United States Patent [19]

Wolda

[11] **3,739,865**

[45] **June 19, 1973**

[54] **WIRELINE CORE BARREL WITH RESILIENT LATCH FINGERS**

[75] Inventor: **Tiete O. Wolda,** Orillia, Ontario, Canada

[73] Assignee: **Boyles Industries Limited**

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[21] Appl. No.: **150,485**

[52] **U.S. Cl.** **175/244,** 175/247

[51] **Int. Cl.** **E21b 43/00**

[58] **Field of Search** 175/99, 244, 246, 175/247

[56] **References Cited**

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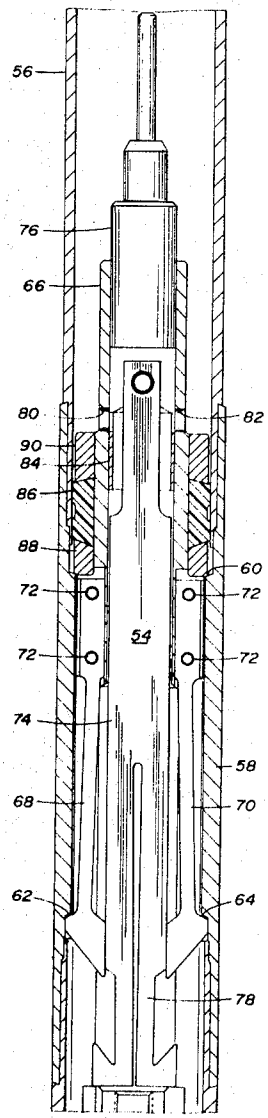
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Primary Examiner—Marvin A. Champion
Assistant Examiner—Jack E. Ebel
Attorney—Robert W. Mayer, Thomas P. Hubbard, Jr., Daniel Rubin, Raymond T. Majesko, Roy L. Van Winkle, William E. Johnson, Jr. and Eddie E. Scott

[57] **ABSTRACT**

A wireline core barrel system that may be used when drilling up or down, including drilling at various inclinations. Latch fingers that are flexible and resilient are rigidly connected to the core barrel body. The latch fingers are moved into and retracted from a latch seat by a moveable actuator that bends the latch fingers in a first actuator position and allows them to spring back into shape in a second actuator position. The core barrel system provides a predetermined pressure signal indicating latching and blocks fluid flow until the core barrel is properly latched.

