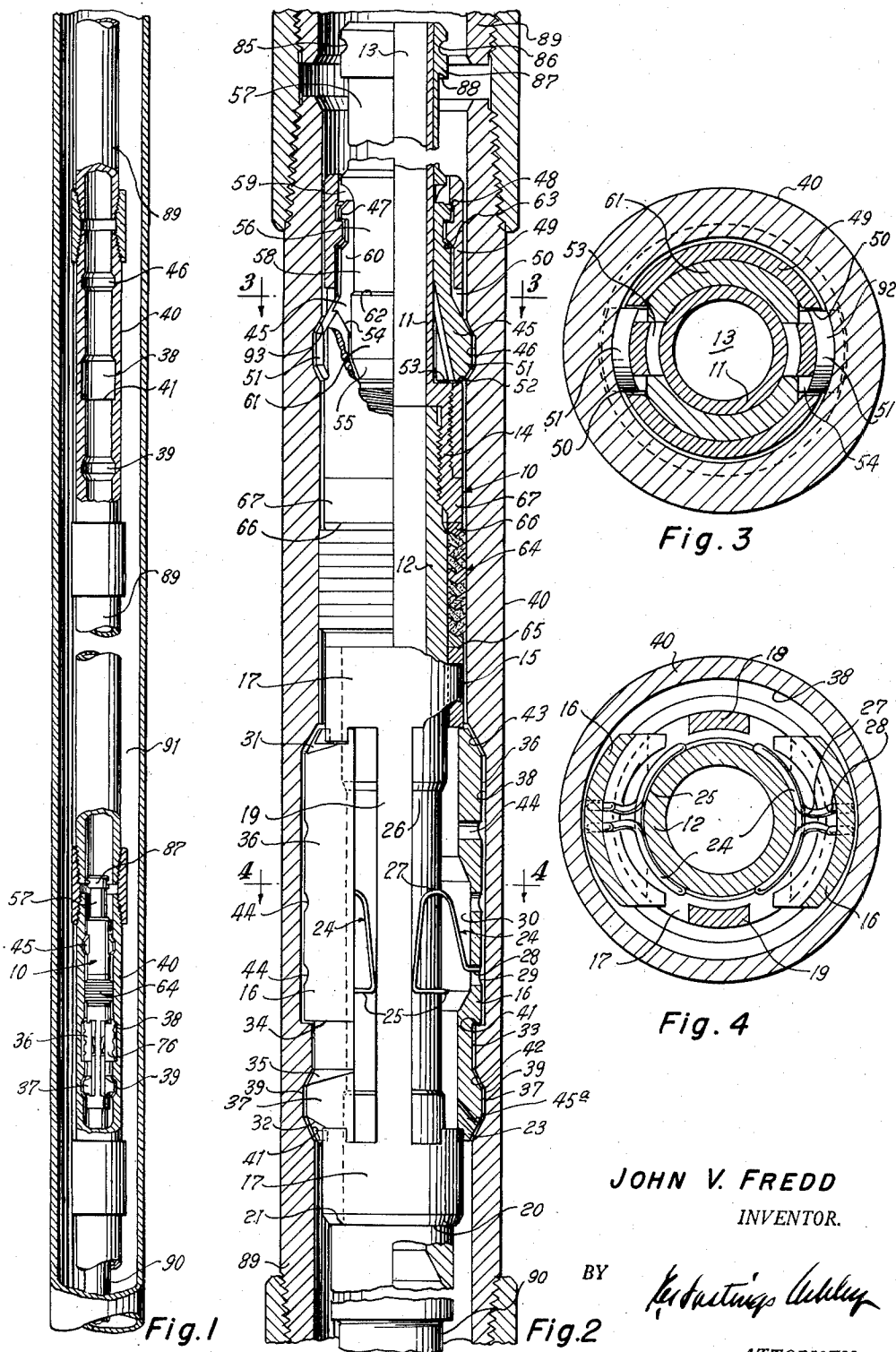
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2,798,559

