Oct. 15, 1940. L. V. MALLORY 2,218,337

APPARATUS FOR RECOVERING IMPLEMENTS FROM WELLS

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Fig. 1

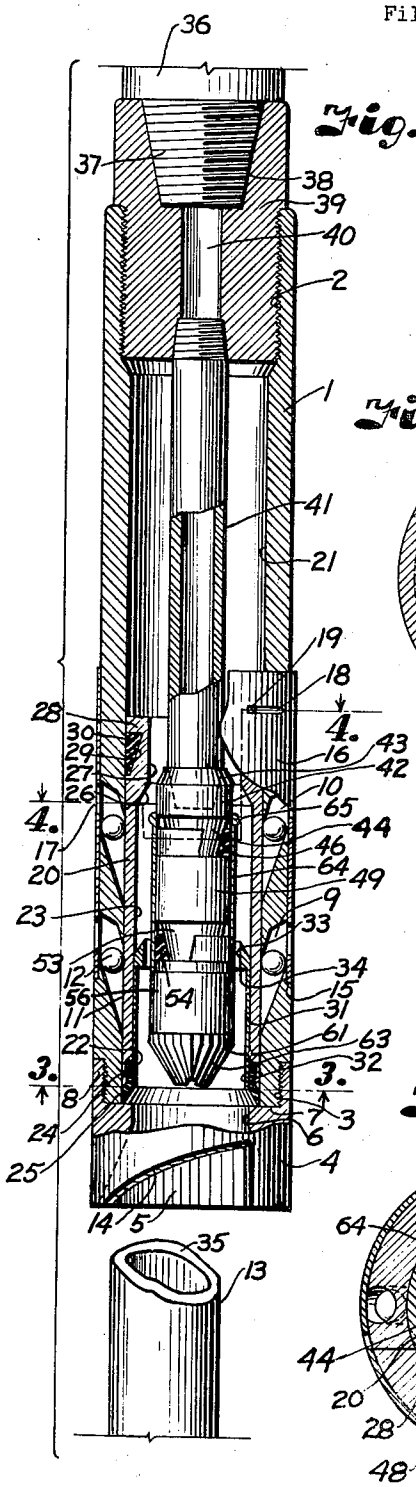



Fig. 2.

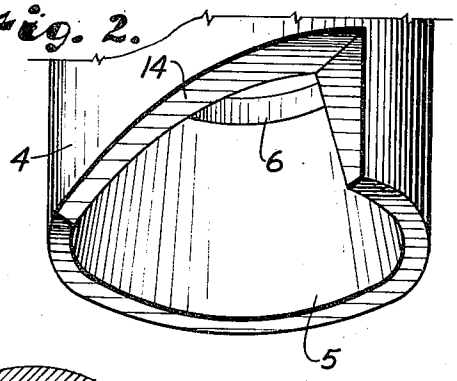



Fig. 3.

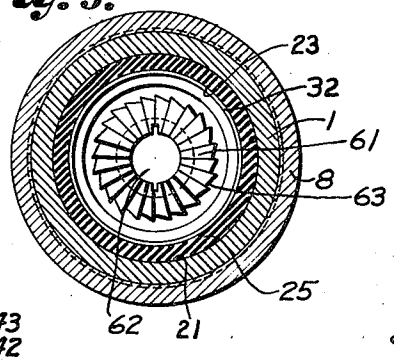



Fig. 4.

