

March 8, 1960

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2,927,775

UNCONSOLIDATED FORMATION CORE BARREL

Filed Dec. 10, 1957

4 Sheets-Sheet 1

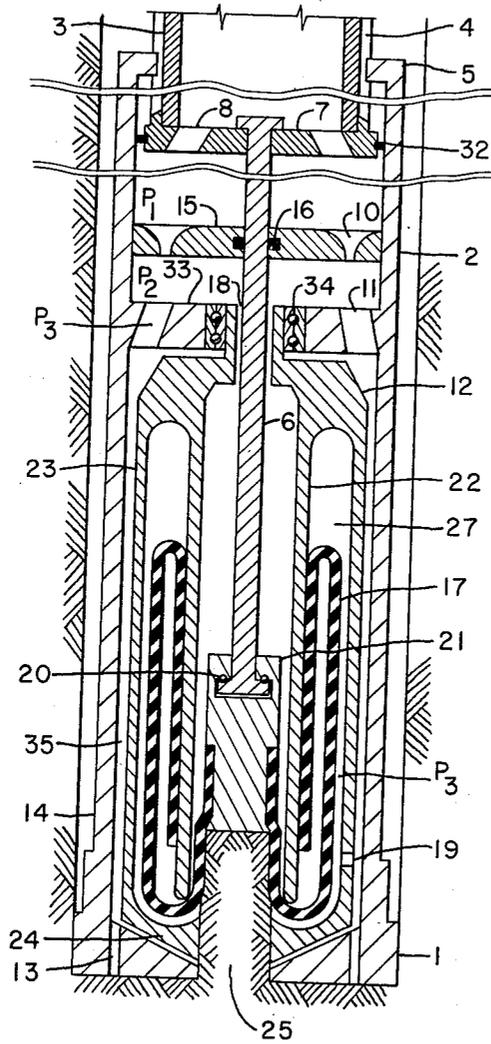


FIG. 1

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4 Sheets-Sheet 2

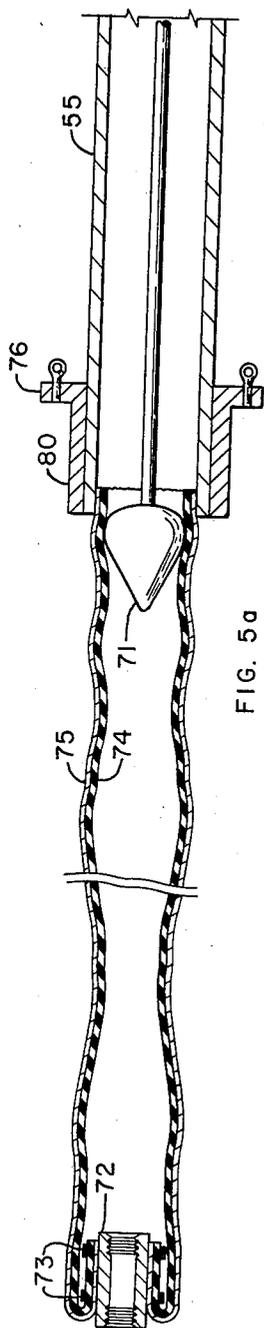


FIG. 5a

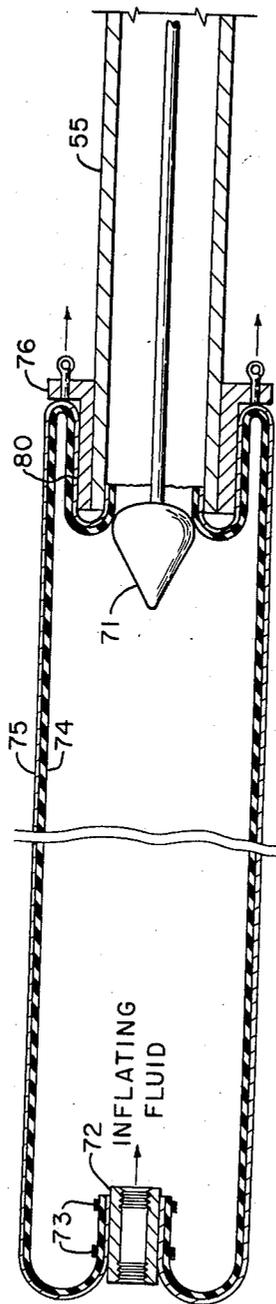


FIG. 5b

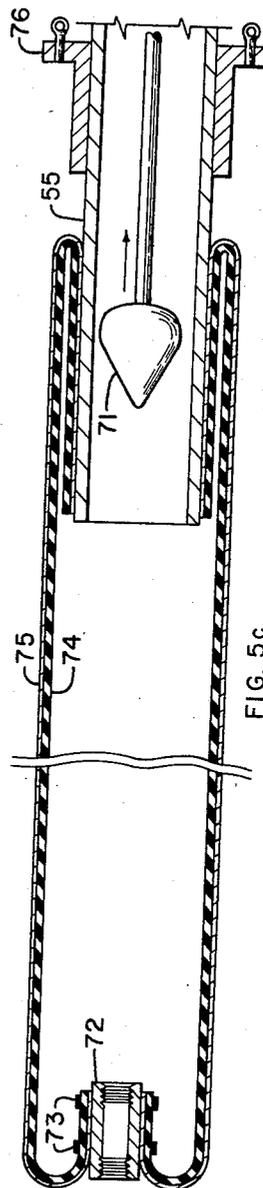


FIG. 5c

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4 Sheets-Sheet 3

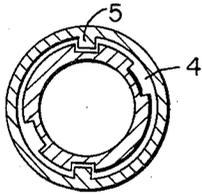


FIG. 4

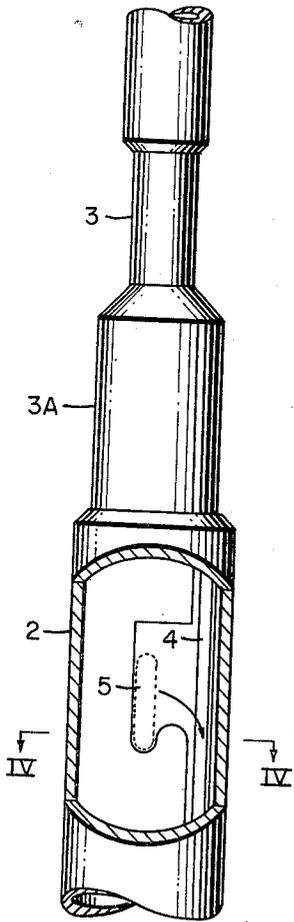


FIG. 2a

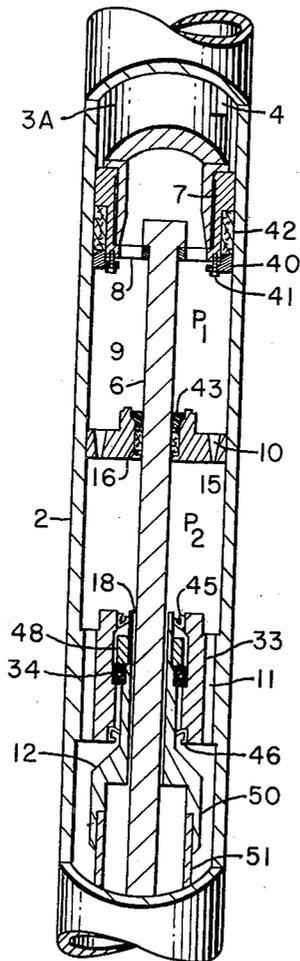


FIG. 2b

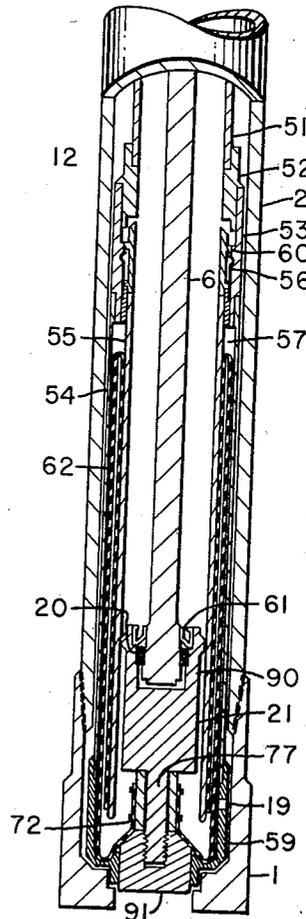


FIG. 2c

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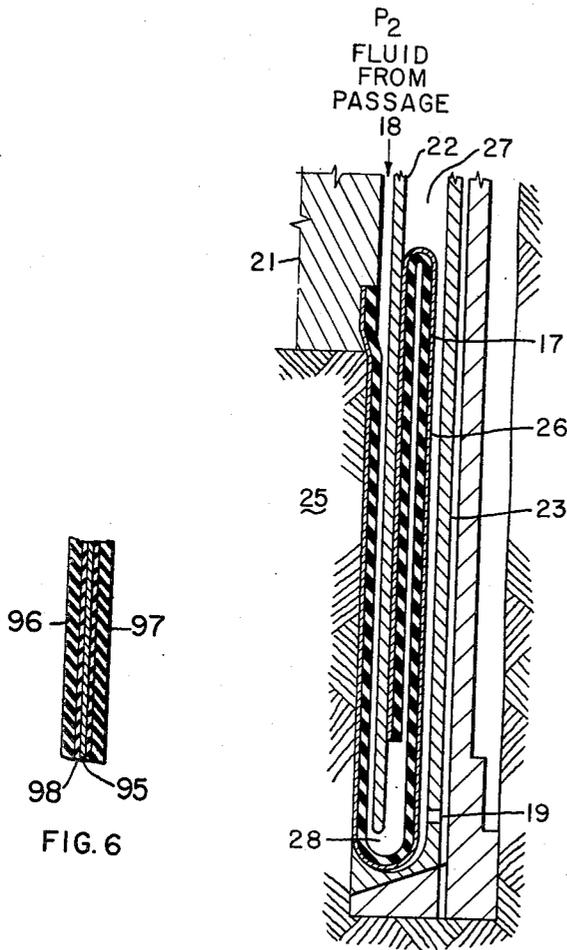


FIG. 3

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## UNCONSOLIDATED FORMATION CORE BARREL

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10 Claims. (Cl. 255—72)

This invention is concerned with an improved apparatus for securing a more representative core from an unconsolidated formation. In accordance with the invention, a coring device is employed which uses a rubber or equivalent elastic sleeve that encases and tightly grips a core as it is being produced, thus supporting a core after it enters the coring device. A preferred adaptation of the invention lies in the use of a fabric or equivalent member such as a canvas sock in conjunction with the elastic sleeve to control radial expansion of the sleeve. The elastic sleeve itself is preferably ribbed or reinforced longitudinally. For example, the sleeve may be provided with rayon or other cord which is imbedded within and extends the length of the sleeve. The sleeve may then expand in diameter while retaining its original length.

