

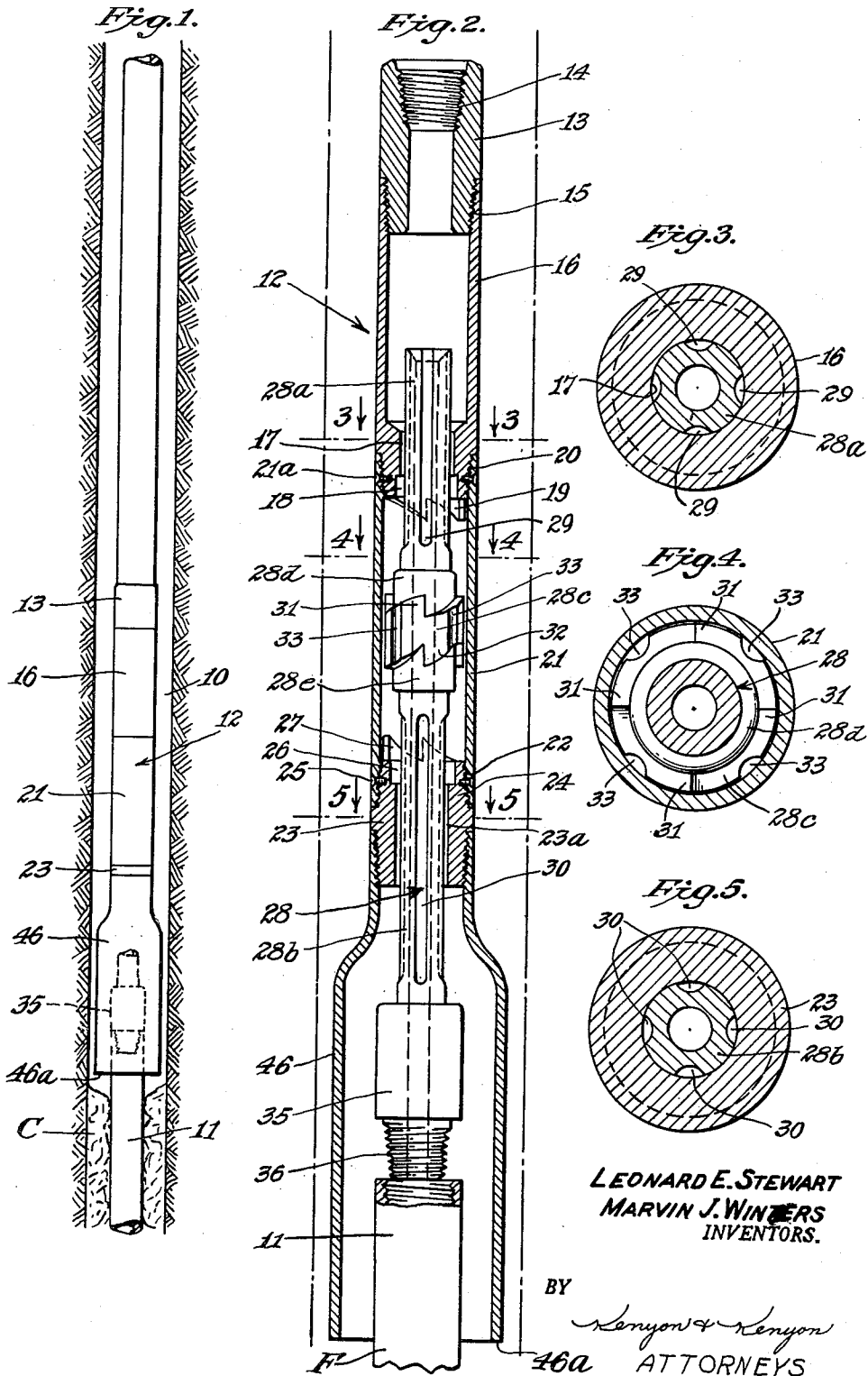
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RETRIEVING ARRANGEMENT FOR WELL DRILLING OPERATIONS

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## RETRIEVING ARRANGEMENT FOR WELL DRILLING OPERATIONS

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This invention relates to well drilling equipment and more particularly to retrieving arrangements for use in retrieving sections of drill pipe, commonly called fish, below a point of separation or a break occurring in a drill pipe.