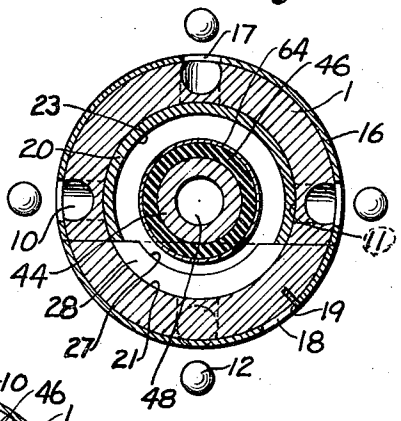
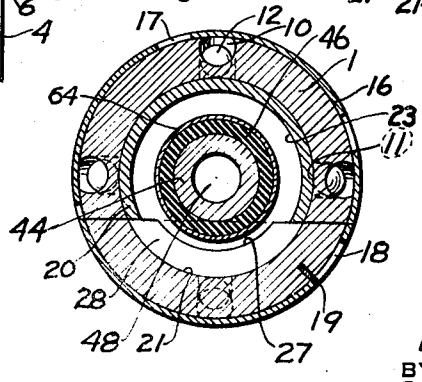



Fig. 5.




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Fig. 6.

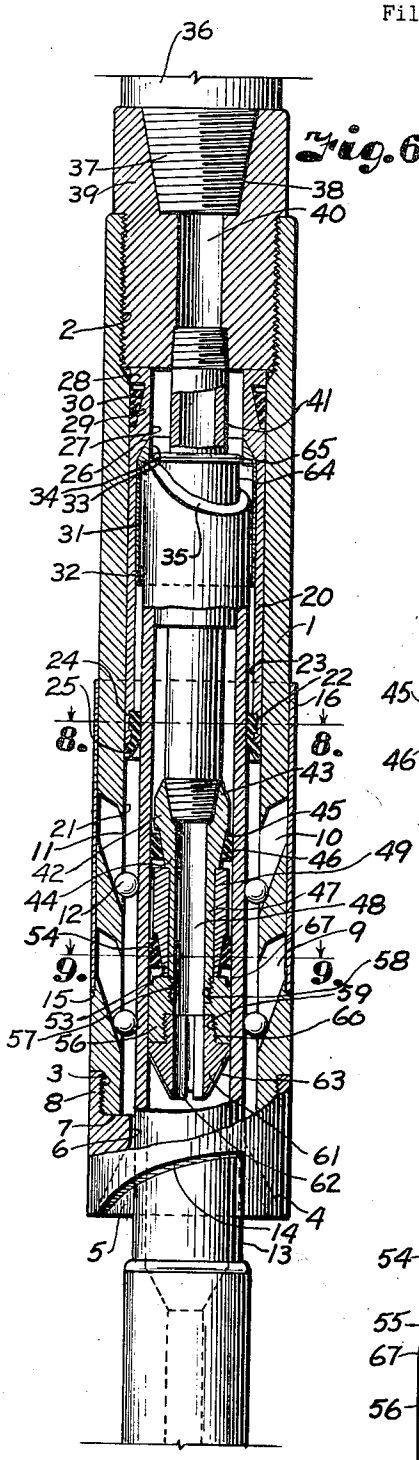



Fig. 7.

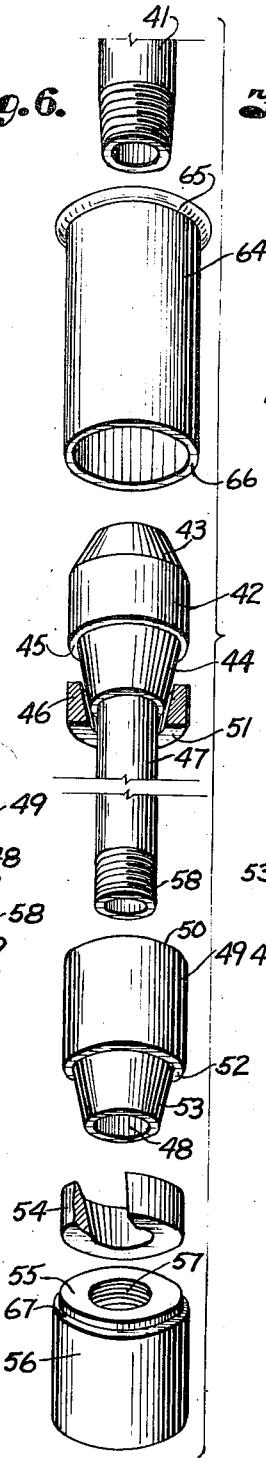



Fig. 8.

