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CORING DEVICE

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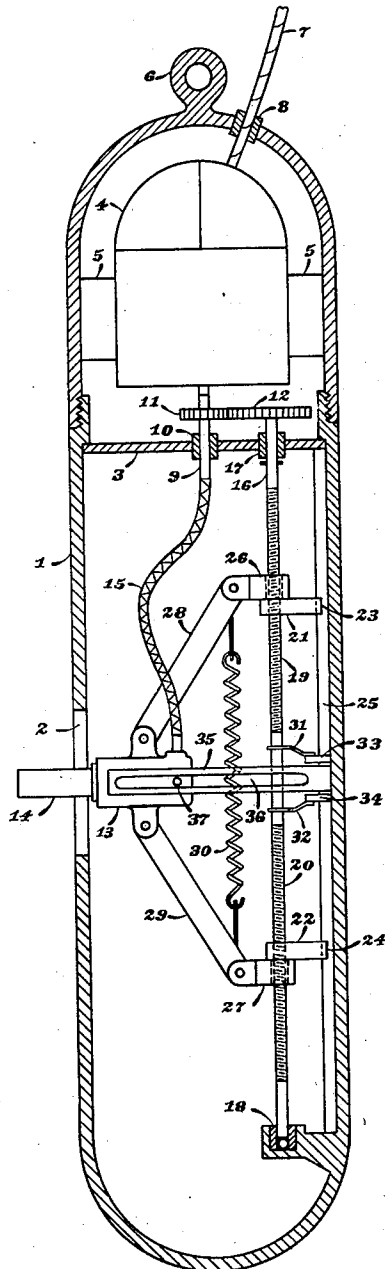


Fig. 1

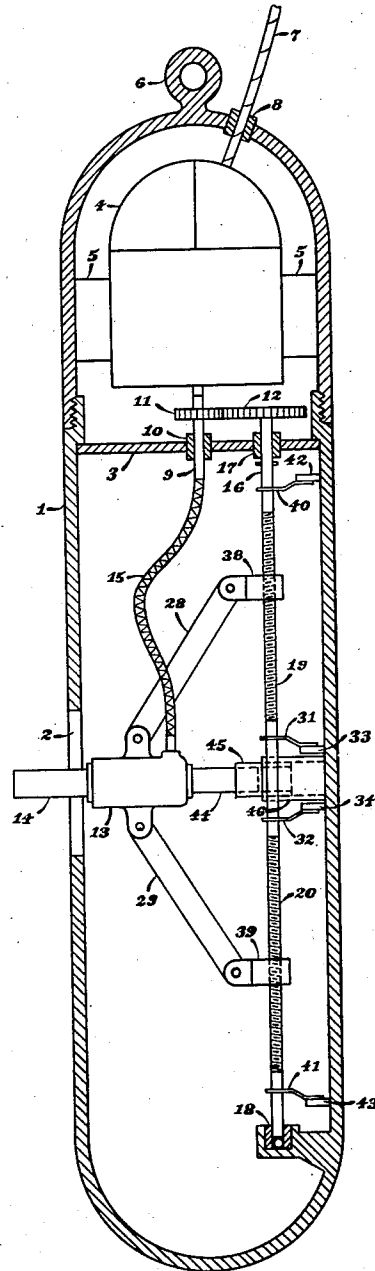


Fig. 2

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CORING DEVICE

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5 Claims. (Cl. 255—1.4)

The present invention relates to improvements in sampling machines, and particularly a core cutting device which is adapted to be lowered into bore holes for the purpose of obtaining core samples of subsurface formations at different levels.

This application is a continuation-in-part of my copending application Serial Number 479,137, filed March 13, 1943, and entitled Coring device.

It is an object of this invention to take core samples within a well bore in such a manner that when the samples are brought to the surface the components thereof will be in the same relative position as when in the original formation.

A further object of this invention is to provide a core cutting device, the operation of which may be controlled from the earth's surface when the device is positioned at a predetermined level in the well bore.

Other objects of this invention are to provide a core cutting device which is comparatively simple in construction, durable, highly efficient and reliable in use, and which may be manufactured at low cost.

My invention will be further understood with reference to the accompanying drawing, in which Figs. 1 and 2, partly in section, represent two modifications of my core cutting device. In the figures, corresponding elements are similarly numbered.

Referring to the drawing, particularly Fig. 1, 1 designates an elongated, closed casing provided with an aperture 2 in the wall thereof.