During drilling operations with drill pipe in oil well drilling, separation of pipe, either at joints or as the result of breaks which may occur deep in the hole, require fishing operations to retrieve the fish. While tools of various kinds for such fishing operations have heretofore been developed and used, complex problems involved in retrieving operations especially where complications of sticking and plugging of the fishes results, have not heretofore, as far as we are aware, been solved to the full satisfaction of drillers.

Principal features and objects of this invention are to provide a fish-retrieving arrangement that is simple in mechanical construction, economical to produce and very effective in use.

In drilling operations, the most effective arrangement for clearing the hole of debris or drillings and for preventing sticking or plugging of the drill pipe is the provision for continuous motion of the drill pipe and drill bit as well as for the free circulation of wash fluid during drilling. When the drill pipe becomes plugged, circulation of wash fluid is prevented, if as usual, its normal path is down through the drill pipe to the outlet at the drill bit and then up through the well or hole outside of the drill pipe. Fishing operations require the drill pipe above the point of break or separation with a retrieving tool attached to be lowered into the hole for coupling to the fish. Once a coupling is effected, if the fish is plugged no wash water can circulate and there is danger that the retrieving tool and drill pipe above the point of separation or break will also become stuck in the hole unless some provision is made whereby wash water or fluid can circulate even after coupling is effected and whereby the drill pipe above the retrieving tool can be kept in rotary as well as reciprocatory motion to prevent sticking.

Further objects and features of this invention, therefore, are to provide a retrieving arrangement permitting circulation of wash water notwithstanding the existence of a plugged fish and permitting rotary and reciprocatory motion of the drill pipe above the retrieving arrangement.

Further objects and features of the invention are to provide a retrieving arrangement including means for attachment of a wash-over pipe for washing out caved-in material in the hole.

Other objects and novel features of the invention will become apparent from the following

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specification and the accompanying drawings, wherein:

Fig. 1 is a vertical section through a well drilling, illustrating an arrangement embodying the invention;

Fig. 2 is a vertical section of the improved retrieving arrangement; and

Figs. 3, 4 and 5 are transverse sections taken respectively along lines 3—3, 4—4 and 5—5 of Fig. 2, each being viewed in the direction of the arrows.

Referring to the drawing, 10 denotes a well hole that is being drilled by a drill bit (not shown) which is carried by a drill collar secured to a lowermost section of a drill pipe 11. The drill pipe 11 is rotated in conventional manner during drilling operations in the hole 10.

Frequently during drilling operations the drill pipe will separate somewhere in the hole either by twisting off or otherwise. It is necessary then to retrieve the "fish," i. e., the lower broken-off section of the drill pipe and the drill bit by fishing operations. These fishing operations frequently become complicated by plugging of the drill pipe below the point of separation, by cave-ins around the stuck pipe or by washing out of the hole around the point of separation to a size many times larger than the normal hole size. The retrieving arrangement constituting the subject matter of this invention is designed to be useful in overcoming complications such as those described and to provide an effective fishing tool.

In the drawing, 12 denotes generally a retrieving arrangement embodying the invention. This arrangement comprises a wash-over sub 13 which is tubular and threaded at 14 for attachment to the complementary threaded part on the lowermost complete section of the drill pipe or rod string sections withdrawn from the hole after a separation or break occurs in the drill pipe. The sub 13 is externally threaded at 15 and threadedly receives a tube or shell 16. The opening or bore 17 at the lower end of the shell 16 has a smaller diameter than the internal diameter of the shell and has an enlarged valve cavity or recess 18 at the outer end of the opening or bore 17 for purposes presently to be described. The rim of the lower end of shell 16 about the recess 18 is serrated to define a set of ratchet teeth 19 which, in the embodiment shown, are intended to effect a right hand or clockwise drive. An external thread 20 is provided on the shell 16.