17 Claims, 6 Drawing Figures



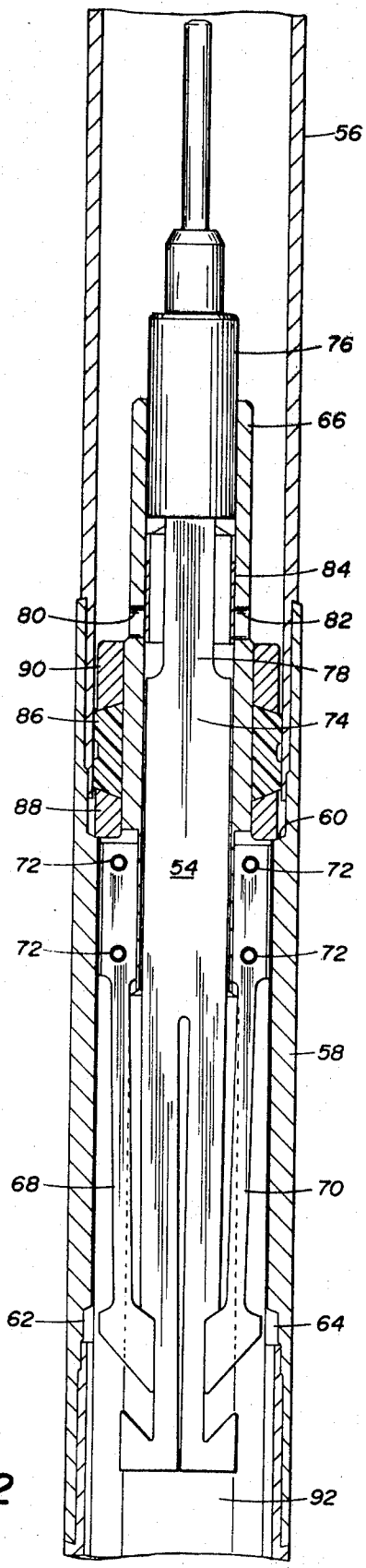


FIG. 2

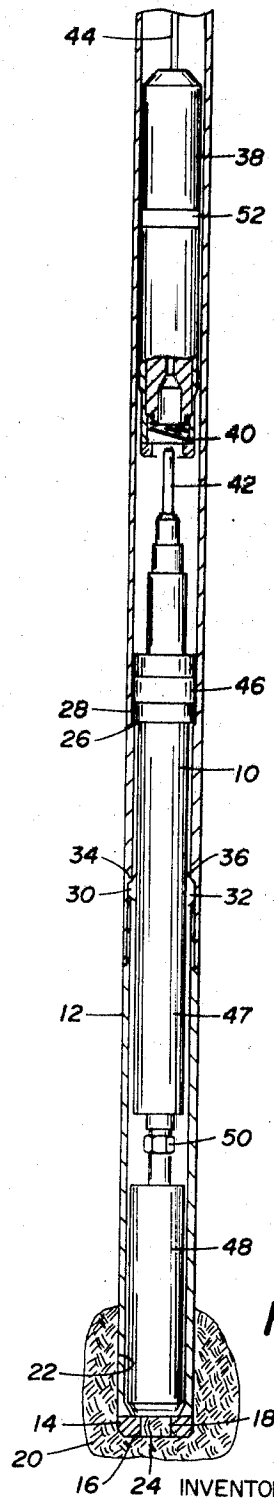


FIG. 1

INVENTOR:
TIETE O. WOLDA

Eddie E. Scott

ATTORNEYS

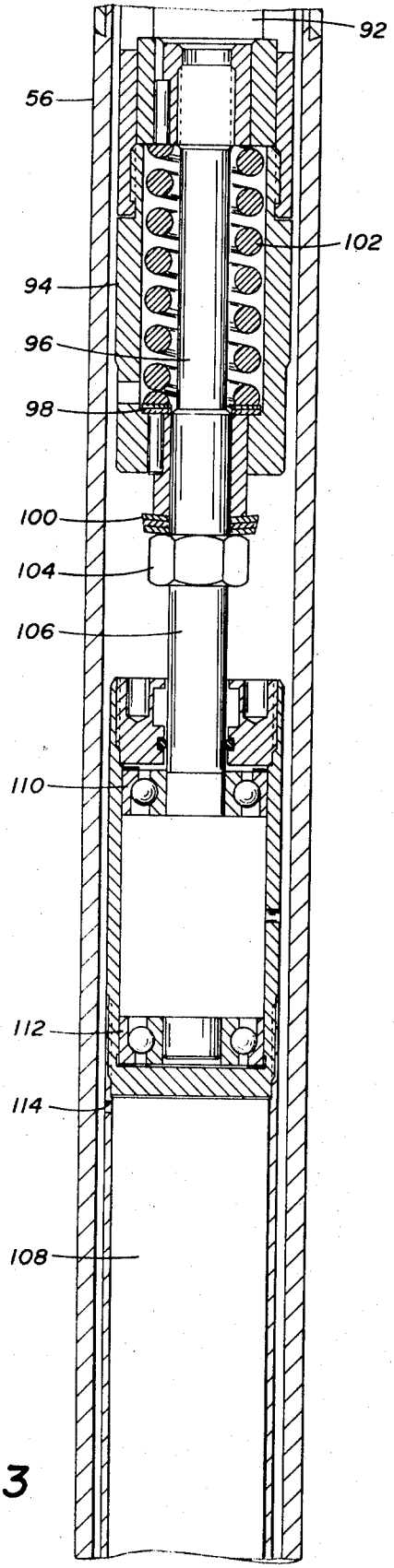


FIG. 3

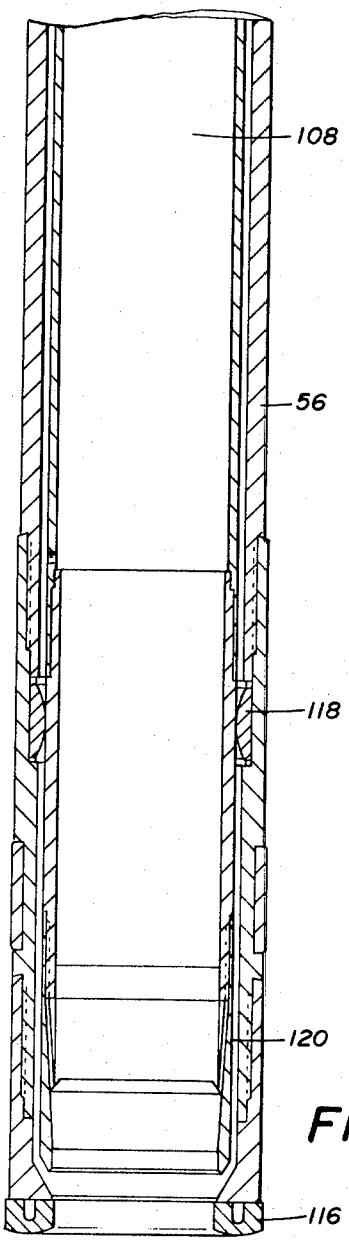


FIG. 4

INVENTOR:
TIETE O. WOLDA

Eddie E. Scott

ATTORNEYS

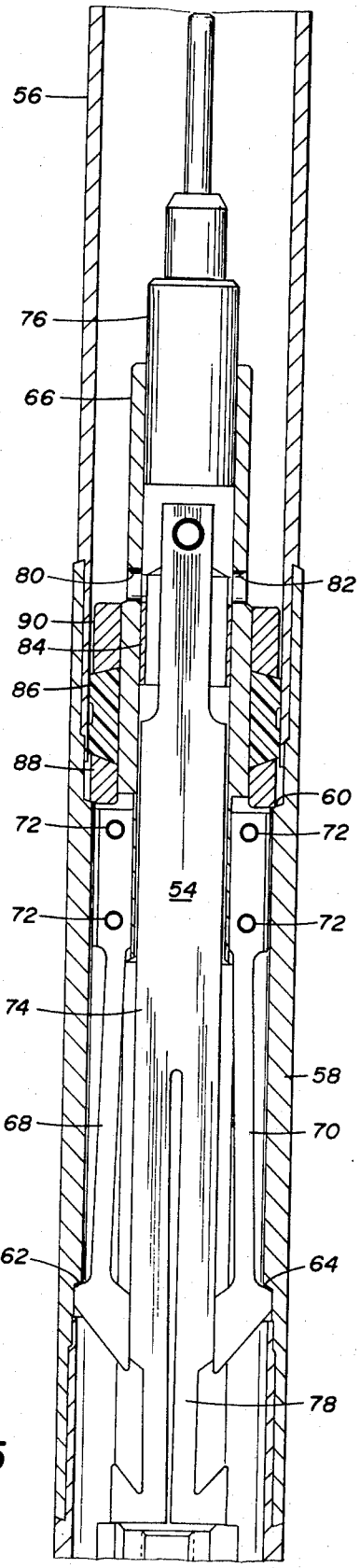


FIG. 5

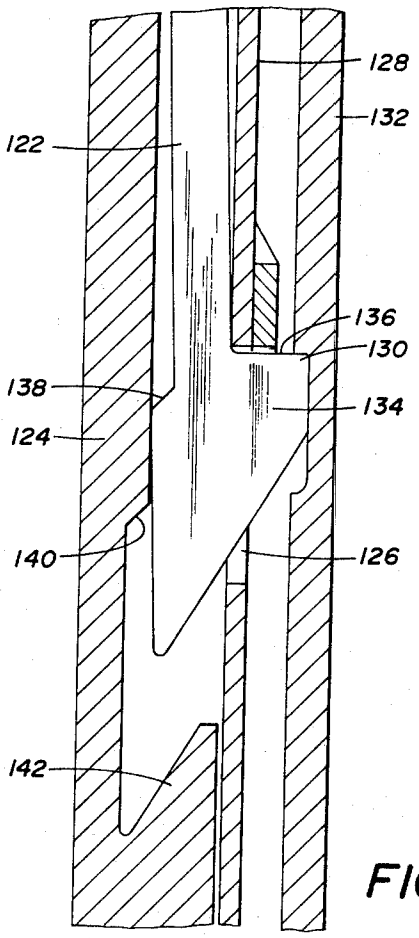


FIG. 6

INVENTOR:
TIETE O. WOLDA

Eddie E. Scott

ATTORNEYS

WIRELINE CORE BARREL WITH RESILIENT LATCH FINGERS

BACKGROUND OF THE INVENTION

The present invention relates to the art of core drilling and more particularly to an improved wireline core barrel system.

It is common practice to take samples or cores of formations to obtain geological information. The cores are obtained by the use of a hollow rotary drill string or drill stem having a core bit at the lower end and a core barrel positioned within the hollow rotary drill string adjacent the core bit. In order to obviate the necessity of removing the entire drill string to obtain the core, a retractable core barrel has been developed. The retractable core barrel is locked in cooperative relation with the core bit until the core sample is taken. At that time a retriever connected to a wireline is utilized to remove the core barrel by drawing it out of the drill string.

In general, the core drilling operations may be categorized as up drilling or down drilling. The down drilling operation being a conventional drilling operation wherein the drilling is downward from horizontal and up drilling being an operation wherein drilling is upward from horizontal, such as drilling upward into the formations above a mine shaft. Core drilling operations are often conducted in formations that contain water or other fluids; therefore, the core drilling operations can be further characterized as wet or dry. It is desirable to be able to use a single wireline