

Aug. 12, 1941.

R. DE LONG

2,252,620

CORING DEVICE

Filed May 20, 1940

3 Sheets-Sheet 1

Fig. 1

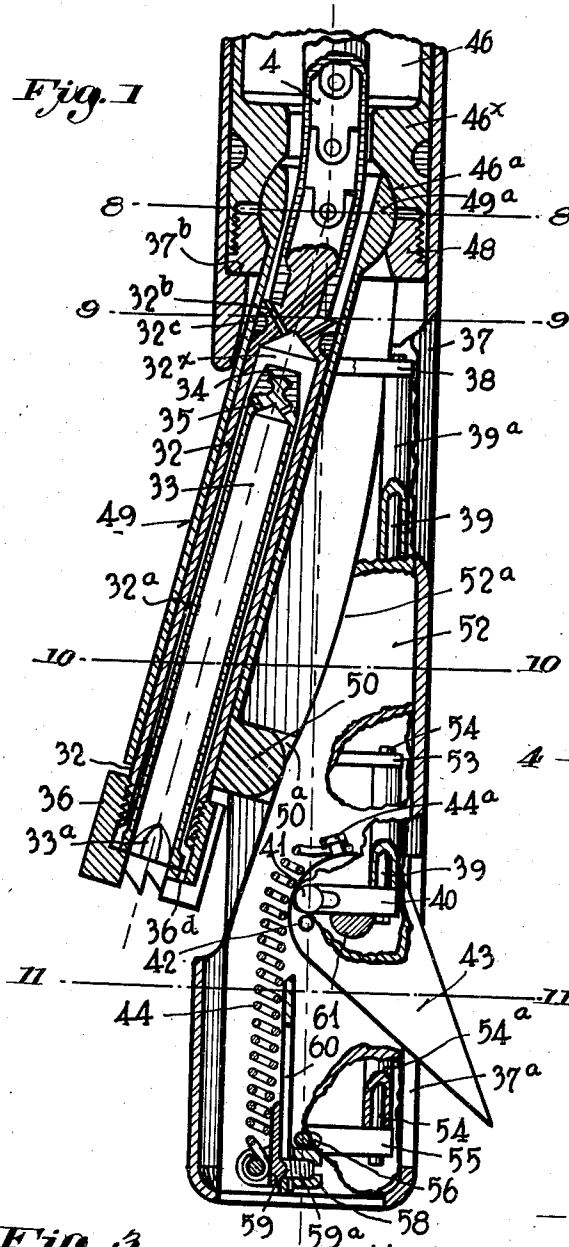


Fig. 2

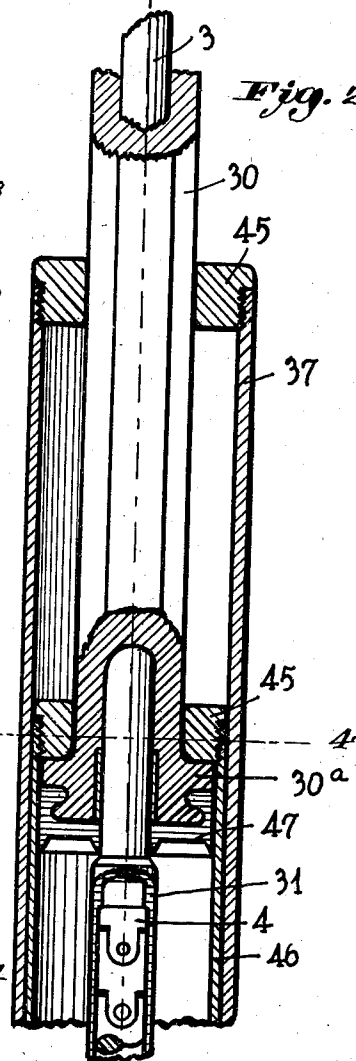


Fig. 3

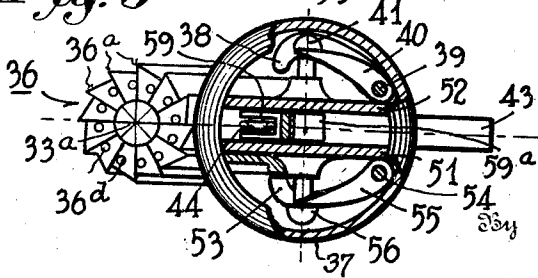