HANGERS FOR WELL TUBING EXTENSIONS AND THE LIKE

Filed April 6, 1953

3 Sheets-Sheet 1



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3 Sheets-Sheet 2

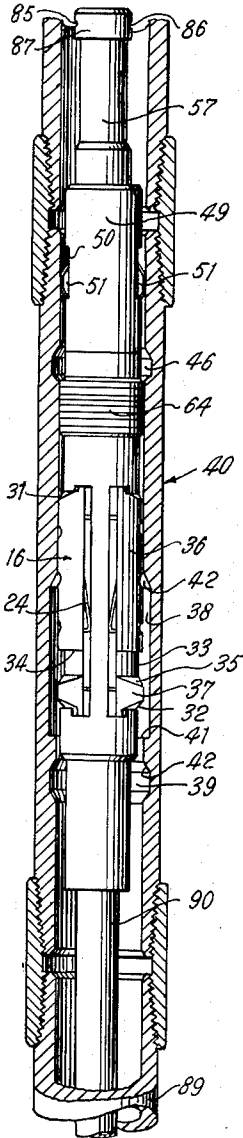


Fig. 5

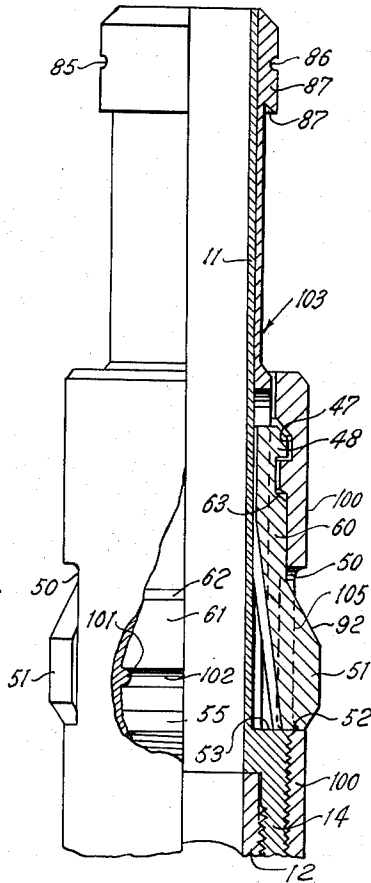
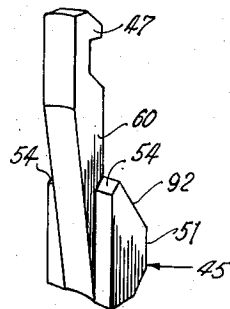


Fig. 9



July 9, 1957

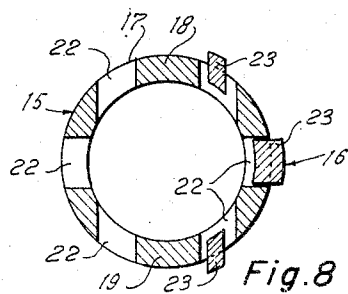
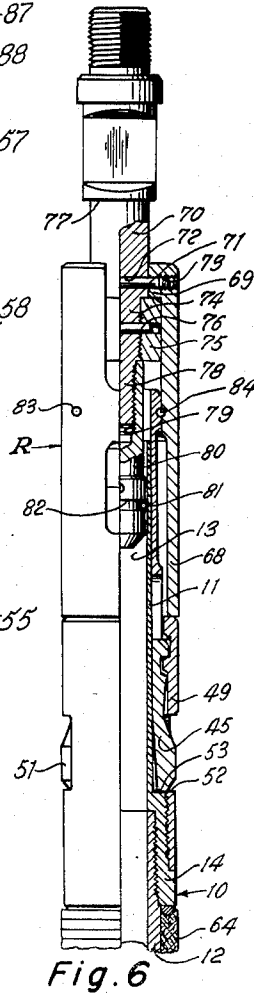
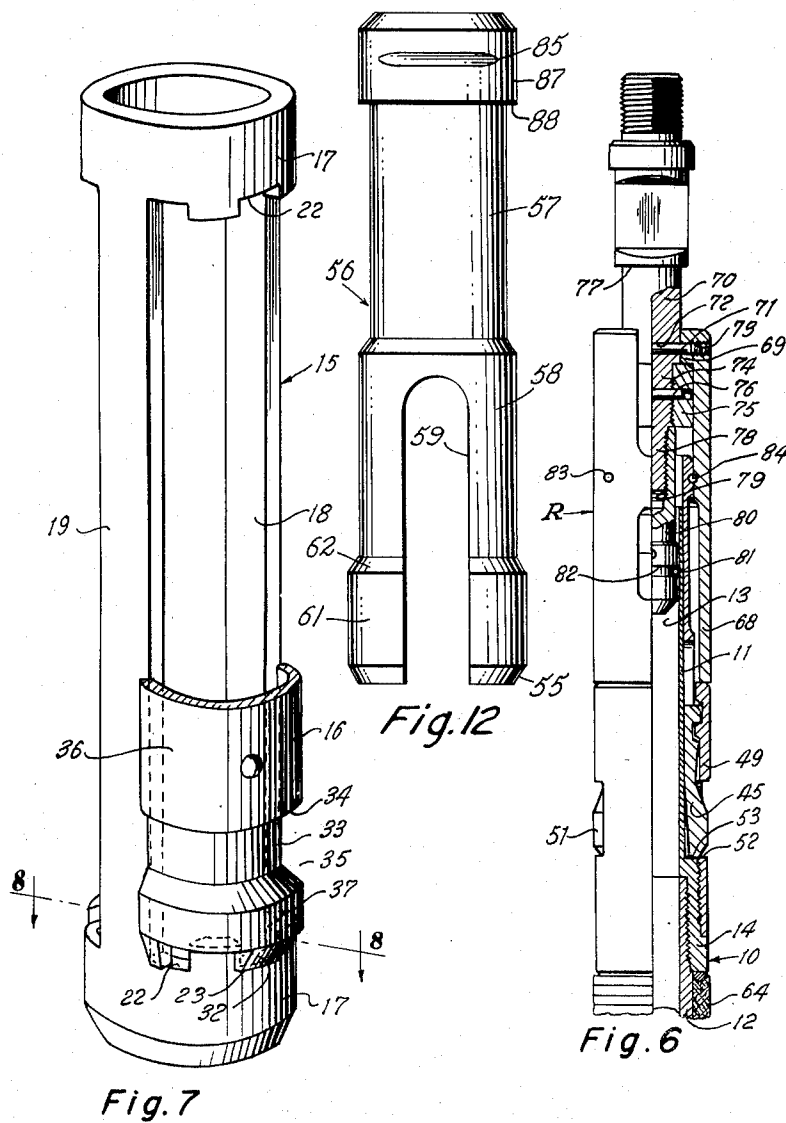
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3 Sheets-Sheet 3