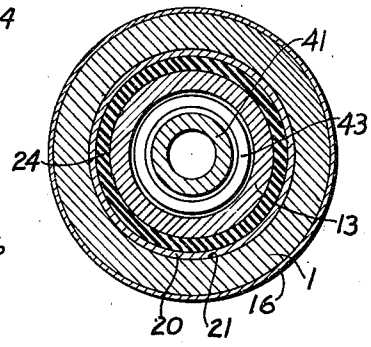
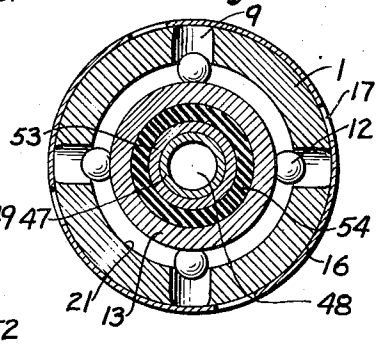



Fig. 9.




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# UNITED STATES PATENT OFFICE

2,218,337

## APPARATUS FOR RECOVERING IMPLEMENTS FROM WELLS

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Application November 8, 1937, Serial No. 173,440

10 Claims. (Cl. 294—102)

This invention relates to an apparatus for recovering implements from wells, and more particularly to an apparatus for recovering lost drill pipe or the like from oil wells.

In drilling wells, and more particularly oil wells, the drilling tools occasionally become disengaged from their actuating means at the surface of the ground either by breaking due to the jarring effect when being reciprocated in a well hole to drill out the same, or the tools become unscrewed due to the twisting action of the drilling tools incident to the drilling operation. In either event, the tools must be saved, if possible, to avoid both the expense of their loss and to permit further drilling in that particular well hole.

It is, therefore, the principal object of the present invention to provide an apparatus for expeditiously retrieving or recovering lost drilling tools from a well hole.

Further objects of the present invention are to provide an apparatus capable of engaging either the coupling collar, the main body shank, or a combination of both on a tool lost in a well; to provide for flushing the well hole and tool to condition the well and tool; to provide a fluid-tight connection between the recovering or fishing apparatus and the tool sought to be recoverd; to provide for disengaging the apparatus from the tool being recovered; to provide for bracing the tool from within during the recovering operation; to provide conditioning means for the lost tool in connection with the recovering apparatus for facilitating engagement of the apparatus with the tool; to provide for the protection of the operating elements of the recovering apparatus; and to provide an efficient, easily operable apparatus of this character.

In accomplishing these and other objects of the present invention, I have provided improved details of structure, the preferred form of apparatus being illustrated in the accompanying drawings wherein:

Fig. 1 is a vertical cross section through the tool recovering apparatus embodying the features of the present invention, parts thereof being broken away to show the relation of elements prior to engagement with an implement lodged in a well.

Fig. 2 is a bottom detail perspective view of the implement guide member adapted for attachment to the retrieving element.

Fig. 3 is a horizontal cross section through the lower end of the retrieving element on the line 3—3, Fig. 1.

Fig. 4 is a horizontal cross section on the line 4—4, Fig. 1, showing the apertures of the mud sleeve aligned with the ball races.

Fig. 5 is a cross sectional view smiliar to Fig. 4, showing the mud sleeve in normal position for closing the ball races.

Fig. 6 is a vertical cross section through the apparatus embodying the features of this invention, illustrating an implement to be recovered engaged within the retrieving element and the relation of the parts of the apparatus when in engagement with the implement.

Fig. 7 is a detail perspective view of the elements employed for interior engagement with the implement when it is being withdrawn from the well, such elements being shown in disassembled spaced relation.

