

Jan. 24, 1939.

H. C. OTIS

2,144,850

WELL DEVICE

Filed April 29, 1935

4 Sheets-Sheet 1

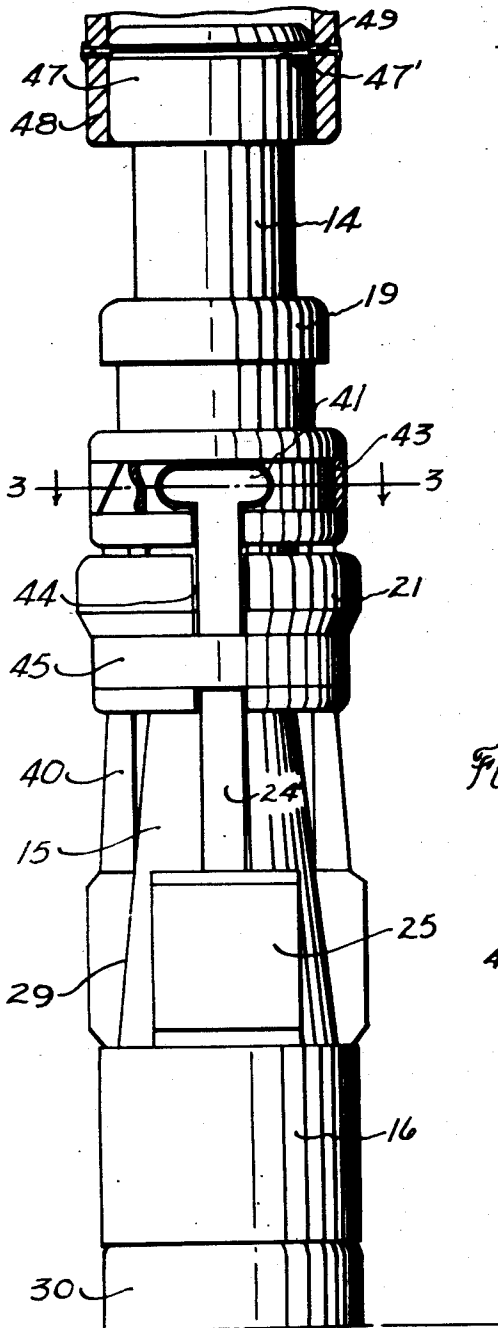


Fig 1

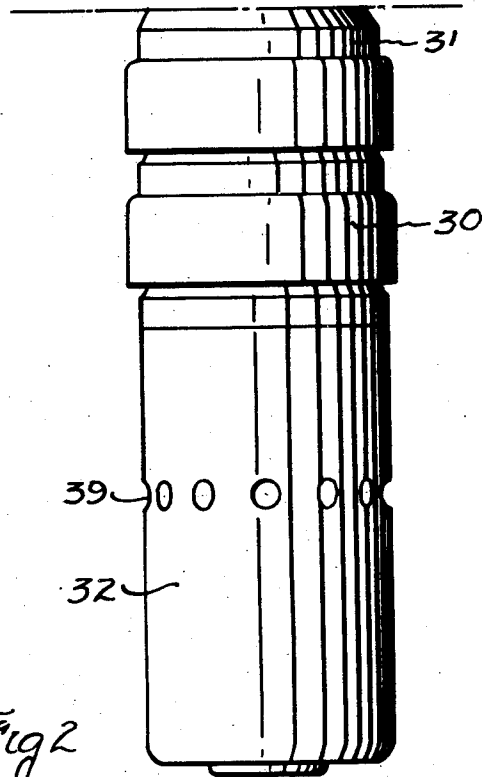


Fig 2

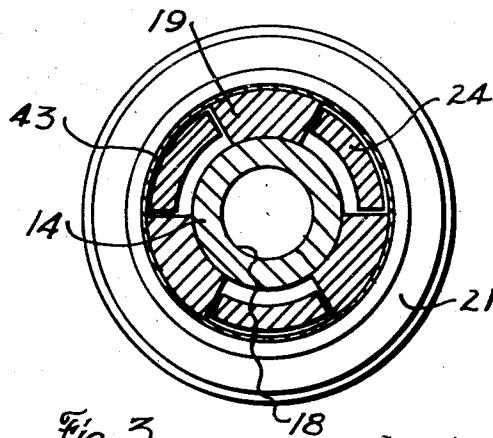


Fig 3

