

April 16, 1946.

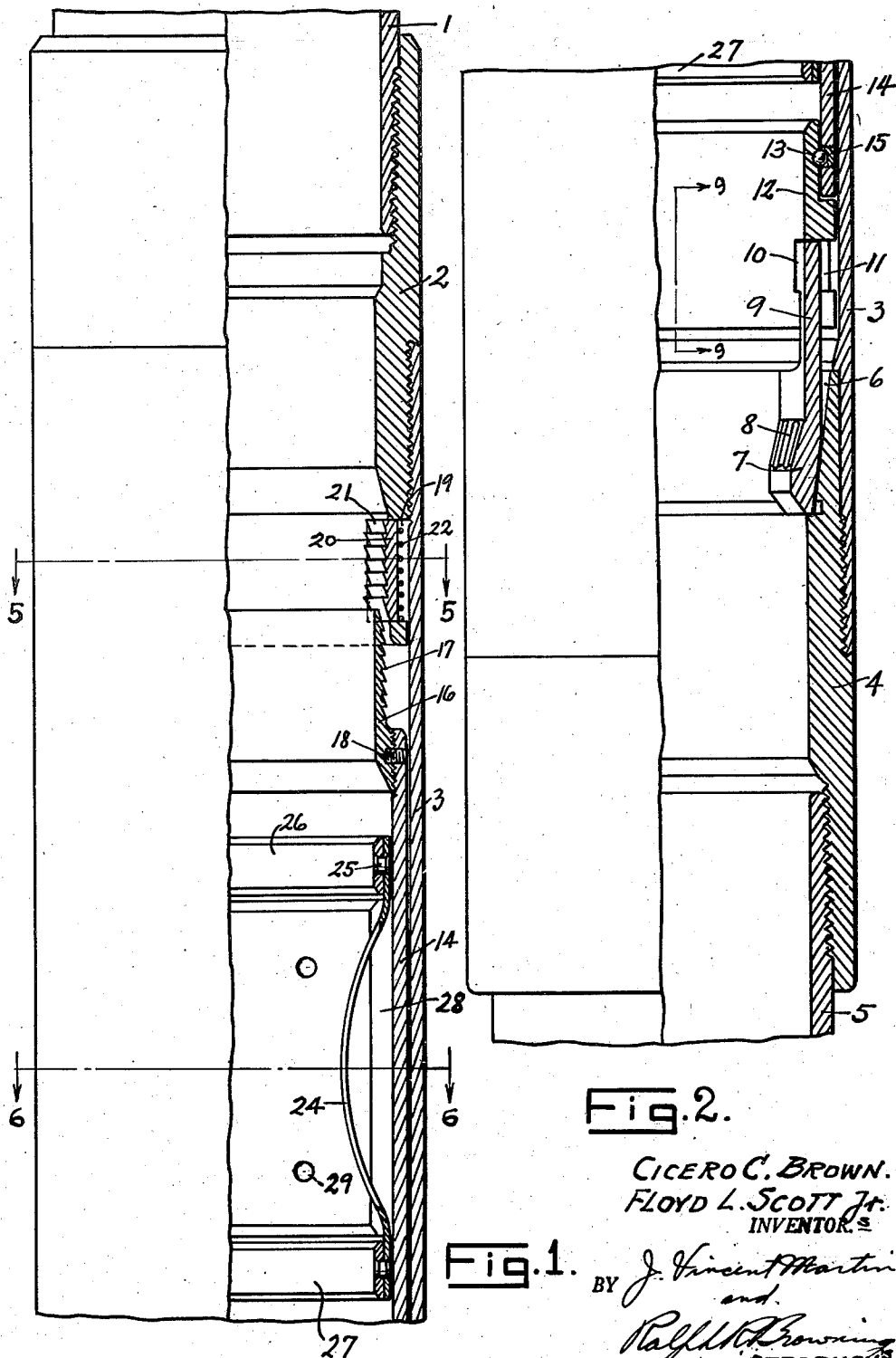
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2,398,515