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1

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HANGERS FOR WELL TUBING EXTENSIONS AND THE LIKE

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Application April 6, 1953, Serial No. 346,974

8 Claims. (Cl. 166—125)

This invention relates to new and useful improvements in well devices, and more particularly to hangers for well tubing extensions and the like.

A well completion process, which is currently in use, permits the drilling rig to be removed from the well site after the well casing has been run and cemented to bottom, the tubing and packer set in place and the well head connections installed, after which perforation of the selected producing formation may be accomplished by means of a small diameter perforating gun lowered through the tubing to the selected level to permit flow from such formation. It is then desirable to install a length of extension tubing which may consist of a number of joints of pipe and may have a length as great as 500 feet or more. The extension is lowered through the well tubing in place in the well and connected to the lower end of such tubing by an anchoring and supporting device which also seals between the extension tubing and the well tubing so that the lower end of the extension tubing is positioned adjacent the producing formation. The hanger of the present invention is particularly adapted for use as a supporting and sealing and anchoring device for connecting the extension tubing to the lower end of the well tubing in place in the well.

It is also desirable that the extension tubing be removable from the well tubing in order that other operations, such as squeeze cementing to seal off improperly located perforations or an undesirable producing formation may be performed, and to permit subsequent reperforation of the casing, cement and well formation at a different level. After such reworking of the well has been completed with the well tubing and packer remaining in place in the well during such operation, the extension tubing is again lowered through the well tubing and anchored in place in the lower end of such well tubing to provide a conduit communicating with the bore of the well adjacent the producing formation. Hence the hanger for the extension tubing must be readily removable and replaceable and must be capable of supporting substantial weights due to the length of the extension tubing carried thereby.

It is an important object of the invention to provide a new and improved anchoring device adapted for use in a well flow conductor to support subsurface well devices in predetermined position in the well flow conductor.

Another object of the invention is to provide an improved device for releasably anchoring well devices in a well flow conductor, the anchoring device having selector means for stopping downward movement of the anchoring device at a predetermined position in the well flow conductor and releasable locking means for preventing upward movement of the anchoring device from the predetermined position.

A further object of the invention is to provide, in a device of the type described, means for actuating the locking means into locking position by downward jars or blows delivered to the actuating means and for releasing the locking means from locking position upon the exertion of an upward force upon the actuating means.

A still further object of the invention is to provide an anchoring device for use in a well flow conductor, having a plurality of vertically spaced longitudinal grooves, and provided with a selector key engageable in a selected pair of the annular grooves to limit downward

2

movement of the anchoring device and also provided with dogs expansible into another of the grooves by a dog expander upon downward movement of the latter relative to the dogs.

Another object of the device is to provide the selector key with a plurality of lateral apertures whereby any foreign material present between the key and the anchoring device may be removed.

Still another object of the invention is to provide the anchoring device with a running tool to which it is releasably connected, and wherein the running tool cannot be detached from the anchoring device until the dog carrier has fully expanded the dogs into locking position.

Further objects and advantages of the invention will readily be apparent from the reading of the following description of devices constructed in accordance with the invention, and reference had to the accompanying drawings thereof, wherein:

Figure 1 is a view, partly in elevation and partly in section, of a well flow conductor having a plurality of landing nipples and showing the anchoring device of the invention locked in position in a selected landing nipple,

Figure 2 is a view, partly in elevation and partly in section, of the anchoring device locked in position in a landing nipple forming a section of a well flow conductor,

Figure 3 is a horizontal sectional view taken on the line 3—3 of Figure 2,

Figure 4 is a horizontal sectional view taken on the line 4—4 of Figure 2,

Figure 5 is an enlarged view, partly in section and partly in elevation, of the anchoring device showing it passing downwardly through a well flow conductor,

Figure 6 is a fragmentary view, partly in elevation and partly in section, of an anchoring device constructed in accordance with the invention and showing the same connected to a running tool for lowering into a well flow conductor,

Figure 7 is a side elevation of the selector key carrier showing the lower portion of one selector key in position in said carrier,

Figure 8 is a sectional view taken on the line 8—8 of Figure 7,

Figure 9 is a fragmentary partly sectional view of a modified form of the anchoring device,

Figure 10 is a fragmentary sectional view of two elements of the modified form of the anchoring device shown in Figure 9,

Figure 11 is a perspective view of one of the locking elements of the anchoring device, and

Figure 12 is a side elevation of the dog expander shown in assembled position in Fig. 1.