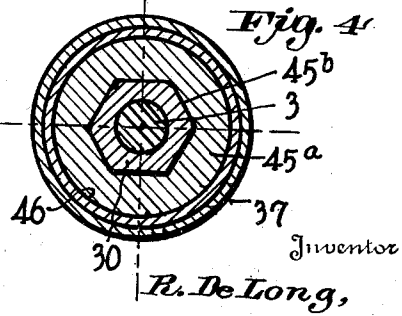


Fig. 4



Barry & Coy

Attorneys

Aug. 12, 1941.

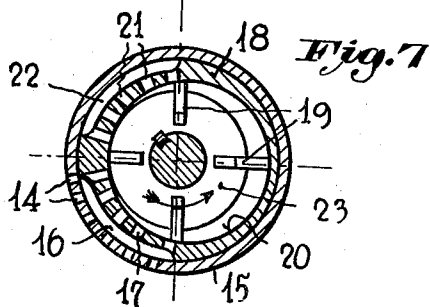
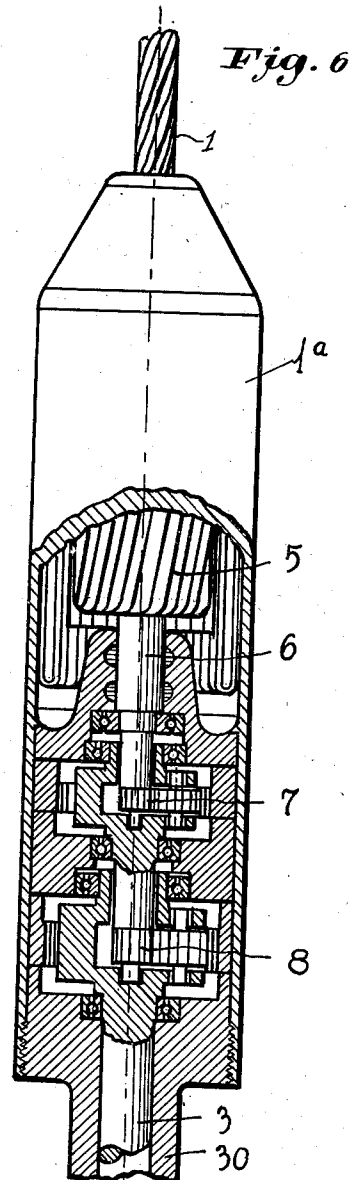
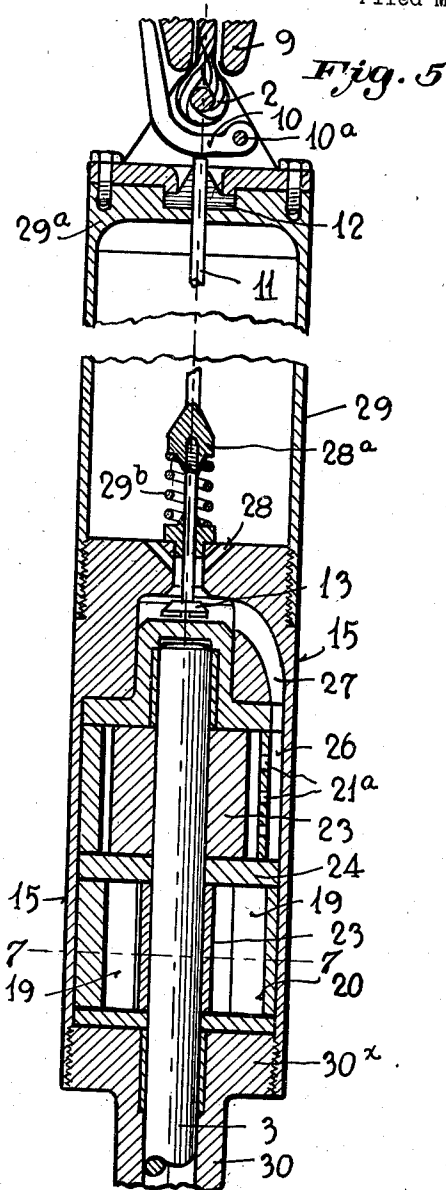
R. DE LONG