In prospecting and drilling for oil, it is a conventional procedure during the drilling of a borehole to determine the character and nature of the substrata through which the hole is being drilled. One method is to periodically remove cores at particular selected depths. These cores are then brought to the surface and analyzed for the purposes stated. Many procedures and apparatuses have been developed for the effective removal of representative cores from earth substrata. In general, the apparatuses employ core bits which drill an annular hole, leaving a center core which is broken off and taken to the earth's surface by various means. The present invention is directed toward an improved coring apparatus wherein a rubber sleeve is used—as the annular hole about a core is drilled—to seal off the flow of fluids into and out of the core, thus securing a more representative core.

Heretofore in the art, a problem has existed with respect to securing cores in all types of formations. With respect to cemented sands, the problem has not been so acute. However, in uncemented sand formations such as in broken formations, it has been very difficult to secure a representative core wherein the grains are undisturbed with respect to each other. Non-disturbance of the grains is necessary if accurate permeability and porosity measurements are to be determined. Heretofore in the art, the core generated by a coring apparatus is forced into a rigid steel sleeve—otherwise generally referred to as a core-receiving barrel—wherein the core is maintained in position by spring-actuated catchers and the like. With this type of coring device, the core tends to bridge and jam within the steel sleeve, thus preventing the securing of the desired long core. The general experience has been that cores from unconsolidated formations cannot be pushed very far into a steel tube before the material of the core will not sustain its own weight. In order to overcome this difficulty, it has been the practice to secure cores of relatively short length when coring unconsolidated structures. In accordance with the present invention, not only is it possible to secure a considerably longer core, but in addition the grains of this relatively longer core are unchanged with respect to each other. Furthermore, contamination of the core is greatly reduced rela-

tive to the contamination experienced with conventional coring apparatus.

In general the invention makes use of a rotary type core barrel which has a rotatable outer barrel and a stationary inner core-receiving barrel. The outer barrel and a coring bit attached to the lower end thereof are driven by drill pipe through J-slot dogs, splines or equivalent means so as to permit the core barrel and its bit to be advanced downwardly by hydraulic pressure while the drill pipe or stem remains at a fixed elevation. A rubber or equipment elastic sleeve is positioned within the core barrel and preferably used in conjunction with a canvas sock or equivalent fabric sleeve of a character to limit radial expansion of the elastic sleeve. One end of the elastic sleeve and of the fabric sleeve (nominally the upper end) is swivel connected through a rod-like member to the drill pipe, thereby supporting the core.

The invention may be more fully understood by reference to the drawings which illustrate the same.