In the drawings, the numeral 10 designates an elongate mandrel having an upper section 11 and a lower section 12 and a central bore 13. The lower end portion 14 of the upper mandrel section is enlarged and internally threaded to receive the externally threaded upper end portion of the lower mandrel section. A positioning or locating assembly is mounted on the lower mandrel section and includes a key carrier 15 and a plurality of selector keys 16. The key carrier comprises a pair of spaced annular members 17 joined by a pair of connecting ribs 18 and 19, the lower annular surface 20 of the lower annular member 17 resting on the annular shoulder 21 of the lower mandrel section.

The annular members 17 of the key carrier have a plurality of opposed vertical guide slots 22 in which are received the studs or guides 23 of the selector keys 16, the guides and guide slots cooperating to permit outward and inward movement of the selector keys perpendicular to the longitudinal axis of the mandrel into expanded and retracted positions.

3

The selector keys are biased outwardly by springs 24. Each of the springs has an inner curved portion 25 which bears against a reduced portion or outer groove 26 of the lower mandrel section, a bight portion 27 disposed between the lower mandrel section and its adjacent key, and an outturned end portion 28 which projects into a lateral aperture 29 of the key. It will be apparent that the springs urge or bias the keys outwardly away from the mandrel, and that springs of other forms than that shown may be employed for the purpose.

Each key is provided with an internal groove or recess 30 which is positioned in aligned relation with the outer groove 26 of the lower mandrel section and the spring 24 is disposed in and between these two grooves. The two grooves are formed in the lower mandrel section and in the keys to provide sufficient operating room for the springs.

The upper and lower ends of the keys are provided with inwardly beveled surfaces 31 and 32 which tend to cam the keys inwardly when they come into contact with obstructions as the anchoring device is moved through a well flow conductor.

Each of the keys is also provided with an external groove 33 which forms a downwardly facing stop shoulder 34 extending substantially perpendicularly to the longitudinal axis of the mandrel and a beveled or tapered upwardly facing surface 35 which extends outwardly and downwardly. The external groove of each key divides the outer portion of the key into an upper key portion 36 and a lower boss portion 37. The vertical or longitudinal dimensions of the key portion and the boss portion of the keys of each anchoring device are so chosen that the keys may move outwardly into expanded position in the well flow conductor only when these portions of the keys are aligned with corresponding annular key grooves 38 and 39 of like dimensions and configuration in a particular landing nipple 40 connected in a well flow conductor or string.

The key groove 38 of the landing nipple defines an annular upwardly facing shoulder 41 which is adapted to engage the downwardly facing stop shoulders 34 of the keys when they are in expanded position to stop further downward movement of the anchoring device through the landing nipple. The beveled surface 35 of the boss portion and the beveled surface 31 of the key portion of the keys are adapted to carry the keys inwardly by engagement with the annular beveled surfaces 42 and 43, defined by the internal key grooves 39 and 38 of the landing nipple, when the anchoring device is moved upwardly in the landing nipple. It will thus be seen that the keys serve to stop or limit downward movement of the anchoring device through the well flow conductor but permit upward movement of the device.

Each of the keys is provided with a plurality of lateral ports 44 as well as the lateral aperture 29 and an inwardly and upwardly extending aperture 45a whose function will be explained below.

In order to permit the anchoring device to be selectively locked in such predetermined position against upward movement, a plurality of expansible locking members or dogs 45 are mounted on the upper mandrel section for movement into an annular internal locking groove 46 provided in the landing nipple 40. The dogs have hooks 47 at their upper ends which extend into an annular groove 48 in a dog holder 49. The dog holder is substantially tubular in form and is internally threaded at its lower end portion onto the externally threaded enlarged portion 14 of the upper mandrel section 11. The dog holder is provided with a plurality of longitudinally extending circumferentially spaced slots 50 in which are disposed outwardly extending bosses 51 of the dogs 45. The lower end portions of the slots 50 are defined by end surfaces 52 which are aligned with the annular stop surface 53 formed by the enlarged portion 14 of the upper mandrel section.

4

The bosses 51 of the dogs are provided with downwardly and inwardly extending beveled camming surfaces or shoulders 54 which are engaged by upwardly and outwardly beveled lower surfaces 55 of a dog expander 56. The dog expander has an upper tubular sleeve portion 57 slidably mounted on the upper mandrel section and a lower enlarged split or collet portion 58 having slots 59 in which the shanks 60 of the dogs are disposed.

The collet portion has an enlarged lower portion 61 which provides outwardly and downwardly inclined or beveled shoulders 62 which are adapted to engage the internal annular shoulder 63 of the dog holder to limit upward longitudinal movement of the dog expander relative to the mandrel and the dog holder.

The dogs are moved to expanded positions when the dog expander is moved downwardly on the upper mandrel section from the position shown in Figure 5 to the position shown in Figure 2.