core barrel system for up and down drilling and in wet or dry holes. Such a system must be extremely versatile in order to perform the required functions under such varying conditions. In down drilling in a dry hole the core barrel must be adaptable to being lowered into position by a wireline, be able to lock firmly in position for coring, have means to receive the core drilled, be able to unlock from the coring position and then be withdrawn up the tubular drill string. When down drilling in a wet hole, the core barrel must include means to form a fluid seal between the tubular drill string and the core barrel body thereby preventing fluid from bypassing the core barrel to allow the core barrel to be pumped into position. Once in position, the core barrel must positively lock in position and allow the fluid to bypass the core barrel during drilling. After the core is drilled, the core barrel must unlock and be drawn to the surface without the necessity of withdrawing the entire stand of fluid above the core barrel from the drill string. When drilling up, the wireline core barrel system must perform the functions required in down drilling in wet holes as well as preventing the liquid from being forced downward out of the drill string by gravity.

Perhaps the single most important requirement of a wireline core barrel system is that it be dependable. The system should operate properly each and every time even though it is subjected to the harsh environmental conditions of the drilling operation. The system should produce a signal when the core barrel is properly latched in coring position to advise the drilling operator that he should begin the core drilling operation. Once the core container is filled, the core barrel should provide a signal to the operator indicating that the core barrel should be retrieved. The core barrel should unlatch positively without requiring hammering and be easily withdrawn from the borehole.

