April 7, 1964 T. MORI 3,127,943

WIRE LINE CORE BARREL

Filed March 5, 1962 2 Sheets-Sheet 1

FIG. 1.

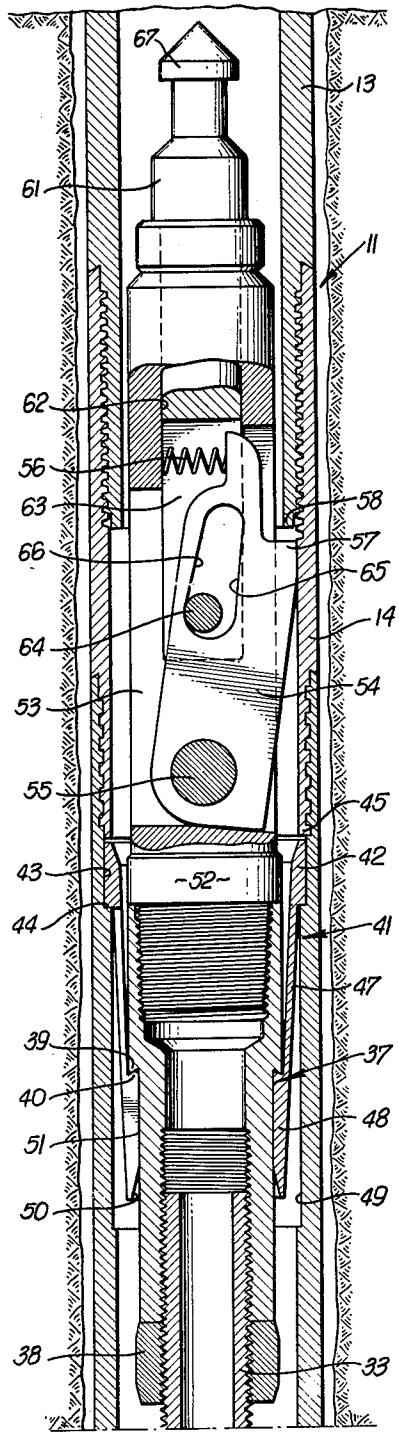
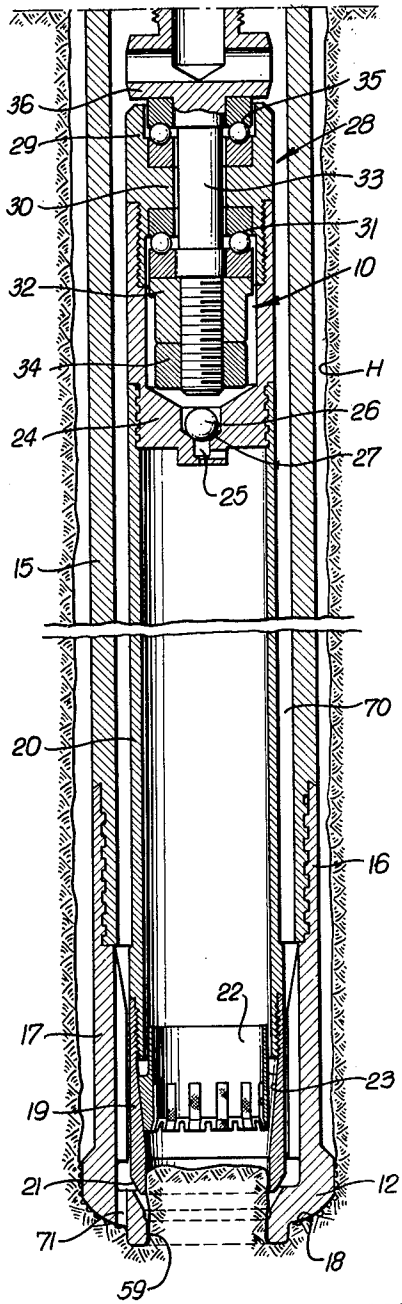


FIG. 1a.



INVENTOR.
TAKESHI MORI
BY
Bernard Kriegel
ATTORNEY.