Fig. 8 is a horizontal cross section on the line 8—8, Fig. 6.

Fig. 9 is a horizontal cross section on the line 9—9, Fig. 6, showing the gripping elements in engagement with the implement.

Referring more in detail to the drawings:

The present invention consists of a retrieving element preferably in the form of a cylindrical "overshot" 1 which is provided with a threaded socket 2 at its upper end, and a threaded lower end 3 for receiving an implement guide member 4.

The guide member 4, which is particularly illustrated in Fig. 2, is of substantially cylindrical shape and is provided with an upwardly and inwardly tapering face 5 terminating in a reduced open upper end 6 and having a shoulder 7 on its upper end bounded by the collar 8, the collar 8 being interiorly threaded for engagement with the threaded lower end of the overshot.

Diagonal raceways are provided in the body of the overshot 1 and in the present instance are shown to consist of spaced annular series 9 and 10 of ball races, each of which initiate at the outer surface of the overshot and are extended downwardly and inwardly to form passageways terminating respectively in apertures 11 on the inner surface of the overshot. The races 9 and 10 are suitably hardened, and gripping members, such as balls 12, which are similarly hardened, are mounted in the races and adapted to gravitate downwardly for engagement with the outer surface of an implement to be retrieved, such as the tool or broken drill pipe 13 when the overshot is lowered into engagement with the tool, such engagement being facilitated by the cut-out portion 14 on the guide member 4.

While in the present instance two series of races are illustrated, each having four similarly disposed races to a series, it is contemplated that six or more races are to be provided in each series, when necessary and depending upon the character of the "fishing" job, and that the races in each series may, if desired, be staggered in relation to each other.

In order to normally retain the balls 12 within their respective ball races and against displacement exteriorly of the overshot, the overshot 1 is provided with an annular shoulder 15 adjacent its lower end for receiving the lower end of a ball retainer such as the mud sleeve 16, which is rotatably mounted on the overshot, and which is provided with spaced series of apertures 17 alignable with the outer entrances of the ball races, the sleeve 16 being rotatable for the purpose of normally covering the outer entrances of the ball races, as shown in Fig. 5, when the balls are to be retained in their races. In order to limit rotation of the sleeve 16, a slot 18 is provided therein preferably adjacent the upper end of the sleeve, the slot being of a size adapted to slidably engage a restraining element 19, such as a dowel pin suitably mounted in the overshot, the slot and pin being related in such a manner that when the overshot is rotated in the usual manner, which is customarily in a clockwise direction, frictional engagement of the sleeve with the sides of the well hole tends to effect closing action of the sleeve relative to the ball race entrances so that the ball races are normally maintained closed.

The balls are retained in their races and against displacement from the interior lower exits thereof, by a retaining member such as the trap sleeve 20, which is slidable within the bore 21 of the overshot and normally engageable over the exit portions of the ball races. The trap sleeve 20 is provided with an annular groove 22 in its bore 23 in spaced relation to the lower end of the sleeve for receiving the upper end of a skirt packing 24 having a flared lower end 25 engageable with and seating upon the shoulder 7 of the guide member 4, and also engaging the bore 21 of the overshot. The upper end of the bore of the sleeve 20 is provided with an inward taper 26 terminating in a reduced bore 27, thereby forming an enlarged or thickened upper end 28 for the sleeve. An upwardly and inwardly tapering annular groove 29 is provided on the periphery of the enlarged portion 28 of the sleeve 20 and a similarly tapered packing element 30 is mounted in the groove, the packing element 30 preferably being of less width than the groove to permit reciprocating or sliding action in the groove and wedging action of the packing element into the smaller end of the groove in response to raising of the sleeve in the bore of the overshot.

