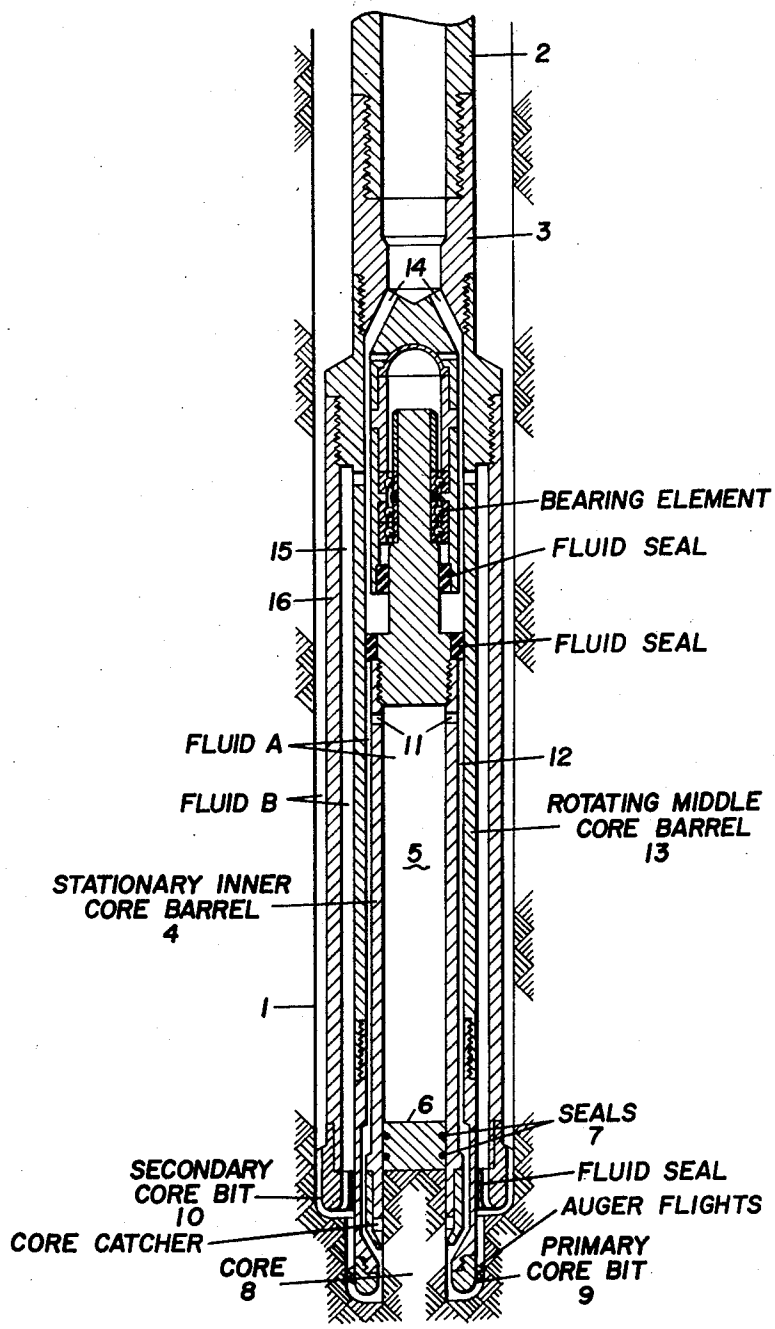
Dec. 2, 1958 C. D. COCHRAN 2,862,691

CORING BIT ASSEMBLY

Filed April 3, 1956



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United States Patent Office 2,862,691 Patented Dec. 2, 1958

2,862,691

CORING BIT ASSEMBLY

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Application April 3, 1956, Serial No. 575,833

3 Claims. (Cl. 255—72)

The present invention is concerned generally with the coring of subterranean strata, and it is particularly directed toward coring operations that are involved in the exploration and drilling for petroleum. The invention is particularly adaptable for securing a representative core, whose fluid content is unaltered from the formation from which it is obtained. In accordance with the present invention, a coring assembly is used which comprises a primary coring bit and a secondary coring bit, and furthermore, comprises the use of a primary sealing fluid and the use of a secondary drilling fluid.