The casing 1 is divided into two compartments by the partition 3, the upper compartment enclosing the electric motor 4 rigidly positioned within the compartment by brackets 5 affixed to the wall thereof. The upper end of the casing 1 is further provided with an eye 6 to which a cable may be attached for lowering or raising the casing in the well bore. An electric conduit 7 is introduced through the casing to supply current for the motor 4 and is insulated from the wall by means of insulator 8. The motor shaft 9 projecting downwardly through the bearing 10 in partition 3 is provided with a small gear 11 to rotate the large gear 12 as will be hereinafter more fully described.

Within the lower compartment of casing 1 is disposed a core bit barrel housing 13 in which is mounted a core bit barrel 14. As shown, the core bit barrel is partially projected through the aperture 2 of the casing 1. Barrel 14 is rotated by suitable gears (not shown) which are actuated

by means of flexible cable 15 connected to the lower end of the motor shaft 9.

Vertically journaled within the lower compartment of casing 1 is a rotatable shaft 16 provided with an upper bearing 17 and a lower bearing 18. The upper portion of shaft 16 is threaded at 19, for example, with a right-hand thread, while the lower portion of the shaft is threaded at 20 with a left-hand thread. Correspondingly threaded to the upper portion of the shaft 16 is sleeve 21 and to the lower portion, sleeve 22. The outer ends of sleeves 21 and 22 are recessed or channeled at 23 and 24 respectively, to slide vertically along the rib 25 rigidly affixed to the wall of the casing 1.

Above sleeve 21 and below sleeve 22 are provided collars 26 and 27 respectively, which collars are slidably mounted upon the shaft 16. Arms 28 and 29 are pivotally connected at one end to the core bit barrel housing 13 and at the other end to collars 26 and 27 respectively. The pivotal connection of the arms may be made with the lugs on the front of the collars as shown, or may be made upon the side of the collars by means of stud bolts, thus offsetting the arms and the housing 13 and permitting further retraction of the housing into the casing 1, and to one side of the threaded shaft. Extending between the arms 28 and 29 adjacent the ends pivoted on collars 26 and 27, is an arm tension spring 30 which tends to draw the arms 28 and 29 toward each other. Associated with shaft 16 at its mid-section, is a pair of flat springs 31 and 32 of forked construction loosely surrounding the shaft, the outer ends of such springs being rigidly affixed to the wall of casing 1 by means of brackets 33 and 34 respectively. Likewise, rigidly affixed to the wall of casing 1 between brackets 33 and 34 is a guide bar 35 provided with a horizontal slot 36 accommodating pin 37 carried by the core bit barrel housing 13. Pin 37 is free to move in either direction in slot 36 as the barrel housing 13 is projected or retracted, and functions in conjunction with guide bar 35 to stabilize the housing 13 and prevent rotation or swinging thereof either transversely of casing 1 or in the plane of the arms 28 and 29. A similar counterpart for guide bar 35 and pin 37 may be provided on the opposite side of the housing 13, and is not visible in the drawing. Thus, with the use of two horizontal guide bars spaced from each other slightly more than the width or diameter of housing 13, and with the pins coacting with the slots in the guide bars, the housing 13 carrying the core bit barrel 14 may be projected or retracted between the

guide bars while being stabilized against undesired rotation or swinging.

In Fig. 2, the sleeves 21 and 22, as well as rib 25 and tension spring 30 have been eliminated. Collars 38 and 39 are internally threaded to coact with the threaded portions 19 and 20 of the shaft 16. Additional flat forked springs 40 and 41 rigidly attached to casing 1 by brackets 42 and 43, respectively, are provided to enable collars 38 and 39 to engage the uppermost and lowermost threads of shaft 16 when such shaft is rotated in the proper direction to project the core bit through aperture 2 in the casing. In order to stabilize the barrel housing 13 against rotation or transverse swinging, there is affixed to back of such housing, a bar or piston-like element 44 which telescopes into a slidable housing 45, which latter in turn telescopes into a second housing 46 rigidly attached to the wall of casing 1 between brackets 33 and 34. This guide or stabilizing arrangement is preferably lined up along the horizontal axis of the core bit barrel housing 13, the vertical shaft 16 being slightly offset to accommodate the stabilizer. While not shown in detail, the element 44 and the slidable housing 45 are provided with suitable stops to limit the horizontal movement thereof and to prevent the telescoping parts from becoming dis-assembled upon projection of the barrel housing 13 through the opening 2 of casing 1. Upon retraction of the housing 13, the guide arrangement telescopes, one part within the other, and permits the housing 13 to be withdrawn into casing 1 sufficiently to bring the core bit barrel 14 within the opening 2 of casing 1.

