

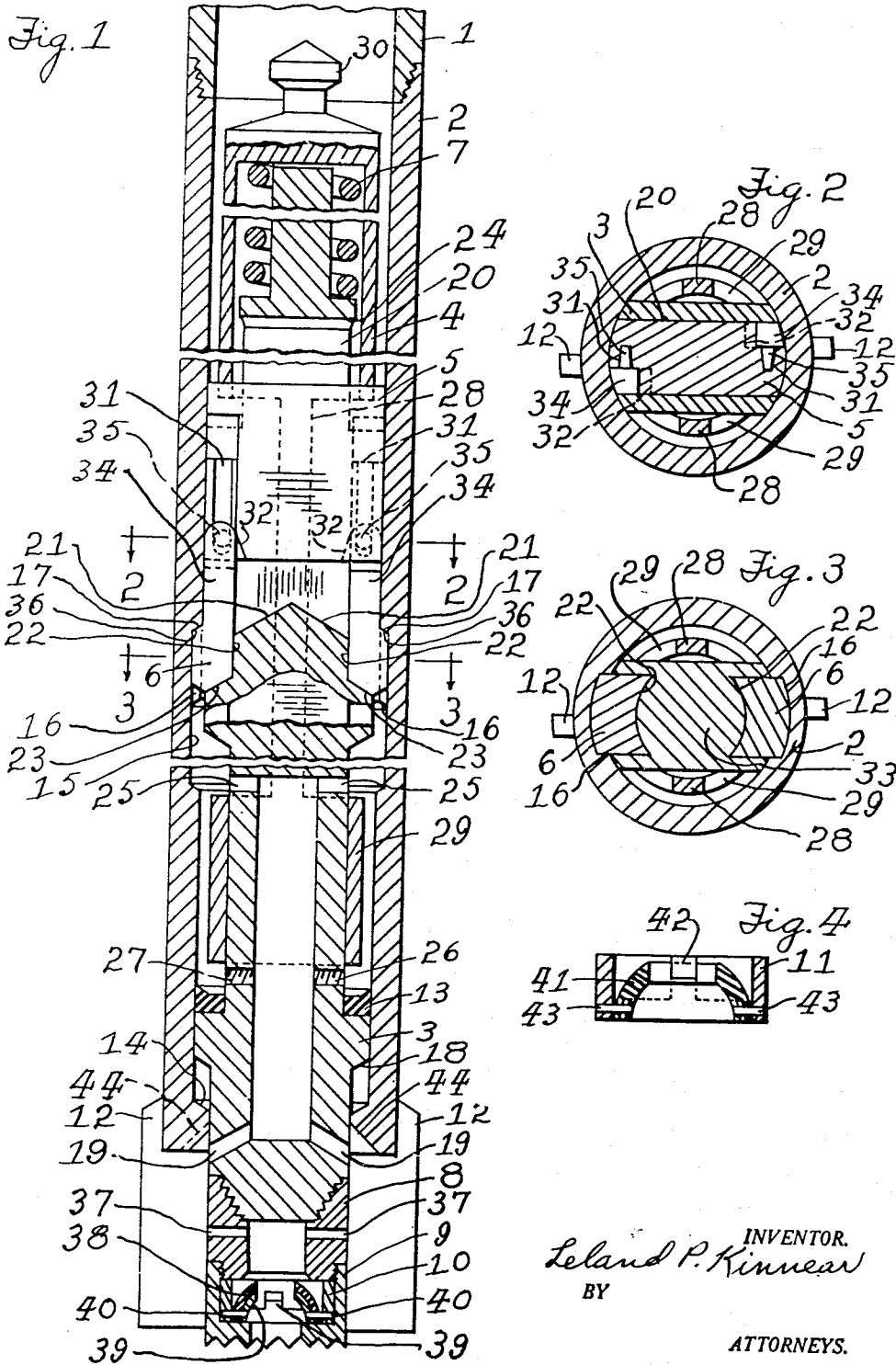
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CORE DRILL APPARATUS

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CORE DRILL APPARATUS

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10 Claims. (Cl. 255—72)

The invention relates to improvement in a core drill apparatus used for the purpose of drilling by the rotary system of drilling and taking core samples of the earth formations being drilled without removing the drill stem from the well, and more particularly, to be used in the drilling and coring in deep wells, such as oil wells and the like.