DESCRIPTION OF THE PRIOR ART

The prior art does not disclose a single wireline core barrel system that can be used for both up and down drilling and in wet and dry holes. The prior art wireline core barrel systems have included a large number of moving parts and have not achieved the desired degree of dependability. Although some prior art systems provide a signal indicating latching, the quality of the signal has not been completely dependable. The latch elements of the prior art systems have created difficulties by failing to positively latch in position and by failing to positively unlatch. These difficulties can result in core drilling when the core barrel is not latched in place and with the core barrel being stuck in the latched position thereby requiring removal of the entire drill string to obtain the core sample. The prior art wireline core barrel systems would land hard upon the landing shoulder producing a shock that is damaging to the landing shoulder and the core barrel.

In the U.S. Pat. No. 2,046,798 to D. Thrift, patented July 7, 1936, a method and apparatus for core drilling is shown. The core barrel disclosed is used with rotary drilling equipment and is adapted to be introduced into the borehole and removed from the borehole by the rotary drill string. A coring bit attached to the lower end of the drill string makes an annular cut which leaves intact a central core for entrance into a core retainer. The system includes means whereby the driller at the surface receives a signal when the core retainer has been filled with a core or when congestion has occurred at a point between the ends of the core retainer preventing the entrance of additional material into the core retainer.

In U.S. Pat. No. 3,120,282 to A. F. Pickard, patented Feb. 4, 1964, a wireline core barrel is shown that can be hydraulically propelled to the bit end of the drill string. The system includes a core barrel inner tube assembly for retaining a core, an overshot assembly for retracting said core barrel inner tube assembly from the bit end of the drill stem and an overshot release assembly for unlatching an overshot assembly from the core barrel inner tube assembly so that the overshot assembly may be retracted separate from the core barrel inner tube assembly. The core barrel inner tube assembly is provided with means that will allow the fluid for hydraulically propelling it into position to pass through the core barrel inner tube assembly and circulate around the drill bit during the drilling operation.

SUMMARY OF THE INVENTION

The present invention provides a wireline core barrel system that can be used for both up drilling and down drilling and in dry and wet holes. The core barrel will latch positively and unlatch positively as well as produce a dependable signal indicating that the core barrel is in proper position for receiving a core. The system includes a drill string with a drill bit attached for drilling a core sample, a core barrel adapted to be transported through the drill string and a retriever that may be used to place the core barrel in position and for withdrawing the core barrel from the drill string. The core barrel is locked in position for receiving the core by at least one flexible and resilient latch finger with one end rigidly affixed to the core barrel and the other end positioned in a latch seat on the drill string. An actuator, movable relative to the core barrel, is adapted

to change the position of the latch finger by deforming and stressing the body of the latch finger. An adjustable seal element is connected to the core barrel thereby providing the core barrel with an enlarged diameter at that point. A passage extends through the core barrel and the passage may be closed by movement of the actuator. The seal on the core barrel provides a cushion to reduce shock when the core barrel lands upon a landing shoulder on the drill string.

It is therefore an object of the present invention to provide a single wireline core barrel system that can be used for both up and down drilling and in dry or wet holes.

It is a further object of the present invention to provide a wireline core barrel that will latch positively in coring position and unlatch from the coring position positively.

It is a still further object of the present invention to provide a core barrel that will remain positively latched in place during the core receiving operation.

It is a further object of the present invention to provide a wireline core barrel that may be positively unlatched and withdrawn from the drill string even if a latch finger is broken.

It is a still further object of the present invention to provide a wireline core barrel system that will produce a dependable signal indicating latching.

It is a still further object of the present invention to provide a wireline core barrel system that will not allow the coring operation to proceed until the core barrel is properly latched in the core receiving position.

It is a still further object of the present invention to provide a wireline core barrel system that produces a dependable signal indicating core blockage.

It is a still further object of the present invention to provide a wireline core barrel system with few moving parts.

It is a still further object of the present invention to provide a wireline core barrel that has greater strength and durability than those of the prior art.

It is a still further object of the present invention to provide a wireline core barrel that is relatively simple and is less expensive to manufacture than those of the prior art.

It is a further object of the present invention to provide a wireline core barrel that is easy to service and maintain.

It is a still further object of the present invention to provide a wireline core barrel that is resistant to corrosion and will operate efficiently in the core drilling environment.

It is a still further object of the present invention to provide a wireline core barrel with an adjustable pumping-in seal.

It is a still further object of the present invention to provide a wireline core barrel system capable of absorbing the shock that occurs when the core barrel lands upon a landing shoulder on the drill string.

The above and other objects and advantages will become apparent from a consideration of the following detailed description when taken in conjunction with the drawing.

BRIEF DESCRIPTION OF THE DRAWING

FIG. **1** is an elevational view of a wireline core barrel system showing a portion of the drill string with a coring bit attached, a core barrel positioned in the drill string for receiving a core sample and a retriever for withdrawing the core barrel from the drill string.

FIG. **2** shows the upper portion of a core barrel constructed in accordance with the present invention wherein the latch fingers are in position for the core barrel to be transported through the drill string.

FIG. **3** shows the middle portion of the core barrel shown in FIG. **2.**

FIG. **4** shows the lower portion of the core barrel shown in FIGS.'s **2** and **3.**

FIG. **5** shows the upper portion of the core barrel of FIG. **2** with the latch fingers positioned in latch seats on the drill string.

FIG. **6** shows on of the latch fingers and the actuator of another embodiment of a core barrel constructed in accordance with the present invention.