In the operation of the device of Fig. 1, the casing 1, with the core bit barrel fully retracted, is lowered into the well bore to the desired level, and current is supplied to the motor 4 through the conduit 7. Rotation of the motor shaft 9 in turn rotates the core bit barrel 14 through the medium of the flexible cable 15. Simultaneously, the small gear 11 actuates the large gear 12 to rotate shaft 16, thereby causing threaded sleeve 21 to move downwardly along the threaded portion 19 of shaft 16, and threaded sleeve 22 to move upwardly along the threaded portion 20 of shaft 16. Tension spring 30 contracts thereby causing collar 26 to follow sleeve 21 downwardly, and collar 27 to follow sleeve 22 upwardly along shaft 16. As collars 26 and 27 approach one another under the influence of the tension spring, the arms 28 and 29 pivoted on the collars and on the core bit barrel housing 13 cause the housing carrying the core bit barrel to project outwardly through the aperture 2 of casing 1. The revolving core bit is thus forced into contact with the formation, thereby cutting a core sample which is retained in the core bit barrel. The ratio of gear 11 to gear 12 is preferably adjusted so that the rate of projection of the core bit corresponds with the cutting speed or the ability of the core bit to penetrate the formation. In the event that a formation of exceeding hardness is encountered, the sleeves 21 and 22 may approach one another at a faster rate than the core bit is able to cut into the formation. The sleeves 21 and 22, upon reaching the ends of their paths of travel toward the mid-section of shaft 16, become disengaged from threaded portions 19 and 20 of the shaft, and are maintained in contact with flat springs 31 and 32, respectively. As the cutting proceeds, the collars 26 and 27 carrying arms 28 and 29, under the influence of the tension spring 30, approach one another and may eventually again

contact sleeves 21 and 22 respectively. Upon completion of the cutting operation, the arms 28 and 29 may be in a substantially horizontal position, the core bit having been projected to its fullest extent. In order to retract the core bit barrel containing the core sample, the casing 1 may be slightly raised or lowered to break off the core at its base, while the bit is still in the formation. The supply of current to the motor is then reversed, and the motor shaft carrying the gear 11 is rotated in the opposite direction. The direction of rotation of the gear 12 is likewise reversed, as is that of shaft 16. The sleeves 21 and 22, which up to this time have been riding free on the mid-section of the shaft, are urged upwardly and downwardly respectively by the flat springs 31 and 32, and "take hold" or engage the threads on the inner end portions of 19 and 20 respectively. Sleeve 21 moves upwardly while sleeve 22 moves downwardly, rotation of the sleeves being prevented by the rib 25 slidably engaging the channels 23 and 24 of the sleeves. In moving upwardly and downwardly, respectively, the sleeves carry the collars 26 and 27 in opposite directions along shaft 16, pulling the arms 28 and 29 inwardly, and thus fully retracting the barrel housing 13 carrying the core bit barrel 14 containing the core sample. When fully retracted, the casing 1 may be raised to the surface and the core sample removed from the core bit barrel. During the operation of projecting or retracting the core bit barrel, the housing 13 is prevented from swinging laterally, or in the plane of the arms 28 and 29, by means of the guide bar 35 and pin 37 associated therewith.

In utilizing that modification of my core cutting device illustrated in Fig. 2 of the drawing, the operation is essentially similar to that described with reference to Fig. 1, with the exception that the tension spring 30 is dispensed with and the threaded collars 38 and 39 are actuated directly by means of threaded portions 19 and 20 of shaft 16. Since the system shown in this modification is inflexible, care must be taken to coordinate the rate of projection of the core bit with respect to the cutting speed or the ability of the core bit to penetrate the formation. This modification is more adapted for use in coring relatively soft formations, since there is less likelihood of binding or "freezing" the mechanism. However, by employing a relatively high core bit speed and a low rate of projection, such difficulty may be avoided.

While the operation of my core cutting device may be controlled from the earth's surface by supplying current to the motor for a period sufficient to effect projection of the core bit and cutting of the core sample, and thereafter reversing the flow of current to accomplish retraction of the core bit, such control may be made fully automatic, if desired, by installing in the casing 1 a plurality of limit switches or reversing switches actuated by contact with the core bit barrel housing 13 when same has been projected or retracted to the desired extent.