A second shell 21 of the same outside diameter as shell 16 is screwed onto the thread 20 on shell 16 and fixed in place by set screws 21a. This

shell 21 is internally threaded at 22, and a tubular plug 23 has one of its threaded ends 24 screwed into the thread 22 and fixed in place by set screws 25. The inner end of plug 23 has a valve cavity 26 of larger size than its bore 23a and the edge of the wall defining the cavity 26 is serrated to define a set of ratchet teeth 27 which, in the embodiment shown, are intended to effect a left or counterclockwise drive. This set of ratchet teeth 27 is oppositely acting to the set 19 and spaced apart therefrom.

A tubular rod 28 is guided slidably in the bore 17 of shell 16 and the bore 23a of plug 23. Longitudinal grooves 29 are provided in the portion 28a of rod 28. Similar longitudinal grooves 30 are provided in the portion 28b of rod 28. The rod 28 has enlarged diameter at 28c intermediate the portions 28a and 28b to fit slidably in the shell 21, and this portion 28c is cut away in its periphery to define oppositely extending oppositely acting sets of ratchet teeth 31 and 32 which respectively are complementary to the respective sets of ratchet teeth 19 and 27. The outer surface of enlarged portions 28c has longitudinal grooves 33 constituting fluid flow passageways for purposes presently to be described. The grooves 29 in portion 28a do not extend the full length thereof, providing the smooth-surfaced valve portion 28d which is admeasured in one position of rod 28 to fit the recess 18 and act as a flow cut-off valve. Similarly, the grooves 30 do not extend the full length of rod portion 28b providing the smooth-surfaced valve portion 28e which in one position of rod 28 fits the recess 26 and acts as a flow cut-off valve as will be described.

A tubular retrieving tool member or means 35 is attached at the lower end of rod 28 being provided, in the embodiment shown, with an externally threaded nipple 36 to engage the thread on the upper drill pipe section of fish portion F that it is desired to retrieve.

The two shells 16 and 21 are made separable at 20 for assembly purposes. In effect, these two shells define a tubular means attached to the sub 13 divided into two compartments separated by the wall containing the bore 17. The tubular rod 28 is movable reciprocally in this tubular means 16, 21, its limiting positions being the respectively spaced-apart sets of ratchet teeth 19 and 27.

#### Operation

Assuming that the drill pipe 11 has parted in the well and that the fish part F of the drill pipe is stuck by a cave-in C around its upper end as well as plugged so that wash fluid will not circulate through it. To retrieve the fish F, the rod string and drill pipe 11 above the point of separation are lifted out of the hole 10. The retrieving arrangement 12 is attached to the lower end of the lowermost full section of the removed drill pipe sections 11 by screwing the sub 13 onto it. The attached arrangement and drill pipes are then again lowered into the hole while wash fluid is sent down through the rod string and drill pipes above the arrangement 12, these also being rotated during lowering. The wash fluid can flow downwardly through the drill pipe, through the component tubular parts of the arrangement 12 and outwardly of the lower end of retrieving member 35 circulating around the inside of wash-over pipe 46 and its lowermost edge 46a and back upwardly to the top of the hole. When the edge 46a reaches the cave-in C in the hole, continued lowering of the rod string and

drill pipes causes the cave-in C to be washed out by the wash fluid, the material washed out flowing upwardly toward the mouth of the hole around the outer surface of the wash-over pipe 46.

As lowering continues, the nipple 36 finally rests on the upper edge of the fish F. Since, as assumed, the fish F is plugged or clogged, the wash fluid cannot flow down through it, but can still flow to the wash-over pipe 46 by passage through the grooves 29, 33 and 30 so that washing out of the cave-in C continues and the wash-over pipe 46 moves deeper into the hole. During this time, the tubular rod 28 slides upwardly relative to plug 23 and shell 16 until the ratchet teeth 31 are engaged by ratchet teeth 19. When this occurs, the rotation of sub 13 and shell 16 with the drill pipe above sub 13 is transmitted via teeth 19 and 31 to rod 28 and its tool end 35 so that the threaded nipple 36 screws into the upper end of fish F to provide a coupling to the fish so that it can be pulled out of the hole. If the fish F is stuck too tightly to be pulled out, raising of sub 13 will disengage ratchet teeth 19 and 31 and cause downward movement of rod 28 until teeth 32 engage teeth 27 whereupon rotation in opposite directions of sub 13 and the drill pipe above it will cause the nipple 36 to be unscrewed from the fish F. At points intermediate the respective engagements of teeth 19 and 31 or 32 and 27, the arrangement 12 may be rotated even though fish F is stuck. This is important to prevent sticking of the arrangement 12 in the hole as a result of cave-ins above the fish during retrieving operations.