An object of the invention is to provide a core barrel assembly adapted to be lowered or sent downwardly through the drill stem to operative position at the lower end of the drill stem and to be disengaged from the drill stem and be raised upwardly therethrough to effect a quick changing of the tool.

Another object of the invention is to provide a tool of the above type wherein pressure on the flushing fluid may be utilized to force the tool downwardly through the drill stem and to cause locking members to couple the tool to the drill stem.

A further object of the invention is to provide a tool of the above type wherein the pressure on the flushing fluid may be utilized to operate valve means simultaneously during the coupling of the locking members to the drill stem.

A further object of the invention is to provide a tool of the above type wherein automatic means may be utilized to disengage the locking members from the drill stem.

A further object of the invention is to provide a novel core retaining means for holding a core sample of the earth formation in the core receiving barrel.

These and other objects will in part be obvious and in part be more fully disclosed in the drawing which shows by way of illustration one embodiment of the invention.

The invention is directed to an inner core barrel of the retractable type to be used in the rotary system of drilling and is adapted for the purpose of completing rapid changing of the core barrel without necessitating the removal of the drill stem each time a core of the earth is to be taken. The core barrel may be lowered and raised through the drill stem in several convenient ways. First, the tool may be constructed so that it may be dropped into the drill stem and permitted to sink or gravitate to the lower end of the drill stem and/or be forced down to the lower end of the drill stem by the pressure on the flushing fluid introduced into the drill stem from the pump in known manner, in either case, upon arrival at the lower end of the drill stem and when coring operation is begun the pressure on the

flushing fluid from the pump automatically operates to cause locking members on the tool to become coupled to the chuck near the lower end of the drill stem. Rotation of the drill stem and feeding the same forward in the known manner causes the core of the earth to be cut and formed and projected into the core receiving barrel where it is held for the purpose of inspection upon removal of the tool from the well. To remove the core barrel from the well the pump may be shut-off and a grappling tool of any known make may be lowered into the drill stem to engage the inner core barrel and the same is lifted to the earth's surface where the core may be inspected to determine its classification. Another method may be employed in removing the inner core barrel from the well, that is, after the core is cut the core barrel has automatic means to release the locking members from engagement with the chuck and the current of the circulating fluid is reversed so that the fluid is forced down outside of the drill stem into the well hole, by the pump connected to a suitable well head known and adapted for such purposes, and the pressure on the flushing fluid is exerted below the core barrel which forces the same to the head of the well where it is caught by suitable means adapted for such purposes.

It is thought that the invention will be more fully understood from the following detailed description thereof in which like numerals denote like parts in the drawing.

Fig. 1 is a vertical side view partly sectional of a section of the drill stem with the removable inner core barrel assembly shown in operative position.

Fig. 2 is a cross-section taken on the line 2—2 of Fig. 1.

Fig. 3 is a cross-section taken on the line 3—3 of Fig. 1.

Fig. 4 is a modified form of a core catcher assembly to that shown in Fig. 1.

In the drawing, 1 denotes a section of drill pipe coupled to a chuck 2 at its lower end which comprise the drill stem used for the purposes of carrying the flushing fluid and for imparting rotation to the drilling tools to be connected thereto. Bit blades 12—12 are provided at the lower end of the chuck for forming the well hole to accommodate the drill stem. Notches 44—44 are formed in the lower end wall of the chuck proper which are provided for the purpose of accommodating drill bits of the type such as shown in my co-pending application styled Collapsible drill, Serial No. 129,641 which is interchangeable with

the present inner core barrel assembly whereby the combination of the several devices may be advantageously employed in drilling and taking cores in deep wells because of the advantage in the rapid changing of the devices for the different operations and for the replacing of the dulled cutting members.