A packing assembly 64 is mounted on the lower mandrel section above the upper annular member 17 of the key carrier to seal between the mandrel and the well flow conductor. The packing assembly is disposed between the upper annular surface 65 of the upper annular member 17 and the lower annular surface 66 formed by the extreme lower enlarged portion 67 of the upper mandrel section.

The anchoring device is lowered into a well flow conductor by a running tool R which includes a skirt 68 having an inwardly extending annular flange 69 on its upper end. A sub 70 extends into the skirt and is secured thereto by a shear pin 71 which extends through aligned lateral apertures 72 and 73 in the sub and in the annular flange 69, respectively. The upper end of the sub may be threaded whereby it may be attached to the end of a flexible running line or other lowering mechanism by a suitable fitting. An intermediate reduced portion 74 of the sub is threaded and provided with a retaining nut 75 which abuts the annular flange 69 of the skirt to limit downward movement of the skirt on the sub. The nut may be locked in position by a dowel pin 76. Upward movement of the skirt relative to the sub is limited by an annular shoulder 77 of the sub which is adapted to abut the annular flange 69.

The extreme lower end portion 78 of the sub is further reduced and threaded to engage in the threaded bore 79 of a plug 80 which may extend into the central bore 13 of the mandrel 10 to plug it. A sealing ring 81 disposed in an annular groove 82 of the plug is provided to seal between the plug and the mandrel.

The skirt 68 is secured to the dog expander by a pair of shear pins 83 and 84 which extend through suitable apertures in the skirt and through the parallel grooves 85 and 86 provided on opposite sides of an outwardly extending flange 87 on the upper end of the dog expander. The flange 87 is undercut to provide an upwardly and inwardly inclined surface 88 which may be engaged by any suitable fishing tool.

The above described anchoring device and running tool may be used to position and lock various types of sub-surface controls in predetermined positions in a well flow conductor or tubing string, which may include a plurality of pipe sections 89 and a plurality of landing nipples 40 connected in the usual manner by securing together adjacent threaded ends of the pipe sections and of the landing nipples. Each nipple 40 of the well flow conductor is provided with key grooves 38 and 39 which are of different dimensions or which are differently spaced, than the key grooves of the other nipples, as is clearly seen in Figure 1. The anchoring device is fitted with keys 16 which will match the key grooves of a particular landing nipple in order that the anchoring device may be positioned and locked in a predetermined point in the well flow conductor in a manner now to be described.

In use, a well device, such as a length of extension

5

tubing 90 is secured to the threaded lower end of the lower mandrel section 12. The extension tubing 90 may consist of a number of sections and may have a length of as much as 500 feet. The extension tubing extends through the well flow conductor which is disposed in the well casing 91 and has an open lower end.

The anchoring device is supported by the running tool R whose skirt 68 extends down over the upper end of the dog expander 56 and is secured thereto by the shear pins 83 and 84. The dog expander in turn supports the mandrel 10 by the engagement of its shoulder 62 with the annular shoulder 63 of the dog holder 49. In this uppermost position of the dog expander, the enlarged portion 61 of the dog expander is disposed above the bosses 51 of the dogs and the dogs are free to remain in their retracted positions.

The running tool, the anchoring device and the tubing are then lowered into the well flow conductor by means of a flexible line or the like, in the usual manner. The keys 16 are in their retracted positions but are biased outwardly to contact the inner walls of the well fluid conductor in the manner shown in Figure 5. The beveled surfaces 32 at the lower ends of the keys insure that the keys will be cammed inwardly whenever they contact any obstruction, such as the ends of pipe sections, in the well fluid conductor during downward movement of the anchoring device.

The anchoring device will move downwardly through and past all landing nipples whose key grooves 38 and 39 do not correspond to the configuration of the keys 16. When the anchoring device moves downwardly into the predetermined landing nipple 40 having the corresponding key grooves, the keys are moved outward into the key grooves and the stop shoulders 34 of the keys abut the annular shoulder 41 of the landing nipple. This engagement of the stop shoulders 34 with the annular shoulder 41 prevents further downward movement of the anchoring device and thus positions and supports the anchoring device in a predetermined position in the well flow conductor, the weight of the anchoring device and the tubing now being supported not by the line but by engagement of the key stop shoulders with the annular shoulder 41.

The anchoring device, however, is still free to move upwardly, since the dogs 45, whose bosses 51 are now aligned with the locking groove 46 of the landing nipple, are in their retracted positions. The lower edge of the skirt 68 of the running tool will now rest upon the upper end of the dog holder 49, so that downward jars imparted to the running tool R by raising the tool slightly and then dropping it will cause the shear pin 71 to be sheared, allowing the sub 70 to move downwardly through the skirt to cause the retaining nut 75 to abut the upper end of the dog expander. Further jarring imparted to the sub will cause downward blows to be imparted to the upper end of the dog expander by the retaining nut, causing the shear pins 83 and 84 to be sheared to detach the running tool from the dog expander. Still further jarring will now cause the dog expander to move downwardly relative to the mandrel, the dog holder and the dogs. During this downward movement of the dog expander, the beveled surface 55 at the lower end of the dog expander engages the corresponding beveled shoulders or surfaces 54 of the dogs, causing the dogs to pivot outwardly so that the bosses 51 extend into the locking groove 46 of the landing nipple. The dog expander holds the dogs in expanded position. The dogs now prevent displacement of the anchoring device either upwardly or downwardly, so that pressure differentials exerted in either direction across the packing 64 will have no effect on the anchoring device which is held firmly in place so that the extension tubing 90 is supported in a predetermined position in the well flow conductor with its lower end extending below the lower open end of the well flow conductor. The running tool may then be withdrawn upwardly leaving the anchoring device in position in the

6

well flow conductor. It will be noted that the anchoring device was locked in place solely by downward jarring action, upward jarring action being precluded by the fact that the keys prevent only downward movement of the anchoring device so that any upward jarring would displace the device from the landing nipple.