It is desirable to maintain the skirt packing 24 on the lower end of the sleeve 20 in snug engagement with the overshot and guide member and to this end, I provide a skirt sleeve 31 slidingly engageable in the bore of the trap sleeve, and having its lower end 32 normally engaged over the upper end of the packing element 24. The upper end of the skirt sleeve is provided with an inset bore 33, thereby forming a shoulder 34 in the upper inner end of the bore thereof adapted for engagement with the upper end 35 of the tool 13 when the overshot is engaged over the tool to raise the skirt and thus permit engagement of the packing with the tool.

With the construction thus far described, it is apparent that, when the overshot 1 is lowered into a well containing a tool, such as the broken drill pipe 13, the guide 4 "finds" the tool and directs it into the bore of the overshot, at which time the upper end 35 of the tool engages the shoulder 34 of the skirt sleeve 32 and subsequently engages the taper 26 in the upper end of the trap sleeve 20 in such a manner that, upon continued lowering of the overshot, the trap sleeve is raised and the balls are released for gravitation downwardly, as shown in Fig. 6, for engagement with the outer surface of the tool for gripping the tool and removing it upon reversal of direction of movement of the overshot from its position in the well.

It has been found that when great pressures are applied as a draft in removing the overshot and tool from the well, the balls sometimes have a tendency to collapse or deform the tool. It is therefore desirable to brace the tool from within so that, while the balls may bite into the tool for effecting a gripping engagement between the overshot and tool, the tool need not be deformed, but may again be used.

In accomplishing this purpose of the invention, I preferably provide the fishing string 36 with a tapered threaded stud 37 adapted for engagement with an oppositely threaded socket 38 on a "sub" or draft connecting element 39, the lower end of which is suitably threaded to engage in the socket 2 at the upper end of the overshot. The "sub" 39 has an interior bore 40, as has the fishing string 36, so that flushing fluid may be introduced into the overshot from the fishing string. The lower end of the bore 40 in the "sub" is provided with threads for engagement with the upper end of a hang pipe 41, which extends downwardly into the overshot and has its lower end engaging, as by threads, with the upper end of a member 42. The member 42 is provided with an upper substantially conically shaped end 43 and an inset oppositely disposed substantially conically shaped member 44, forming a shoulder 45 for receiving the upper end of a packing element 46 sleeved over the member 44. The member 42 has a central bore and is preferably provided with a tubular projection 47, which extends downwardly therefrom a sufficient distance to extend through the bore 48 of a member 49 having a flat upper end 50 engageable with the underface 51 of the packing element 46 in such a manner that the packing element seats on the member 49 and has some degree of vertical play between the shoulder 45 of the member 42 and the flat upper end 50 of the member 49. The member 49 is provided with a shoulder 52 on its underface from which depends a substantially conically shaped element 53 which is adapted to receive, in sleeved relation thereon, a packing element 54, the packing element being of a width less than the length of the conical element 53 for adapting the packing element for vertical play between the shoulder 52 of the member 49 and the upper flat face 55 of a socket element 56, the socket element having a threaded bore 57 for receiving the lower threaded end 58 of the extension 47 on the member 42. The socket 56 is preferably interiorly threaded, as at 59 in Fig. 6, for receiving the threaded end 60 of a tool conditioning and/or milling member 61 having an interior bore 62 and a fluted substantially conical surface 63 engageable within the interior of the tool sought to be recovered for reaming out burrs or the like from the tool and facilitating insertion of the bracing member 42—49—56 thereinto.

It is contemplated, in using an apparatus embodying the features of the present invention, to condition the well preparatory to extraction of the tool from the well as well as to condition the tool for aiding in its extraction. To this end, as the overshot is lowered to a position in the well adjacent the tool, as determined by the log of the well and the condition of the portion of the tool withdrawn from the well at the time of loss of the portion 13 of the tool, flushing fluid is preferably applied through the fishing string and bracing member to loosen and wash away caved material from about the upper end of the tool. The overshot is also preferably rotated in such a manner that the milling element 63 may engage the end of the tool and remove burrs therefrom.