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3 Sheets-Sheet 2



INVENTOR.
R. De Long,
BY *Barry & Coy*
ATTORNEYS.

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R. DE LONG

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3 Sheets-Sheet 3

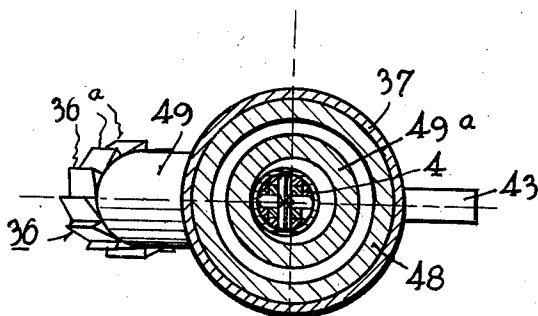


Fig. 8

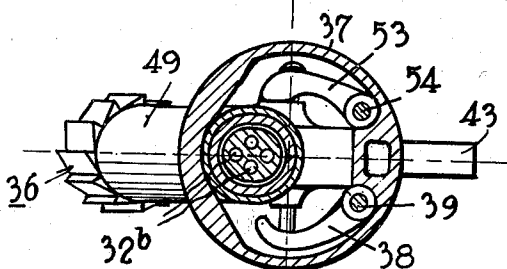


Fig. 9

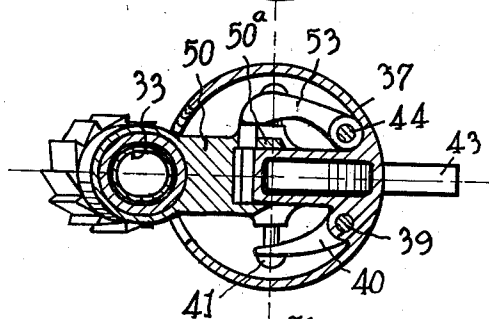


Fig. 10

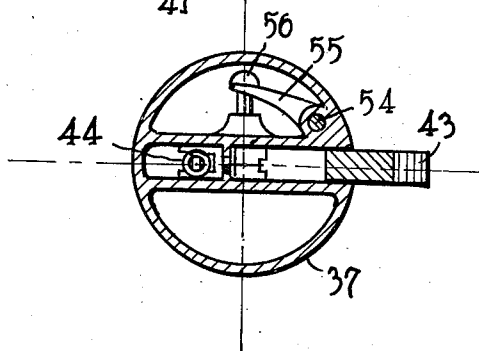


Fig. 11

INVENTOR.
R. De Long,
BY *Barry + Cyr*
ATTORNEYS.

UNITED STATES PATENT OFFICE

2,252,620

CORING DEVICE

Raleigh De Long, Houston, Tex., assignor of forty per cent to Fohs Oil Company, Houston, Tex., a corporation of Delaware

Application May 20, 1940, Serial No. 336,301

17 Claims. (Cl. 255—1)

This invention relates to a side wall coring tool, and more particularly to a novel coring device.

One of the objects of the invention is to provide a universal side wall coring device or tool capable of taking a core by the use of a rotating core barrel adapted to be attached to the end of a bailing line, plain lifting cable, wire line, or a cable comprising one or more electrical insulated conductors. When desired, the core taking machine, device, or tool may be attached to the lower end of a string of pipe, suitable tubing or drill stem, or any device to lower the tool or core taking device into a well.