WASHOVER OVERSHOT

Filed Oct. 15, 1943

4 Sheets-Sheet 1



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4 Sheets-Sheet 2

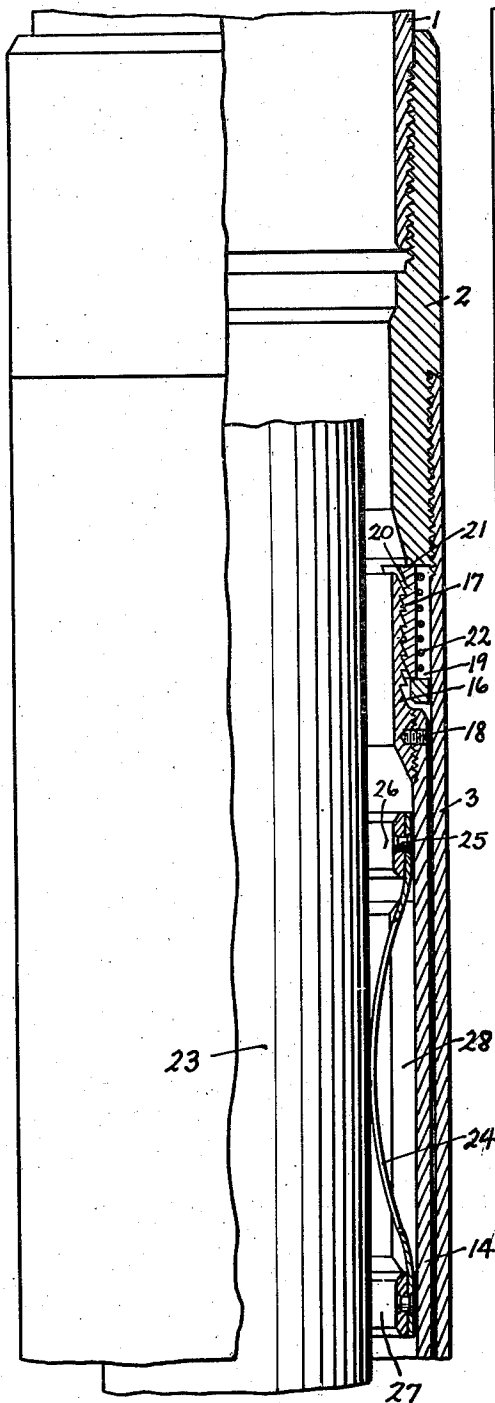


Fig. 3.

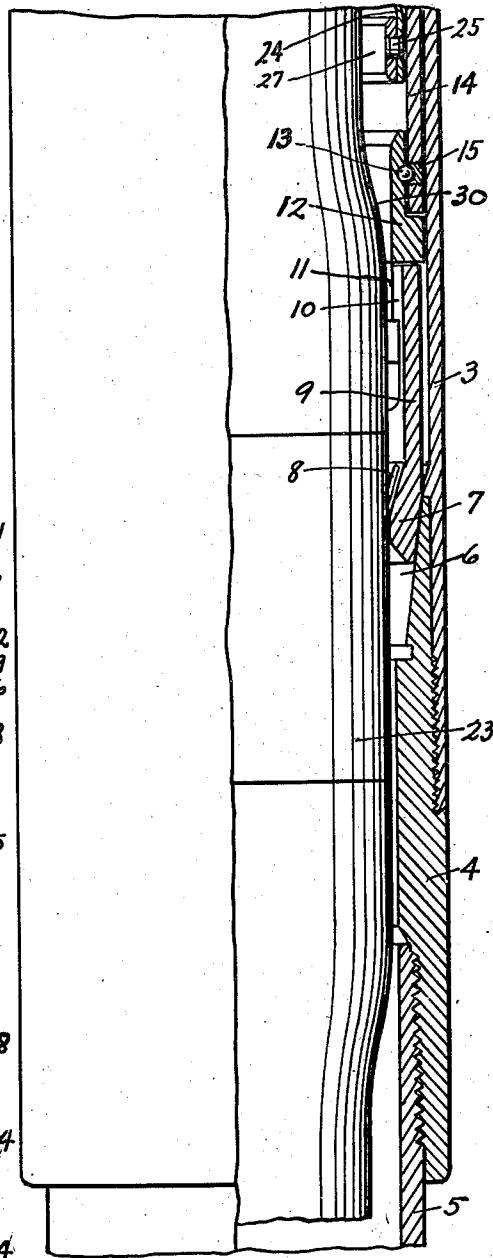


Fig. 4.

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4 Sheets-Sheet 3.

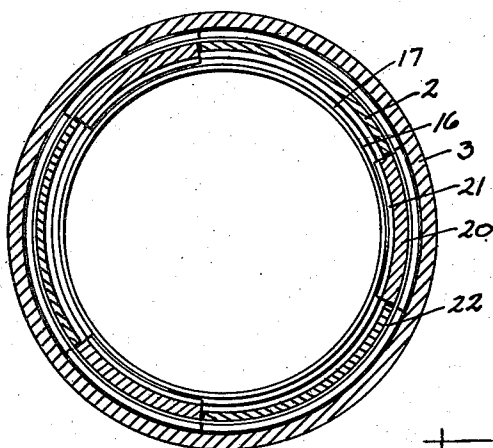


FIG. 5.

