

Sept. 30, 1930.

W. I. McLAUGHLIN

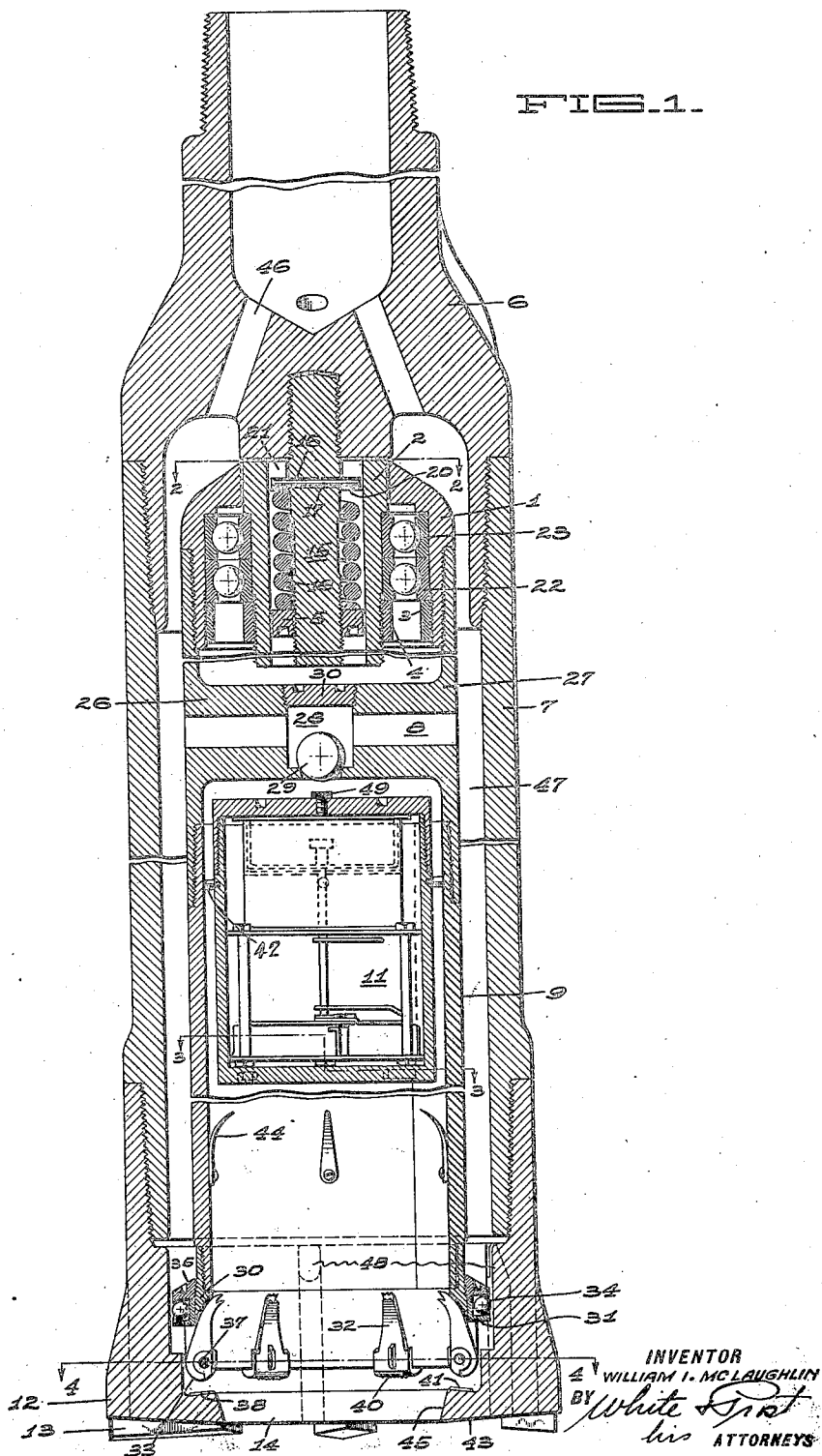
1,777,010

CORE BARREL

Filed Oct. 13, 1925

3 Sheets-Sheet 1

FIG. 1.