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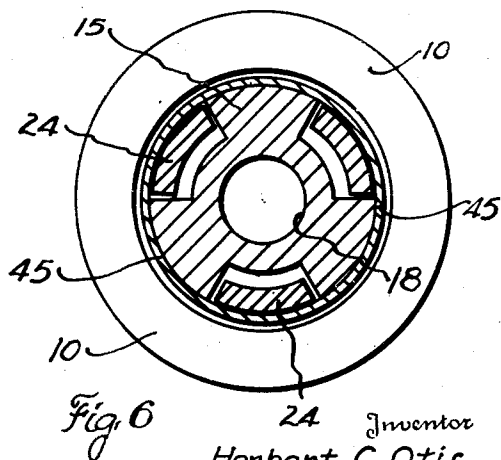
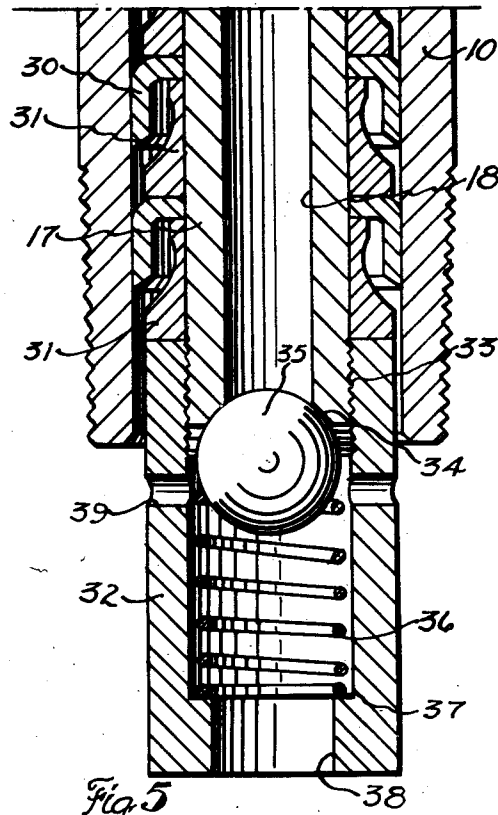
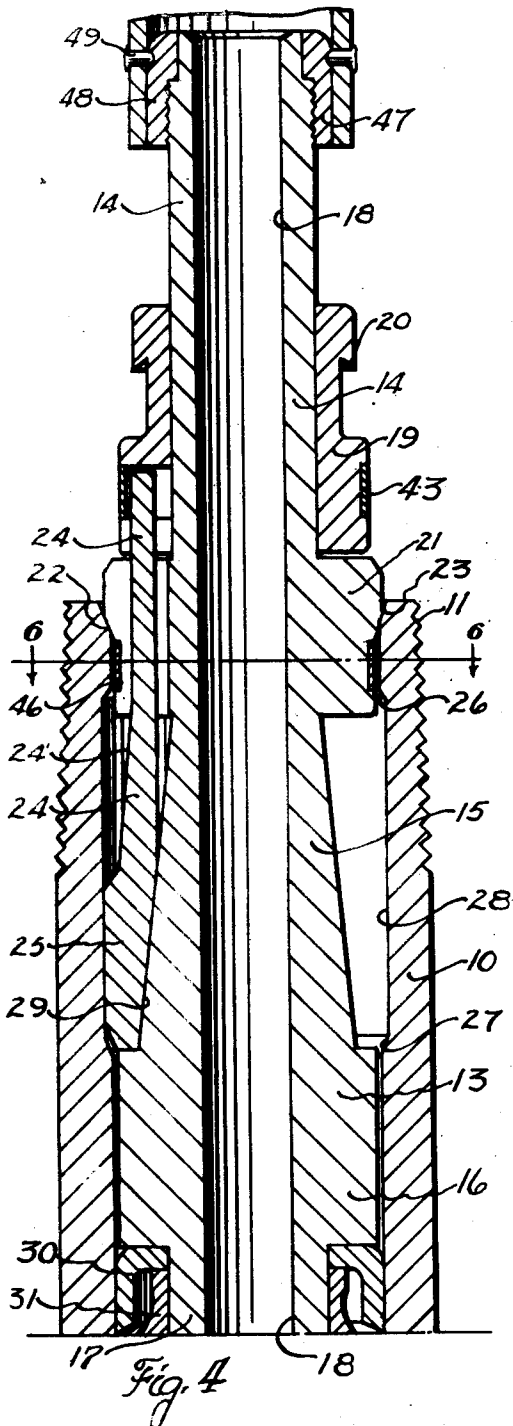
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WELL DEVICE

