United States Patent

Wolda

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[54] **APPARATUS FOR LOWERING AND RETRIEVING A CORE BARREL**

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

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[52] **U.S. Cl.** **175/246,** 294/86.14, 294/86.18, 294/86.21

[51] **Int. Cl.**.....**E21b 9/20,** E21b 25/00

[58] **Field of Search**....294/86.1, 86.14, 86.17–86.21, 294/86.25, 86.29, 86.3, 86.32; 24/263 DF; 166/301; 175/246–248

[56] **References Cited**

UNITED STATES PATENTS

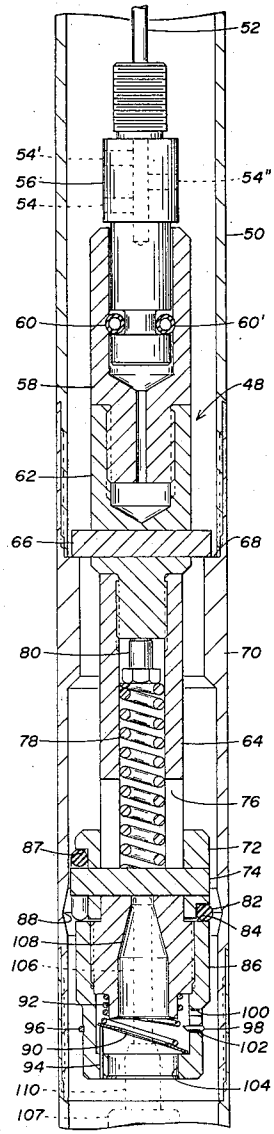
1,017,305	2/1912	McBride	294/86.29
2,252,767	8/1941	Hudson	294/86.21
2,264,480	12/1941	Owen	294/86.32 X
2,559,315	7/1951	Osmun	294/86.17
3,120,283	2/1964	Braun	175/246
3,292,717	12/1966	Hall et al	175/246 X

Primary Examiner—David H. Brown
Attorney—Robert W. Mayer et al.

[57] **ABSTRACT**

A lowering and retrieving system that may be used when core drilling, either up or down, including drilling at any inclination. A flexible seal element is mounted around the periphery of a lowering and retrieving device and looped over a pin on a movable actuator element. The flexible seal element forms a fluid seal with a hollow drill string allowing the lowering and retrieving device to be pumped through the drill string. An elongated spear head on a retractable core barrel contacts and moves the movable actuator element thereby changing the position of the flexible seal element and a fluid channel around the lowering and retrieving device is opened.