April 7, 1964 T. MORI 3,127,943

WIRE LINE CORE BARREL

Filed March 5, 1962 2 Sheets-Sheet 2

FIG. 2.

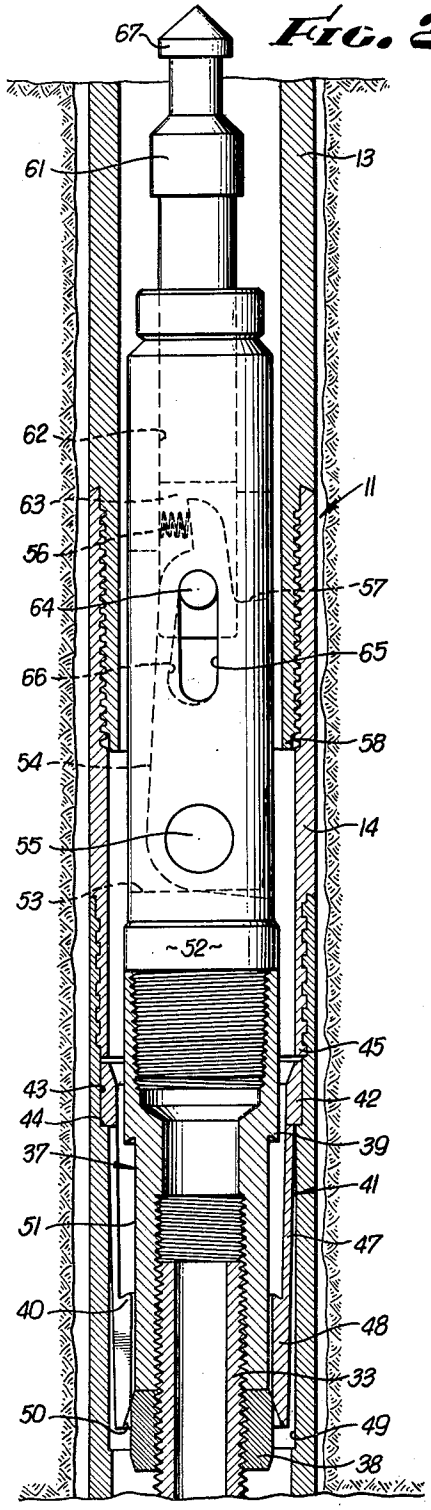


FIG. 3.

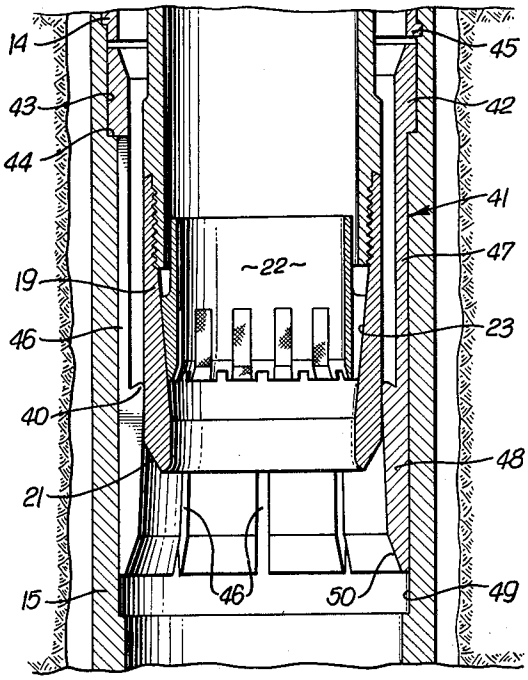
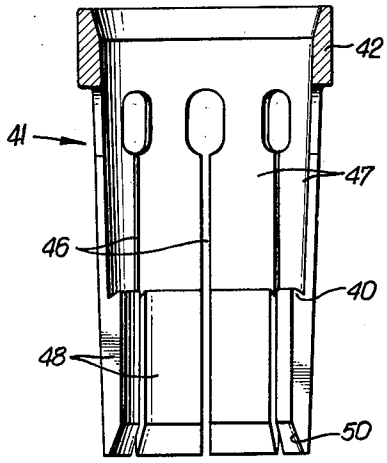


FIG. 4.