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4 Sheets-Sheet 2



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WELL DEVICE

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4 Sheets-Sheet 3

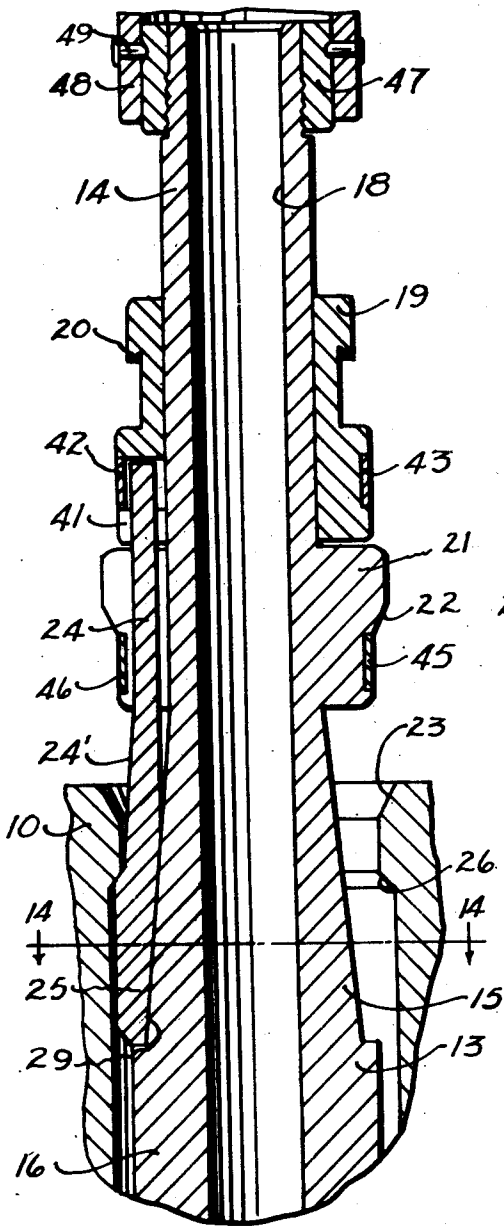


Fig. 7

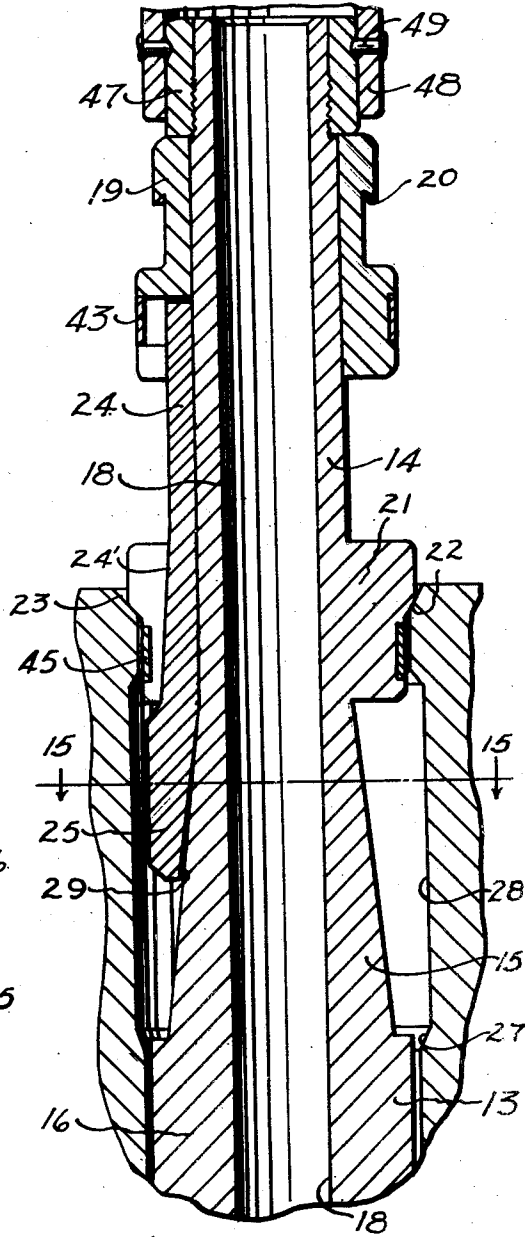


Fig. 8

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WELL DEVICE

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4 Sheets-Sheet 4

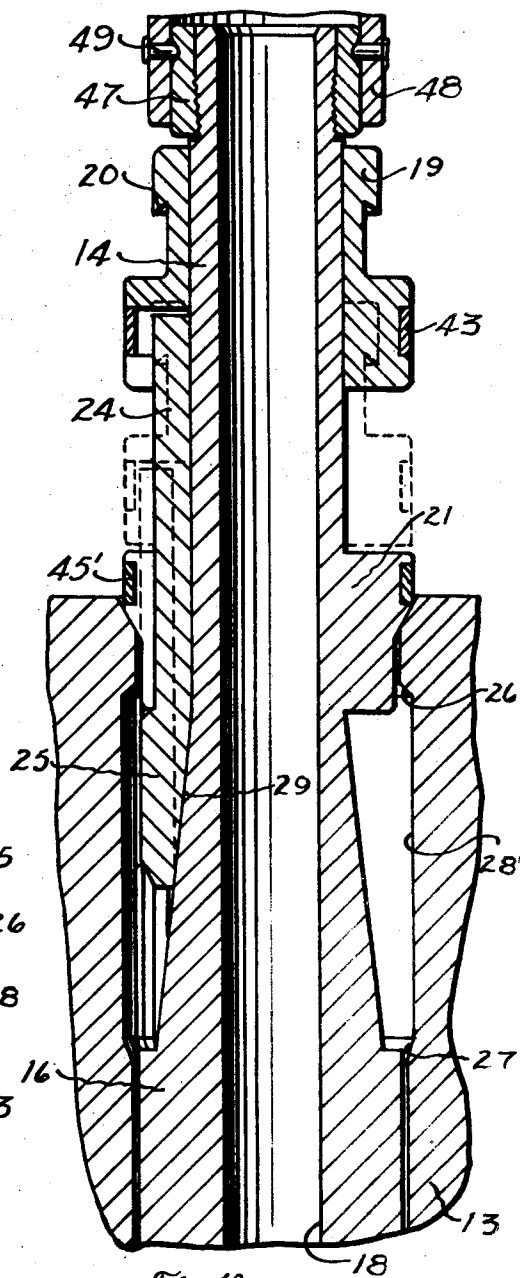
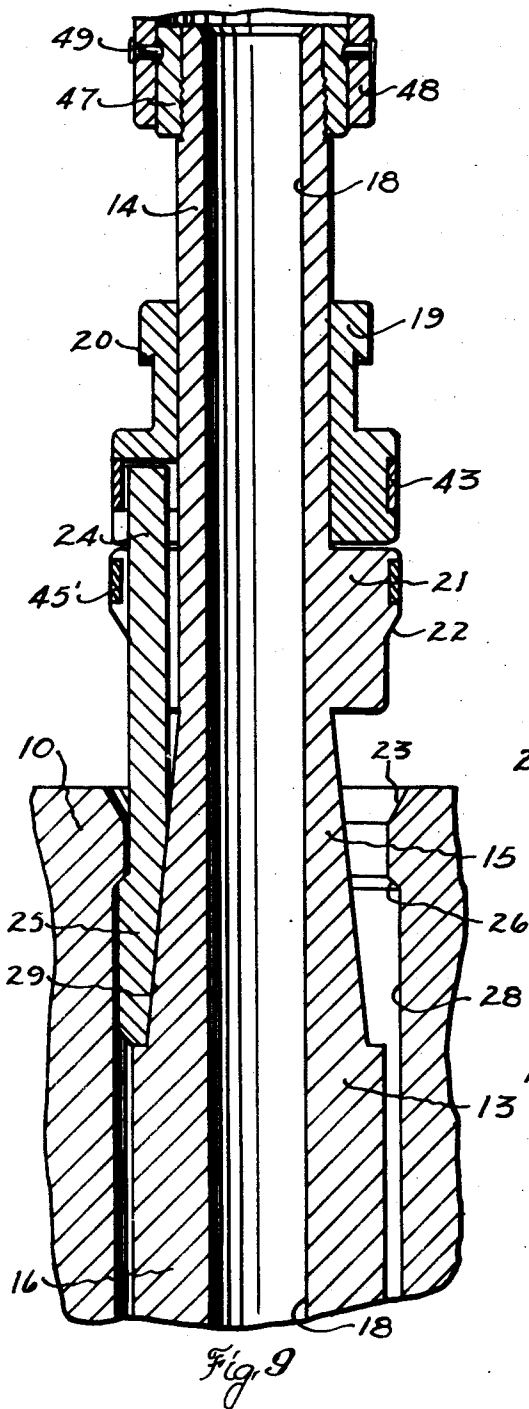


Fig. 10

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## UNITED STATES PATENT OFFICE

2,144,850

## WELL DEVICE

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Application April 29, 1935, Serial No. 18,788

13 Claims. (Cl. 166—13)

This invention relates to new and useful improvements in well devices.

It has become common practice in the oil fields to use core barrels which are removable through the drill stem. With the equipment now in use in connection with these core barrels, it is not possible to use a float valve for the purpose of floating long strings of drill or other pipe into the well, or to use a choke at the lower end of the string, because the devices which are now available, are not removable, and therefore the core barrel can not be either run in or pulled out of the string while the float valve or choke is in place.

One object of the invention is to provide an improved removable carrier arranged to be lowered into a string of tubing or pipe, and locked in place, so as to support a float valve for floating a string of drill or other pipe into the well, and also to act as a blow-out preventer when the string of tubing is being pulled from the well, or to support a bottom-hole choke.