Another object is to furnish a tool capable of taking a clean core from the side wall of a well or hole drilled, or bored, or being drilled, or bored, at any specific or specified depth.

A further object is to supply a coring tool or device that is of relatively simple and inexpensive construction, and one which will be durable and not liable to get out of order, and is simple to operate.

Another object is, the device can be used in a well that has limited equipment as well as one that is being drilled with elaborate equipment, and also in wells that have been abandoned, and where all equipment has been moved away.

A still further object is to provide a device capable of taking a clean sample or core from the side wall of a well or bore by means of a deflecting, rotating core barrel, operating through a deflecting non-rotating tube or guide.

A still further object is to provide a device capable of taking a clean sample or core from the side wall of a well by using the differential pressure of the liquid or slush in the well, that is the effective pressure above the tool receiving cylinder for the driving power, and when so desired, the tool may be operated by an electric motor, power being supplied through an electric conductor or conductors of a supporting logging cable, or a special cable made for the purpose. When the core tool is fastened to the end of a drill stem or string of pipe, it can be operated by pump from above, or by rotating the drill stem or pipe, with a rotor. The tool can also be used or operated by pump pressure and rotor at the same time to advantage in very hard formations.

With the foregoing objects outlined and with other objects in view which will appear as the description proceeds, the invention consists in the novel features hereinafter described in detail, illustrated in the accompanying drawings,

and more particularly pointed out in the appended claims.

In the drawings:

Fig. 1 is a vertical sectional view of the lower end portion of my improved tool.

Fig. 2 is a similar view of the middle section just above that of Fig. 1.

Fig. 3 is a bottom plan view of the structure shown in Fig. 1.

Fig. 4 is a horizontal cross-sectional view taken on the line 4—4 of Fig. 2.

Fig. 5 is a vertical sectional view of the liquid or slush power unit.

Fig. 6 is a similar view of an electric power unit and reduction gears.

Fig. 7 is a horizontal cross-sectional view taken on the line 7—7 of Fig. 5.

Figs. 8, 9, 10 and 11 are horizontal views taken respectively on the lines 8—8, 9—9, 10—10 and 11—11 of Fig. 1.

Referring first to Figs. 1 and 3, it will be noted that the lower portion of the tool may consist of a casing 37 provided internally with substantially diametrical vertically disposed partition walls 51 and 52, each having a cam edge 52a which functions as a guide for a slidable shoe or slipper 50 fixed to the lower end portion of a non-rotatable guide tube 49 which is adapted to be lowered into a projected position or raised into a retracted position.

The casing 37 has a vertical slot 37a in its wall to permit an anchoring spike 43 to swing into and out of the casing. Such spike is pivotally mounted on a pin 61 supported by the walls 51 and 52. It is normally held in a retracted position by a locking pin 41 extending into a hole 42 of the spike. Such pin is mounted in a bearing in the wall 52 and is engaged by the forked extremity of an arm 40; the latter being fixed to a rotatable vertical shaft 39 which extends upwardly through a supporting sleeve 39a fixedly mounted on the outer side of the wall 52. Another arm 38 is fixed to the upper end of the shaft 39 and is adapted to be engaged by the toothed peripheral portion of a cutter 36 when the latter is in its uppermost position. Rotation of such cutter, when in such position, will cause the teeth 36a to move the arm 38 in a counter-clockwise direction, looking downwardly, and this will cause the lever 40 to move in the same direction and pull the locking pin 41 from the hole 42. When this happens, the spike is turned in a counter-clockwise direction by means of a coil spring 44 which has one of its ends fixed to a vertically slidable member 59. The member