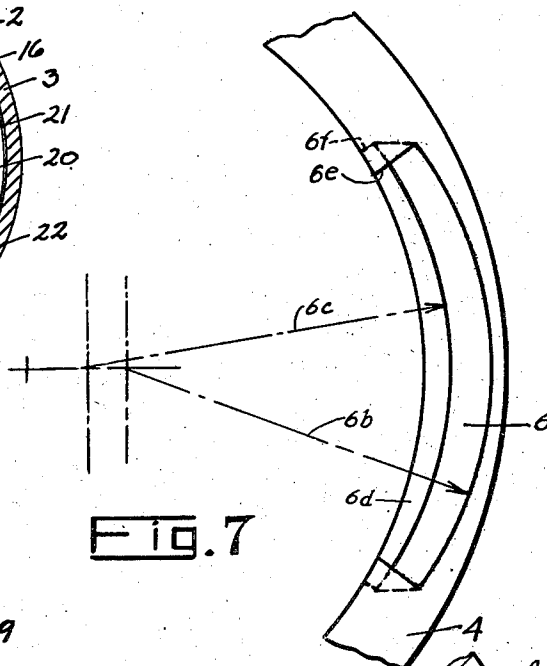


FIG. 7

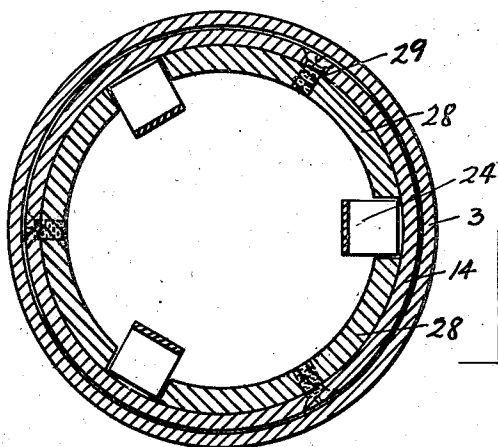


FIG. 6.