A further object of the invention is to provide an improved mechanism for locking and unlocking the carrier, whereby an assured operation is obtained.

Still another object of the invention is to provide an improved carrier adapted to carry a float valve, or a valve provided with a reduced bore to form a choke, or wherein the valve proper may be eliminated and a choke substituted therefor.

Another object of the invention is to provide a valve or choke carrier equipped with a packer and arranged to undergo a limited vertical movement while locked in the string, either in response to fluid pressure, or to actual movement by means placed in the well.

A construction designed to carry out the invention will be hereinafter described together with other features of the invention.

The invention will be more readily understood from a reading of the following specification and by reference to the accompanying drawings in which an example of the invention is shown, and wherein:

Figure 1 is an elevation of the upper portion of a float valve and carrier constructed in accordance with the invention, a portion of one of the retaining rings being omitted to show the mounting for the dogs, and the supporting cap being shown in section.

Figure 2 is an elevation of the lower portion of the same.

Figure 3 is an enlarged horizontal cross-sectional view taken on the line 3—3 of Figure 1.

Figure 4 is an enlarged vertical sectional view of the upper portion of the device in its lower locked position.

Figure 5 is an enlarged vertical sectional view of the lower portion of said device.

Figure 6 is a horizontal cross-sectional view taken on the line 6—6 of Figure 4.

Figure 7 is an enlarged vertical sectional view of the upper portion of the device, showing it in its upper locked position when the packer is under pressure.

Figure 8 is a vertical sectional view showing the carrier in its lower position and the dogs elevated and released.

Figure 9 is an enlarged vertical sectional view of the upper portion of another form of the device, showing it in its upper locked position when the packer is under pressure, and

Figure 10 is a vertical, sectional view, showing the carrier in its lower position and the dogs elevated and released.

In the drawings, the numeral 10 designates a cylindrical housing, which may take the form of an elongated nipple having screw-threaded pins 11 at each end. This nipple may be connected in the drill pipe in any suitable manner. It is to be understood that the invention is not to be limited to use in a drill pipe or drill stem but may be used in a tubing as well.

For insertion into, and locking in the nipple, a carrier 13 is provided. The carrier includes an elongated neck 14 at its upper end extending upwardly from a frusto-conical shank 15, which latter constitutes an expanding element. The shank extends upwardly from a cylindrical head 16, from which a reduced stem 17 depends. An axial bore 18 extends entirely through the carrier. The head 16 is slightly less in diameter than the bore of the nipple 10 so as to slide freely therethrough, but to have a limited lateral movement therein.

A dog collar 19 has a snug sliding fit on the neck 14. This collar is provided with an undercut overhanging annular lip 20 as is shown in detail in Figures 1, 4, 7 and 8. An annular stop flange 21 surrounds the base of the neck 14. This flange is provided with an inclined shoulder 22 which is adapted to engage in an inclined seat 23 at the top of the nipple, whereby the carrier is supported when inserted in the nipple.

A plurality of locking dogs 24 are pivotally carried by the collar 19 and extend through the flange. These dogs are provided with elongated shanks which are formed with inclined faces

55

24'. The shanks have bosses 25 at their lower ends, each boss being beveled at its upper and lower ends, the upper beveled end being arranged to engage an annular shoulder 26, at the top of a cylindrical locking recess 28, formed in the nipple at its upper portion when the carrier is moved vertically in said recess. The inner faces 29 of the dogs are inclined and curved to conform to the inclination and curvature of the shank 15, whereby said bosses 25 are displaced into the recess 28, when the dogs are moved downwardly on said shank; and conversely whereby the bosses of the dogs will swing from said recess when said dogs are elevated.

On the reduced stem 17, inverted packing cups 30 are mounted and are held in place and spaced apart by thimbles 31, as is best shown in Figures 4 and 5. These cups may be made of any suitable material such as leather, synthetic rubber or any other composition which will serve the purpose. The thimbles are considerably less in diameter than the inner diameter of the nipple, thus permitting the pressure fluid which rises in the tubing string (not shown) and the nipple 10 to enter and expand the cups, thereby packing off the device in the lower portion of the nipple. (See Fig. 5.) The cups and their component parts constitute a packer.

A cylindrical valve cage 32 has its upper end internally screw-threaded at 33 so as to be screwed onto the lower end of the stem 17, and to bear against the lowermost thimble 31, thereby locking or jamming said thimble in place. The cage is less in diameter than the bore of the nipple 10, thus permitting the pressure fluid to flow upwardly to the cups. A valve seat 34 is formed at the lower end of the bore 18 at the bottom of the stem 17 and receives a ball valve 35. The ball 35 is supported by a coil spring 36 resting on an annular shoulder 37 at the bottom of the cage, as is shown in Figure 5. The cage has an axial opening 38 at its bottom for the passage of fluid and the release of extraneous matter.