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FIG. 2.

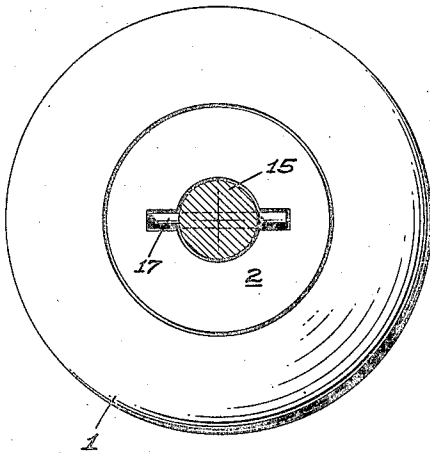


FIG. 3.

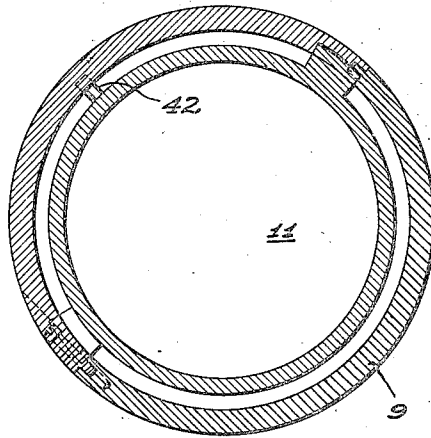
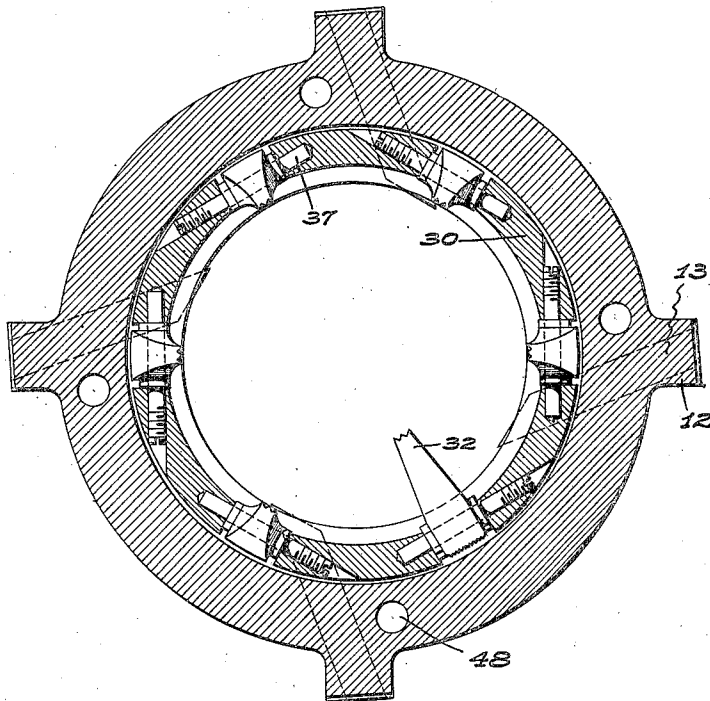


FIG. 4.



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3 Sheets-Sheet 3

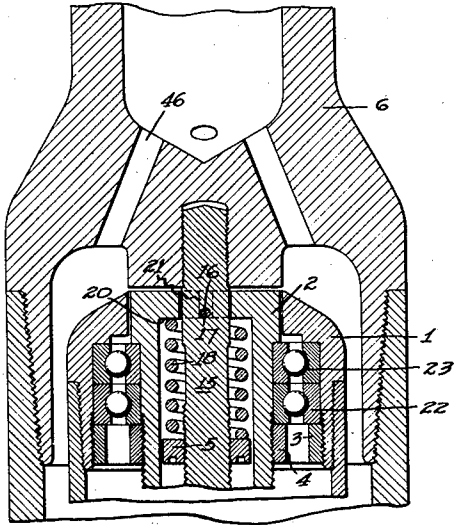


FIG. 5.

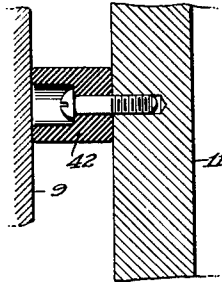


FIG. 7.