Figure 1 is a magnified out of proportion schematic view in longitudinal cross section of an apparatus embodiment of the invention.

Figure 2 illustrates a preferred embodiment of the invention showing an upper section, an intermediate section, and a lower section thereof.

Figure 3 is a fragmentary view in longitudinal cross section of the apparatus of Figure 1 illustrating a preferred form of combination fabric and elastic sleeve construction for use in practicing the invention.

Figure 4 is a view taken along the section lines I—I of Figure 2.

Figure 5 illustrates one method of loading a barrel of the invention with an elastic sleeve and an expansion-limiting sleeve.

Figure 6 is a fragmentary section illustrating longitudinal reinforcement in one embodiment of an elastic sleeve.

Referring specifically to Figure 1, the apparatus illustrated there includes a cutter head or bit 1 comprising a conventional drag or diamond bit which is attached to the lower end of outer barrel 2. The upper end of barrel 2 is supported from the lower end of the string of drill pipe 3. Slots 4 and dogs 5 or equivalent means are provided at the upper end of the barrel 2 and the lower end of the drill string 3 to enable the barrel to rotate in unison with the drill string and to slide longitudinally relative thereto. A J-slot and dog assembly especially suitable for this purpose is described later in connection with the apparatus of Figure 2.

The lower end of the drill string 2 terminates in a flange-like member 7 which is attached to the drill string and through which drilling fluid may pass by virtue of ports 8. A piston ring or equivalent seal 32 is provided around the periphery of member 7 to effect a sliding but fluid-tight relation between that member and the outer barrel 2.

Inner barrel 12 is disposed within the outer barrel 2. Supporting member 33 including a swivel joint 34 serves to support the inner barrel 12 from the outer barrel 2 and to provide rotational movement therebetween. Ports 11 are provided in the supporting member 33 to enable drilling fluid to pass therethrough.

An elongated rod 6 is suspended from the drill string 3 by means of member 7 and extends downward and terminates within the inner barrel 12. Attached to the lower end of rod 6 by means of swivel 20 is plug element 21. One end of elastic, preferably rubber, sleeve 17 is attached to the lower section of plug element 21.

The embodiment of inner barrel 12 shown in Figure 1, is double-walled, and the walls define a recess 27 therebetween. The inner wall 22 houses the actual core-

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receiving member or portion of the inner barrel. Rubber sleeve 17 extends from the lower end of plug element 21 into recess 27 and clings to the outer surface of inner wall 22. While the rubber sleeve may vary appreciably in composition and structure and may be made out of any suitable rubbery or equivalent material, one specification is to have it be of a diameter less than the core being cut. The rubber sleeve is preferably fabricated with reinforcing, as for example with rayon or equivalent cords laid longitudinally in such a manner that the sleeve will expand in diameter but will retain its original length.

A particularly preferred adaptation of the invention is the elastic sleeve in conjunction with a second sleeve of a character to limit the degree of radial expansion of the elastic sleeve. A fabric sleeve 26 suitable for this purpose is shown in cross section in Figure 3. As indicated in that figure, a flexible, non-stretching fabric in the form—for example—of a canvas or nylon outer sleeve is mounted so as to be the outermost material within the recess 27. Thus, in operation, the nylon or other fabric sleeve 26 controlling the extent of radial expansion of the rubber sleeve 17 is positioned between the rubber sleeve and the outer surface of the inner wall of barrel 22 and extends around the outside of the rubber sleeve 17 on down to the lower portion of the outer wall 23. As indicated earlier, outer and inner walls 22 and 23, respectively, constitute, in Figures 1 and 3, integral parts or elements of a single, non-rotating barrel. In one sense, it may also be considered that wall 22 defines the inner or core-receiving barrel of the overall core barrel, and that wall 23 defines an intermediate barrel which in this instance rotates with the core-receiving barrel.

Returning to sleeve 17, it has been previously stated that this member is made of rubber or an equivalent elastic material. In this connection, it may be a natural or synthetic rubber or any other material such as a natural or synthetic polymer which is stretchable and substantially impermeable to fluids in the same manner as rubber. Neoprene having a durometer value of about 40 has been especially useful for the purpose. As illustrated in Figure 6, neoprene sleeves have been used in the form of 3-ply tubing—the outer ply 96 and inner ply 97 being neoprene and the middle ply 98 being neoprene reinforced with rayon cords 95. The cords 95 run the length of the tubing and enable the tubing to expand without longitudinal distortion.