INVENTOR.
TAKESHI MORI
BY
Bernard Kriegel
ATTORNEY.

United States Patent Office 3,127,943 Patented Apr. 7, 1964

3,127,943

WIRE LINE CORE BARREL

Takeshi Mori, Salt Lake City, Utah, assignor to Christensen Diamond Products Company, Salt Lake City, Utah, a corporation of Utah

Filed Mar. 5, 1962, Ser. No. 177,560
8 Claims. (Cl. 175—246)

The present invention relates to apparatus for securing core samples in well bores, and more particularly to wire line core barrels.

In wire line core barrels, in which an inner core barrel mechanism is lowered through a string of drill pipe and releasably latched in an outer barrel to which the core bit is secured, it is desirable to suspend the inner barrel on a suitable upper supporting or stop shoulder fixed to the outer barrel in such manner that the outer barrel and bit can rotate without rotating the inner barrel in which the core is received. The inner barrel must pass through the supporting shoulder, which is of a restricted diameter, when being lowered in place within the outer barrel and when being elevated therethrough, which has heretofore limited the diameter of the inner barrel that could be used and has resulted in the obtaining of a correspondingly reduced diameter core.

Previous attempts have been made to use a larger diameter inner core barrel by eliminating the stop shoulder completely, the lower end of the inner core barrel then resting upon the core bit. This arrangement has not been satisfactory since the inner barrel then tends to rotate with the core bit and outer barrel or housing, resulting in poor core recovery. Moreover, at times, the lower end of the inner core barrel structure is swedged inwardly.

Accordingly, it is an object of the present invention to provide a core barrel apparatus of the wire line type in which a larger diameter inner core barrel can be lowered within an outer core barrel and appropriately suspended therewithin.

Another object of the invention is to provide a core barrel apparatus of the wire line type, in which a larger diameter inner core barrel can be lowered and suspended within an outer core barrel without resting on the core bit, the outer barrel being rotatable without rotating the inner barrel.

A further object of the invention is to provide a core barrel apparatus of the wire line type embodying an expansible supporting or stop device through which an inner core barrel can pass, which has a larger diameter than the normal diameter of the device when supporting the inner barrel in suspension.

This invention possesses many other advantages, and has other objects which may be made more clearly apparent from a consideration of a form in which it may be embodied. This form is shown in the drawings accompanying and forming part of the present specification. It will now be described in detail, for the purpose of illustrating the general principles of the invention; but it is to be understood that such detailed description is not to be taken in a limiting sense, since the scope of the invention is best defined by the appended claims.

Referring to the drawings:

FIGURES 1 and 1*a* together constitute a longitudinal section, with parts shown in side elevation, of a wire line core barrel apparatus, with the inner core barrel portion of the apparatus latched in place, FIG. 1*a* constituting a lower continuation of FIG. 1;

FIG. 2 is a longitudinal section through the upper or suspension portion of the core barrel apparatus, illustrating the upper, inner portion of the apparatus moving through the suspension device;

FIG. 3 is an enlarged longitudinal section through the suspension portion of the apparatus, illustrating the lower portion of the inner core barrel passing through such suspension portion;

FIG. 4 is a longitudinal section through the expandible core barrel suspension device.

The apparatus illustrated in the drawings is of the wire line core barrel type, in which an inner core barrel structure **10** is lowered through a string of drill pipe (not shown) connected to an outer core barrel or housing **11**, for the purpose of rotating a core head or bit **12** attached to the latter. After a desired length of core has been formed and moved into the inner barrel structure, it is retrieved by elevating the inner barrel structure on a wire line (not shown) through the drill pipe to the top of the hole.

As specifically illustrated, the outer core barrel or housing **11** includes a tubular upper section **13** adapted to be suitably secured to the lower end of the string of drill pipe, the lower end of the upper section being threaded into an intermediate tubular section **14**, which is, in turn, threaded into the upper end of a lower tubular section **15** threaded into the upper box end **16** of a bit shank **17** having the core head **12** at its lower end for cutting the annular portion of the bottom **18** of the hole H, thereby producing a core adapted to pass upwardly into the inner core barrel structure **10**. The core head or bit **12** illustrated may be of the diamond type, although it is to be understood that any suitable core bit can be used.