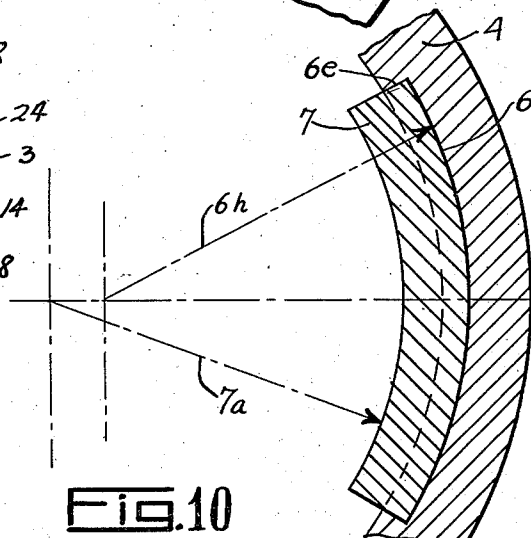


FIG. 10

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4 Sheets-Sheet 4

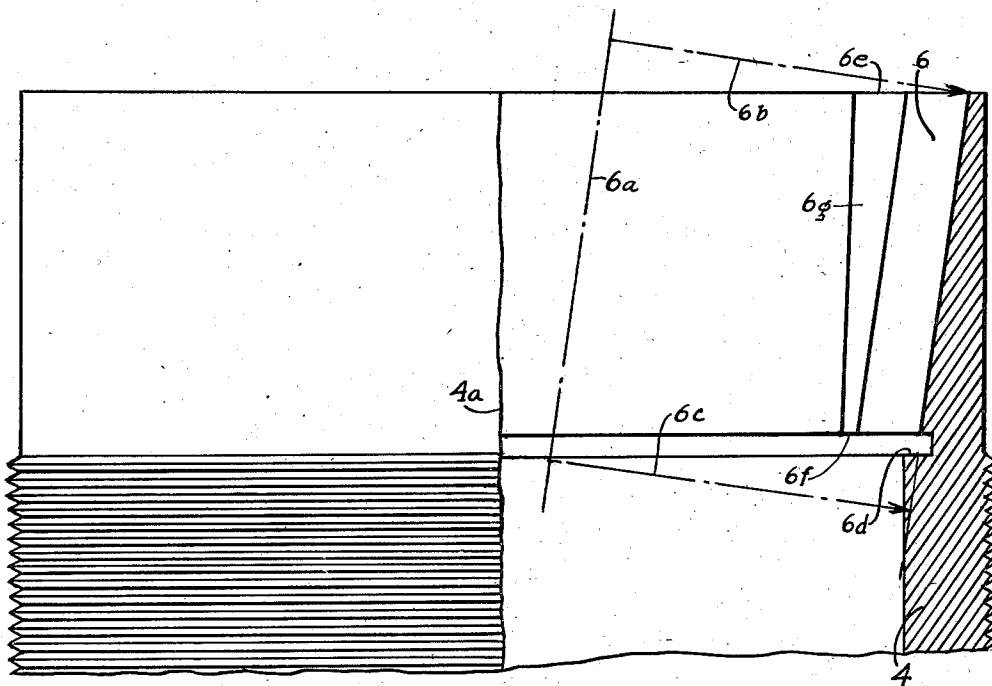


Fig. 8.

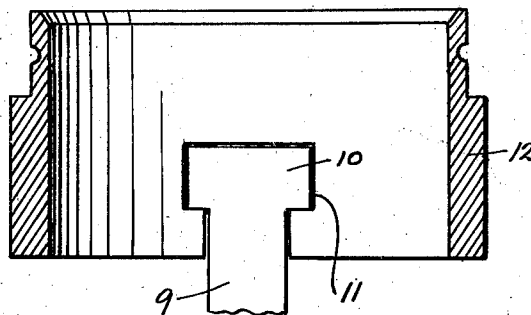


Fig. 9.

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UNITED STATES PATENT OFFICE

2,398,515

WASHOVER OVERSHOT

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Application October 15, 1943, Serial No. 506,398

10 Claims. (Cl. 294—102)

This invention relates to a gripping device for the purpose of gripping pipes, rods and similar objects and has for its general object the provision of such a device which will be better adapted to situations encountered in actual practice.

Devices for gripping pipes and similar objects have been for a long time well known but such devices have been limited in capacity and effectiveness as compared with their size and have also been limited in their adaptability to different situations encountered in actual operation. Thus, for example, in the case of overshots employed for removing objects from an opening such as a well bore it frequently occurs that the annular space about the outside of the object to be removed is of such limited dimensions that overshots heretofore devised have been too large to permit their efficient use. When they are used it not infrequently occurs that they become stuck in the limited annular space available. The same is true of other types of devices for gripping pipes, rods and the like.

Furthermore, in devices heretofore employed wherein slips are used for the purpose of gripping the pipe or other object, the slips have ordinarily been forced into gripping engagement by relative motion between a slip bowl or guide having a conical seat and a slip likewise having a conical surface for engaging such seat. These engaging conical surfaces are designed ordinarily so that they will fit exactly at some point at which the slip is supposed to fully engage the object to be gripped. However, if due to wear or for some other reason the object to be gripped does not have exactly the dimensions for which the gripping device was designed, or if the gripped device is of such weight and material that the slips will bite into or deform the same under the force of the engagement, the conical surfaces will not be fully engaged, and because of the thus reduced bearing surface in engagement between the slips and their supports, the slips themselves are frequently broken or the seating surfaces on the slips and on the slip bowls or guides are deformed because of excessive loading on the reduced bearing areas.

It is, therefore, a more specific object of this invention to provide a gripping device of the type referred to in which the load capacity of the gripping device will not depend upon the exact size of the member to be gripped.

Another object of this invention is to provide a structure of the type referred to in which the gripping device may be made of maximum capacity and minimum dimensions so that it may be

operated within smaller clearances than devices heretofore employed.

It is also noteworthy that in the past such devices in the form of overshots have usually been made non-releasable for the reason that the releasing structures heretofore devised have been undependable and of such a nature that they have been likely to cause the fouling of the device when used in spaces of limited dimensions.

It is, therefore, an object of this invention to provide an overshot structure with an improved releasing device which will be relatively sure in operation and which will not occupy an excessive amount of space.

It is a further object to provide such an overshot with a releasing device which will not be apt to become fouled when employed in relatively small annular spaces or when used in connection with the gripping of irregularly shaped objects.

Other objects and advantages of this invention will become apparent from the following description taken in connection with the accompanying drawings wherein is set forth by way of illustration and example, but not by way of limitation, one embodiment of the invention.

In the drawings:

Fig. 1 is a view partly in side elevation and partly in vertical cross section illustrating the upper portion of a gripping device constructed in accordance with this invention.