In the prospecting and drilling for oil, it is a conventional procedure during the drilling of the bore hole to determine the character and nature of the substrata through which the bore hole is being drilled. One method is to periodically remove cores of the formations 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 an earth substrata. In general, these coring devices or core bits drill an annular hole, leaving a center undisturbed core which is broken off and taken to the surface by various means.

However, heretofore, in the art a problem has existed with respect to securing uncontaminated and undisturbed 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 of sand are undisturbed with respect to each other. It is necessary to secure undisturbed sand cores if accurate permeability and porosity measurements are to be determined. Heretofore, in the art the core is usually forced into a rigid steel sleeve 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 in the core barrel, thus preventing the securing of the desired long core. The experience has been that many formations in an unconsolidated state cannot be pushed very far into a steel tube before the material will not sustain its own weight. In order to overcome this, it has been the practice to secure cores of relatively short length. 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 and with the same orientation with respect to each other.

The process of the present invention may be fully understood by reference to the drawing, illustrating one adaptation of the same. Referring to the drawing, a coring assembly of the present invention is shown disposed in the bottom of bore hole **1** attached to the lower end of a drill stem **2** by means of drill collar **3**. The assembly comprises an inner stationary core barrel element **4**. This stationary barrel contains within the barrel a primary fluid A which is preferably of a high viscosity so as to act as a sealing agent. A movable sealed plug element **6** suitably

sealed by seal **7** is disposed at the bottom of the inner stationary barrel **4** and moves upwardly as the core **8** enters the inner core barrel **4**. The inner primary core bit **9** as well as outer secondary core bit **10** is rotated by means of the pipe string. Primary core bit **9** cuts an annulus about core **8**, thus permitting the core to enter core barrel **4**. In operation, fluid A in area **5** flows through port elements **11** into the annulus **12** which is the space between the core barrel **4** and an intermediate rotating core element **13**. This element contains rigidly attached to the bottom thereof the primary core bit **9**.

Fluid A from the area **5** flows downwardly in this annulus around primary core bit **9** and seals off the outer circumference of core **8** as it enters stationary core retaining barrel **4**. Excess liquid from space **5** flows upwardly from the core bit **9** and commingles at the lower point of secondary core bit **10** with a secondary drilling fluid B which may be a conventional drilling fluid. The secondary drilling fluid flows downwardly within the pipe string **2** and within the drill collar **3**. The secondary fluid flows through ports **14** and into the annulus **15** which is the space between the inner rotating core barrel **13** and an outer rotating core barrel **16**. Core barrel **16** contains attached to its lower end the secondary coring bit **10**.

The secondary fluid flows downwardly in area **15** around the lower edges of coring bit **10** and upwardly in the area between the outer core barrel and the bore hole wall.

The extent to which primary core bit **9** extends below secondary core bit **10** may vary appreciably as, for example, from about 4–20 inches. It is, however, preferred that primary coring bit **9** extend about 6–8 inches below secondary coring bit **10**.

As pointed out heretofore, the present invention is concerned with an improved two-stage, two-fluid coring device for obtaining cores in an unaltered state. In operation, the actual core is cut using a thin inner primary coring bit and employing a fluid A, preferably, a viscous fluid as the cutting fluid. Fluid A is forced from the storage chamber, the core retaining barrel, to the cutting face of the primary bit by a free floating plug. This fluid, with the aid of auger teeth, carries the cuttings from the cutting plane of the primary bit to the cutting plane of the secondary outer bit where the cuttings are picked up by fluid B, a conventional mud fluid and carried to the surface. In operation, fluid A serves a dual purpose of carrying chips and sealing the core as it is cut. The secondary bit cuts the hole to gauge size, using fluid B.