While the foregoing description presents a preferred embodiment of the invention and certain modifications thereof, the invention is not confined to the specific details described. Numerous changes and modifications may be made both in general appearance and arrangement of the elements, and such changes and modifications are intended to come within the scope of the appended claims.

I claim:

1. A device for cutting core samples, comprising a casing having an aperture in one wall thereof, a core bit barrel housing disposed within said casing, a rotatable core bit barrel mounted in said housing for movement through said aperture, guide means for stabilizing the core bit barrel housing, a rotatable shaft journaled within said casing, said shaft being provided with opposed threads, means for rotating said core bit barrel and said shaft, and means for projecting and retracting said core bit barrel relative to said aperture comprising collar means operatively associated with the opposed threads of said shaft and arms pivotally connected with said collar means and said core bit barrel housing.

2. A device for cutting core samples, comprising an elongated casing having an aperture in the wall thereof, a core bit barrel housing disposed within said casing, a rotatable core bit barrel horizontally mounted in said housing and adapted for limited projection through the aperture of said casing, a guide member horizontally disposed in said casing to stabilize the core bit barrel housing, a motor disposed within said casing, means connecting said motor and said core bit barrel to rotate said barrel, a rotatable threaded shaft journaled within said casing and operably connected to said motor, a pair of sleeves threaded upon said shaft and adapted to approach one another upon rotation of the shaft in one direction and to depart from one another upon rotation of the shaft in the opposite direction, a pair of collars slidably mounted upon said shaft without said sleeves and adapted to follow the travel of said sleeves upon said shaft, means pivotally connecting said barrel housing and said collars, and tension means urging said pivotally connecting means to project the core bit barrel through the aperture in said casing.

3. A device for cutting core samples, comprising an elongated casing having an aperture in the wall thereof, a core bit barrel housing disposed within said casing, a rotatable core bit barrel horizontally mounted in said housing and adapted for limited projection through the aperture of said casing, a guide member horizontally disposed in said casing to stabilize the core bit barrel housing, a motor disposed vertically within said casing, a flexible cable connecting said motor and said core bit barrel to rotate said barrel, a rotatable shaft journaled vertically within said casing and geared to said motor, said shaft having two threaded sections of opposed pitch, a pair of sleeves respectively threaded upon

the opposed threaded sections of said shaft and adapted to approach one another upon rotation of the shaft in one direction and to depart from one another upon rotation of the shaft in the opposite direction, a pair of collars slidably mounted upon said shaft without said sleeves and adapted to follow the travel of said sleeves upon said shaft, a pair of arms each pivotally connected at one end to said core bit barrel housing and at the other end to each of said collars respectively, and a spring urging said arms to approach one another and to project the core bit barrel through the aperture in said casing.

4. A device for cutting core samples, comprising an elongated casing having an aperture in the wall thereof, a core bit barrel housing disposed within said casing, a rotatable core bit barrel horizontally mounted in said housing and adapted for limited projection through the aperture of said casing, a guide member horizontally disposed in said casing to stabilize the core bit barrel housing, a motor disposed within said casing, means connecting said motor and said core bit barrel to rotate said barrel, a rotatable threaded shaft journaled within said casing and operably connected to said motor, a pair of sleeves threaded upon said shaft and adapted to approach one another upon rotation of the shaft in one direction and to depart from one another upon rotation of the shaft in the opposite direction, and means pivotally connecting said barrel housing and said sleeves.

5. A device for cutting core samples, comprising an elongated casing having an aperture in the wall thereof, a core bit barrel housing disposed within said casing, a rotatable core bit barrel horizontally mounted in said housing and adapted for limited projection through the aperture of said casing, a guide member horizontally disposed in said casing to stabilize the core bit barrel housing, a motor disposed vertically within said casing, a flexible cable connecting said motor and said core bit barrel to rotate said barrel, a rotatable shaft journaled within said casing and geared to said motor, said shaft having two threaded sections of opposed pitch, a pair of sleeves respectively threaded upon the opposed threaded sections of said shaft and adapted to approach one another on rotation of the shaft in one direction and to depart from one another upon rotation of the shaft in the opposite direction, and a pair of arms each pivotally connected at one end to said core bit barrel housing and at the other end to each of said sleeves respectively.

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