Fig. 2 is a similar view illustrating the lower portion of the same tool and providing a continuation of the lower portion of Fig. 1.

Figs. 3 and 4 are views similar to Figs. 1 and 2 respectively but showing the device as it is being passed downwardly over a pipe to be gripped and showing the parts of the device in their released position.

Fig. 5 shows a transverse cross section taken along the line 5—5 of Fig. 1.

Fig. 6 is a view showing a transverse cross section taken along the line 6—6 of Fig. 1.

Fig. 7 is a fragmentary top plan view of a portion of the slip bowl or guide illustrated in Fig. 8 and showing certain features of one of the slip seats formed therein.

Fig. 8 is a view partly in side elevation and partly in longitudinal cross section illustrating the slip bowl or guide forming a part of the structure shown in Figs. 1 to 4 inclusive.

Fig. 9 shows a longitudinal cross section through the slip retainer ring and slip connections.

Fig. 10 shows a fragmentary cross section

through the slip and slip bowl taken along the line 10-10 of Fig. 8 and showing the full seating of the cylindrical seat and slide surfaces against each other.

Referring more in detail to the drawings, the tool as illustrated in Figs. 1 and 2 is suspended upon a pipe 1 through which the tool is to be operated. On the lower end of this pipe is threadedly secured a collar 2 forming a top connection, and this collar is externally threaded to receive a sleeve 3 which encloses the major portion of the working parts of the tool. Threaded into the lower end of the sleeve 3 is the slip bowl or guide 4 in which the slip supporting guides or seats are formed. The slip bowl or guide comprising the body 4 is internally threaded at its lower end to receive a pipe 5 or other member which it may be desirable to connect thereto.

The slip seats 6 which are formed within the upper portion of the slip bowl or guide 4 are made cylindrical as distinguished from conical, each seat being formed on its own axis which is inclined with respect to the axis of the holder and which preferably intersects said axis, and the outer surfaces of the slips 7 are likewise made cylindrical and of the same radius to fit the seats 6. Thus in Fig. 8 the line 6a represents the axis of the cylindrical seat surface 6 in the slip guide 4 and it will be seen that this axis is inclined with respect to the axis 4a of the slip guide 4. The broken lines 6b and 6c in Fig. 8 represent radii of the cylindrical surface 6 at its upper and lower ends respectively, these radii being equal in length because of the fact that the surface 6 is cylindrical. A fragmentary top plan view showing the cylindrical guide surface 6 is contained in Fig. 7, the upper and lower radii 6b and 6c being likewise shown in this figure as being of equal length. In this figure also the shoulder 6d is shown at the lower end of the cylindrical seat surface 6 and the retaining radial side walls are indicated as lying between the solid line 6e at the upper end of the cylindrical seat surface 6 and the dotted line 6f at the lower end thereof. Inasmuch as the arcs struck about the radii 6b and 6c are of equal length, the radial retaining surface between the upper edge 6e and the lower edge 6f at the opposite edges of the cylindrical seat surface 6 would not be visible in Fig. 7 except in dotted lines as illustrated. One such surface, however, is illustrated at 6g in Fig. 8. It will thus be seen that the outer surfaces of the slips 7 will at all times seat fully against the seat surfaces 6 regardless of the vertical position of the slips. Thus, if the member to be gripped is of somewhat larger dimensions than that for which the tool was designed so that the slips come into gripping engagement with the member while they are still a substantial distance up in their seats 6, they will still have a full bearing between their outer surfaces and the slip seat surfaces 6. This is clearly indicated in Fig. 10 of the drawings in which the radius of the cylindrical seat surface 6 is indicated at the point of the section by the line 6h and the radius of the gripping portion of the slip 7 is indicated at 7a. Referring to Fig. 7 it will be seen that the side walls of the slip guides or seats are made radial with respect to the axis of the cylindrical surface forming the slip seat and that they, therefore, converge inwardly. The vertical edges of the slips are made of similar conformation so that when the slips are in place within their respective seats they will be held against radial or lateral movement away from their seats, although longitudinal

movement with respect to their seats will be freely permitted. Downward movement of the slips will be limited by the upwardly facing shoulder at the lower end of each slip guide or seat.

The individual slips are provided with suitable teeth 8 on their inner surfaces so that they may grip the pipe or other object in such a manner as to manipulate it in the desired direction. In the case of the teeth illustrated these are arranged vertically so as to make possible the transmission of rotary force to the object to be gripped. In the case of a pipe such as illustrated in Fig. 4 where a definite external shoulder is present, such slips may also be used to exert a very substantial lifting force on the pipe, but if lifting force alone against a smooth cylindrical surface be desired, then the teeth 8 on the slips might be arranged horizontally in a manner well known to persons skilled in the art. Any number of slip seats may be provided in the seat bowl to receive a predetermined number of slips. Ordinarily three or four slips will be employed.