11 Claims, 3 Drawing Figures



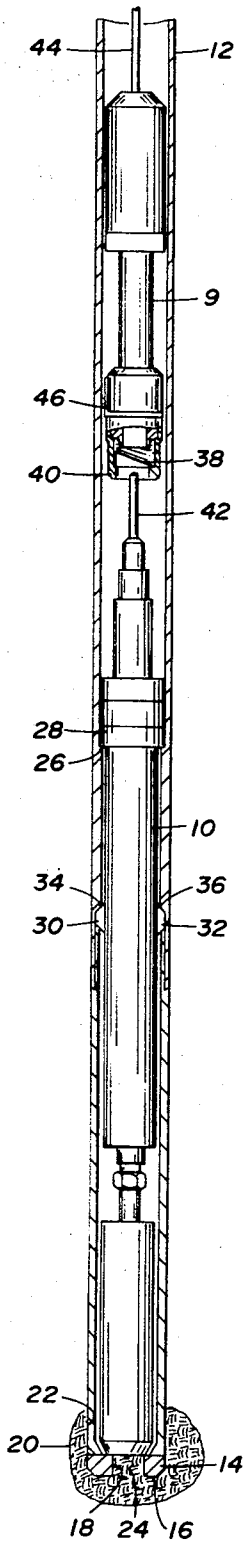


FIG. 1

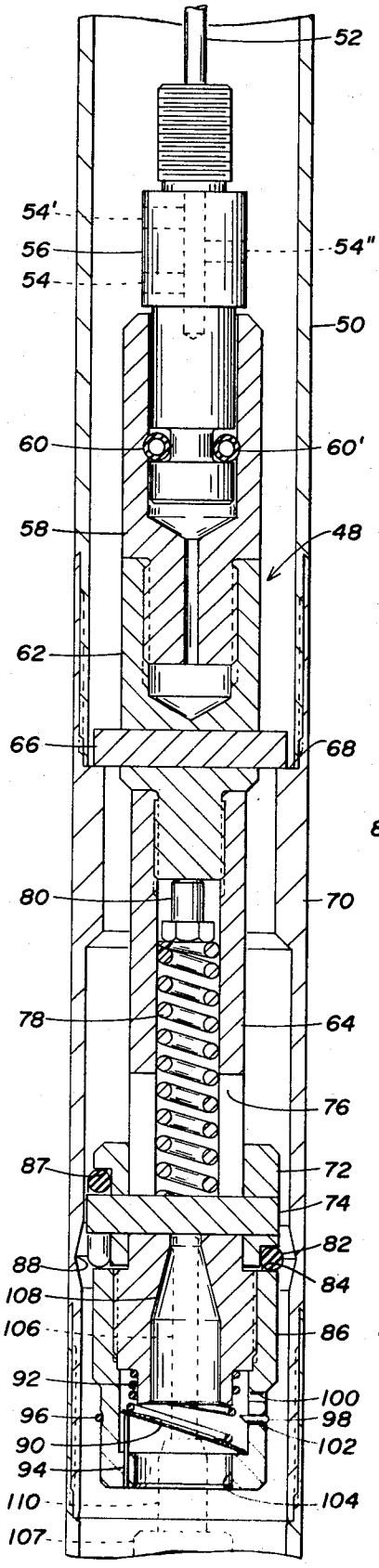


FIG. 2

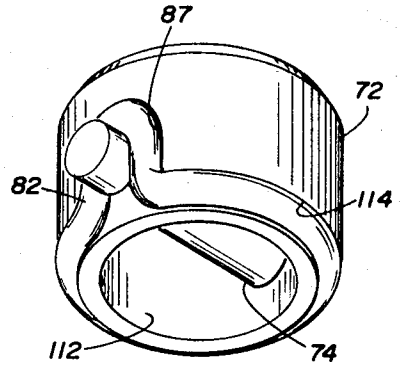


FIG. 3

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APPARATUS FOR LOWERING AND RETRIEVING A CORE BARREL

BACKGROUND OF THE INVENTION

The present invention relates to the art of core drilling and more particularly to a system for lowering a core barrel to the core taking position and for retrieving the core barrel once a core sample is taken.

It is a common practice to take "samples" or "cores" of formations to obtain geological information. The cores may be obtained using a hollow rotary "drill string" or "drill stem" having a coring bit connected to the lower end and a core barrel positioned within the hollow rotary drill string adjacent the coring 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 coring bit until the core sample is taken. At that time, a core barrel retriever connected to a wireline is transported through the drill string to contact and remove the core barrel from the drill string.

In general, the core drilling operation may be categorized as up drilling or down drilling. The down drilling operation being a conventional drilling operation wherein 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 fluid; therefore, the core drilling operations can be further characterized as wet or dry. It is desirable to be able to use a single system for lowering and retrieving the core barrel during both up drilling and down drilling and in wet or dry holes. Such a core barrel lowering and retrieving system must be extremely versatile to perform the required functions under such varying conditions. In down core drilling in a dry hole, the system must lower the core barrel into position by wireline, allow the core barrel to lock firmly in position for coring, disengage the core barrel and withdraw it from the drill string. When down core drilling in a wet hole, the system must include means that form a fluid seal with the tubular drill string to allow the lowering and retrieving device to be pumped downward and engage the core barrel. Once the lowering and retrieving device reaches the core barrel, it must firmly engage an element on the core barrel, a channel must be opened to bypass fluid around the lowering and retrieving device and the lowering and retrieving device with the core barrel engaged must be withdrawn from the drill string. When core drilling upward, the system must perform all of the functions required in down drilling in wet holes as well as preventing the fluid from being forced downward out of the drill string by gravity.