The guide member 4 may also be employed and suitably adapted for removing burrs from the outer surface of the tool so that the tool may be directed to a position within the bore of the overshot and also about the outer surface of the bracing element in the interior of the overshot.

When the flushing operation is employed, it is desirable to pack off the interior of the overshot from the flushing fluid and the packing elements 24, 30, 54, and 46 are employed for this purpose. Prior to engagement of the overshot with the tool, the packing elements 46 and 54 are retained in desired position on the cone supports 44 and 53 by the packing sleeve 64, Fig. 7, which is preferably of cylindrical conformation and provided with a bead 65 at its upper end. The sleeve 64 is of such a length that it engages over the member 42—43 and is adapted to seat at its lower end 66 on a shoulder 67 provided on the upper end of the socket 56, thus normally retaining the packing elements 54 and 46 from engagement with the sides of the bore of the tool 13.

The operation of an apparatus and the steps in the employment of a method embodying the features of the present invention are as follows:

It is first reasonably accurately determined what fishing or recovering conditions can be expected in the well by the condition of the broken end of the drill pipe or tool withdrawn from the well at the time of the break. Depending upon the type of break, a guide member 4 is used which is adapted to be engaged over either a collar on the tool in the well, if the tool has merely become unscrewed, or in the event that a break has occurred, as illustrated in the drawings, a guide member 4 having a smaller bore is employed and attached to the lower end of the overshot 1.

Assuming the elements of the apparatus to have been assembled substantially in the order of their description, and the sub 39 to have been applied to a rotatable fishing string 36, the recovering apparatus is lowered into the well by the fishing string to a point adjacent the tool 13 as determined by the log of the well indicating the point of break of the drill string.

An easy rotary motion is next preferably applied to the fishing string and the overshot is then caused to slowly settle down upon the "fish" or lost tool. The guide 4 directs the upper end of the tool into the bore of the overshot and, upon continued rotation of the string, the milling element 61 acts upon the ragged end of the fish until it enters the bore thereof. The upper end of the tool 13 engages the shoulder 34 of the skirt sleeve 31 and, upon continued lowering of the overshot raises this sleeve so that the packing element 24 is free to engage the outer surface of the tool. Continued downward movement of the overshot effects lifting of the skirt sleeve 31 into engagement with the taper 26 of the trap sleeve 20 for raising the sleeve 20 to the upper end of the bore 21 of the overshot at which point movement of the sleeve 20 ceases due to engagement of the upper end thereof with the lower end of the "sub" 39. Upward movement of the sleeve 20 opens the exit openings of the ball races 9 and 10 and the balls are permitted to gravitate downwardly for engagement with the outer surface of the tool 13. Since the balls are preferably of hardened steel and preferably run in hardened steel raceways, when the vertical movement of the overshot is reversed, that is, when draft is applied thereto for raising the overshot, the balls, seating on the lower surfaces of the raceways and in the wedge formed by such lower surfaces and the outer face of the tool 13, bite into the tool for effecting a griping action between the overshot and tool.

In its upward movement in the bore of the overshot, the upper end 35 of the tool 13 engages the bead 65 on the sleeve 64 of the bracing element in the overshot and lifts the same for releasing the packing elements 46 and 54 for effecting their engagement with the inner surface or with the bore of the tool 13, as shown in Fig. 6. Due to the cone shaped supports for the packing elements, it is apparent that when the packing elements are released, they are permitted to move upwardly in response to upward movement of the tool in the bore of the overshot and the packing elements are carried therewith for wedging engagement in the wedge formed by the bore of the tool and the tapered surface of their supports for effecting a seal between the bracing elements and the bore of the tool.

The skirt packing on the sleeve 20 due to its engagement with the outer surface of the tool 13 packs off the upper end of the bore of the overshot from flushing fluid introduced into the well hole and tool through the bore of the bracing elements in the overshot.