59 has a threaded stud 58 extending through a vertical guide slot 60 arranged between the walls 51 and 52. A nut or abutment 59a on the stud is normally engaged by a pin 56 which prevents the member 59 from moving upwardly and thereby holds the spring 44 under tension. The pin 56 slides horizontally in the wall 51 and is connected to the forked end of an arm 55, and when said arm is moved in a clockwise direction (looking downwardly), the pin will be withdrawn from its position above the nut 59a so that the guide 59 can rise. To accomplish this, the arm 55 is fixed to the lower end of a shaft 54 extending through a vertical sleeve 54a mounted at the outer side of the wall 51. Another arm 53 is fixed to the upper end of the shaft 54 and is adapted to be struck by an extension 50a of the slipper 50 when the guide tube 49 moves downwardly. It will therefore be understood that when the guide tube approaches its lowermost position, it will act through the parts 50, 50a, 53, 54, 55 and 56 to release the member 59 and relieve the spring 44 of tension so as to permit the spike 43 to be retracted when the tool is pulled out of the well.

The casing 37 is of course slotted to accommodate movements of the guide tube 49, and immediately above the slot, the casing is provided with a horizontal shoulder 37b which acts as a stop for a nut 48 having a threaded connection with the lower end 46x of a vertically slidable barrel or plunger chamber 46 guided by the casing 37. The parts 46x and 48 form a substantially cylindrical cavity 46a for the reception of the substantially cylindrical head 49a of the guide tube 49. The joint thus formed allows the head of the tube to pivot within the parts 46x, 48, so that the lower end of the tube will be projected outwardly as the tube descends with the barrel 46. The tube 49 serves as a guide for the core barrel which consists of an outer tube 32 and an inner tube 33 which have their lower ends secured to the cutter head 36. The walls of these tubes are spaced apart to provide an annular passage 32a for drilling fluid which passes to said space from the barrel 46 through a passageway formed in the parts 46x and 49. From the passageway, the fluid passes through ports 32b in the head of the tube 32 and enters a chamber 32x formed between the heads of the tubes. A packing ring 32c is arranged between the tube 32 and the guide tube 49 to prevent such fluid from travelling between those tubes. The fluid from the chamber 32x passes through the passageway 32a and is discharged from the cutter through holes 36d. The lower end portion of the core barrel is provided with a conventional core catcher 33a.

The core barrel may be of the type disclosed in the United States patents to Frisby No. 168,010, Christian No. 1,379,170, or Stone No. 1,720,700, and it may be rotated by any suitable flexible shaft 4 (which may be of the type disclosed in the United States patents to Stewart No. 729,694 or McCaskey No. 1,258,233). The shaft is preferably covered with rubber or some flexible material 31 which functions to stiffen it and to protect the working parts from abrasive particles that are in the liquid or drilling fluid of the well.

The head of the inner tube of the core barrel is provided with ports 35 normally covered by a rubber cup 34. As a core enters the barrel, water trapped within the inner tube will be dis-

charged through the ports 35, as the skirt of the cup will flex and permit this.

As best shown in Figs. 2 and 4, the barrel 46 which slides in the casing 37, has its head closed by a nut 45a, and this nut, as well as the nut 45 at the top of the casing, is provided with a hexagonal hole 45b to slidably guide a non-rotating slip or slide tube 30 through which an axially movable rotatable shaft 3 extends; the latter being connected at its lower end to the upper end of the flexible shaft 4. The tube 30 terminates at its lower end in a foot 30a which forms part of a plunger that is movable lengthwise of the barrel 46. A packing 47 forms part of such plunger, and when the lower end of the barrel 46 comes to rest on the shoulder 37b (Fig. 1), the plunger can continue to move downwardly under the influence of the tube 30, so as to push the flexible tube downwardly and to force drilling fluid out of the barrel 46 and eventually through ports 36d of the cutter.