The inner core barrel mechanism **10** can be pumped or allowed to gravitate down through the string of drill pipe, being capable of mounting within the outer core barrel **11** in suspended relation with respect thereto, and of being releasably latched in position to prevent its withdrawal or upward movement from the outer core barrel until desired. As specifically shown, the lower section **19** of a tubular non-rotatable inner core barrel **20** has a tapered guide or nose **21** inclined in a downward and inward direction, this lower guide portion having a suitable core catcher **22** therein adapted to coact with an internal tapered surface **23** of the section **19** for the purpose of embracing the core when it is formed and preventing it from dropping out of the inner core barrel.

The inner core barrel **20** extends upwardly within the outer core barrel **11** and is of a suitable length, which may, for example, be 20 feet. The upper end of the inner core barrel is threadedly secured to a pressure relief valve mechanism or sub **24** having a relief passage **25** therethrough communicating with the interior of the inner core barrel and opening into the tubular sub **24**. A one-way check valve member **26**, such as a ball, is adapted to move downwardly into engagement with a companion seat **27** surrounding the passage to prevent downward flow of fluid into the core barrel, the ball being adapted to move upwardly from engagement with its seat **27** to permit fluid in the inner core barrel to move upwardly therefrom as the core moves relatively upwardly in the inner barrel.

The inner barrel **20** is carried in suspension from the outer barrel **11**, but will not rotate therewith because of a swivel connection **28** therebetween. As disclosed, the upper portion of the pressure relief mechanism or sub **24** is threadedly attached to an outer swivel head **29** having an internal flange **30**, the lower side of which bears upon a suitable lower thrust ball bearing device **31** carried by a lower bearing support **32** threaded onto a mandrel **33**, its unthreading being precluded by a suitable lock nut **34** threaded on the mandrel and bearing against the lower support. An upper thrust ball bearing device **35** bears upon the upper side of the internal flange **30**, the upper end of the upper thrust bearing engaging an external flange **36** integral with the mandrel.

The mandrel itself is threaded upwardly into a suspension head 37, being prevented from inadvertently unscrewing therefrom by a suitable lock nut 38, the suspension head having a downwardly facing shoulder 39 adapted to rest upon an inwardly directed stop shoulder 40 formed upon a supporting sleeve 41 which is secured to the outer housing or core barrel 11. As shown, the sleeve includes an upper circumferentially continuous portion 42 received within a recess 43 in the outer barrel between an upwardly facing shoulder 44 on the upper portion of the lower housing section 15 and the lower end 45 of the intermediate section 14.

The sleeve 41 is provided with a plurality of longitudinal and circumferentially spaced slots 46 opening through the lower end of the sleeve and forming spring-like latch legs 47 having lower inwardly directed feet 48, the latch legs and feet normally tending to occupy an inward position with the feet 48 disposed under the downwardly facing shoulder 39 of the suspension head. The feet 48 and latch legs 47 are adapted to be cammed outwardly into an elongate recess 49 in the lower housing section 15 so as to have an effective internal diameter which is slightly greater than the maximum external diameter of the inner core barrel 20 and its lower portion 19. However, when occupying the normal inward position, such as disclosed in FIG. 1, the effective internal diameter across the latch feet 48 is substantially less than the outside diameter of the inner core barrel 20.

The lower inner portions 50 of the latch feet 48 are inclined in a downward and outward direction so as to be cammed outwardly into the recess or enlarged diameter bore 49 of the lower housing section 15 when parts of the inner core barrel mechanism 10 move upwardly thereagainst. To insure against inadvertent release of the latch feet 48 from the suspension head 37, the lower shoulder 39 of the suspension head is inclined in a downward and outward direction, engaging the upper ends 40 of the feet 48, which are inclined in the same direction. By virtue of the coaction between these inclined surfaces, the suspension head 37 tends to hold the latch feet 48 inwardly against the periphery 51 of the head and under its shoulder 39.