The cage is provided with radial ports 39 located below the center of the ball 35, when the latter is seated. When the string is being lowered into the well, or when the carrier is being lowered into the said string, the pressure fluid entering the ports 39 will tend to hold the ball 35 on its seat 34; however, when fluid is being forced down the string through the bore 18, the valve will be displaced downwardly so that its center will be below the ports 39 and this will permit a free outlet.

When the carrier is lowered into the well, its parts will be positioned as shown in Figure 1, the dogs resting upon the head 16. As the carrier moves downwardly the valve cage 32 will first enter the upper end of the nipple 10, followed successively by the packing cups 30 and the head 16. The lower bevels of the bosses 25 will next engage the seat 23 at the top of the nipple, whereby the dog assembly will be arrested and the shank 15 moved downwardly. As the shank travels downwardly, the inclined faces 29 of the dogs will tend to ride on said shank, whereby the pivoted dogs will be retracted. This action will be aided by the tendency of the beveled bosses 25 to ride down the inclined seat 23.

By the time the dog assembly is elevated to the position shown in Figure 8, the dogs will have swung inwardly so that their bosses 25, will have been retracted sufficiently to freely enter the upper end of the bore of the nipple 10. As soon as the bosses enter the upper end of the recess

28, the dog assembly will no longer be supported, therefore the dogs will slide downwardly on the shank, whereby the bosses will be extended into the recess 28. The downward movement of the carrier will be halted when the shoulder 22 of the stop flange comes to rest upon the seat 23, as is shown in Figure 4; while the downward movement of the dogs will be arrested when the bosses reach the head 16.

If the carrier is elevated the bosses 25 will engage the shoulder 26 at the top of the recess 28, thus limiting said movement and preventing withdrawal of said carrier from the nipple. The length of the locking recess 28 allows ample clearance above and below the bosses, thus minimizing the exactness necessary to lock the dogs in the nipple. This provision also permits a limited movement of the carrier and allows the bottom-hole pressure acting against the cups 30 to move the carrier upwardly, whereby the dogs are held in their extended position. Thus, it will be seen that when the dogs are extended into the recess and the carrier elevated either by the bottom-hole pressure or mechanically, said carrier is locked in the nipple.

In order to remove the carrier from the nipple 10, it must first be forced downwardly to the position shown in Fig. 4. An equalization of the pressure above and below the carrier is first obtained, after which a downward movement of the carrier is easily accomplished. With parts in this position the collar 19 is then elevated until it strikes a collar 47 screwed on the upper end of the neck 14, as is shown in Fig. 8. The dogs sliding up the shank 15 will be retracted, as will be explained, so that the carrier may be withdrawn from the nipple. The carrier may then be elevated in the string of pipe. This will clear the bore of the nipple so that a core barrel or other tool may be passed therethrough.

While the dogs 24 may be pivoted in the collar 19, in any suitable manner, I have found the construction illustrated in Figures 1, 4, 7 and 8 to be entirely satisfactory. It is preferable to employ three dogs spaced at equal distances, as is shown in Fig. 3. Each dog includes, in addition to its boss 25 and shank, a T-shaped hanger 40, as is shown in detail in Figure 1.

The collar 19 is provided with a plurality of T-shaped slots 41 receiving and suspending the cross heads 40' at the upper ends of the hangers 40. The cross heads are held in these slots by flat retaining rings 42, which are preferably split and seated in an annular recess 43 so as to lie flush with the outer surface of the collar. The stop flange 21 is provided with a plurality of vertical slots 44 through which the hangers extend. Below the shoulder 22, the ring is provided with a split retaining ring 45 engaging in an annular recess 46, whereby the hangers are loosely confined in the slots. Sufficient clearance is provided to permit the dogs to freely swing and move into their different positions. The hangers and their heads are free to move radially of the carrier in the slots 41 and 44.

Any suitable means may be provided for lowering the carrier into the tubing string to position it within the nipple 10. It has been found satisfactory to provide the collar 47 with an annular groove 47' for receiving the inner ends of rivets 49 carried by the cap 48 forming part of the tool shown in my Letters Patent No. 1,920,103 dated July 25, 1933.