Also, because of the space between sets of ratchet teeth 19 and 27, the tool and drill pipe above the fish can be reciprocated vertically as well as rotated even though nipple 36 is coupled to the fish, while preparations for lowering string shot or other fish-loosening operations are being made.

Often a drilled hole becomes worked out to many times its size around the point of separation. In such event, the top of the fish F becomes longitudinally misaligned in the hole and this may result in days of relay in trying to connect the fish with the fishing tool. However, the overhanging wash-over pipe 46 of the instant fishing arrangement 12 tends to obviate such delays by tending to recenter the misaligned fish end with the nipple 36 so that a coupling may be made between them. The tool 12 has many other obvious features and advantages. Since the bypass grooves 29 and 30 and 33 permit flow of wash water to the wash-over pipe even if the fish is plugged wash fluid can continue to act to wash out the cave-in about the stuck fish to free it for withdrawal from the hole.

Also, since valve surfaces 28d or 28e can be moved to close off flow through grooves 29 or 30, the wash fluid in such event can be forced down into the fish in an effort to clean its plugging contents.

While in the specific embodiment shown, the nipple 36 is shown as a simple threaded part, it may be modified to provide a tapping thread or in other ways where conditions necessitate such modification. Many other variations in structural detail within the scope of the claims are possible and are contemplated. There is no intention, therefore, of limitation to the exact details shown and described.

What is claimed is:

1. A retrieving arrangement for use with drill

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pipe comprising a tubular sub attachable to a drill pipe, tubular means attached to the sub and divided into two compartments, a tubular rod movable reciprocally in the tubular means, oppositely acting ratchet teeth carried at spaced apart points in said tubular means, oppositely acting ratchet teeth carried by the tubular rod for engagement respectively with the first named ratchet teeth, coupling means carried by the tubular rod for coupling it to a fish, and passageways in the tubular rod permitting flow of wash fluid through the sub and outwardly of said tubular rod notwithstanding a plugged condition of said fish.

2. A retrieving arrangement as described in claim 1 wherein the rod has a valve member formed integrally therewith, the tubular means has a valve-seat cavity formed integrally therewith, and said valve member and valve-seat cavity are brought into engagement when the rod has moved to one end of its path of travel whereby flow of wash fluid in said mentioned passageways is restrained.

3. A retrieving arrangement for use with drill pipe comprising a tubular sub attachable to a drill pipe end, a tubular member secured to said sub, a second tubular member secured to the first named tubular member, a tubular plug member secured to the second-named tubular member, a tubular rod slidable reciprocally relative to said two tubular members, said first named tubular member having a reduced internal diameter in a portion thereof in which an end of said tubular rod is slidably guided, the other end of said rod being slidably guided in said tubular plug member, oppositely acting sets of ratchet teeth at spaced apart points in said second-named tubular member, said tubular rod having an enlarged portion fitting slidably within the second-named tubular member and carrying oppositely directed oppositely acting sets of ratchet teeth each for engagement respectively with one of the first-named sets of oppositely acting ratchet teeth, and coupling means carried by said tubular rod member outwardly of said plug member for coupling to a fish, and said tubular rod having surface grooves defining passageways for flow of wash fluid downwardly through the tubular members and externally of said tubular rod notwithstanding a plugged condition of the fish.

4. A retrieving arrangement for use with drill pipe comprising a tubular sub attachable to a drill pipe, a tubular shell threadedly secured to said sub and having a bore in one portion of smaller internal diameter than that of the other portion of the shell, a second tubular shell threadedly secured to the first-named shell, a tubular plug having a bore of smaller internal diameter than that of said second shell, a tubular rod slidable reciprocally in said two bores and having an enlarged portion movable reciprocally in said second shell, oppositely acting sets of ratchet teeth at spaced apart points in said second shell, oppositely acting sets of ratchet teeth on said enlarged portion of said tubular rod each latter set for engagement respectively with one of said first named sets of ratchet teeth, coupling means carried by said tubular rod outwardly of said plug member for coupling to a fish, and a wash over pipe secured to said plug member, said tubular rod having grooves defining flow passageways through said bores to permit flow of wash fluid through the shells and to the wash over pipe notwithstanding a plugged condition of the fish.