When the inner core barrel structure 10 has been lowered through the drill string and is appropriately mounted in the outer core barrel 11, with the suspension head 37 carried by the spring-like latch feet 48, it is prevented from inadvertent removal and substantial upward movement within the core barrel by a suitable latch mechanism. As shown, the upper end of the suspension head 37 is threaded onto the lower end of an elongate latch body 52 having a longitudinal slot 53 therethrough, in which a latch dog 54 is pivotally mounted on a hinge pin 55 extending across the slot. A compression spring 56 bears against the upper free end of the latch dog and tends to swing it outwardly against the intermediate housing section 11, so that a locking nose 57 on the dog is disposed under a latch shoulder 58 provided by the lower end of the upper section 13. The parts are so proportioned that when the inner core barrel mechanism 10 has been disposed in the outer core barrel 11 with the suspension head 37 engaging the shoulder 40 of the latch feet 48, the lower tapered end 21 of the inner core barrel is disposed slightly above the core head or bit 12 and adjacent to the central opening 59 in the core head or bit through which the core will enter the apparatus. At this time, the locking nose 57 of the latch dog is disposed immediately under the latch shoulder 58, to prevent any substantial upward movement of the inner core barrel device 10 relative to the outer core barrel 11.

When the inner core barrel structure 10 is to be retrieved from the outer core barrel, a suitable overshot (not shown) is lowered on a wire line (not shown) and will become coupled to a spear head pull bar or plunger 61 slidable longitudinally in a bore 62 in the upper end of the latch body 52, this plunger having a slot 63 aligned with the latch body slot 53 and in which the latch dog 54 is movable. The plunger has a retracting pin 64 secured thereto and extending across its slot 63 and in an enlarged opening 65 in the latch dog, the opening having an inclined side 66 when the latch dog 54 is disposed under the latch shoulder 58. When the overshot engages the upper spear head 67, an upward pull is taken on the wire line. The pull bar 61 is pulled upwardly causing its pin 64 to engage the inclined face 66 of the slot 65 and shift the latch 54 inwardly of the latch shoulder 58 and fully within the confines of the latch body 52, the latch being held in such position, as illustrated in FIG. 2. The inner core barrel mechanism 10 can now be elevated from the outer core barrel mechanism 11 and through the entire string of drill pipe to the top of the well bore for retrieval of the core from the inner core barrel 20. The core catcher 22 will have moved downwardly and wedges against the tapered inner surface 23 of the guide portion of the inner core barrel to prevent the core from dropping out of the barrel.

As described above, the latch feet 48 and latch legs 47 inherently tend to occupy an inward position, such as disclosed in FIG. 1, providing a restriction within the outer core barrel. The inner core barrel mechanism 10 is lowered through the string of drill pipe. When the tapered guide 19 reaches the latch feet 48, its tapered nose 21 will engage the stop shoulder portion 40 of the latch device and cam the legs 47 and feet 48 outwardly into the recess or enlarged bore 49 of the outer housing 11, the inner core barrel then being movable downwardly through the expanded latch legs and feet, such as shown in FIG. 3. The entire inner core barrel mechanism 10 below the suspending head shoulder 39 can now move downwardly through the suspension latch device 41, and when the reduced outside diameter portion 51 of the suspension head comes opposite the latch feet 48, the latter will inherently retract and form a restriction in the outer core barrel, positioning the upwardly facing stop shoulder 40 for engagement by the downwardly facing companion stop shoulder 39 on the suspension head, the parts then being in the position illustrated in FIGS. 1 and 1*a*. At this time, the latch dog 54 has been shifted outwardly by the spring 56 and under the latch shoulder 58.