The extension tubing 90 is usually employed to squeeze off or seal off perforations in the casing when it becomes necessary to perforate the well casing at a different level, or for washing sand out the well bore. In this case, a packer (not shown) may be set to seal the well annulus or space 91 between the well casing and the well flow conductor above the perforations. A back flow check valve (not shown) is also provided which allows fluid flow downwardly through the annulus into the well flow conductor above the packer but below the anchoring device. Cement is then pumped down the well fluid conductor and through the extension tubing from whose lower end it flows into the well bore and is forced into the perforations under pressure exerted from the surface. The back flow check valve is used primarily to prevent back flow of cement from between the well flow conductor or tubing and the small extension tubing 90 to the annular space between the casing and flow conductor above the packer. Excess cement is then removed from the well by pumping water into the annulus at the surface down through the check valve into the annular space between the well fluid conductor and the extension tubing and thence upward through the extension tubing and the well flow conductor to the surface.

During this back flushing operation, sufficient pressure is exerted in the well fluid conductor that a certain amount of water passes between the packer assembly 64 and the well flow conductor and thoroughly cleans the anchoring device. The water flows through the apertures in the keys 16 and into the space between the keys and the lower mandrel section to remove any cement which may be lodged there. The keys are thus freed for movement into retracted positions. The back flushing operation is performed only a few minutes after the cementing operation, so that the cement cannot set around the extension tubing and so that any cement lodged behind the keys will not have time to set.

After the back flushing operation is performed, the anchoring device and the extension tubing 90 are removed from the well tubing by lowering any suitable fishing tool (not shown) through the well flow conductor to engage the surface 88 of the flange 87 on the upper end of the dog expander. An upward pull exerted on the upper end of the dog expander will cause it to move upwardly relative to the dogs to position the enlarged portion 61 of the dog expander above the bosses 51 so that the dogs will be free to move into their retracted position. Further upward movement causes the shoulder 62 of the dog expander to engage the annular surface 63 of the dog holder so that continued upward movement of the fishing tool will cause an upward pull to be exerted on the dog holder and therefore on the mandrel. The mandrel will then move upwardly the upper downwardly and outwardly inclined surfaces 92 of the bosses, thus camming the dogs into retracted position by engagement with the upwardly and inwardly inclined surface 93 of the locking groove. At the same time, the beveled upper surfaces 31 of the keys engage the beveled annular surface 43 of the landing nipple to cam the keys inwardly to retracted positions. The anchoring device and the extension tubing 90 can then be lifted to the surface.

In Figures 9 and 10 is shown a modified form of the anchoring device in which the dog holder 100 is provided with an arcuate inwardly extending projection 101 which is adapted to engage in the arcuate recesses 102 in the outer surfaces of the lower collet portion 104 of the dog expander 103. The dog expander is formed of metal so that the collet portion 104 thereof may be flexed slightly

inwardly by the arcuate projections as said expander is moved downwardly in the dog holder from the position shown in Figure 10 to the position shown in Figure 9, and then outwardly when the arcuate recesses 102 become aligned with the arcuate projections 101. During this downward movement, of course, the dogs 105 are moved into expanded positions.

The projections 101 and the arcuate recesses 102 cooperate to hold or lock the dog expander to the dog holder to prevent accidental upward displacement of the dog expander relative to the dogs. Since both the recesses and the projections are arcuate in form, a relatively strong upward pull exerted on the dog expander will cause the collet portions 104 to be cammed inwardly to disengage the collet portions 104 from the arcuate projections and permit upward movement of the dog expander. Of course, the dog expander could be provided with an arcuate projection instead of a recess, in which case the dog holder would be provided with corresponding arcuate recesses. Other parts of the dogs, dog holder and dog expander are given the same identifying numerals as the form first described.

It will be seen that the projections 101 and the arcuate recesses 102 serve to firmly secure the dog expander in its lower position wherein it holds the dogs 105 in expanded position to prevent accidental upward displacement of the dog expander.