Each of the slips 7 is also formed with a stem 9 which extends upwardly and is formed with a T-shaped head 10 on its upper end fitting into a T slot 11 in a slip retaining ring 12. This slip retaining ring is slidably mounted within the sleeve 3 and may be rotatably supported through the medium of a ball bearing 13 within the lower end of a sliding operating sleeve 14. It will be seen that the balls forming the ball bearing 13 may be inserted through a suitable opening in the sleeve 14 into the complementary grooves or races formed in the exterior of the slip retaining ring 12 and in the interior of the sleeve 14. After the insertion of the balls this opening would be closed by means of a suitable plug 15.

Secured to the upper end of the sleeve 14 is an element 16 which might be termed a ratchet sleeve having downwardly facing buttress type threads 17 on its outer surface. This sleeve may be threaded or otherwise secured within the sleeve 14 as illustrated, and then locked thereto by means of a set screw 18 or the like.

The lower portion of the fitting 2 inside the sleeve 3 is provided with a series of circumferentially spaced windows 19 in which are positioned radially movable dogs 20 having upwardly facing segmental buttress type threads 21 formed on their inner faces. These dogs are at all times urged radially inwardly by means of a circumferentially extending spring 22.

From the foregoing it will be seen that when the sleeve 14 from which the slip retaining ring 12 and the slips 7 are suspended is moved upwardly within the sleeve 3, the buttress type threads 17 will engage within the segmental threads 21 on the dogs 20 moving these dogs outwardly as the two members engage. After the members are engaged with each other the dogs 20 will be moved inwardly into full engagement with the threads 17 by means of the spring 22. When the parts are in this position the slips 7 will be suspended within the upper portions of their seats as illustrated in Fig. 4 and will not grip a member such as the pipe 23 which may be positioned within the tool at the time.

In order to disengage the parts 16 and 20 from each other so that the slips may move downwardly within the slip support 4 and engage a pipe such as the pipe 23, it is necessary to provide a means whereby the sleeve 14 and its associated parts may be held against rotation while the sleeve 3 and the fitting 2 are rotated to disengage the buttress type threads 17 and 21. For

this purpose there have been provided a plurality of circumferentially spaced friction springs 24 which may be referred to as bow springs and which are located within the sleeve 14. These springs have their opposite ends secured as by means of rivets 25 or the like to a pair of floating rings 26 and 27. These spring 24 are adapted to receive and frictionally grip a pipe such as the pipe 23 as illustrated in Fig. 3 so that when the major portion of the tool including the fitting 2 and the sleeve 3 is rotated, the springs 24 and their associated rings 26 and 27 will be frictionally held against rotation. In order that this holding force might be transmitted to the sleeve 14, there are inserted in the sleeve 14 and secured thereto between the springs 24 a plurality of segmental blocks or keys 28. These may be secured in place by any desired means such as the screws 29.

Now if the device be lowered over a pipe in the manner illustrated in Figs. 3 and 4, the slips 7 upon striking some enlargement in the pipe such as illustrated at 30 will be urged upwardly toward an upper position within their seats. This is, of course, accompanied by an upward movement of the sleeve 14 and the member 16 carrying the buttress threads 17. This member entering between the dogs 20 will cause the buttress threads 17 to engage the buttress threads 21 and thereafter suspend the sleeve 14 and the dogs 7 in such upper position.

It will be appreciated, of course, that the parts may be placed in this upper position before being engaged over an element such as the pipe 23 if so desired.

Having passed the tool over the pipe 23 or other member to be gripped and having placed it in a position where it is desired to grip the pipe 23, the major portion of the tool is then rotated by means of the suspending pipe 1 while the sleeve 14 and the element 16 are held against rotation by means of the springs 24. This relative rotation between the parts 16 and 20 will result in disengagement of the buttress type threads 17 and 21, whereupon an upward movement of the pipe 1 and its associated parts including the slip support 4 will result in an inward movement of the slips 7 so that they will engage the pipe 23 and grip the same.