DETAILED DESCRIPTION OF THE INVENTION

Referring now to FIG. **1,** a core barrel generally designated by reference numeral **10** is shown positioned within a rotary drill string **12.** The rotary drill string **12** consists of a series of sections of hollow drill pipe connections together to form a drill string. For example, the drill string **12** may be made up of a series of sections of threaded drill pipe connected together end to end. A coring bit **14** is connected to the lower end of the rotary drill string **12.** The coring bit **14** includes a circular cutting face **16** and a central opening **18.** The cutting face **16** may include any of the cutting structures known in the prior art such as diamonds impregnated in a metal matrix. As the drill string **12** and core bit **14** are rotated, the cutting face **16** serves to disintegrate the formation **20** and form a borehole **22.** The central opening **18** in core bit **14** allows a core **24** to build up during the drilling operation. In order to obtain geological information about the formation **20,** a section of the core **24** is withdrawn from borehole **22** using the wireline core barrel system of the present invention.

The core drilling operation may be conducted either up or down from the horizontal and including drilling at any inclination. For example, the core drilling operation may be conducted from the surface by drilling downward into the formations or the core drilling operation may be conducted upward into the formations above a mine shaft. Rotary drilling equipment (not shown) is positioned at the face of the formations through which the drilling operation is to proceed. The rotary drilling equipment supplied both rotary and thrust forces to the drill string and may consist of any of the various rotary drilling machines known in the prior art. Most drilling operations require a fluid circulation system for cooling the bit and flushing the cuttings and drilling debris from the borehole. Such a fluid circulation system may include a hydraulic pump (not shown) connected to the drill string **12.** The hydraulic pump circulates drilling fluid through the interior of the drill string **12,** across the face **16** of the coring bit **14** and upward in the annulus between the borehole wall and the exterior of the drill string.

In order to obtain a sample of formation **20,** the core barrel **10** must be positioned within the drill string **12** adjacent coring bit **14.** When core drilling in dry holes, the core barrel **10** may be lowered into position using the force of gravity and when core drilling in wet holes, the core barrel **10** is pumped into position using the drilling fluid. The core barrel **10** is moved toward the bit end of drill string **12** until it reaches a landing shoul-

der 26 on the drill string 12. A complimentary landing shoulder 28 on core barrel 10 contacts the landing shoulder 26 on the drill string preventing further downward movement and suspending the core barrel in proper position for receiving the core 24. After the core barrel 10 reaches the coring position, it is latched firmly in place by latches 30 and 32 that engage latch seats 34 and 36 on the drill string 12. When the core barrel 10 has received the desired core sample, it must be withdrawn from the borehole 22. This is accomplished by a retriever 38 that is transported through the drill string 12 until it reaches core barrel 10. A gripping element 40 on retriever 38 engages a spear connection 42 on core barrel 10. The latches 30 and 32 are disengaged from latch seats 34 and 36 and the core barrel 10 and retriever 38 are withdrawn from the drill string by a cable 44 connected to retriever 38 and a hoist (not shown).

The core barrel 10 includes a packing rubber 46 that gives the core barrel an enlarged diameter to form a fluid seal between the drill string 12 and core barrel 10. The core barrel 10 may than be pumped into position by fluid pressure from the drilling equipment. Once the core barrel is latched in place and firmly connected to the drill string 12, the drilling fluid must be allowed to bypass the core barrel 10 in order to cool the core bit 14 and flush drill cuttings and debris from the borehole.

Since the upper portion 47 of core barrel 10 is firmly connected with the drill string it will rotate when the drill string is rotated. To prevent the core sample from being unnecessarily disturbed, the core sample container 48 must be prevented from rotating; therefore, a swivel 50 is provided to connect the core sample container 48 and the upper portion 47 of core barrel 10.

Since the retriever 38 is generally pumped into position in the same manner as the core barrel 10, the retriever 38 contains a seal element 52 similar to the packing rubber 46 on core barrel 10. This seal element 52 as well as the packing rubber 46 must be bypassed by the fluid standing on the drill string when the retriever 38 and core barrel 10 are being withdrawn from the drill string 12. Otherwise, the entire stand of fluid in the drill string would have to be withdrawn before the core sample could be obtained. Fluid channels are opened through the retriever 38 and the core barrel 10 by the pulling force of cable 44.

Referring now to FIG. 2, the upper portion of a core barrel 54 constructed in accordance with the present invention is shown with the entire core barrel 54 being shown by a combination of FIGS.'s 2, 3 and 4. When FIGS.'s 2, 3 and 4 are arranged one above the other with FIG. 2 being the top figure and FIG. 4 the bottom figure, the complete core barrel 54 is shown. Core barrel 54 easily fits within a hollow rotary drill string 56 that includes a latch and landing shoulder section 58. The latch and landing shoulder section 58 is similar to the other sections of the drill string but includes an internal shoulder 60 and a pair of latch seats 62 and 64.

The upper portion of core barrel 54 consists of a cylindrical tubular housing 66 somewhat smaller in diameter than the interior of drill string 56. A pair of latch fingers 68 and 70 are rigidly affixed to the tubular housing 56 by four mounting pins 72. The latch fingers 68 and 70 are constructed of a flexible and resilient material such a spring steel. The latch fingers 68 and 70 are shown in their unflexed position wherein the core barrel may be transported through the drill string. An actuator 74 is positioned within the tubular housing 66 and adapted to slide therein from a first position wherein the latch fingers 68 and 70 fit in recesses in the side of actuator 74 to a second position wherein the latch fingers are forced outward by the actuator 74 into a stressed position.