It will now be apparent that a new and improved anchoring device adapted for use in well flow conductors has been provided which includes a mandrel having a plurality of selector keys for engagement with corresponding key grooves in a preselected landing nipple forming a section of the conductor for preventing downward movement of the anchoring device past a selected position in the conductor, and having a plurality of dogs movable into expanded locked positions to prevent movement of the mandrel in either upward or downward direction from the selected position. It will also be apparent that a dog expander has been provided which moves the dogs into expanded positions upon downward movement of said dog expander relative to the mandrel. It will also be seen that a running tool has been provided for lowering the anchoring device into the well flow conductor which has a skirt 68 detachably connected to the dog expander and a sub 70 connected to the skirt by a shear pin 72, the shear pin 72 being shearable when the skirt abuts the dog holder 49 to allow the dog expander to be moved downwardly relative to the skirt only when the anchoring device is properly positioned in a preselected landing nipple 40 and held against downward movement therein by the keys 16.

It will also be apparent that the described construction of the anchoring device permits the mandrel to have a central bore of maximum size whereby an extension tubing 90 of large size may be connected thereto.

The foregoing description of the invention is explanatory only, and changes in the details of the construction illustrated may be made by those skilled in the art, within the scope of the appended claims, without departing from the spirit of the invention.

What I claim and desire to secure by Letters Patent is:

1. A device for releasably anchoring well tools at a selected level within a well pipe comprising: a landing nipple adapted to be connected in the pipe as a part thereof at said selected level and having internal recess means therein providing an upwardly facing stop shoulder; a mandrel; locking means on the mandrel for radial expansion; expander means slidably mounted on said mandrel, said locking means and said expander means having cooperating surfaces engageable to radially expand the locking means to locking position upon downward movement of said expander means relative to said locking means on said mandrel; a selector key mounted on the mandrel; and a resilient element urging the key outwardly,

said key having an upper surface inclined outwardly downwardly of the longitudinal axis of the mandrel and a downwardly facing stop surface disposed below the upper surface and substantially normal to the longitudinal axis of the carrier; said downwardly facing stop surface of said key being engageable with the upwardly facing stop shoulder in the nipple recess means to stop downward movement of the mandrel at said nipple, said inclined upper surface of said key permitting said key to be moved upwardly out of said nipple whereby said mandrel may be moved upwardly away from said nipple; said engagement of said stop surface of said key with said stop shoulder in the nipple recess providing the sole means for stopping downward movement of the mandrel and supporting said locking means while said expander means is moved downwardly to move said locking means to expanded locking position, said expander means being movable downwardly to expand said locking means only after such engagement of said downwardly facing stop surface of said key with the upwardly facing stop shoulder in the nipple, such expanding movement being effected without disengaging said downwardly facing stop surface of the key from the upwardly facing stop shoulder in the nipple.

2. Anchoring device for releasably anchoring well tools at a selected level within a well flow conductor having a plurality of longitudinally spaced landing nipples each provided with longitudinally spaced annular grooves, some of the grooves of each landing nipple differing in dimensions and configuration from corresponding grooves of the other landing nipples, one groove of each landing nipple having an upwardly facing stop shoulder, comprising: a mandrel movable through said conductor and having locking dogs movable outwardly to engage in one of the grooves not having said stop shoulder; a key having projections adapted to engage in a pair of grooves of a preselected one of said landing nipples, said key being carried by said mandrel and movable outwardly to engage in the grooves of the preselected landing nipple, said key having a stop portion engageable with said stop shoulder of the preselected landing nipple to arrest downward movement of the carrier; and expander means slidable downwardly on said mandrel for moving said dogs outwardly; said expander means being movable downwardly to move the dogs outwardly to locking position only after downward movement of the mandrel is arrested by engagement of the key stop portion with the stop shoulder of the preselected landing nipple, such engagement of the key stop portion with the landing nipple stop shoulder holding the mandrel and locking dogs against downward movement to permit such downward movement of the expander means relative to said locking dogs.

3. An anchoring device including: an elongate mandrel having a tubular dog holder mounted exteriorly thereof and concentric with the longitudinal axis of said mandrel, said dog holder having a plurality of longitudinally extending slots; a plurality of dogs swingably carried by said dog holder and having outwardly extending bosses movable outwardly of said dog holder through said slots; a dog expander slidably mounted on said mandrel and having a portion movable between said mandrel and said dogs and said dog holder; cooperating means on said dog expander and said dogs for expanding said dogs outwardly when said dog expander is moved downwardly on said mandrel; cooperating means on said dog expander and said dog holder for limiting upward movement of said dog expander relative to said dog holder; and a key carried by said mandrel and resiliently biased laterally outwardly therefrom, said key having a projection providing a downwardly facing stop shoulder adapted to engage an upwardly facing stop shoulder in a well flow conductor to stop downward movement of said mandrel therein; said dog expander being movable downwardly on the mandrel to move said cooperating means on said dog expander and said dogs into cooperating engagement only after downward movement of said mandrel has been stopped by said stop shoulder of said key and while said stop shoulder

9

of said key is so engaged with said stop shoulder of said tubing.

4. In combination with the device of claim 3, a running tool having a skirt detachably secured to said dog expander and extending thereover, the lower edge of said skirt being adapted to engage the upper end of said dog holder; a sub mounted for limited movement in the skirt; and shearable means for holding said sub immovable relative to said skirt, said sub being rendered movable relative to said skirt upon jarring imparted to said running tool when said lower end of said skirt abuts the upper end of said dog holder, said sub being adapted to engage said dog expander to detach said dog expander from said skirt when said sub is rendered movable relative to said skirt.