The sleeve 26, as stated earlier, is preferably made of fabric of a character to limit expansion of tubing 17. Neoprene-coated nylon cloth, for example, as sold by the Vulcan Rubber Products, Inc., under the trade-name "Vulcan Cover Tight" is very suitable for the purpose. Canvas, various natural and synthetic fiber cloths, glass and asbestos cloths, metal wire cloths, etc., may also be used. The cloth, however, should be thin and flexible so as to be readily pleated or otherwise compressed or folded into a reduced diameter. The cloth need not be impermeable to fluids; however, it may be impregnated or covered as desired with conventional rubbers, plastics, polymers, etc. Sleeve 26 may be expansible to a degree, but it must have a limiting or maximum size beyond which it will not stretch or expand.

As further indicated in Figures 1 and 3, rubber sleeve 17 is preferably positioned on the inner wall or barrel 22 in an overlapping or double-back manner. Thus, one end of the rubber sleeve is positioned near the lower end of the wall or barrel 22; and the sleeve extends up along the length of the barrel, where it is folded back and brought down and around the bottom of the barrel to the plug element 21.

Intermediate barrel or outer wall 23 extends down below the inner barrel or wall 22 and together with the latter member defines an enclosure 27 for the rubber sleeve 17. The lower end of the outer barrel preferably terminates adjacent the surface of cores entering the inner barrel 22 so that drilling fluid finds it difficult to

penetrate within the latter barrel. The outer surface of the outer wall 23 is spaced from the inner surface of the outer barrel 2 and defines an annular passageway therebetween for the flow of drilling fluid to the bit 1. Ports 13 are provided within the bit such that mud or other drilling fluid flows through the ports in the bit and then upwardly in the annular area 14 between the outer surface of barrel 2 and the borehole wall.

Transverse plate or equivalent cross member 15 is provided within the outer barrel 2 at a point above the supporting member 33. Plate 15 is secured along its outer periphery to the barrel 2, and it is provided with a central hole and suitable packing 16 to permit the outer barrel 2 and its assembly to slide downwardly along rod 6 as coring progresses. Jet ports 10 are provided in cross member 15 to permit drilling fluid to pass through this member and to experience a pressure drop in so passing.

As mud circulation is established through the core bit 1, hydraulic pressure  $P_1$  acts across the cross-sectional area of the outer barrel 2—e.g., on the plate 15 and supporting means 33—to form a piston-like, pushing-down thrust on the bit 1. A lower pressure  $P_2$  is used for inflating the sleeve 17. It will be recognized that  $P_2$  is lower in value than  $P_1$  by virtue of the pressure drop through the nozzles or jet ports 10. Inflation of the sleeve 17 is accomplished by using a static path annular clearance 18 between rod 6 and barrel 12. In other words, the pressure within the inner barrel 22 is substantially equal to  $P_2$ , since substantially no pressure drop occurs through the path 18.

Port 19 is positioned at the lower end of the outer wall 23 to provide fluid communication between recess 27 and the annular passageway 35 for the flow of drilling fluid through the core barrel. Thus, it will be apparent that the pressure  $P_3$  within recess 27 is substantially equal to the pressure of the drilling fluid within the lower end of the annulus 35. As stated above,  $P_3$  is smaller than  $P_2$ , the pressure tending to inflate the sleeve 17 within the recess 27. Hence, whenever drilling fluid is passing through the core barrel embodiment shown in Figure 2, inflation of the sleeve 17 tends to occur. In order to restrain the elastic sleeve from contacting and rubbing against the inner surface of the wall 23, the sleeve is preferably provided with a sleeve 26 of limited expansion as shown in Figure 3, and as described hereinbefore. Sleeve 26 limits the radial expansion of sleeve 17 and should itself have a maximum diameter less than the inner diameter of the wall 23.

In operation, then, referring to Figure 3, sleeve 26 is expanded to its maximum diameter in storage recess 27 by fluid pressure  $P_2$  exerted through the static fluid passage path 18 around rod 6. As can be seen, sleeve 26 keeps pressure  $P_2$  from expanding sleeve 17 into contact with the inner surface of outer wall 23. Contact with this surface would create a friction drag sufficient to prevent movement of the sleeve 17. Fluid cushion 28 also serves to allow the sleeve 17 to pass around the lower end of inner wall or core-receiving barrel 22 without friction drag. Upon contact with a core, sleeve 26 folds against the core inside sleeve 17. Most generally, sleeve 26 experiences a pleating action when it is pinched between sleeve 17 and a core. The pleats extend the length of the core and are usually evenly spaced around the core.