When downward movement of the fishing string is arrested due to engagement of the "found" tool therewith, the rotary motion of the fishing line is preferably stopped and upward draft is applied to the fishing line. This action causes the balls to bite into the softer material of the fish and the more draft that is applied to the line, the more severe is the bite of the balls into the fish. It is apparent, therefore, that under normal conditions the fish must yield to the draft pressure exerted on the fishing line.

It is preferred that once engagement is known to have been effected between the overshot and fish, to temporarily stop draft on the fishing string and effect circulation of flushing fluid in and about the fish for softening the formation in the well and facilitating withdrawal of the tool. Such fluid pressure has a constructive influence on the fish in the well formation and is found to materially relieve the draft elements on the surface of the ground used in retrieving the fish.

In the event the fish is stuck so securely in the well as to overtax the draft elements and preclude its removal, the overshot may be removed from its engagement with the fish by relieving the draft and fluid pressure and rotating the fishing string, thereafter gradually applying draft to the string. Under such conditions, the balls are found to rotate on the fish in an upwardly spiraling direction until such time as they escape from the fish

and the milling element relieves itself from engagement with the fish in substantially the same manner.

In the event that cavings or the like are anticipated in the well before finding the fish, the wash line or fluid flushing line may be employed either with or without rotary motion of the fishing string and before the overshot actually engages the fish. This tends to prevent clogged circulation and effects a preconditioning of the well hole for the operation of clearing it of lost tools in the manner described.

The principal advantages in a method and apparatus embodying the features of the present invention are that lost tools in a well may be easily found and quickly recovered. The well may be preconditioned to facilitate removal of such tools. A simple and ready engagement is had between the lost tool and recovering elements. The gripping elements are maintained in the retrieving element until such time as they are intended for use. Further, a fluid seal is provided within the retrieving element for preventing clogging or other difficulties normally encountered in fishing operations.

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

1. In an apparatus of the character described, a fishing tool, means for lowering and raising the fishing tool relative to a well, means on the tool for engaging and withdrawing an implement lodged in the well, said tool having a passageway for fluid to flush the implement, sealing means on the tool for packing off the tool relative to the implement, and means in the tool normally confining said sealing means, said last named means releasing said sealing means in response to engagement thereof by said implement to allow packing off of said tool.

2. In an apparatus of the character described, a fishing tool, means for lowering and raising the fishing tool relative to a well, means on the tool for engaging and withdrawing an implement lodged in the well, said tool having a passageway for fluid to flush the implement, sealing means on the tool for packing off the tool relative to the implement, means in the tool acting on said sealing means in response to engagement thereof by said implement to effect said packing off of said tool, said sealing means being engageable with the interior of said implement, and sealing means in the tool engageable with the exterior of the implement.

3. An apparatus of the character described including a retrieving element, means for lowering and raising the retrieving element into and out of a well for engagement with an implement lodged in the well, gripping means in the retrieving element engageable with the implement for removing the implement from the well upon withdrawal of the retrieving element, means for flushing the implement for loosening its lodgement in the well, and spaced means on the retrieving element respectively engageable with interior and exterior portions of the implement respectively to form a fluid seal therefor relative to said retrieving element.

4. An apparatus of the character described including a retrieving element, means for lowering and raising the retrieving element into and out of a well for engagement with an implement lodged in the well, gripping means in the retrieving element engageable with the implement for removing the implement from the well upon withdrawal of the retrieving element, means for flushing the implement for loosening its lodgement in the well, spaced means on the retrieving element respectively engageable with interior and exterior portions of the implement respectively to form a fluid seal therefor relative to said retrieving element, and means normally confining said last named means and releasing the same responsive to engagement thereof by the implement to allow packing off the retrieving element relative to the implement.