5. A running tool for an anchoring device of the type described comprising: a tubular skirt provided with an aperture for receiving a shear pin for detachably securing said skirt to the anchoring device; a sub having a portion extending into said skirt and slidable therein and having spaced shoulders providing for limited movement of said sub longitudinally relative to said skirt; and shearable means holding said sub releasably secured to said skirt with said skirt in its lowermost position relative to said sub.

6. A well tool adapted for use in a well conductor having internal grooves providing an internal upwardly facing stop shoulder therein and a downwardly facing lock shoulder spaced from said stop shoulder, said tool including: a tubular body; expansible and retractable locking means on said body engageable with said lock shoulder to lock said body in said conductor; external sealing means on said body engageable with said conductor for sealing therebetween; said body having a portion reduced in external diameter; a stop member mounted on said reduced portion of said body and movable laterally thereof to expanded and retracted positions, said stop member being arcuate in cross section and having a cylindrical external surface provided at its upper and lower ends with outwardly convergent beveled surfaces, said stop member having an arcuately elongate downwardly facing stop shoulder thereon disposed in a plane perpendicular to the cylindrical outer surface of the stop member, said stop shoulder being engageable with the upwardly facing shoulder of the well conductor for arresting downward movement of said body in said conductor, said arcuate cross-sectional shape of said stop member permitting said stop member to move inwardly of said reduced portion of said body to a retracted position wherein said external cylindrical surface of said stop member does not project beyond the maximum diameter of said tool; carrier means on said reduced portion of said body and having upper and lower annular members provided with opposed upper and lower guide and retaining slots; upwardly projecting guide and retaining lugs at the upper end of said stop member engageable in corresponding guide and retaining slots in the upper annular member of said carrier means; downwardly projecting guide and retaining lugs at the lower end of said stop member engageable in corresponding guide and retaining slots in the lower annular member of said carrier means; means on said body biasing said stop member to expanded position; said locking means being movable to locking position without disengaging the stop shoulder of the stop member from engagement with the upwardly facing stop shoulder of the well conductor; said guide and retaining lugs engaging said annular members for limiting outward movement of said stop member.

7. A well tool for treating a well having well tubing positioned therein with its lower end open and spaced from the bottom of the bore of the well, said well tool including: an elongate imperforate tubular conductor member comprising a plurality of elongate imperforate conductor sections detachably connected together and open at the lower end of the member; means at the upper

10

end of said conductor member resiliently held in supporting engagement with a selected section of said well tubing for supporting said conductor member at a selected position at the lower end of said tubing with the lower end of said conductor member projecting a substantial distance below the lower open end of said tubing; and means on said conductor member for sealing between said conductor member and said lower end of said well tubing for confining flow of fluids interiorly of said conductor member between said conductor member and said well tubing, whereby the conductor member forms a downward extension of the well tubing without requiring movement of the well tubing string; and wherein the means at the upper end of the conductor member for supporting said conductor member at a selected position at the lower end of the tubing includes: a landing nipple adapted to be connected in the tubing string as a part thereof and having an internal recess therein providing an upwardly facing stop shoulder; a mandrel connected to the upper end of the tubular conductor member; locking means mounted on the mandrel for lateral movement; expander means, slidably mounted on said mandrel, and engageable with said locking means to move said locking means to locking position upon downward movement of said expander means on said mandrel; a selector key mounted for lateral movement on said mandrel and resiliently biased outwardly, said selector key having a boss with a downwardly facing stop surface thereon adapted to engage in the recess of the landing nipple with said downwardly facing stop shoulder in engagement with the upwardly facing stop shoulder of the landing nipple, such engagement resiliently supporting the mandrel and the elongate conductor against downward movement, said expander member being movable downwardly to move said locking means to locking position only after said stop shoulder of said key has engaged said stop shoulder in said landing nipple recess, said expander means being movable to move said locking means to locking position without disengaging the stop shoulder of the key from engagement with the stop shoulder in the recess of the landing nipple; said expander member being movable upwardly from engagement with said locking means to permit said locking means to move to retracted position, whereby the conductor member may be removed from the well tubing when desired.

8. A running tool for anchoring devices of the type described comprising: a tubular skirt provided with an aperture for receiving a shear pin for detachably securing said skirt to the anchoring device, the bore of said tubular skirt being enlarged below said aperture to facilitate movement of said anchoring device in such lower portion of said tubular skirt; a sub having a portion extending downwardly into said skirt mounted on said skirt for limited movement relative to said skirt; upper and lower stop means on said sub spaced apart and engageable with said skirt for permitting such limited longitudinal movement of said sub relative to said skirt; said lower stop means being disposed to engage the anchoring device detachably secured to said skirt upon downward movement of said sub in said skirt; and shearable means holding said sub secured to said skirt in an elevated position with said skirt engaging said lower stop means, said shearable means being releasable to permit said sub to move downwardly in said skirt.

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