With the inner barrel structure 10 latched and suspended in the outer barrel 11, the lower end 21 of the inner core barrel 20 is spaced slightly above the core head or bit 12, there being no contact therebetween. The coring operation can now take place, the drilling string being rotated to rotate the outer core barrel 11 and the core bit 12, appropriate downweight being imposed through the drill string on the latter to cut the annular portion of the bottom of the hole and produce the core, the core formed passing relatively upwardly through the core catcher 22 and into the inner core barrel 20. During the drilling action, drilling fluid is pumped down through the string of drill pipe, passing through the annular space 70 between the inner and outer core barrels 10, 11 and through fluid nozzles or ports 71 in the core bit head onto the bottom 18 of the hole, for the purpose of carrying the cuttings from the bottom of the hole and around the exterior of the outer core barrel 11 and the drill pipe to the top of the well bore. During the rotation of the outer core barrel 11 and the bit 12, the latch mechanism 52—58, etc., suspension head 37 and mandrel 33 will rotate with it. However, such rotation will not be imparted to the inner core barrel 20 in view of the swivel connection 28 between it and the mandrel provided by the upper and lower thrust bearings 35, 31. As a result, the inner core barrel 20 is not rotated around the core, which might adversely effect it and interfere with proper core recovery. During the entry of the core into the inner barrel 20, the fluid thereabove passes out through the passage 25 unseating the check valve mem-

ber 26 and moving out of the core barrel 20 and through the swivel region into the outer core barrel 11.

When the appropriate length of core has been produced, it can be retrieved by lowering of the overshot on the wire line and coupling the former to the spear head pull bar 61, the latter then being pulled upwardly by taking an upward strain on the wire line, causing the retracting pin 64 to move upwardly along the latch 54 and shift it inwardly to the released position, such as disclosed in FIG. 2. As the inner core barrel mechanism 10 moves upwardly in the outer core barrel mechanism 11, any of its parts of larger diameter than the retracted normal internal diameter across the latch feet 48 will expand the latch feet and the legs 47 outwardly, such as disclosed in FIG. 2, by engaging the lower tapered surface 50 on the latch feet. The entire inner core barrel mechanism 10 can be pulled upwardly through the latch feet and the latch legs, expanding the latter outwardly to their full extent, such as disclosed in FIG. 3, until the entire inner core barrel mechanism is elevated above the outer core barrel 11 and into the drill pipe. The elevation of the wire line can continue to remove the inner core barrel with the core therein completely from the drill pipe, the core catcher 22 preventing loss of the core from the inner core barrel.

It is, accordingly, apparent that a wire line type of coring device has been provided, in which the outside diameter of the core barrel can be made larger than the suspension shoulder which will eventually support it after it has been appropriately latched in place. The larger external diameter of the core barrel means that its internal diameter can be made correspondingly larger, resulting in the ability to provide a core bit that can cut a larger diameter core received within the larger internal diameter core barrel. The suspension shoulder 40 on the sleeve 41, if incapable of outward expansion, would have the diameter illustrated in FIG. 1, which would mean that the outside diameter of the core barrel 20 would have to be correspondingly smaller. However, by virtue of providing the expansible suspension elements, such as the spring-like legs 47 and feet 48 on the latch sleeve, a larger core barrel can be used, since it will cam or expand the stop or suspension shoulder portion 40 outwardly until the core barrel 20 has been run into its desired position within the outer core barrel 11, after which the latch device 47, 48 can inherently retract to a smaller effective diameter to provide the shoulder 40 upon which the suspension head 37 can rest. The suspension mechanism may rotate with the outer core barrel 11, but the swivel 28 will insure that the inner barrel 20 need not rotate with the outer barrel.

I claim:

1. In coring apparatus: an outer core barrel; an inner core barrel structure adapted to be lowered into and elevated from said outer core barrel; suspension means carried by said outer barrel and through which said inner barrel structure can pass; said suspension means comprising expandible and contractable supporting instrumentalities engageable by and expanded outwardly by said inner barrel structure; said inner barrel structure having a suspension member at its upper portion adapted to engage said instrumentalities when contracted to suspend said structure in said outer core barrel.

2. In coring apparatus: an outer core barrel; an inner core barrel structure adapted to be lowered into and elevated from said outer core barrel; suspension means carried by said outer barrel and through which said inner barrel structure can pass; said suspension means comprising inherently contractable and outwardly expandible supporting instrumentalities engageable by and expanded and held outwardly by a lower portion of said inner barrel structure when passing therethrough; said inner barrel structure having a suspension member at its upper portion adapted to engage said instrumentalities when contracted to suspend said structure in said outer core barrel.