A movable carrier head 4 slides over the upper cylindrical reduced portion of shank 3 and is provided with a plate 5 at its lower end which travels within the window 20 of the shank 3. The plate 5 has a limited slidable movement in the elongated window 20 of the shank 3 and is provided with grooves 31—31 in which pins 35—35 of the locking members 6—6 are pivotally connected. The locking members 6—6 are provided with associated shank portions 34—34 which have off-set indentures below the pins 35—35 which are located near the upper end of the shank portions 34—34 so that the locking members 6—6 are under-slung below the bottom of the plate 5 giving the locking members free pivotal movement. Inclined faces 5b—5b are made by indentures in the lower portions of plate 5 and are disposed oppositely of each other and are so arranged that each inclined face bears against the edge of its respective locking member near the upper end of the shank portions thereof when the locking members are in retracted position. While the inner core barrel assembly is being passed down through the drill stem the locking members are disposed inwardly of the outer edges of the window 3c and immediately above the inclined faces 21—21 which form the top of the guide block 33 located in the bottom portion of the window 20. The spring 7 disposed between the carrier head 4 and surrounding the top annular portion of the shank 3 keeps the carrier head 4 and the shank 3 spaced apart. By the aid of the spring 7 the top of the plate 5 is held up against the top 24 of the window 20 while the tool is in transit within the drill stem. Oppositely disposed of the guide block 33 two sockets 22—22 are formed above shoulders 23—23 to accommodate the locking members when in operative position. When the annular shoulder 18 of the inner core barrel assembly lands on the annular seat 14 in the chuck the downward movement of the assembly is arrested placing the locking members 6—6 in position to be forced outwardly through the elongated window 20 and into the annular recess 15 provided in the inner wall of the chuck. The annular recess permits the locking members to be coupled to the chuck in any position in which the core barrel assembly may be turned when seated on the annular seat 14 of the chuck. This insures positive coupling of the core barrel assembly to the chuck on any one of the 360 degrees in which the assembly may be turned relative to the annular seat 14 in the chuck when the assembly is stopped and seated on the chuck. Simultaneously with the stopping of the assembly on the annular seat 14 of the chuck the pressure on the flushing fluid introduced into the drill stem from above by the pump (not shown) depresses the movable carrier head 4 which is attached to the plate 5, compressing the spring 7 and forcing the locking members to bear on the inclined faces 21—21 which deflect said locking members outwardly into the annular recess 15 and downwardly into the sockets 22—22. Above the annular recess 15 vertical slots 16—16 are oppositely disposed in the inner wall of the chuck which communicate with said annular recess. By lowering the drill stem the core barrel

assembly which protrudes therebelow contacts the bottom of the well hole causing the shoulders 36—36 of the locking members to bear against the top of the annular recess and upon rotation of the drill stem by the well known manner the locking members are caused to register with the slots 16—16 thereby allowing the drill stem to slide down over the core barrel assembly until the inclined shoulders 36—36 of the locking members engage the inclined shoulders 17—17 at the top of the slots 16—16, thus raising the annular shoulder 18 on the core barrel assembly somewhat off the annular seat 14 of the chuck.

Simultaneously with the coupling of the locking members with the chuck the sleeve valve 29 which is connected to the carrier head by arms 28—28 is actuated by the movement of the carrier head 4 when depressed by the pressure on the flushing fluid and thus opening the ports 25—25 allowing the flushing fluid to pass downwardly through the lower end of the shank 3 and thus to the ports 19—19 to be discharged on to the front faces of the bit blades 12—12 for cleaning the bits. The annular packing gasket 13 surrounds the cylindrical portions of the shank 3 below the sleeve valve 29 and forms a seal between the shank and the wall of the chuck when the core barrel assembly is in operative position in the chuck.