In retractable systems heretofore known, the seal elements used to form a fluid seal with the tubular drill string have not performed in an entirely satisfactory manner. Some of the seal elements fail to respond when a fluid bypass channel is to be opened around the lowering and retrieving device. The pressure of the circulating fluid holds the seal element in the fluid blocking position even though the means for adjusting the seal element has been moved to the fluid channel open position. Some of the seal elements of the prior art wear out rapidly and must be replaced at short intervals. In addition, some of the seal elements of the prior art are difficult to assemble in operative position of the body of the lowering and retrieving device.

DESCRIPTION OF THE PRIOR ART

A prior art retriever is shown in U. S. Pat. No. 3,120,282 to A. F. Pickard, patented Feb. 4, 1964. The "retriever" or "overshot assembly" consists of a body portion with a pair of pulling dogs and a piston with an enlarged diameter that forms a close fit with the inner surface of the drill stem slidably connected to the body portion. The overshot assembly may be pumped into position for the pulling dogs to engage a spear point on the core barrel. The piston is then moved to a second position wherein a fluid channel is opened to bypass fluid around the overshot assembly.

Another of the prior art retrievers is shown in U. S. Pat. No. 3,120,283 to L. A. Braun, patented Feb. 4, 1964. The "retriever" or "overshot" includes a body portion with a pair of pulling dogs attached. A resilient collar is positioned around the outer surface of the retriever body and forms a fluid seal with the inner diameter of the drill string to allow the retriever to be pumped into position. The pulling dogs clamp onto a spearhead of the core barrel to allow the core barrel to be withdrawn from the drill string. A fluid channel is opened through the body of the retriever to allow fluid to bypass the resilient collar.

In U. S. Pat. No. 3,266,835 to P. B. Hall et al, patented Aug. 16, 1966, a "retriever" or "overshot" that may be lowered and raised through a rotary drill string is shown. The overshot includes a multiplicity of downwardly extending spring fingers. Each finger has a projection with a locking shoulder at the end. The fingers of the overshot clamp onto a spearhead on the core barrel and the core barrel may be withdrawn from the borehole.

In U. S. Pat. No. 3,292,717 to P. B. Hall et al, patented Dec. 20, 1966, another "retriever" or "overshot" that may be pumped into position is shown. The overshot body is provided with a piston packing which slidably fits within the drill string. The packing may be removed to allow the overshot to be used in dry holes. The overshot also has fingers that grip a spearhead on the core barrel for withdrawing the core barrel from the drill string.

SUMMARY OF THE INVENTION

The present invention provides a single system for lowering and retrieving a core barrel during up or down core drilling and in wet or dry holes. The system includes a retractable core barrel and a lowering and retrieving device that may be transported through the drill string to position or withdraw the core barrel. A seal element on the body of the lowering and retrieving device forms a fluid seal with the drill string to allow the device to be pumped into position proximate the core barrel. An actuator element changes the position of the seal element to allow fluid to bypass the device when it is being withdrawn from the drill string. The seal element resists wear and is easy to assemble in operative position on the body of the lowering and retrieving device. The lowering and retrieving system will prevent water from draining downwardly out of the drill string during up drilling operations when sections of pipe are being added to the drill string.

It is therefore an object of the present invention to provide a lowering and retrieving system that can be used in all inclinations of holes.

It is a further object of the present invention to provide a device that may be used as a retriever or a lowering collet.

It is a still further object of the present invention to provide a lowering and retrieving device with a seal element that is moved from its working position after the device has been pumped into place to a second position to allow fluid to bypass the device when the device is being withdrawn from the drill string.

It is a still further object of the present invention to provide a lowering and retrieving device with a seal element that will withstand wear during core taking operation.

It is a still further object of the present invention to provide a lowering and retrieving device with a seal element that may be moved positively from a sealing position to a position wherein fluid may bypass the lowering and retrieving device.