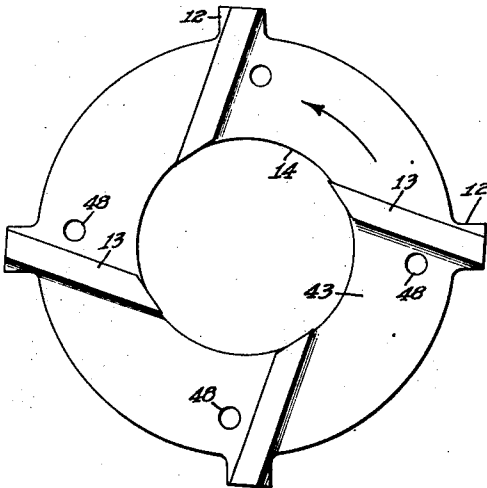


FIG. 6.

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WILLIAM I. McLAUGHLIN, OF SAN FRANCISCO, CALIFORNIA, ASSIGNOR TO STANDARD OIL COMPANY OF CALIFORNIA, OF SAN FRANCISCO, CALIFORNIA, A CORPORATION OF DELAWARE

CORE BARREL

Application filed October 13, 1925. Serial No. 62,228.

The invention relates to core barrels for rotary well drilling purposes and more particularly to those types of core barrels which are designed to show not only the nature of the material being drilled through, but also to show the direction of the dip and strike of the formation being drilled through. Such types of core barrels are disclosed in my co-pending applications Serial No. 694,237 filed February 21, 1924, and Serial No. 714,668 filed May 20, 1924.

When cutting a core from the formation at the bottom of a well by methods heretofore employed, it has been difficult to prevent the core from breaking at or near the cutting edge of the drill. As a result, the cores which were obtained were often made up of several sections, each turned away from its original position in the well and therefore of no value for determining the dip and strike of the formation.

Heretofore it has been customary to prevent the rotation of the core with respect to the core retainer by means of toothed dogs or spring fingers arranged at intervals within the core retainer and adapted to press against the core, thus holding it firmly and preventing rotation thereof. I have found that devices used for this purpose have the disadvantage of tending to prevent the entrance of the core into the core retainer, thereby defeating the purpose of the invention and preventing the formation of a core of sufficient length to show the dip and strike of the formation being cut.

Another difficulty encountered heretofore in the operation of core drills has been the breaking of the core from the surrounding formation after the core has been cut out. Types of core barrels now generally employed rely upon toothed dogs to accomplish this operation. These dogs are pivoted in such a manner that they will permit the entrance of the core but will grip the core when the core barrel is pulled upward. I have found that a core composed of a hard substance is not readily gripped by the present type of toothed dogs and that other means must be employed if a core is to be obtained which will show the true dip and strike of the formation being cut.

An object of the present invention is to provide a core drill in which the cutting teeth are so disposed as to produce a minimum amount of friction between the cutting edge of the drill teeth and the core, so that the tendency of the core fracture is reduced.

Another object of the invention is to provide a core drill which will permit the free and easy entrance of the core into the core retainer. A further object of the invention is to provide means operative upon vertical upward movement of the core barrel for forcing toothed dogs into the core for the purpose of fracturing the core from the formation.

Another object of this invention is to provide shock absorbing means to prevent injury to the direction indicating mechanism.

A further object of the invention is to generally improve the construction of core barrels so that they will operate more efficiently in the production of cores.

The invention possesses other advantageous features, some of which with the foregoing will be set forth at length in the following description, where I shall outline in full that form of my invention which I have selected for illustration in the drawings accompanying and forming part of the present specification. In said drawings I have shown one form of core barrel embodying my invention but it is to be understood that I do not limit myself to such form, since the invention as set forth in the claims may be embodied in a plurality of forms.

Referring to said drawings:

Figure 1 is a vertical section through a core barrel embodying my invention, a part thereof being broken away to reduce the size of the figure.

Figure 2 is a cross-section taken on the line 2—2 Figure 1.

Figure 3 is a cross-section taken on the line 3—3 Figure 1.