To disengage and remove the core barrel assembly from the drill stem one proceeds in the following manner. The drill stem is raised and the pressure on the flushing fluid forces the assembly downwardly causing the annular shoulder 18 to again land on the annular seat 14 in the chuck. The pump is shut-off and the spring 7 which has been compressed under the pressure of the fluid from the pump will automatically raise the carrier head 4, plate 5, and locking members 6—6 thereby releasing the locking members from coupled engagement with the chuck to a retracted position within the window 20 so that the assembly may be raised upwardly through the drill stem by reversing the direction of the fluid so that fluid under pressure is forced down outside of the drill stem and inside of the well hole to exert its force against the lower end of the assembly and thus force said assembly upwardly through the drill stem to the head of the well in recovering the assembly and the core therein for inspection. A grappling device also may be lowered into the drill stem by wire line or the like to engage the grapple head 39 and lift the assembly to the head of the well. Any known grappling adapted for such purposes may be used and it is thought to be unnecessary to show such a device as many types of the same are common. When wire line and grapple device is used to raise the core barrel upwardly through the drill stem the threaded holes 26 and 27 are provided for drain holes so as not to swab the fluid from the drill stem above the core barrel. When the core barrel is raised by reversing the flow of the fluid screw plugs are used to close the holes 26 and 27 so that no fluid can by-pass the core barrel.

The core receiving barrel 8 is joined to the lower end of the shank 3 and is provided with vent holes 3a—3a through the wall thereof near its upper end for venting off any fluid in the barrel which is thus displaced by an incoming core entering the barrel from the lower end thereof. A core cutter head 9 is screwed to the lower end of the core receiving barrel for the purpose of cutting and forming a core of the earth. A core

catcher assembly is freely mounted between the lower end wall of the core receiving barrel and the interior shoulder in the core cutter head and consists of an annular ring 10 with a plurality of upwardly converging spring fingers 39 joined together at their lower ends by an annular band formed integral with said spring fingers preferably of the same material, and, an annular rubber sleeve member 38 surrounding said plurality of spring fingers and bound at its lower end between the ring 10 and the annular band part of the spring fingers by rivets 40 or the like. This construction and arrangement is preferable, however, the same may be varied such as placing the annular band part of the spring fingers between the lower end of the ring 10 and the lower end of the rubber sleeve member 38 so that the spring fingers may be protected by the rubber sleeve member from an incoming core from the opening in the cutter head 9. Any known elastic material and/or yieldable material such as leather, canvas, screening or the like may be used as a substitute for the rubber sleeve member shown, however, all to be considered within the scope of this invention. And, the assembly may be modified so that the spring fingers may be omitted from the core catcher assembly so that only the rubber sleeve member or the like is used for retaining a core in the core barrel. The rubber sleeve member shown has a central opening therethrough which is reduced toward its upper end so that a core may pass therethrough by stretching the rubber and after the core has passed therethrough the rubber sleeve member will pinch in causing the spring fingers and rubber sleeve member to be urged inwardly to grip the core thereby making it possible to retain soft formations, especially, such as oil sand and the like in the core receiving barrel, which are many times lost with the known devices used for retaining cores in the core barrel.

Another embodiment of the core catcher assembly is shown in Fig. 4, in which 11 denotes an annular ring to which is attached an annular rubber sleeve member 41 somewhat reduced near its upper end, said sleeve encasing the core catcher fingers 42 with a portion of the fingers protruding above and through the upper end wall of the annular rubber sleeve member giving the effect of a cat's claw encased in the nail for pinching or gripping. Rivets 43 are provided for holding the assembly together in the same manner as the other forms of the core catcher shown.

Many changes in the construction and arrangement of the parts may be made without departing from the scope and spirit of the invention disclosed.

Having thus described the invention, what I claim as new and desire to secure by Letters Patent, is:

1. A core drill apparatus comprising a drill stem casing, a seat and a recess in said casing, a removable core barrel assembly including a seating head having a core receiving tube attached thereto adapted to be passed through said casing and seated thereon, a window in said seating head, a movable head including locking members slidable within said window and movable relative to said seating head for coupling said locking members to said casing, a guide block on said seating head for deflecting said locking members outwardly into said recess to engage said casing and for maintaining said locking members in coupled relation to said casing.

2. A core drill apparatus comprising a drill

stem casing, a seat and a recess in said casing, a removable core barrel assembly including a seating head having a core receiving tube attached thereto adapted to be passed through said casing and seated thereon, a window in said seating head, a movable head including locking members pivotally connected thereto slidable within said window and movable relative to said seating head for coupling said locking members to said casing, a guide block on said seating head for deflecting said locking members outwardly into said recess to engage said casing and for maintaining said locking members in coupled relation to said casing.