If after pulling upon the pipe 23 or making other attempts to manipulate it in the desired manner it is found impossible to dislodge it or it is desired for some other reason to disengage the tool from the pipe 23, this may be accomplished by merely lowering the tool with respect to the pipe 23. When the tool is lowered the springs 24 which are in frictional engagement with the pipe 23 will tend to remain stationary and when the keys 28 engage the upper end of the ring 27 this engagement will tend to arrest downward movement of the sleeve 14 and the slips 7. Continued downward movement of the tool will again engage the buttress type threads 17 and 21 with each other whereupon the slips will be held in their released upper positions in their seats and will not grip the pipe 23. The tool may then be removed from the pipe 23 by an upward lifting force.

It is to be noted in connection with the springs 24 that both ends of each spring are secured against radial movement so that neither end of any spring may be moved radially inwardly to foul the tool. It is further to be noted that when the tool is moved over a pipe or the like so that the springs 24 engage the end of the pipe or a

shoulder thereon, the first result will be that the movement of the springs and the associated rings 26 and 27 is stopped until the keys 28 come in contact with the ring 27. Thereupon further movement tends to straighten out the springs 24 and move them upwardly. The lower ends of the springs are, of course, anchored to the ring 27 but the upper ends of the springs together with the ring 26 are free to move upwardly and thus permit the springs to straighten out until their central portions have moved outwardly far enough to permit the entry of the pipe or the passage of the shoulder thereon. The same thing occurs when the device is being moved upwardly along the pipe and a shoulder thereon is engaged by the springs 24. In that instance, however, the ring 26 will continue to be moved upwardly by the engagement of the keys 28 whereas the ring 27 will be free to move downwardly with respect to the sleeve 14 until the springs 24 have expanded sufficiently to allow the shoulder on the pipe to pass. Thus it will be seen that the springs in each case are allowed to expand and as they expand to move in the same direction as that in which they are pushed by engagement with the pipe.

It is further to be noted that the rings 26 and 27 are positioned inside of the ends of the springs 24 and secured thereto so that the ends of the springs cannot under any circumstance move inwardly into the path of the pipe being engaged or a shoulder thereon, yet both ends of the springs are free to move in an axial direction with respect to the tool as the central portions of the springs are flexed outwardly in passing over a pipe or a shoulder thereon.

It has been found that a tool constructed in accordance with the foregoing description may be made with an unexpectedly thin wall section so that it may be employed where the annular clearance about the member to be gripped is very small. Due to the formation of the slips and slip seats within the slip support, the slips will always be in full engagement with their seats and the excessive stresses which might otherwise be placed upon the slips and their seats in the event the member to be engaged is not exactly the proper size for the tool or in the event that the slips bite into such member more than anticipated will be avoided.

Means has also been provided whereby the slips may be positively held out of gripping engagement at all times desired yet may be released for gripping whenever the occasion arises. If desired, after the slips have been brought into gripping engagement, they may be readily released by a simple downward movement of the tool with respect to the member gripped.

From the foregoing it will be appreciated that a tool has been provided which is fully capable of carrying out all of the objects and advantages sought by this invention.

Having described our invention, we claim:

1. In a device for gripping pipe or the like, a slip bowl and slip means having cooperating cylindrical guide and slide surfaces respectively, said surfaces being formed on an axis disposed at an angle to the axis of the slip bowl, and means for releasably supporting the slip in a portion of the guide where it will not be in engagement with the member to be gripped, said means being engageable by relative axial movement and releasable by relative rotary movement of its respective parts, said means including a circumferentially threaded element and a plu-

rality of circumferentially spaced members disposed about the circumference of said element, each having a threaded portion engaging the threaded circumference of said element, and resilient means urging said members radially into engagement with said element.

2. In a device for gripping pipe or the like, a slip bowl and slip means having cooperating cylindrical guide and slide surfaces respectively, said surfaces being formed on an axis disposed at an angle to the axis of the slip bowl, means slidable axially with said slips and rotatable with respect thereto, parts having coacting buttress type threads carried on said means and on said slip bowl respectively, one of said threaded parts being movable radially toward and away from the other, one of said parts consisting of an annular member and the other of said parts consisting of a plurality of circumferentially spaced elements engaging the first part at a plurality of circumferentially spaced regions and means for urging said one part radially in a direction to engage the other.

3. In a device for gripping pipe or the like, a slip holder and a slip having cooperating cylindrical guide and slide surfaces respectively, said surfaces being formed on an axis disposed at an angle to the axis of the slip holder, means slidable axially with said slips and rotatable with respect thereto, parts having coating buttress type threads carried on said means and on said slip holder respectively, one of said threaded parts being movable radially toward and away from the other, means for urging said one part radially in a direction to engage the other, and a part engaging said slidable means and adapted to engage the part to be gripped, to oppose rotation of said slidable means and make possible the disengagement of said threaded parts.