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

BRIEF DESCRIPTION OF THE DRAWING

FIG. 1 shows a core barrel latched in the core receiving position in a hollow rotary drill string and a lowering and retrieving device located immediately above the core barrel.

FIG. 2 is a sectional view of a lowering and retrieving device constructed in accordance with the present invention.

FIG. 3 shows the seal and actuator elements of the lowering and retrieving device shown in FIG. 2.

DETAILED DESCRIPTION OF THE INVENTION

Referring now to FIG. 1, a lowering and retrieving device constructed in accordance with the present invention and generally designated by the reference number 9 is shown positioned immediately above a core barrel 10 in a hollow rotary drill string 12. Rotary drill string 12 consists of a series of hollow drill pipe sections connected together to form the 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. 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 the 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 core drilling operation. In order to obtain geological information about the formation 20, a section of the core 24 is withdrawn from the borehole 22.

Core drilling operations may be conducted either up or down from the horizontal including drilling at any inclination. For example, the core drilling operation may be conducted from the surface by drilling downward into the formation, 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 supplies 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 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.

A sample of the formation 20 is obtained by a core barrel 10 being moved into core receiving position within the drill string 12 adjacent coring bit 14 until it receives a section of the core 24, at which time the core barrel 10 is removed from the drill string 12. When core drilling in dry holes, the lowering and retrieving device 9 is connected to core barrel 10 and they are both lowered into position using the force of gravity. The lowering and retrieving device 9 disengages the core barrel 10 and is withdrawn from the drill string. When drilling in wet holes, core barrel 10 may be pumped into position by itself using the drilling fluid. Core barrel 10 moves toward the bit end of the drill string 12 until it reaches a landing shoulder 26 on the drill string 12. A complementary landing shoulder 28 on core barrel 10 contacts the drill string landing shoulder 26, 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.

Once the core barrel 10 has received the desired core sample, it must be withdrawn from the borehole 22. This may be accomplished with the lowering and retrieving system of the present invention including the lowering and retrieving device 9 that is transported through the drill string 12 until it reaches core barrel 10. A latching washer 38 in the lower portion 40 of the device 9 engages a spear connection 42 on core barrel 10. Latches 30 and 32 are disengaged from latch seats 34 and 36 and the core barrel 10 is withdrawn from the drill string by a cable 44 connected to the lowering and retrieving device 9.

The lowering and retrieving device 9 includes a seal element 46 that give it an enlarged diameter to form a fluid seal with the drill string 12. The lowering and retrieving device 9 may therefore be pumped into position by fluid pressure from the drilling equipment. The seal element 46 must be bypassed by fluid standing in the drill string when the device 9 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. In addition, during up drilling the fluid in the drill string 12 must be prevented from coming downward out of the drill string when sections of drill pipe are being added. The lowering and retrieving system of the present invention accomplishes this by acting as a check valve to prevent downward flow of fluid when

additional sections of the drill string are being added and allowing fluid to move upward past the lowering and retrieving device 9 during the core drilling operation.

Referring now to FIG. 2, a lowering and retrieving device constructed in accordance with the present invention and designated generally by the reference number 48 is shown positioned within a hollow rotary drill string 50. The lowering and retrieving device 48 is connected to the end of a cable 52. Because the cable 52 may turn or revolve in the drill string as the device 48 is being lowered or retrieved, three socket setscrews 54, 54', 54'' connect cable 52 to a cable socket 56 and the cable socket 56 fits within a swivel housing 58 and is held therein by a pair of socket retaining pins 60, 60'. The swivel housing 58 is affixed to the upper portion 62 of the lowering and retrieving device body 64.

A removable retaining pin 66 is positioned within the upper portion 62 of body 64. When the lowering and retrieving device 48 is in position to act as a check valve during up drilling, the removable retaining pin 66 contacts a shoulder 68 on a special retaining coupling section 70 of the drill string 50 and the device 48 is held in the proper position. The retaining pin 66 may easily be removed for other core taking operations.