3. A core drill apparatus comprising a drill stem casing, a seat and a recess in said casing, a removable core barrel assembly including a seating head having a core receiving tube attached thereto adapted to be passed through said casing and seated thereon, a window in said seating head, a movable head including locking members pivotally connected thereto slidable within said window and movable relative to said seating head for coupling said locking members to said casing, sockets on said seating head for receiving said locking members, a guide block on said seating head for deflecting said locking members outwardly into said recess and downwardly into said sockets and for maintaining said locking members in coupled relation to said casing.

4. A core drill apparatus comprising a drill stem casing, a seat and a recess in said casing, a removable core barrel assembly including a seating head having a core receiving tube attached thereto adapted to be passed through said casing and seated thereon, a cutter member attached to the lower end of said core receiving tube, a window in said seating head, a movable head including locking members slidable within said window and movable relative to said seating head for coupling said locking members to said casing, a guide block on said seating head for deflecting said locking members outwardly into said recess to engage said casing and for maintaining said locking members in coupled relation to said casing.

5. A core drill apparatus comprising a drill stem casing, a seat and a recess in said casing, a removable core barrel assembly including a seating head having a core receiving tube attached thereto adapted to be passed through said casing and seated thereon, a cutter member attached to the lower end of said core receiving tube, a window in said seating head, a movable head including locking members pivotally connected thereto slidable within said window and movable relative to said seating head for coupling said locking members to said casing, a guide block on said seating head for deflecting said locking members outwardly into said recess to engage said casing and for maintaining said locking members in coupled relation to said casing.

6. A core drill apparatus comprising a drill stem casing, a seat in said casing, a removable core barrel assembly including a seating head having a core receiving tube attached thereto adapted to be passed through said casing and seated thereon, a window in said seating head, a movable head including locking members slidable within said window and movable relative to said seating head for coupling said locking members to said casing, fluid passages through said seating head whereby flushing fluid may be passed to the exterior of said casing for maintaining circulation of flushing fluid during coring operations.

7. A core drill apparatus comprising a drill stem casing, a seat in said casing, a removable core barrel assembly including a seating head having a core receiving tube attached thereto adapted to be passed through said casing and seated thereon, a cutter member attached to the lower end of said core receiving tube, a window in said seating head, a movable head including locking members slidable within said window and movable relative to said seating head for coupling said locking members to said casing, fluid passages through said seating head whereby flushing fluid may be passed to the exterior of said casing for maintaining circulation of flushing fluid during coring operations.

8. A core drill apparatus comprising a drill stem casing, a seat and a recess in said casing, a removable core barrel assembly including a seating head having a core receiving tube attached thereto adapted to be passed through said casing and seated thereon, a cutter member attached to the lower end of said core receiving tube, a packer on said seating head adapted to seal between said seating head and said casing, a window in said seating head, a movable head including locking members slidable within said window and movable relative to said seating head for coupling said locking members to said casing, a guide block on said seating head for deflecting said locking members outwardly into said recess to engage said casing and for maintaining said locking members in coupled relation to said casing.

9. A core drill apparatus comprising a drill

stem casing, a seat and a recess in said casing, a removable core barrel assembly including a seating head having a core receiving tube attached thereto adapted to be passed through said casing and seated thereon, a cutter member attached to the lower end of said core receiving tube, a packer on said seating head adapted to seal between said seating head and said casing, a window in said seating head, a movable head including locking members pivotally connected thereto slidable within said window and movable relative to said seating head for coupling said locking members to said casing, a guide block on said seating head for deflecting said locking members outwardly into said recess to engage said casing and for maintaining said locking members in coupled relation to said casing.

10. A core drill apparatus comprising a drill stem casing, a seat in said casing, a removable core barrel assembly including a seating head having a core receiving tube attached thereto adapted to be passed through said casing and seated thereon, a packer on said seating head adapted to seal between said seating head and said casing, a window in said seating head, a movable head including locking members slidable within said window and movable relative to said seating head for coupling said locking members to said casing, fluid passages through said seating head whereby flushing fluid may be passed through said seating head to the exterior of said casing for maintaining circulation of flushing fluid during coring operations.

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