3. In coring apparatus: an outer core barrel; an inner core barrel structure adapted to be lowered into and elevated from said outer core barrel; suspension means carried by said outer barrel and through which said inner barrel structure can pass; said suspension means comprising inherently contractable and outwardly expansible supporting instrumentalities having a normal contracted internal diameter less than that of the maximum outside diameter of said inner core barrel structure and engageable by and expanded outwardly by said inner barrel structure when passing therethrough; said inner barrel structure having a suspension member at its upper portion; said suspension member having a periphery of an outside diameter no greater than said normal contracted internal diameter and an outwardly directed shoulder above said periphery for resting upon said instrumentalities when said instrumentalities are contracted about said periphery to suspend said structure in said outer core barrel.

4. In coring apparatus: an outer core barrel; an inner core barrel; a mandrel; a swivel mounting said inner barrel on said mandrel; expandible and contractable suspension means carried by said outer barrel and having a contracted internal diameter less than the outside diameter of said inner barrel and engageable by and expanded outwardly by said inner barrel to an expanded internal diameter greater than the outside diameter of said inner barrel to permit said inner barrel to pass downwardly through said suspension means; and a suspension member on said mandrel adapted to rest upon said suspension means when contracted to suspend said inner barrel in said outer barrel.

5. In coring apparatus: an outer core barrel; an inner core barrel; a mandrel; a swivel mounting said inner barrel on said mandrel; inherently contractable and outwardly expandible suspension means carried by said outer barrel and having a normal contracted internal diameter less than that of the maximum outside diameter of said inner core barrel and an expanded internal diameter greater than the outside diameter of said inner barrel to permit said inner barrel to pass through said suspension means; and a suspension member on said mandrel having a periphery of an outside diameter no greater than the contracted internal diameter of said suspension means and an outwarldy directed shoulder above said periphery for resting upon said suspension means when said suspension means is contracted about said periphery to suspend said inner barrel in said outer barrel.

6. In coring apparatus: an outer core barrel; an inner core barrel structure adapted to be lowered into and elevated from said outer core barrel; a suspension sleeve carried by said outer barrel and having circumferentially spaced, laterally expandible and contractable latch feet engageable by and expanded outwardly by said inner barrel structure; said inner barrel structure having a suspension member at its upper portion adapted to engage said feet when contracted to suspend said structure in said outer core barrel.

7. In coring apparatus: an outer core barrel; an inner core barrel structure adapted to be lowered into and elevated from said outer core barrel; a suspension sleeve carried by said outer barrel and having circumferentially spaced, laterally expandible and inherently contractable latch feet; said latch feet having a normal contracted internal diameter less than that of the maximum outside diameter of said inner core barrel structure and engageable by and expanded outwardly by said inner core barrel structure when passing therethrough; said inner barrel structure having a suspension member at its upper portion; said member having a periphery of an outside diameter no greater than said normal contracted internal diameter of said feet and an outwardly directed shoulder above said periphery for resting upon said feet when contracted about said periphery to suspend said structure in said outer core barrel.

8. In coring apparatus: an outer core barrel; an inner core barrel; a mandrel; a swivel for mounting said inner barrel on said mandrel; a suspension sleeve carried by said outer barrel and having circumferentially spaced, laterally expandible and contractable latch feet engageable by and expanded outwardly by said inner core barrel, said latch feet having a contracted internal diameter less than the outside diameter of said inner barrel and an expanded internal diameter greater than the outside diameter of said inner barrel to permit said inner barrel to engage and expand said feet and pass downwardly through said feet; and a suspension member on said mandrel adapted to rest upon said feet when contracted to suspend said inner barrel in said outer barrel.

References Cited in the file of this patent

UNITED STATES PATENTS

2,134,988	Stokes	Nov. 1, 1938
2,167,991	Oliver	Aug. 1, 1939
2,184,361	Noble	Dec. 26, 1939
2,712,922	Stokes	July 12, 1955
3,004,614	Janson et al.	Oct. 17, 1961