In Figs. 5, 6 and 7, I have illustrated means for moving the tube 30 downwardly and rotating the shafts 3 and 4. For example, in Fig. 5 it will be noted that the upper end of the tube 30 terminates in a head 30x that is screwed into the lower end of the body 15 of a liquid or slush power unit. The shaft 3 extends above the head 30x into the unit, and is preferably provided with a pair of rotors 23, each having radially slidable vanes 19 which operate in a cylindrical chamber 20 eccentrically arranged with reference to the axis of the shaft. Under the control of means hereinafter described, liquid or slush from the well can enter the chamber 20 (in which the lower rotor rotates), through ports 14, a space 16 and ports 17. Such fluid will rotate the rotor in the lower chamber 20, and will then be discharged through ports 21 into a passageway 22 which serves to conduct the same upwardly to the inlet ports 17 of the chamber in which the upper rotor rotates. The fluid will be discharged from the upper chamber through ports 21a into a passageway 26 which conveys the same upwardly through a port 27, 28, controlled by a valve member 13. The stem of said member has a threaded connection at its upper end with a head 28a from which a post 11 rises. The latter passes through the head 29a of a tubular member 29 which is threadedly connected to the upper end of the motor body 15. The post is surrounded by a sealing washer 12 arranged in the head 29a, and is normally held in uppermost position by a coil spring 29b arranged between the head 28a and the top of the motor casing 15.

As long as the valve member is closing the port 27, 28, the motor cannot function, but as soon as the member 13 is moved into the position shown in Fig. 5, well fluid can pass through the motor and cause rotation of the shaft 3. It will be observed that two or more rotors 23 may be employed, as the number of stages used will depend upon the differential pressure between the hydrostatic head of the liquid in the well above the core tool, and the absolute pressure in the cylindrical chamber or receiver 29. One stage rotary engines have been used for many years as a steam, air or gas prime mover, and I have found that by operating such a rotary engine with liquid or slush under pressure, that it is very efficient and capable of delivering high torque with a low turning speed. Depression of the post 11 and opening of the valve is accomplished by means of a lever 10 pivotally mounted at 10a on the head 29a and bearing against the

upper end of the pin. This lever is actuated by a cam sleeve 9 which may be released at the top of the well so as to slide down the supporting line 2 of the tool, until it reaches the lever 10.

Instead of employing a fluid motor, I may employ an electric motor as shown in Fig. 6. In this construction, the wire line 1 will include insulated conductors for electricity, and will support the motor casing 1a in which the motor 5 is arranged. Such motor drives a shaft 6 which actuates reduction gear trains 7 and 8 operatively connected to the driven shaft 3 which, of course, is connected to the flexible shaft 4.

In operating either form of the invention, the tool will be lowered into the well by any suitable means such as the line 2 or 1, and at such time, the barrel 46, guide tube 49 and coring barrel will be in their uppermost positions. When a depth is reached where a core is to be taken, the motor or power unit will be started in operation. In Fig. 5, this will be accomplished by dropping the weight 9, and in Fig. 6 by an electric switch at the surface. In Fig. 5, the opening of the valve 13 will permit liquid in the well to pass through the motor and into the casing 29 which may contain a condensable gas or might be under vacuum conditions. At any rate, the operation of the motor will cause rotation of the shafts 3 and 4, and as the cutter head 36 (Fig. 1) is in contact with the arm 38, the stepped teeth at the side of the cutter (due to the rotation of the core barrel), will move the arm or lever 33. The latter will cause shifting of the locking pin 41 out of the hole 42, so that the spring 44 (connected to the spike at 44a) will snap the latter outwardly and cause the spike to enter the wall of the well at one side and jam the opposite side of the casing 37 against the wall of the well. As this will fix the part 37 in a stationary position, the wire line or cable can be lowered so that the guide tube 30 will push downwardly on the plunger 47 and the latter, due to the liquid in the barrel 46, will force the barrel downwardly until it comes to rest on the shoulder 37b. As the barrel descends, the slipper 50 will slide along the cam edges 52a, and as the cutter is rotating at this time, it will first cut a ledge at one side of the wall of the well. As the wire line or cable is lowered further, the plunger 47 will push the liquid out of the barrel 46, and also cause the flexible shaft 4 to push the rotating core barrel out of the guide tube so that a core will enter the core barrel.

Immediately before the guide tube 49 reaches its lowermost position, the extension 50a will act on the lever 53 to release the abutment pin 56 so that the spring 44 will be relieved of its tension.