5. An apparatus of the character described including a retrieving element, means for lowering and raising the retrieving element into and out of a well for engagement with an implement lodged in the well, gripping means in the retrieving element engageable with the implement for removing the implement from the well upon withdrawal of the retrieving element, means for flushing the implement for loosening its lodgement in the well, spaced means on the retrieving element respectively engageable with interior and exterior portions of the implement respectively to form a fluid seal therefor relative to said retrieving element, and means normally confining said last named means and releasing the same responsive to engagement thereof by the implement to allow packing off the retrieving element relative to the implement, said confining means consisting of sleeves, one of which is engageable with the other to move the same upon itself being engaged by the implement.

6. An apparatus of the character described including an overshot, means engaged with the overshot for lowering and raising the overshot relative to a well, ball races extending through the overshot, balls in said races, means mounted interiorly of the overshot normally retaining the balls in said races, said means being movable in response to engagement thereof with a tool in the well for effecting engagement of the overshot with the tool, and means rotatably mounted exteriorly of the overshot normally closing said ball races and having apertures therein alignable with the ball races for opening the outer ends thereof.

7. An apparatus of the character described including an overshot, means engaged with the overshot for lowering and raising the overshot relative to a well, ball races extending diagonally through the overshot, balls in said races, means normally retaining the balls in said races, said means being movable in response to engagement thereof with a tool in the well for effecting engagement of the overshot with the tool, a flushing member in the overshot for conditioning the well for withdrawal of the tool from the well, means for packing off the interior of the overshot relative to the tool, tool milling means on said well flushing member, and means normally engaging with the packing means movable in response to engagement thereof with the tool for effecting engagement of the packing means with the tool.

8. An apparatus of the character described including an overshot, means engaged with the overshot for lowering and raising the overshot relative to a well, diagonal ball races extending through the overshot, balls in said races, a trap sleeve normally retaining the balls in said races, said trap sleeve being movable in response to engagement thereof with a tool in the well for effecting gripping engagement of the balls with the tool, a flushing element in the overshot for conditioning the well for withdrawal of the tool from the well, means on the trap sleeve and flushing element for packing off the interior of the over-

shot relative to the tool, tool milling means on said element, and a packer sleeve normally engaging with the packing means on the flushing element movable in response to engagement thereof with the tool for effecting engagement of the packing means with the tool to effect a fluid seal between the overshot, tool and flushing element.

9. An apparatus of the character described including an overshot, means engaged with the overshot for lowering and raising the overshot relative to a well, diagonal ball races extending through the overshot, balls in said races, a trap sleeve normally retaining the balls in said races, said trap sleeve being movable in response to engagement thereof with a tool in the well for effecting gripping engagement of the balls with the tool, a flushing element in the overshot for conditioning the well for withdrawal of the tool from the well, means on the trap sleeve and flushing element for packing off the interior of the overshot relative to the tool, tool milling means on said element, a packer sleeve normally engaging with the packing means on the flushing element movable in response to engagement thereof with the tool for effecting engagement of the packing means with the tool to effect a fluid seal between the overshot, tool and flushing element, and a mud sleeve rotatably mounted exteriorly of the overshot having apertures selectively alignable with the outer ends of the ball races.

10. An apparatus of the character described including an overshot, means engaged with the overshot for lowering and raising the overshot relative to a well, diagonal ball races extending through the overshot, balls in said races, a trap sleeve normally retaining the balls in said races, said trap sleeve being movable in response to engagement thereof with a tool in the well for effecting gripping engagement of the balls with the tool, a flushing element in the overshot for conditioning the well for withdrawal of the tool from the well, means on the trap sleeve and flushing element for packing off the interior of the overshot relative to the tool, tool milling means on said element, a packer sleeve normally engaging with the packing means on the flushing element movable in response to engagement thereof with the tool for effecting engagement of the packing means with the tool to effect a fluid seal between the overshot, tool and flushing element, a mud sleeve rotatably mounted exteriorly of the overshot having apertures selectively alignable with the outer ends of the ball races, and means for limiting rotation of the mud sleeve to normally maintain the ball races closed.

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