Figure 4 is a cross-section taken on the line 4—4 Figure 1.

Fig. 5 is a detail cross sectional view showing the spring mounting for the core retainer.

Fig. 6 is a bottom plan view of the drill bit.

Fig. 7 is cross sectional detail of the

resilient separators inserted between the core retainer and the indicator housing.

The device of my invention comprises an outer barrel 7, preferably composed of a plurality of cylindrical sections screwed together. The upper section of the outer barrel 7 is screwed to or otherwise secured to a coupling 6 which, at its opposite end, is attached to the drill pipe, by means of which the outer barrel is rotated. Secured to the lower end of the outer barrel is a drill bit or drill shoe 12 which is provided with cutting teeth 13 arranged in the form of an annulus, so that a central aperture or passage 14 is provided in the drill bit to accommodate the core which is cut from the formation.

Screwed into the center of the lower end of the coupling 6 and extending downward into the outer barrel 7 is a pin 15 having a diametric bore 16 through which a pin 17 is inserted. Threaded onto the lower end of the pin 15 is a nut 5, upon which bears a coiled spring 18, which surrounds the pin 15. Surrounding the spring 18 is a collar 2 having an inwardly turned flange or shoulder 20 at its upper end which bears against the upper end of the spring 18. The shoulder 20 is provided with a transverse slot 21 in which the pin 17 is disposed, so that the collar 2 may not rotate with respect to the pin 15, while at the same time permitting vertical movement of the collar with respect to the pin, due to varying flexure of the spring 18.

Surrounding the collar 2 and rotatable with respect thereto is a collar 1 to which the inner barrel or core retainer is secured. The collar 1 is supported on the collar 2 by anti-friction bearing means which permit free relative rotation of the two collars. Interposed between shoulders on the upper ends of the collars 1 and 2 and the nuts 3 and 4 screwed to the collars respectively adjacent their lower ends, are ball bearing races 22 between which the balls 23 are arranged. The inner barrel is thus rotatably suspended on the collar 2, so that it has a free relative rotational movement and a vertical movement with respect to the outer barrel 7.

The inner barrel 9 is connected or secured to the collar 1 by the coupling member 26, which is preferably provided with screw threaded portions engaging complementary screw threaded portions on the collar 1 and the inner barrel 9. The coupling member 26 is preferably provided with a transverse partition 27, having a transverse bore 8 extending therethrough and opening on the sides of the coupling member. The outer diameter of the coupling member and of the inner barrel 9 is less than the inner diameter of the outer barrel 7, so that a passageway 47 is provided between the two barrels, this passageway extending upward into the coupling 6 where it communicates with passageway 46, thereby establishing communication

with the drill pipe, which is screwed to the upper end of the coupling 6. The transverse partition 27 is also provided with a central axial bore 28, the upper end of which is closed by a screw plug 30 and the lower end of which is normally closed by a check valve 29, this check valve operating to permit the flow of material from within the core retainer or inner barrel 9 into the transverse passageway 8 but prevents the flow of material in the opposite direction.

The core retainer or inner barrel 9 comprises a hollow cylindrical body which is preferably split longitudinally into sections which are secured together by any suitable means, such as bolts, which are not shown. The inner barrel 9 is made of suitable lengths, depending upon the length of the core which it is desired to obtain, and is of less length than the outer barrel, so that it terminates within the outer barrel above the drill shoe on the lower end thereof. Screwed to the lower end of the inner barrel 9 is a collar 30 having a shoulder between which and the ring nut 35, screwed to the collar 30, a lower ball race 31 is held. Disposed in the ball race are a plurality of balls 34 which are in bearing engagement with the inner cylindrical surface of the drill shoe 12, so that the inner barrel is rotatably supported and guided at its lower end.