In operation, as barrel 2 is rotated by the rotation of stem 3, the bit 1 cuts into the earth's formation. Plug 21 along with barrel 12 does not rotate. Rod 6 rotates and is supported by pipe stem 3 through member 7. Rod 6 in turn supports swivel element 20 supporting plug 21. Barrel 2 along with non-rotating barrel 12 advances as the bit 1 drills an annular hole. Sleeve 17 is forced downwardly by the hydraulic differential pressure  $P_2$ — $P_3$  against a shoulder 24 constituting the lower end of outer wall or intermediate barrel 23. At this point sleeve 17 is forced around the core 25 and holds the core in com-

pression. The weight of the core is supported at all times by rod 6 which in turn is supported from drill stem 3. When the dogs 5 reach the bottom of their travel in the J-slots 4, all of the pressure on the bit 1 for drilling is removed. Continued rotation of the drill stem and the outer barrel and bit in the absence of a drilling load sets up sufficient vibration or "whip" to cause the core to "drill off." The core barrel and its core may then be retrieved from the borehole in a conventional manner. The squeeze of the sleeve 17 upon the core formation material furnishes a core breaker and a catcher action.

To recapitulate briefly, the elastic sleeves used in the practice of the invention should have certain characteristics. The material used in the sleeves should have a diameter no less than the diameter of a core being cut, and it should be impervious to the flow of fluids. The elastic sleeves should have the properties of radial expansion but should retain their original length when expanded. Furthermore, the sleeves should have a limited fixed diameter beyond which additional pressure will not increase their diameter. While the sleeve assembly described in conjunction with the drawing has been one comprising an inner rubber sleeve and an outer fabric sleeve, it is to be understood that an integral sleeve having the properties as specified will be satisfactory.

Another particular advantage of the present invention is the use of the hydraulic thrust or push on the coring assembly to load the bit. This constant hydrostatic force permits a more uniform action on the coring bit which in turn tends to secure a more representative core sample.

Attention is next directed to Figure 2 in which, as mentioned earlier, is illustrated a preferred embodiment of the invention. Figure 2a shows an upper section of the embodiment, and Figures 2b and 2c show intermediate and lower sections, respectively.

Referring to Figure 2a and Figure 4, there are illustrated the drill stem 3 and outer barrel 2 of the core barrel. A mandrel 3A, which may be considered as an integral part of the drill string, is attached at its upper end to the drill string 3 and is provided with two longitudinal J-slots 4. Pins or dogs 5 are attached to the inner surface of the outer barrel 2 and are adapted to engage the J-slots 4. Thus, as drill stem 3 is moved downwardly with respect to the outer barrel 2, the pins or dogs 5 contact the top of the J-slots in the mandrel 3A. Then by turning drill stem 3 and its attached mandrel 3A with respect to the outer barrel 2, the pins or dogs 5 align themselves with the long straight portions of the J-slots 4 in the mandrel. Outer barrel 2 is then able to move downwardly with respect to drill stem 3, the pins 5 sliding in the slots 4.

Restated briefly, the coring apparatus of Figure 2 is lowered within a borehole with the dogs 5 located within the short leg sections of the J-slots 4. Then, with the bit 1 resting on the bottom of the hole, the dogs 5 are released and placed within the long portions or legs of the J-slots by simply lowering the drill stem 3 relative to the outer barrel 2 and thereafter turning the stem with respect to the barrel. The outer barrel and bit are then free to core under conditions wherein down-flowing mud or other drilling fluid flows through the ports 8 in member 7—where member supports rod 6. Packing or equivalent sealing means 42 between member 7 and ring 40 effects a sliding, fluid-tight seal between the member 7 and the outer barrel 2. Screws 41 interconnecting ring 40 and member 7 enable these members to be drawn together so as to compress the packing 42.

Drilling fluid flows from area 9 through jet ports 10 and exerts a downward thrust on the rotating outer barrel 2 by virtue of the cross-sectional area of the member 15. Packing 16 and a packing nut 43 threadedly engaging member 15 combine to effect a fluid-tight but sliding seal between member 15 and rod 6.

After passing through the ports 10, drilling fluid next passes through ports 11 in the supporting member 33.

Supporting member 33 includes a swivel bearing 34 which enables the inner barrel assembly 12 to remain stationary while the outer barrel 2 rotates. Seals 45 and 46 are provided above and below the swivel 34 to prevent drilling fluid from reaching the swivel. A bearing retainer 48 threadedly engages member 33 and holds bearing 34 in position.

Inner barrel assembly 12 is functionally equivalent to the inner barrel 12 of Figure 1. It varies, however, from the latter barrel somewhat in its structural details. The variations in the structure of the inner barrel of Figure 2 have been made to simplify the assembly and use of the tool.