An actuator element 72 is positioned to slide along the outer surface of body 64 and is slidably connected to retriever body 64 by an actuator pin 74 that extends through an elongated opening 76 in body 64 and is affixed to the actuator element 72. The actuator element 72 is urged toward its lowest position by a balance spring 78 and a balance spring adjuster 80 that fit within body 64. The balance spring 80 is compressed between the upper portion 62 of body 64 and the actuator pin 74. A seal element 82 is positioned around the lowering and retrieving device 48 between a shoulder 84 on the lower portion 86 of body 64 and the actuator element 72. The seal element 82 loops over one end of actuator pin 74 and fits within a U-shaped groove 87 in actuator element 72.

A latching washer 90 is positioned within the lower portion 86 of body 64 and a spring 92 positioned above washer 90 urges latching washer 90 downward. An overload pin 94 extends through the lower portion 86 of body 64 and contacts one side of latching washer 90. A lowering spring 96 is positioned in a groove that extends around the outer circumference of lower portion 86 of body 64. A projecting end portion 98 of lowering spring 96 may be positioned within either retrieving hole 100 or lowering hole 102 that extend into the lower portion 86 of body 64.

An opening 104 in the lower portion 86 of body 64 allows the elongated portion 106 of a spearhead 107 connected to the core barrel (not shown) to enter the lowering and retrieving device 48. The elongated portion 106 continues into a funnel-shaped opening 108 in body 64 until it contacts the actuator pin 74. Further upward movement of the elongated portion 106 moves the actuator pin 74 and actuator element 72 upward against the resistance of balance spring 78. Since the seal element 82 is looped over the actuator pin 74, one side of the seal element 82 will be moved upward changing the orientation of the seal element 82, device 48 and drill string 50 thereby opening a fluid channel around the device 48. Meanwhile an enlarged latching portion 110 of spearhead 107 will enter the opening 104 and pass through the opening in the center of latching washer 90 and be firmly engaged by latching washer 90.

Referring now to FIG. 3, the actuator element 72, seal element 82 and actuator pin 74 of the lowering and retrieving device 48 are shown. The actuator element 72 is an open ended cylinder with a central opening 112. The opening 112 is slightly larger than the body 64 of the lowering and retrieving device 48 thereby allowing actuator element 72 to slide freely along body 64. A groove 114 on the outer surface of the lower end of actuator element 72 receives the seal element 82. A U-shaped groove 87 allows a portion of seal element 82 to loop over the end of actuator pin 74 that extends into the U-shaped groove. The seal element 82 remains in a relaxed position and is not stretched when in place. It can be appreciated that the length of seal element 82 facilitates its assembly and disassembly from actuator element 72. With the looped portion removed from U-shaped groove 87, the seal element 82 can easily be moved over the largest diameter element of the lowering and retrieving device 48.

The structural details of one embodiment of a lowering and retrieving system constructed in accordance with the present invention having been described, the operation of the system will now be considered with reference to FIGS. 2 and 3. The first operation that will be considered is the lowering of a core barrel into coring position in a down hole that is dry. In this situation, it is unnecessary to use the special retaining coupling 70 and it is not included when the drill string 50 is being made up. In addition, the retaining pin 66 and the seal element 82 are removed. Since the hole does not contain water, the device 48 may easily be lowered into position and the seal element is not required.

The core barrel and the lowering and retrieving device 48 are placed end-to-end and the core barrel is moved toward device 48 until the elongated portion 106 and the enlarged latch portion 110 of the spearhead 107 move into opening 104 of lowering and retrieving device 48. As the enlarged latch portion 110 contacts latching washer 90, it causes the latching washer 90 to align itself at right angles to the axis of body 64. The enlarged latch portion 110 moves upward into the central opening in latching washer 90 until the elongated portion 106 contacts the actuator pin 74. At this point, the spring 92 is fully collapsed and any attempt to pull the core barrel and device 48 apart causes the latching washer 90 to cant on the enlarged latch portion 110 and grip it firmly. The overload pin 94 prevents one edge of the latching washer 90 from moving downward whereas the spring and enlarged latching portion 110 attempt to force the opposite edge of latching washer 90 downward and a firm connection between the lowering and retrieving device 48 and the core barrel is assured.