The upper end 76 of the actuator 74 is a solid cylinder that fits within the tubular housing 66 and closes it upper end. The upper end 76 of actuator 74 slides freely within the tubular housing 66 but prevents any fluid within drill string 56 from entering the tubular housing. The lower section 78 of actuator 74 has a rectangular cross section thereby leaving a fluid passageway through the entire lower portion of the core barrel 54. A pair of holes 80 and 82 are located in the side of tubular housing 66 to allow fluid from within the drill string 56 to flow freely through the core barrel 54 unless they are blocked by valve element 84. The valve element 84 is affixed to actuator 74 and moves with actuator 74 to block or unblock the holes 80 and 82. when in the position shown, the actuator 74 and valve element 84 block the fluid passage; however, they may be moved either up or down to unblock the holes 80 and 82. The angular ends of the latch fingers 68 and 70 and the hook-shaped ends of actuator 74 cooperate to insure that the latch fingers 68 and 70 will be retracted even if they are broken.

A ring-shaped packing rubber 86 is mounted on the exterior of tubular housing 66 and provides the core barrel 54 with an enlarged diameter to form a fluid seal with the wall of the drill string 56. The extension of the packing rubber 86 may be adjusted by a back-up ring 88 positioned below packing ring 86 and a threaded packing nut 90 positioned above packing rubber 86. The packing rubber is squeezed between packing nut 90 and back-up ring 88 and the amount of extension may be varied by adjusting the packing nut 86. The back-up ring 88 forms a landing shoulder on core barrel 54 and coupled with the packing rubber 86 and packing nut 90 provide a cushioning structure when the core barrel 54 lands upon landing shoulder 60 on the drill string.

A pair of elongated extensions 92 of the tubular housing 66 (one on each side of actuator 74) connect the upper portion of the core barrel with the spring and spindle housing 94 shown in FIG. 3. Positioned within the spring and spindle housing 94 and adapted to slide therein is an elongated spindle 96. A spindle retainer 98 is affixed to spindle 96 at a point inside of housing 94 and a second spindle retainer 100 is affixed to spindle 96 some distance below retainer 98 and outside of housing 94. This allows the spindle 96 to move up and down within certain limits established by the retainers 98 and 100. A spring 102 is positioned within housing 94 surrounding spindle 96 thereby urging the spindle 96 into its lowest position. The length of spindle 96 may be adjusted by a lock nut 104 that engages the threaded lower portion 106 of spindle 96. A core sample container 108 is rotatably connected to the lower portion 106 of spindle 96 by bearings 110 and 112. Thus, the core sample container 108 rotates freely relative to the upper portion of the core barrel and upward pressure on the core barrel 108 will produce upward movement of spindle 96 acting against the force of spring 102. A hole 114 in the upper end of core sample container 108 allows fluid to exit from the container 108 as the container is filled with a core sample.

Referring now to FIG. 4, the core sample container 108 is shown positioned adjacent the coring bit 116. A stabilizer ring 118 holds the core sample container 108 firmly in position to receive the core as it is drilled. A core lifter 120 is connected to the lower end of core sample container 108 and serves to retain the core sample within container 108 throughout the core sampling operation.

The structural details of one embodiment of a core barrel constructed in accordance with the present invention having been described, the operation of the core barrel will now be considered with reference to FIG.'s 2, 3, 4 and 5 which show the core barrel 54 positioned in the drill string 56. The core barrel 54 is placed inside of rotary drill string 56 and moved into core receiving position adjacent the coring bit. In dry holes, the packing nut 90 is loosened to reduce the extension of packing rubber 86 and the core barrel 65 is lowered into position by a retriever that engages the elongated upper portion of actuator 74. Once the core barrel 54 reaches the coring position, the retriever disengages the spear point and is withdrawn from the drill string. In wet holes, the packing nut 90 is tightened thereby compressing packing rubber 86 and increasing its extension to provide a fluid seal between the tubular housing 66 and the interior of the drill string 56 and the core barrel 54 may be pumped into position. It can be appreciated that the adjustability of the extension of the packing rubber 86 serves to compensate for wear of the packing rubber. In addition, the packing rubber 86 serves as a cushion to absorb shock when the core barrel 54 lands upon the landing shoulder 60. Since the back-up ring is not affixed to the tubular housing 66, the shock from striking the landing shoulder 66 is transmitted from back-up ring 88 to packing rubber 86.