Referring specifically to the lower portion of Figure 2b and to Figure 2c, it will be seen that the inner barrel assembly 12 includes an upper end member 50, and elongated cylindrical member 51 and an adapter 52. Cylindrical member 51 is connected at its upper end to the upper end member 50 and at its lower end to the adapter 52. The adapter in turn connects to member 53 which directly or indirectly supports intermediate barrel 54 and inner (or core-receiving) barrel 55. Spring-loaded detent means 56 attached to the upper end of the core-receiving barrel engages recess means in the ring 53 to lock the core-receiving barrel within the core barrel assembly. The intermediate barrel 54 is fastened, as for example by a threaded connection, to the ring 53. The core-receiving barrel, as shown in Figure 2c, is fastened to member 60 to which the detent means 56 is attached.

Core-receiving barrel 55 and intermediate barrel 54 define recess 57 in which sleeve 62 is positioned. A lower end member 59 containing port 19 is attached to the lower end of the intermediate barrel 54 and constitutes the lower end of the inner barrel assembly 12 of Figure 2c.

Plug element assembly 21 includes body member 90, collar 72 and cap 91; and it is attached at its upper end to the lower end of rod 6. Swivel bearing 20 enables rod 6 to rotate relative to plug element 21, and seal 61 prevents fluid from contacting the swivel.

One end of sleeve 62—which is elastic and radially expandable up to a point as described earlier—is attached to the collar portion 72 of the plug element 21. The remainder of the sleeve extends down around the cap 91 and then up into the recess 57 where it is folded back and lies against the outer wall surface of the barrel 55.

The operation of the apparatus of Figure 2 will not be described in detail, since it is felt that its operation will be readily apparent from this figure, especially when taken in conjunction with Figures 1 and 3 and the preceding discussion. Accordingly, attention is next directed to Figure 5 in which is illustrated one suitable manner for loading a sleeve assembly of the invention upon an inner core barrel. Different stages of the loading operation are shown in Figures 5a, 5b, and 5c; and the core-receiving barrel in this instance is assumed to be of the readily removable type shown in Figure 2.

The apparatus shown in Figure 5 includes core-receiving barrel 55, plug 71, collar 72, clamps 73, elastic sleeve 74, limiting sleeve 75, and pulling flange 76.

In describing Figure 5, it will be assumed that the core-receiving barrel 55 of a character to receive a three-inch diameter core; that the limiting diameter of the sleeve 75 is about four and one-half inches; and that the sleeve 74 has a normal diameter (unstretched) of two inches. A core barrel of the type shown in Figure 2c having these dimensional characteristics has been successfully used. The intermediate barrel (see 54 in Figure 2c) of this same core barrel has an internal diameter of about five inches.

Referring first to Figure 5a, the loading operation is commenced by clamping one end of each sleeve 74 and 75 to the collar 72. Clamps 73 are provided for this purpose, and it will be noted that the elastic sleeve in this instance is clamped over the limiting sleeve 75. The

remainder of each sleeve is rolled back over the collar 72, and the opposite ends of the sleeves are nipped or held between the inner wall surface of the end of barrel 55 and the plug 71. The maximum diameter of plug 71 is preselected such that this member can be slid or moved through the barrel 55 when the sleeves 74 and 75 are not interposed between this member and the barrel.

With the apparatus in the condition shown in Figure 5a, air, water, or other fluid is passed through collar 72 so as to inflate the sleeves 74 and 75. Collar 72 may be threaded at its outer end to connect to a hose or other member for receiving the inflating fluid. The act of inflation causes both sleeves to expand to the maximum diameter possible for sleeve 75. The expanded sleeves are forced into the position shown in Fig. 5b by movement toward barrel 55; and the inflating fluid is then bled off. Bands are then wrapped around the sleeves to hold them against surface 80 of flange 76, and the plug 71 is pushed out of engagement with the sleeves. The sleeves are pulled around the end of the barrel 55 into the position shown in Figure 5c, and the plug 71 and its attached rod are removed as shown in Fig. 5c. The bands around the sleeves are removed; and the flange 76 is then pulled free. Following this, the external end of barrel 55 is plugged or capped; and the sleeves are re-inflated and manually rolled on the barrel 55 simply by moving collar 72 toward the barrel and working both sleeves on the barrel. The cap or plug on the barrel is then removed, and the sleeve is ready for installation within the core barrel proper.

To facilitate the task of inserting the core-receiving barrel 55 (after it has been sleeve-loaded) within the core barrel of Figure 2c, the bit 1 and the lower end member 59 are preferably removed. Then, as the barrel 55 is inserted, the extension 77 of body portion 90 slides through the collar 72 and is locked in position by means of cap 91. As explained earlier, detent means 56 physically holds the core-receiving barrel itself within the overall core barrel assembly.