When it is desirable to place the carrier in the nipple 10, which has been previously connected

in the string of tubing, the cap 48 is slipped over the collar 47 so that the rivets 49 will engage in the groove 47'. As previously described the bosses 25 will rest upon the head 16 and the carrier will enter the nipple 10 and come to rest in the position shown in Figure 4. When the tool is elevated the carrier will be lifted to the position shown in Figure 7. By operating the tool in the usual manner the cap 48 will be pulled upwardly from the collar 47, the ends of the rivets 49 shearing off so as to free the collar 47. The bosses 25 of the dogs engaging the shoulder 26, will limit the upward movement of the carrier, thus holding it stationary when the running tool exerts an upward pull to shear-off the rivets. If there is sufficient bottom-hole pressure, the carrier will be maintained in its elevated position owing to the expanding of the cups 30 by said pressure. However, if there is not sufficient pressure to hold the carrier elevated it will drop bodily to the position shown in Figure 4.

When it is desired to remove the carrier from the nipple, the fishing tool as shown in the aforesaid Letters Patent is connected to the device so as to engage the lip 20. When this occurs the parts will be in position shown in Figure 7 and by operating the tool, the carrier 13 will be forced downwardly to the position shown in Figure 4. Then upon an upward pull, the collar 19 will be slid up the neck 14, whereby the inclined dogs 24 will be elevated to the position shown in Figure 8. As said dogs are elevated the inclined faces 24' of the shank thereof will ride against the underside of the ring 45, which will force the dogs inwardly to the position shown in Figure 8. This will retract the dogs so that the carrier may now be elevated from the nipple and carried up the string. It is obvious that any suitable tools may be used for placing the carrier in position or removing it from the nipple. When the carrier is removed, the valve cage 32 is, of course, carried with it.

In Figures 9 and 10, I have shown another form of the invention. In this form the split ring 45 is eliminated and a similar ring 45' is disposed around the stop flange 21 being mounted at the upper end thereof, instead of at the lower end. Thus, when the flange is seated in the inclined seat 23 at the top of the nipple, this ring is above the seat and is not located to be engaged by the shanks of the dogs 24.

The operation is the same as in the first form except that the ring 45' does not serve to move the dogs inwardly to retract the same when the carrier is being removed from the nipple. Assuming the dogs 24 to be in the position shown in dotted lines (Figure 10) and it is desired to remove the carrier, an upward pull on the collar 19 will raise the dogs 24. However, these dogs will remain in their expanded position until the bevel, at the upper end of their bosses 2, strikes the shoulder 26 at the top of the locking recess 28. Due to the inclination of the bevel and shoulder, it is obvious that the lower end of the dogs will be swung inwardly, which will permit the carrier to be removed from the nipple.

By raising the ring 45 and depending on the engagement of the bevel at the upper end of the bosses 25 with the shoulder 26 for the retraction of the dogs 24, the inclined face 24' of the shank of each dog may be eliminated. This permits the shank and hanger of each dog to be made of an equal thickness throughout, which adds strength to said dogs. However, both structures

matter of choice as to which the particular operator may employ.

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

1. A well device including, a housing having 5 an elongated locking recess, a carrier having a fluid passage extending therethrough, a packer on the carrier, dogs on the carrier adapted to engage in the recess of the housing, and stop means on the carrier intermediate the ends 10 thereof for engaging the housing to arrest downward movement of said carrier, whereby the packer is positioned in the housing and the dogs are registered with the locking recess.

2. A well device including, a housing having a 15 locking recess, a carrier, a packer on the carrier, dogs on the carrier adapted to engage in the recess of the housing, and stop means on the carrier for engaging the housing to arrest downward movement of said carrier, whereby the packer is positioned in the housing and the dogs are registered 20 with the locking recess.

3. A well device including, a housing having a locking recess, a carrier having a fluid passage 25 extending therethrough, dogs on the carrier adapted to engage in the recess of the housing, and stop means on the carrier for engaging the housing to arrest downward movement of said carrier, whereby the dogs are positioned in the housing and said dogs are registered with the 30 locking recess.

4. A well device including, a housing having a locking recess therein, a carrier adapted to enter 35 said housing and having an axial bore extending therethrough, a valve mounted on the carrier and seated at one end of said bore, dogs on the carrier adapted to engage in the recess of the housing, means on the carrier for expanding the dogs into 40 the housing, and means on the carrier at the upper portion thereof having a stop for engaging the housing to arrest downward movement of said carrier and thereby register the dogs with the recesses and also having an element arranged to retract the dogs when said dogs are moved up- 45 wardly to permit removal of said carrier from the housing.

5. A well device including, a housing having a locking recess, a carrier having a fluid passage 50 extending therethrough, a packer on the carrier, dogs on the carrier adapted to engage in the recess of the housing, and stop means on the carrier for engaging the housing to arrest downward movement of said carrier, whereby the packer is positioned in the housing and the dogs are registered 55 with the locking recess, said stop means being arranged to retract the dogs from the locking recess when the dogs are moved upwardly, whereby said carrier may be removed from the housing.