4. In a tool adapted to be lowered into a well and manipulated therein, a pair of parts relatively movable to manipulate the tool, means for moving one of said parts, and a friction anchor associated with the other part and adapted to engage a surface within the well for frictionally holding said other part against movement, said friction anchor comprising bowed friction leaf spring means, and means on said other part for engaging one end of said spring means and dragging said end of the spring means therewith while leaving the other end of said spring means free to move within the limits of the resiliency of the spring means.

5. In a tool adapted to be lowered into a well and manipulated therein, a pair of parts relatively movable to manipulate the tool, means for moving one of said parts, and a friction anchor associated with the other part and adapted to engage a surface within the well for frictionally holding said other part against movement, said friction anchor comprising a laterally buckled friction member, and lost motion means for engaging with said other part that end of said laterally buckled member which is the leading end as the tool is moved in one direction or the other in the well while leaving the trailing end free for longitudinal movement, regardless of the direction of movement of the tool in the well.

6. In a tool adapted to be lowered into a well and manipulated therein, a pair of parts relatively movable to manipulate the tool, means for moving one of said parts, and a friction anchor associated with the other part and adapted to engage a surface within the well for frictionally holding said other part against movement, said

friction anchor comprising a longitudinally extending bowed friction leaf spring, a ring at each end of said spring and secured thereto, both rings being free of said other part, and a key on said other part between said rings, whereby regardless of whether said spring is moved upwardly or downwardly while it is in frictional engagement with a surface within the well, the ring at that end of the spring which happens to be the leading end of said spring will engage said key to anchor such leading end of said spring against movement with respect to said other part while leaving the trailing end of said spring free for longitudinal movement with respect to said other part regardless of the direction of movement of the spring.

7. In a tool adapted to be lowered into a well and manipulated therein, a pair of parts relatively movable to manipulate the tool, means for moving one of said parts, and a friction anchor associated with the other part adapted to engage a surface within the well for frictionally holding said other part against movement, said friction anchor comprising a longitudinally extending bowed friction leaf spring, a pair of anchor rings one secured to each of the opposite ends of said spring and both free of said other part, a key on said other part between said rings, whereby upon movement of said other part in either direction while said spring is in frictional engagement with a surface within the well, said key will engage the ring at that end which for the direction of movement of the tool is the leading end of said spring to anchor said spring against longitudinal movement with respect to said other part while leaving the trailing end of said spring free for such longitudinal movement regardless of the direction of movement of the spring, said key on said other part also being in engagement with said spring adjacent its ends to hold said other part against rotative movement with respect to said spring.

8. In a tool adapted to be lowered into a well and manipulated therein, a pair of parts relatively movable to manipulate the tool, means for moving one of said parts, and a friction anchor associated with the other part and adapted to engage a surface within the well for frictionally holding said other part against movement, said friction anchor comprising a laterally buckled friction member extending longitudinally of said other part, a pair of anchor rings secured to the opposite ends of said laterally buckled friction member respectively and both free of said other part, a key on said other part between said rings, whereby upon longitudinal movement of said other part within the well while said laterally buckled friction member is in engagement with a surface within the well, said key will engage the ring which is secured to that end which for the direction of movement of the tool is the leading end of said laterally buckled friction member to anchor such leading end of said member with respect to said other part while leaving the trailing end of such member free to move longitudinally, regardless of the direction of movement of said other part.

9. In a tool adapted to be lowered into a well and manipulated therein, a pair of parts relatively movable to manipulate the tool, means for moving one of said parts, and a friction anchor associated with the other part and adapted to engage a surface within the well for frictionally holding said other part against movement, said friction anchor comprising a laterally buckled

friction member, a pair of rings, one secured to each of the opposite ends of said laterally buckled friction member and both free of said other part, a key on said other part between said rings whereby upon longitudinal movement of said other part said key will engage the ring at that end which for the direction of movement of the tool is the leading end of said laterally buckled friction member to anchor such leading end against movement with respect to said other part while leaving the trailing end of said laterally buckled friction member free for such longitudinal movement with respect to said other part regardless of the direction of movement of said other part, said key being in engagement with said laterally buckled friction member to anchor

said laterally buckled friction member against rotational movement with respect to said other part.

10. An overshoot including a body, a gripping member movable to and from operative position with respect to said body, and parts having interengageable buttress type threads carried by said body and gripping member respectively in positions to automatically interengage and latch said member in inoperative position when it is moved to such position, one of said parts being rotatable with respect to the other to disengage said threads and release said member for movement to operative position.

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