When a core has been taken and an upward pull is exerted on the line 1 or 2, the core barrel will first be drawn into the tube 49, then the core barrel and tube 49 will rise together until the slipper 50 moves to a position above the arm or lever 38 which, of course, causes the side of the cutter head 36 to again come in engagement with the arm 38. At the time when the arm is engaged by the cutter head, of course, the cutter is not rotating and the lock pin 41 can move into the hole 42 of the spike when the latter is retracted to the required position. The wall spike will continue to hold the tool in place as long as the weight of the casing or shell 37 is on the pivot pin 61.

Of course, substantially the same operation will take place when the electric motor is used

in place of the fluid motor, because as soon as the current is turned on, the motor 5 will act to rotate the shaft 3.

From the foregoing it is believed that the construction, operation and advantages of my improved coring device may be readily understood by those skilled in the art, and I am aware that changes may be made in the details disclosed without departing from the spirit of the invention, as expressed in the claims.

What I claim and desire to secure by Letters Patent is:

1. In a coring device, an elongated hollow casing, a radially extensible guide member positioned in said casing intermediate its ends, means for holding said member in a retracted position in the casing, a rotary core barrel guided by said member, the means for holding said member in the casing being movable lengthwise of the casing, and a motor operatively connected with the core barrel for actuating the same.

2. In a coring device, an elongated hollow casing, a radially extensible guide member positioned in said casing intermediate its ends, a chamber slidably mounted in the casing, said guide member being pivotally connected to the chamber, a rotary core barrel guided by said member and axially movable relatively thereto, said core barrel having cutting teeth and a passageway for conducting liquid thereto, said passageway communicating with the interior of the chamber, and means operatively connected with the core barrel for rotating the latter.

3. In a coring device, an elongated hollow casing, a radially extensible guide member positioned in said casing intermediate its ends, a chamber slidably mounted in the casing, said guide member being pivotally connected to the chamber, a rotary core barrel guided by said member and axially movable relatively thereto, said core barrel having cutting teeth and a passageway for conducting liquid thereto, said passageway communicating with the interior of the chamber, means operatively connected with the core barrel for rotating the latter, and means for forcing liquid from the chamber through said passageway.

4. In a coring device, an elongated hollow guide casing, a member axially slidable in the casing, a guide member pivotally connected to the slidable member, an axially movable and rotatable core barrel extending into the guide member and guided thereby, means for causing one end portion of the core barrel to be projected out of the casing when the slidable member is moved in one direction, and means operatively connected with the core barrel for rotating and axially moving the latter.

5. In a coring device, a casing having a slotted wall, a chamber axially movable in the casing, a guide tube movably connected to the chamber, cooperating means on the guide tube and casing for causing the tube to project from the casing through said slot when said chamber is moved relatively to the casing, a rotatable and axially movable core barrel movable in the guide tube, and means for rotating and depressing the core barrel.

6. A coring device, an elongated hollow casing having a slot in the wall thereof, a chamber slidable axially within the casing, a guide member pivotally connected to the chamber a rotary core barrel guided by the guide member and movable axially relatively thereto, a plunger in the chamber movable toward and away from said guide

member, a shaft operatively connected to the core barrel and extending through the plunger, and a motor operatively connected to the shaft for driving the latter.

7. A coring device, comprising an elongated hollow casing having a slot in the wall thereof, a chamber slidable axially within the casing, a guide member pivotally connected to the chamber, a rotary core barrel guided by the guide member and movable axially relatively thereto, said core barrel being provided with a cutter, a plunger in the chamber movable toward and away from said guide member, a shaft operatively connected to the core barrel and extending through the plunger, a motor operatively connected to the shaft for driving the latter, and a fluid-conducting passageway extending from the chamber to the cutter.