The lowering spring 96 is positioned with the end portion 98 in lowering hole 102. End portion 98 will project slightly into the opening in the lower portion 86 of body 64 at a point immediately above latching washer 90. The core barrel and lowering and retrieving device are then lowered into the drill string 50 and moved downward until the core barrel latches into position. The inertia effect of the device 48 tries to

drive the body **64** farther onto the elongated portion **106** and enlarged latch portion **110**. When this occurs, the latching washer **90** is forced back past the end portion **98** of lowering spring **96**. The latching washer **90** is then held vertical to the axis of body **64** by end portion **98** of lowering spring **96** and the device **48** can be pulled upward disengaging the core barrel and leaving it in its latched position. Most core barrels include means whereby they may be pumped directly into position in wet holes without using the lowering and retrieving device **48**.

The core barrel lowering operation having been described, the retrieving of the core barrel will now be considered with reference to FIGS. **2** and **3**. The projecting end portion **98** of lowering spring **96** is placed in hole **100** and the lowering and retrieving device **48** is positioned within drill string **50** and transported through drill string **50** until it engages elongated upper portion **106** and enlarged latch portion **110** of the spearhead **107**. In dry holes extending downward, the device **48** may be lowered into position at the end of cable **52**. In wet holes, the seal element **82** is positioned on the lowering and retrieving device **48** and the balance spring adjuster **80** is adjusted so that seal **82** forms a fluid seal with the drill string **50** and the device **48** is pumped into position. When the lowering and retrieving device **48** reaches the core barrel, the elongated portion **106** and the enlarged latch portion **110** of the spearhead **107** move into the opening **104** of lowering and retrieving device **48**. The elongated portion **106** of spearhead **107** continues upward into the funnel-shaped opening **108** of body **64** thereby assuring that the lowering and retrieving device **48** is aligned with the core barrel. The elongated portion **106** of spearhead **107** contacts the actuator pin **74** compressing spring **78** and forcing actuator element **72** and actuator pin **74** upward. The end of actuator pin **74** projecting into the U-shaped groove **87** insures that one side of the seal element **82** will be moved upward changing the configuration of the seal and opening a fluid channel around the lowering and retrieving device. The channel is thus opened positively each and every time and the opening of the channel does not depend upon the elastic properties of seal element **82**. Since the seal element **82** remains in its relaxed position during the core taking operation, it is more resistant to wear than a seal element that is in a deformed position during the same operation.

The enlarged portion **110** of spearhead **107** enters the central opening in latching washer **90** and any attempt to move the core barrel and the lowering and retrieving device **48** apart causes the latching washer **90** to cant on the enlarged latch portion **110** and grip it firmly. The cable **52** is then tightened to begin withdrawing the device **48** and the core barrel from the drill string. The pulling force is transmitted to spearhead **107** and it causes the core barrel to unlatch from the coring position so that the core barrel may be withdrawn from the drill string. Since actuator pin **74** has been moved upward, the seal **82** remains in a bypass channel open position and fluid standing in the drill string will bypass the lowering and retrieving device **48**. Once the lowering and retrieving device **48** and the core barrel are withdrawn from the drill string **50**, they may be disengaged by inserting an elongated instrument into the opening in the lower portion **86** of body **64** and moving the latching washer **90** to a position perpendicular to body **64**.

Should the core barrel for some reason become stuck in the drill string, the safety pin **94** will allow the core barrel to be released before the cable **52** is broken. The safety pin **94** will be forced out of the lower portion **86** of body **64** by a predetermined force applied by latching washer **90**. If the core barrel is stuck and the predetermined force is applied through the cable **52** and body **64** to the latching washer **90**, the safety pin **94** will be forced out allowing washer **90** to move perpendicular to the axis of body **64** thereby releasing its grip on the enlarged latch portion **110** of spearhead **107** and the core barrel will be released before the cable **52** is broken.