Once the barrel 55 is in position, the lower end member 59 is slid over cap 91 and is threaded to the intermediate barrel 54. Bit 1 is then threaded to outer barrel 2, and the core barrel is ready for a coring operation.

While the apparatus shown and discussed in this description constitutes a preferred embodiment of the invention, it will be recognized that numerous changes and variations may be made in the apparatus without departing from the spirit or scope of the invention.

The invention claimed is:

1. An improved coring apparatus which comprises an outer barrel supported from the lower end of a pipe string in a telescoping and co-rotatable manner, an inner barrel disposed within said outer barrel, supporting means including swivel means to support said inner barrel from said outer barrel in a manner to provide relative rotational movement therebetween, an elastic sleeve material surrounding and mounted on the exterior surface of said inner barrel, and means for drawing said sleeve material within said inner barrel and encasing a core as it is cut by said apparatus.
2. An apparatus as defined in claim 1 in which said means for drawing said elastic sleeve within said inner barrel is a rod and swivel assembly suspended from said pipe string, said assembly having disposed at its lower end thereof a plug element to which one end of said elastic sleeve is attached, said swivel enabling said pipe string to rotate relative to said plug element.
3. An apparatus as defined by claim 2 in which said elastic sleeve comprises a rubbery material.
4. An apparatus as defined by claim 3 in which said rubbery sleeve is reinforced in a longitudinal direction, thus restricting longitudinal expansion of the sleeve.
5. An improved coring apparatus for use at the lower end of a pipe string which comprises an outer barrel sup-

ported from the lower end of said pipe string in a telescoping and co-rotatable manner, an inner core-receiving barrel disposed within said outer barrel, supporting means including a swivel joint to support said inner barrel from said outer barrel and to enable rotational movement therebetween, a rubbery sleeve surrounding said inner barrel and supported therefrom, a plug element within said inner barrel, means including a swivel to support said plug element from said pipe string and to enable rotational movement of said pipe string relative to said plug element, said sleeve being attached at one end to said plug element and adapted to enter within said inner barrel upon downward movement of said inner barrel relative to said plug element.

6. An improved coring apparatus for use at the lower end of a pipe string which comprises an outer barrel supported from the lower end of said pipe string in a telescoping and co-rotatable manner, a core-receiving barrel mounted within said inner barrel in a manner to provide relative rotational movement therebetween, a plug element disposed within said core-receiving barrel and adapted to move along the length thereof, means supporting said plug element from said pipe string and providing freedom of rotational movement between said plug element and said pipe string, an elastic rubber sleeve disposed around and supported by said inner barrel, one end of said sleeve being attached to said plug element and adapted to be drawn within said inner barrel upon downward movement of said inner barrel relative to said plug element.

7. An apparatus as defined in claim 6 including an intermediate barrel positioned between said inner and outer barrels, said intermediate barrel defining an enclosure with said inner barrel for said sleeve, and being adapted to rotate with said outer barrel.

8. An improved coring apparatus which comprises an outer barrel supported from the lower end of a pipe string in a telescoping and co-rotatable manner, a core-receiving barrel disposed within said outer barrel, supporting means including a swivel to support said core-receiving barrel from said outer barrel in a manner to enable relative rotational movement therebetween, an elastic sleeve surrounding and mounted on the exterior surface of said core-receiving barrel, a flexible, non-stretching sleeve co-extensive with said elastic sleeve and encasing said elastic sleeve around said core-receiving barrel, and means for drawing said sleeves within said inner barrel and encasing a core as it is cut by said apparatus.

9. An apparatus as defined in claim 8 in which the elastic sleeve is rubber and the non-stretching sleeve is a fabric sleeve.

10. An improved coring apparatus which comprises an outer barrel supported from the lower end of a pipe string in a telescoping and co-rotational relation, a core-receiving barrel disposed within said outer barrel, means including a swivel to support said core-receiving barrel from said outer barrel, a third barrel rotatable with said outer barrel and interposed between said outer barrel and said core-receiving barrel, said third barrel and said core-receiving barrel defining an annular recess therebetween, a plug element longitudinally moveable within said core-receiving barrel and supported from said pipe string by means including a swivel, said swivel enabling said pipe string to rotate relative to said plug element, an elastic sleeve attached at one end to said plug element and extending into said recess, said sleeve being supported from said core-receiving barrel and having a maximum diameter less than the internal diameter of said third barrel.

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