8. In a coring device, a casing having a slot in the wall thereof, a radially extensible guide member pivotally mounted in the casing and adapted to project through said slot, a rotary core barrel guided by said member, means for rotating and axially moving the barrel, said casing having a second slot arranged diametrically opposite the first-mentioned slot, an anchoring member movably mounted in the casing and adapted to be projected through the last-mentioned slot and to engage one side of the wall of a well and force the casing toward the opposite well wall, and means for controlling the last-mentioned means.

9. In a coring device, an elongated hollow casing, a guide member pivotally mounted in and movably lengthwise of the casing and adapted to be projected therefrom, said casing being provided with a slot arranged diametrically opposite said guide member, a wall spike pivotally mounted in the casing and adapted to be projected through said slot, a lock controlled by movement of the guide member relatively to said casing and adapted to hold the spike in retracted position, and automatic means for projecting said spike upon release of the locking means.

10. In a coring device, an elongated hollow casing, a guide member pivotally mounted in the casing and adapted to be projected therefrom, said casing being provided with a slot arranged diametrically opposite said guide member, a wall spike pivotally mounted in the casing and adapted to be projected through said slot, a lock adapted to hold the spike in retracted position, and controlled by movement of the guide member relatively to said casing, and automatic means for projecting said spike upon release of the locking means, said spike projecting means including a tensioned spring.

11. In a coring device, an elongated hollow casing, a guide member pivotally mounted in the casing and adapted to be projected therefrom, said casing being provided with a slot arranged diametrically opposite said guide member, a wall spike pivotally mounted in the casing and adapted to be projected through said slot, a lock adapted to hold the spike in retracted position, and controlled by movement of the guide member relatively to said casing, and automatic means for projecting said spike upon release of the locking means, said spike-projecting means including a tension spring, means for holding the spring under tension, and a device controlled by said

guide member for releasing the spring tensioned means.

12. In a coring device, an elongated hollow casing provided with first and second slots, a barrel axially slidable in the casing, a guide tube having its upper end pivotally connected to the lower end of the barrel, cooperating means on the guide tube and in the casing for causing the lower end of the tube to be projected through one slot when the barrel is moved downwardly, a core barrel member rotatably and axially movable in the tube, an anchoring device movably mounted in the casing and adapted to be projected through the second slot, and means controlled by one of said members for controlling the projection and retraction of said anchoring device.

13. In a coring device, a supporting element, a prime mover supported by the supporting element, a casing, means slidably connected to the casing for supporting the motor, guiding means movably connected to the casing, an axially movable rotary core barrel guided by the guide member, means extending through said slidable member and operatively connecting the motor to the core barrel, and means for anchoring said casing in a well.

14. In a coring device, a rotary core barrel, a guide for the barrel, a closed chamber, and a fluid operated motor operatively connected to said barrel and having an exhaust duct communicating with said chamber, whereby when the chamber is submerged in liquid or drilling fluid, the motor will be actuated due to the differential pressure between the well and the interior of said chamber.

15. In a coring device, a casing, a barrel axially movable in the casing, a guide tube movably connected to the barrel, cooperating means on the guide tube and casing for causing the tube to project from the casing when the barrel is moved downwardly relatively to the casing, a rotatable and axially movable core barrel movable in the guide tube, and means for rotating and depressing the core barrel.

16. In a coring device, a casing, a barrel axially movable in the casing, a guide tube movably connected to the barrel, cooperating means on the guide tube and casing for causing the tube to project from the casing when the barrel is moved downwardly relatively to the casing, a rotatable and axially movable core barrel movable in the guide tube, means for rotating and depressing the core barrel, said core barrel being provided with a cutter head, and a passageway for drilling fluid extending through the core barrel and cutter head and communicating with the interior of said first-mentioned barrel.

17. In a coring device, a supporting element, means for anchoring said element at a point in a well where a core is to be taken, a downwardly and outwardly movable guide tube operatively associated with said element, means associated with the element and arranged above the guide tube for causing the latter to move downwardly, a core barrel axially and rotatably guided by the tube, and an upwardly and downwardly movable rotary motor operatively connected with said core barrel for actuating the latter.

RALEIGH DE LONG.