When the core barrel 54 is being pumped into position, the actuator 74 is moved to the location shown in FIG. 2 wherein the latch fingers 68 and 70 are in the relaxed position away from the walls of the drill string with the valve element 84 blocking holes 80 and 82. When the actuator is in this position, the core barrel 54 completely blocks the drill string 56 and may be pumped into position. Once the core barrel 54 reaches the internal shoulder 60 on the drill string, the back-up ring 88 will strike shoulder 60 and prevent further downward movement. Since the core barrel 54 completely blocks fluid flow through the drill string 56 additional pumping will cause a rapid build up of fluid pressure in the drill string 56. This build up in pressure advises the operator that the core barrel is located adjacent the core bit. The fluid pressure will continue to rise until a sufficient force is applied to the exposed portions of the upper end of actuator 74 to force actuator 74 downward and overcome the resistance of latch fingers 62 and 64. Once the required pressure is reached, the force on actuator 74 moves latch fingers 68 and 70 outward into the latch seats 62 and 64. The amount of fluid pressure, i.e., the force on actuator 74, required to move latch fingers 68 and 70 is a function of the inclination of the actuator surface engaging the latch fingers and their material strength. Therefore, the core barrel system of the present invention will provide a predetermined pressure signal indicating latching of the core barrel. If the latch fingers 68 and 70 do not latch in place, the pressure increases beyond the predetermined pressure signal value and the operator knows that the core barrel has failed to latch in place. Once the latch fingers 58 and 70 have latched in place, the actuator 74 moves downward and the valve element 84 moves to the position shown in FIG. 5 opening holes 80 and 82 and allowing fluid in the drill string 56 to circulate through the core barrel during the core drilling operation. Consequently, there is little possibility of drilling when the core barrel of the present invention is in the unlatched position.

With the core barrel 108 locked in the core receiving position adjacent the coring bit 116, the core taking operation is ready to proceed. The drill string 56 is rotated and a core begins to build up through the center opening of core bit 116 and into the core container 108. The fluid in core container 108 is forced upward and will exit through hole 114 into the drill string 56. When the core container 108 is completely filled with a core or when a core blockage occurs, an upward force is applied to core container 108. This upward force is transmitted through spindle 96 to the lower portion 78 of actuator 74. Actuator 74 is moved upward until the valve element 84 is in a position blocking holes 80 and 82. This prevents fluid from bypassing core barrel 54 and a pressure signal is transmitted to the operator. The operator then knows it is time to retrieve the core barrel. Since formation conditions tend to vary, the amount of upward pressure on core container 108 during the core taking operation varies and a downward force must be applied to spindle 96. This is accomplished by a spring 102 that acts against spindle 96. To compensate for changing formation conditions, spindle 102 can be replaced with a spring of a selected strength to increase or decrease the resistance of upward movement of the spindle to suit the particular formation being cored.

The core barrel 54 is retrieved by the retriever being lowered until is grasps the elongated upper portion of actuator 74. An upward force is then applied to actuator 74 through the cable and retriever. Actuator 74 moves upward until the latch fingers 68 and 70 snap into their relaxed position in the recesses in actuator 74. Since resilient latch fingers 68 and 70 are in a stressed condition when they are in latch seats 62 and 64, they tend to naturally snap back into their relaxed position. Should one or both of the latch fingers 68 and 70 be broken, they will be retracted by the hook-shaped lower end 78 of actuator 74 as actuator 74 is moved farther upward. To avoid withdrawing the entire stand of fluid in the drill string 56 between the core barrel and the drilling equipment, a fluid channel must be opened through core barrel 54 to bypass fluid through tubular housing 66. This is accomplished by the actuator 74 continuing to move upward until the valve element 84 is above holes 80 and 82 thus unblocking the holes and forming a fluid passageway through core barrel 54. The actuator 74 continues to move upward until the hook-shaped lower end 78 contacts the angular ends of latch fingers 68 and 70. Force is then transmitted through latch fingers 68 and 70 to the entire core barrel 54 and it may be withdrawn from the drill string.

Referring now to FIG. 6, a latch finger 122 of another embodiment of a core barrel of the present invention is shown. The latch finger 122 is rigidly affixed to core barrel body 128. In its relaxed position, the lower end 134 of latch finger 122 fits in a recess in actuator 124 and the core barrel may be transported through the drill string. Once the core barrel is in position for receiving a core, a downward force is applied to actuator

124. This force is created by the pressure build up of the drilling fluid in wet holes or the force of gravity in a dry down hole. The force builds up until it is sufficient to overcome the resistance of latch finger **122.** The amount of force required is a function of the inclined surface **138** and **140** and the material strength of latch finger **122.** The latch finger **122** then swings out into a latch seat **130** in the drill string **132.** The upper surface **136** of latch finger **122** locks firmly in latch seat **130** and the core taking operation may proceed. When the core barrel is to be unlatched, the actuator **124** is moved upward and the lower end **134** of latch finger **122** snaps out of latch seat **130** and into the recess in actuator **124.** Since the lower end **134** of the latch finger **122** swings outward and away from the latch seat **130,** the change of the core barrel becoming stuck in the latched position is minimized. However, should latch finger **122** become broken or otherwise prevented from unlatching, it will be positively retracted from latch seat **130** by the hook-shaped lower end **142** that engages the slanted lower portion **134** of latch finger **122.** In addition, the hook-shaped lower end **142** insures that latch finger **122** will be held firmly in the retracted position as the core barrel is withdrawn from the drill string.