With respect to fluid A, it is preferred this fluid be one which flows readily under the ambient conditions that prevail during coring operations and that it be chemically inert toward the coring equipment as well as toward the core sample. Further desirability of this sealing agent is that it have lubricating qualities to reduce the friction that exists between the core and the core barrel, as well as to effectively coat the core with an effective sealing film whereby virgin fluids are trapped in the core being cut. One specific fluid would be an asphalt with preferred properties of specific gravity of 1 to 1.2, a viscosity of 800 centistokes or more, and with a high surface tension whereby the core is coated and sealed without penetration of this fluid into the core. Fluid A would not be limited to this material, and may include other materials comprising a viscous or sealing fluid, such as a thermo-setting plastic or any chemical-setting substance, such as a time-setting plastic and the like.

Both the primary and the secondary coring bits cut or drill annular holes. In a preferred operation, it is desirable that the thickness of the annulus of the primary coring element be about ¼–½ the thickness of the outer coring element. In general, it is preferred that the diameter of the actual core be from 3–6". The thickness

of the annulus cut by the outer coring assembly should be about 5 to 2".

What is claimed is:

1. An improved core barrel assembly adapted to be fastened to the lower end of a drill string, comprising an inner non-rotating core-retaining barrel, a primary rotating barrel positioned about and extending below said core-retaining barrel with said core-retaining barrel and said primary rotating barrel defining an annular space, the lower end portion of said primary core barrel and the lower end of said core-retaining barrel defining an annular passageway, a primary core bit attached to the lower end of said primary rotating barrel, a secondary rotating barrel positioned about said primary rotating barrel, a secondary core bit attached to the lower end of said secondary rotating barrel, ports positioned in the upper area only of said core-retaining barrel establishing fluid communication between the inner space of said core-retaining barrel and said annular space between said core-retaining barrel and said primary rotating barrel, a seal in the top portion of said annular space between the core-retaining barrel and the primary rotating barrel and above said ports, said annular space terminating at its lower end in said annular passageway, other ports establishing fluid communication between the inner space of said drill string and the annular space between said primary rotating barrel and said secondary rotating barrel, and a movable sealed plug element at the bottom end of said inner non-rotating core-retaining barrel adapted to move farther within said core-retaining barrel in response to the entry of a core.

2. An improved core barrel assembly adapted to be fastened to the lower end of a drill string comprising an inner non-rotating core-retaining barrel with its upper end closed, a primary rotating barrel positioned about and extending below said core-retaining barrel with said core-retaining barrel and said primary rotating barrel defining an annular space, a primary core bit attached to the lower end of said primary rotating barrel, the lower end portion of said primary core barrel and said primary core bit together with the lower end of said core-retaining barrel defining an annular passageway, a secondary rotating barrel positioned about said primary rotating barrel,

a secondary core bit attached to the lower end of said secondary rotating barrel, an adapter attaching said primary rotating barrel and said secondary roating barrel to said drill string in a manner such that rotating of the drill string rotates said primary rotaing barrel and said secondary rotating barrel, a bearing element adapted to support said core-retaining barrel from said adapter in a non-rotating position within said primary rotating barrel, ports positioned in the upper area of said core-retaining barrel establishing fluid communication between the inner space of said core-retaining barrel and said annular space, a seal in the top portion of said annular space between the core-retaining barrel and the primary rotating barrel and above said ports, said annular space terminating at its lower end in said annular passageway, other ports establishing fluid communication between the inner space of said pipe string and the annular space between said primary rotating barrel and said secondary rotating barrel, and a movable sealed plug element at the lower end of said inner non-rotating core-retaining barrel adapted to move upward within said core-retaining barrel in response to the entry of a core whereby, as the core enters said core-retaining barrel, fluid contained within said core-retaining barrel is caused to flow through said ports and flow downwardly in said annular space and through said annular passageway and coat the core immediately as it is cut by the bit.

3. An apparatus as defined by claim 2 in which the primary core bit is positioned below said secondary core bit.

References Cited in the file of this patent

UNITED STATES PATENTS

2,073,877	Oliver	Mar. 16, 1937
2,146,263	Johnston	Feb. 7, 1939
2,264,449	Mounce	Dec. 2, 1941
2,587,231	Schierding	Feb. 26, 1952
2,615,680	Kjellman et al.	Oct. 28, 1952
2,703,697	Walker	Mar. 8, 1955

FOREIGN PATENTS

1,107,204	France	Dec. 29, 1955