6. A well device including, a housing having a 60 locking recess, an annular shoulder at the upper end of said recess, a carrier adapted to enter said housing and having an axial bore therethrough, dogs on the carrier having bosses arranged to engage in the recess of the housing, means on the 65 carrier for expanding the bosses into the recess, and stop means on the carrier for engaging the housing to arrest downward movement of the carrier, whereby the bosses are registered with the locking recess, the annular shoulder being so 70 arranged that upward movement of the carrier will cause the bosses to strike said shoulder, whereby the bosses are retained in the housing recesses to prevent removal of the carrier from the housing. 75

7. A well device including, a housing having a locking recess, a beveled annular shoulder at the upper end of the said recess, a carrier adapted to enter said housing and having an axial bore there-  
 5 through, dogs on the carrier having bosses arranged to engage in the recess of the housing, said bosses having their upper ends beveled, means on the carrier for expanding the bosses of the dogs into the recess, and stop means on the carrier  
 10 for engaging the housing to arrest downward movement of the carrier, whereby the bosses of the dogs are registered with the locking recess, the beveled annular shoulder at the upper end of the recess being so located that upward move-  
 15 ment of the carrier will cause the upper beveled ends of the dogs to strike said shoulder, whereby the bosses of the dogs are retained in said recesses to prevent removal of the carrier from the housing.
8. A well device including, a housing having an elongated locking recess, a carrier having a fluid passage extending therethrough, a packer on the carrier, dogs on the carrier adapted to engage in  
 20 the recess of the housing, and stop means on the carrier for engaging the housing to arrest down-  
 25 ward movement of said carrier whereby the packer is positioned in the housing and the dogs are registered with the locking recess.
9. A well device including, a housing adapted to be connected in a string of well tubing so as to constitute a section thereof, said housing having  
 30 a vertically elongated recess therein, a carrier adapted to enter said housing, locking means movably mounted on the carrier for engaging in  
 35 the housing recess, and movable means for moving the locking means into and out of locking and vertically sliding position in the housing recess, the elongated housing recess affording an elongated vertical sliding movement of the carrier  
 40 and the locking means while said means is locked in the said recess, said housing recess being of sufficient length to permit the locking means to slide vertically therein from locked position to un-  
 45 locked position.
10. A well device including, a housing adapted to be connected in a string of well tubing so as to constitute a section thereof, said housing having  
 45 a vertically elongated recess therein, a carrier adapted to enter said housing, locking means  
 50 movably mounted on the carrier for engaging in the housing recess, movable means for moving the

locking means into and out of locking and verti-  
 cally sliding position in the housing recess, the  
 elongated housing recess affording an elongated  
 vertical sliding movement of the carrier and the  
 locking means while said means is locked in the  
 5 said recess, said housing recess being of sufficient  
 length to permit the locking means to slide verti-  
 cally therein to release from the said moving  
 means, and means for actuating said locking  
 means controllable from the top of the well. 10

11. A well device including, a tubular housing  
 arranged to be connected in a string of well tub-  
 ing and provided with an annular vertically elon-  
 gated recess therein, a carrier having an axial  
 flow passage extending therethrough and ar-  
 15 ranged to enter the housing, locking means slid-  
 ably mounted on the carrier out of the flow pas-  
 sage and arranged to enter the recess of the hous-  
 ing, means on the carrier for displacing the lock-  
 ing means into the housing recess, whereby said  
 20 locking means is held in the housing recess when  
 said carrier and locking means are moved verti-  
 cally, and means on the locking means for en-  
 gagement by a tool for sliding the locking means  
 on the carrier and vertically in the recess of the  
 25 housing.

12. A well device including, a tubular housing  
 arranged to be connected in a string of well tubing  
 and provided with an annular vertically elongated  
 recess therein, a carrier having an axial flow  
 30 passage extending therethrough and arranged to  
 enter the housing, a packer on the carrier, lock-  
 ing means movably mounted on the carrier above  
 the packer out of the flow passage and arranged  
 to enter the recess of the housing, and means on  
 35 the carrier for displacing the locking means into  
 the housing recess, whereby said locking means  
 is held in the housing recess when said carrier  
 and locking means are moved vertically.

13. As a sub-combination in a well device, a  
 40 cylindrical tubular housing having means at each  
 end for connecting it in a string of well tubing,  
 said housing having a longitudinal elongated  
 cylindrical recess in its bore, an internal annular  
 stop shoulder in the bore of the housing at the  
 45 upper end of the recess, and an annular inclined  
 seat at the upper end of the housing surrounding  
 the bore thereof for receiving an inclined locking  
 member.

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