5. The retrieving arrangement of claim 4, in which said bores have valve cavities and in which said tubular rod has valve surfaces movable into respective ones of the valve cavities to cut off flow of wash fluid through said grooves thereby compelling the flow of said wash fluid into the fish to wash out its plugging contents.

6. A retrieving arrangement for use with drill pipe comprising a hollow member attachable to a drill pipe, an outer tubular member secured to said hollow member for movement vertically and rotationally therewith and having its lower end adapted to serve as a wash-over pipe, an inner tubular member positioned within said outer tubular member and movable axially with respect thereto, two sets of teeth spaced apart from each other within said outer tubular member and fixed with respect to each other and said outer tubular member, a separate set of teeth carried by the inner tubular member for selective engagement respectively with said first mentioned sets of teeth, coupling means secured to the lower end of the inner tubular member for coupling it to a fish, and a passageway between said inner and outer tubular members permitting flow of wash fluid through the wash-over pipe and exteriorly of said inner tubular member notwithstanding a plugged condition of said fish.

7. A retrieving arrangement as described in claim 6 wherein the inner tubular member has a valve member formed integrally therewith, the outer tubular member has a valve-seat cavity formed integrally therewith, and said valve member and valve-seat cavity are brought into engagement when the inner tubular member is at one limit of its path of travel whereby flow of wash fluid in said passageway is restrained.

8. A retrieving arrangement for use with drill pipe comprising a hollow member attachable to a drill pipe, an outer tubular member secured to said hollow member for movement vertically and rotationally therewith and having its lower end adapted to serve as a wash-over pipe, an inner tubular member positioned within said outer tubular member and movable axially with respect thereto, an opposed pair of teeth one of which is positioned within and fixed with respect to the outer tubular member and the other of which is fixed with respect to the inner tubular member, said teeth being engageable when the inner tubular member is at the upper limit of its axial path of movement with respect to the outer tubular member and thereby to transmit rotational motion between said tubular members, said tubular members being free to rotate independently of each other when said teeth are disengaged, coupling means secured to the lower end of the inner tubular member for coupling it to a fish, and a passageway between said inner and outer tubular members permitting flow of wash fluid through the wash-over pipe and exteriorly of said inner tubular member notwithstanding a plugged condition of said fish.

9. A retrieving arrangement as described in claim 8 wherein the inner tubular member has a valve member formed integrally therewith, the outer tubular member has a valve-seat cavity formed integrally therewith, and said valve member and valve-seat cavity are brought into engagement when the inner tubular member is at one limit of its path of travel whereby flow of wash fluid in said passageway is restrained.

10. A retrieving arrangement for use with drill pipe comprising a hollow member attachable to a drill pipe, an outer tubular member secured to

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said hollow member for movement vertically and rotationally therewith and having an open ended lower portion which serves as a wash-over pipe, an inner tubular member positioned within said outer tubular member and movable rotatably and axially with respect thereto, means positioned within said outer tubular member fixed with respect thereto, and further means carried by said inner tubular member and fixed with respect thereto, said first and second mentioned means cooperating to impart rotation from the outer to the inner tubular member when said inner tubular member is at least at one end of its axial path of movement with respect to the outer tubular member, coupling means secured to the lower end of the inner tubular member for coupling it to a fish, and a passageway between said inner and outer tubular members permitting flow of wash fluid through the wash-over pipe and exteriorly

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of said inner tubular member notwithstanding a plugged condition of said fish.

11. A retrieving arrangement as described in claim 10 wherein the inner tubular member has a valve member formed integrally therewith, the outer tubular member has a valve-seat cavity formed integrally therewith, and said valve member and valve-seat cavity are brought into engagement when the inner tubular member is at one limit of its path of travel whereby flow of wash fluid in said passageway is restrained.

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