When drilling upward, the lowering and retrieving system of the present invention acts as a check valve to prevent fluid from draining out of the drill string when additional sections of the drill string are being added. The special retaining coupling **70** is added to the drill string and the retaining pin **66** is positioned in the upper portion **62** of the body **64**. The lowering and retrieving device **48** is moved upward through the drill string until the retaining pin **66** contacts the shoulder **68** on the special retaining coupling **70**. At this point, the seal **82** is positioned in the recess **88** and fluid can bypass the lowering and retrieving device **48**. When an additional section of the drill string is to be added, pumping of drilling fluid is stopped and the lowering and retrieving device **48** will fall backward until the seal **82** contacts the narrowed portion of the special retaining coupling **70** next to the recess **88**. The lowering and retrieving device **48** therefore acts as a check valve allowing fluid to move upward during the drilling operation but preventing it from moving back downward as new sections of the drill string are added.

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

1. An apparatus for positioning a core barrel in a core receiving position in a drill string and for withdrawing the core barrel from the core receiving position, comprising:

a main body;

a line connected to said main body;

a seal element that forms a fluid seal between the main body and the drill string;

an actuator means movable relative to said main body for moving said seal element to a position wherein it does not form a fluid seal between the main body and the drill string, said actuator means including means for gripping a section of said seal element; and

core barrel engaging means for connecting the main body to the core barrel.

2. The apparatus of claim **1** wherein said actuator means includes an actuator element that is positioned to slide upon said main body and means on said actuator element for gripping a section of said seal element.

3. The apparatus of claim **3** wherein said seal element is a flexible ring positioned around said main body and held at one point by said means for gripping a section of said seal element.

4. The apparatus of claim 3 wherein said flexible ring has a central opening with a diameter larger than the external diameter of said main body.

5. In a system for obtaining a core sample of an earth formation penetrated by a borehole wherein a hollow drill string and a coring bit, connected to the lower end of the drill string, extend into the borehole and a core barrel for collecting the core sample is moved through the drill string into coring position adjacent the coring bit, apparatus for withdrawing the core barrel from coring position within the drill string, comprising:

a main body adapted to fit within and be transported through the drill string;

a line connected to said main body;

a seal element adapted to fit on said main body and form a fluid seal with the drill string;

engaging means on said main body for connecting the core barrel to the main body; and

movable actuator means slidable relative to said main body for adjusting said seal element so that it does not form a fluid seal with the drill string when the engaging means have connected the core barrel to the main body, said movable actuator means including means for gripping a section of said seal element.

6. The apparatus of claim 5 wherein said movable actuator means includes an actuator element that is positioned to slide upon said main body and means on said actuator element for gripping a section of said seal element.

7. The apparatus of claim 6 wherein said seal element is a flexible ring positioned around said main body and held at one point by said means for gripping a section of said seal element.

8. The apparatus of claim 7 wherein said flexible ring has a central opening with a diameter larger than the external diameter of said main body.

9. In a system for obtaining a core sample from an earth formation penetrated by a hollow drill string with a coring bit attached wherein a core barrel for collecting the core sample is moved through the drill string into coring position adjacent the coring bit, apparatus for moving the core barrel into coring position and for withdrawing the core barrel from the coring position, comprising:

a main body;

a line connected to said main body;

an elongated spear point connected to said core barrel;

seal means on said main body for forming a fluid seal with the drill string;

movable actuator means slidable relative to said main body for adjusting said seal element so that it does not form a fluid seal with the drill string when the actuator means is contacted by said elongated spear point, said movable actuator means including means for gripping a portion of said seal means; and

engaging means on said main body for gripping the spear point when the core barrel is being moved through the drill string and for releasing the core barrel when the core barrel is moved into coring position.

10. The apparatus of claim 9 wherein said seal means is a flexible ring positioned around said main body and held at one point by said means for gripping a portion of said seal means.

11. The apparatus of claim 10 wherein said movable actuator means includes an actuator element that is positioned to slide upon said main body and means on said actuator element for gripping a section of the flexible ring.

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