The embodiments of the invention in which an exclusive property or privilege is claimed are defined as follows:

1. A core barrel that may be transported through a drill string, comprising:

a core barrel body that is smaller in diameter than the interior of said drill string;

a core sample container connected to said core barrel body, said core sample container being smaller in diameter than the interior of said drill string;

at least one flexible latch finger with resilient characteristics, said flexible latch finger having a portion rigidly affixed to said core barrel body and a latch portion wherein said flexible latch finger and said core barrel body have a maximum diameter that is smaller than the interior diameter of said drill string when said latch finger is in an unflexed position; and

an actuator means for changing the position of said latch portion thereby bending and stressing said flexible latch finger and moving said latch portion to a position wherein said flexible latch finger and said core barrel have a maximum diameter than is larger than the interior diameter of said drill string.

2. The core barrel of claim **1** wherein said actuator means is an actuator element that is movable relative to said core barrel body and includes a surface that contacts said latch finger to change the position of said latch portion.

3. The core barrel of claim **2** wherein said core barrel body includes a portion having an enlarged diameter and a fluid passage through said core barrel to channel fluid by said portion having an enlarged diameter and wherein said actuator means includes a valve means for closing the fluid passage.

4. The core barrel of claim **3** wherein said portion having an enlarged diameter is a packing rubber mounted on said core barrel body between a movable back-up ring and an adjustable packing nut.

5. The core barrel of claim **4** wherein said core sample container is connected to said core barrel body by bearing means for allowing the core barrel body to rotate relative to said core sample container and wherein said bearing means includes means for moving said actuator element to close said valve means.

6. In a system for obtaining a core sample that includes a drill string extending into a borehole, a core bit connected to said drill string, a latch seat on said drill string and a retriever adapted to be transported through said drill string; a retractable core barrel comprising:

a core barrel body that is smaller in diameter than the interior of said drill string;

a core sample container connected to said core barrel body, said core sample container being smaller in diameter than the interior of said drill string;

at least one flexible and resilient latch finger with a portion rigidly affixed to said core barrel body and a latch portion adapted to fit in said latch seat wherein said flexible latch finger and said core barrel body have a maximum diameter that is smaller than the interior diameter of said drill string when said latch finger is in an unflexed position;

an actuator means, movable relative to said core barrel body, for moving said latch portion of said latch finger into said latch seat, thereby bending and stressing said flexible latch finger;

a seal element mounted on said core barrel body that forms a fluid seal between said core barrel body and said drill string;

a fluid passage through said core barrel body to allow fluid to flow through said core barrel; and

means on said actuator means for blocking and for unblocking said fluid passage.

7. The core barrel of claim **6** wherein said actuator means is an actuator element with an actuating surface that contacts said latch finger to move said latch portion of said latch finger into said latch seat in a first actuator position and allows said latch portion of said latch finger to move out of said latch seat in a second actuator position.

8. The core barrel of claim **7** wherein said actuator element includes a pressure surface exposed to the interior of the drill string above said core barrel for allowing the pressure of the fluid to move said actuator element into said first actuator position.

9. The core barrel of claim **8** wherein said means for blocking and unblocking said fluid passage includes a valve element connected to said actuator element.

10. The core barrel of claim **9** wherein said actuator element includes means for contacting and withdrawing said latch portion of said latch finger from said latch seat in a third actuator position.

11. The core barrel of claim **10** wherein said actuator includes a connection for said retriever to allow said retriever to move said actuator to said third actuator position and said valve element out of said fluid passage.

12. The core barrel of claim **11** wherein said seal element is a resilient packing element located between a movable back-up ring and an adjustable packing nut.

13. The core barrel of claim **12** wherein said core sample container is connected to said core barrel body by bearing means for allowing said core barrel body to rotate relative to said core sample container.

14. The core barrel of claim **13** including means between said core sample container and said actuator to move the valve element connected to said actuator to a position blocking said fluid passage.

15. In a system for obtaining a core sample of an earth formation that includes a drill string extending into a borehole in the earth formation, rotary drilling equipment for rotating said drill string, a coring bit connected to the lower end of said drill string, a fluid circulation system connected to said drill string for circulating drilling fluid through said drill string, a latch seat on said drill string and a retriever that may be transported through said drill string; a retractable core barrel comprising:

a core barrel body adapted to fit within said drill string, said core barrel having a maximum diameter smaller than the diameter of said drill string;

a core sample container connected to said core barrel body, said core sample container being smaller in diameter than the interior of said drill string;

at least one flexible and resilient latch finger, said finger having a portion rigidly affixed to said core barrel body and a latch portion adapted to fit in said latch seat wherein said flexible latch finger and said core barrel body have a maximum diameter that is smaller than the interior diameter of said drill string when said latch finger is in an unflexed position;

a seal element mounted on said core barrel body that forms a fluid seal between said tubular core barrel body and said drill string;

at least one fluid passage through aid tubular core barrel body;

actuator means responsive to pressure of the drilling fluid for moving the latch portion of said at least one latch finger into the latch seat when the pressure of the drilling fluid exceeds a predetermined value; and

valve means connected to said actuator means for opening and closing said fluid passage.

16. The core barrel of claim 15 wherein said actuator means is a movable actuator element with a pressure surface exposed to the drilling fluid and an actuating surface adapted to contact said latch finger to move said latch portion of said latch finger into said latch seat.

17. The core barrel of claim 16 wherein said valve means includes a valve element connected to said movable actuator element and positioned to open said fluid passage when said latch portion of said latch finger moves into said latch seat.

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