Mounted on the lower end of the inner barrel 9 are a plurality of toothed dogs 32 which are normally held in retracted position so that they do not engage the core as it enters the inner barrel. These dogs 32 are pivoted on fillister pins 37 which are disposed in tangential bores in the collar 30. The dogs 32 are formed on their lower ends below the pivot pins 37 with cam surfaces 33 which, when the outer barrel is moved upwardly with respect to the inner barrel, engage the shoulder 38 of the cutting shoe, causing the dogs to rock about their pivots and causing the toothed ends thereof to be driven into the core. The cam surfaces 33 of the dogs and the shoulder 38 of the cutting shoe, are preferably provided respectively with serrations 40 and 41, which are brought into engagement when the outer barrel is raised with respect to the inner barrel, thereby preventing relative rotation of the two barrels when they are in such relation.

It is desirable to prevent rotation of the inner barrel 9 with respect to the core that is formed, and for this purpose the inner barrel is provided on its inner surface with a plurality of spring fingers 44, which are flexed inwardly to engage the core. These fingers 44 are preferably pointed on their ends so that any relative rotation of the core retainer with respect to the core will be indicated by scratches made on the surface of the core by these spring fingers.

Means are provided within the inner barrel,

for indicating after the core barrel has been withdrawn from the well, the exact oriented position of the inner barrel at the time that the core was fractured from the formation. During the upward movement of the core barrel from the well, the inner barrel is held against rotation with respect to the outer barrel by engagement of the dogs 32 with the shoulder 38, so that by determining the oriented position of the inner barrel at the time that the core was fractured, it is possible to determine, after the core barrel has been removed from the well, the proper oriented position of the core, so that the dip and strike of the formation from which the core was taken may be definitely determined. This is accomplished by means of a magnetic compass which is contained within and secured to the inner barrel, the compass and its setting mechanism being contained within the housing 11, disposed within the upper portion of the inner barrel. The compass and the method of setting the needle permanently while in the well is the subject of my co-pending application Serial No. 714,668, filed May 20, 1924, to which reference is hereby made for a complete disclosure thereof. The cylindrical casing 11 is preferably held in position by a series of resilient supports 42 which serve to reduce the vibration and jarring which is transmitted to the casing 11. The casing is provided with a plug 49 which when removed relieves any vacuum or pressure within the casing. Since the retainer is supported by spring 18 while the drill is rotating during a boring operation, jars or vibrations from the bit will not be transmitted directly to the indicating mechanism 111.

The lower face 43 of the cutting shoe is inclined upwardly away from the edge of the central bore or aperture, so that the cuttings from the teeth 13 will tend to move outwardly away from the entrance to the core retainer. The cutting teeth 13 are preferably arranged at an angle to the radius of the cutting shoe and the inner edges of the cutting teeth extend slightly beyond the inner edge of the face 43, so that the diameter of the core which is cut is slightly less than the diameter of the aperture in the bit, so that the core freely passes through the aperture. The inner surface 45 of the cutting bit is also preferably inclined outward from the lower edge thereof or from the face 43, so that an aperture of increasing diameter inwardly is produced, thereby eliminating any friction between the cutting shoe and the core. The cutting shoe is provided with passageways 48 which open at their upper ends into the passage way 47 and at their lower ends on the face 43 of the bit, to permit mud or other fluid to be carried to the cutting face of the drill bit. Any mud, air or debris which may get into the core retainer 9 in advance of the

core is permitted to escape past the check valve 29. This check valve also serves to seal the upper end of the core retainer against the entrance of air or fluid from above, thereby tending to create a vacuum within the core retainer when the core barrel is pulled up to break off the core. This vacuum aids in holding the core within the retainer.

The operation of the core barrel is as follows. It will be noted that while the core barrel is being lowered upon the formation to be cored, the spring 18 holds the core retainer up from the shoulder 38 of the drill bit 12, so that the dogs 32 are free to lie back within the bore of the collar 30. The core barrel is lowered to within a short distance, say 20 feet, of the bottom of the hole, and the mud pump is then started and operated for a sufficient time to clear the hole of settlements. The core barrel is slowly rotated until the bottom of the well is reached. The core barrel is then run upon the bottom until a core of sufficient length has been formed. The core enters the bore of the face 43 of the bit 12, passing up into the core retainer 9, which does not revolve. If the core retainer should accidentally revolve before the core has been broken from the formation, the spring fingers 44 will scratch the surface of the core, indicating the amount of rotation that has occurred. It is desirable that the inner barrel, or core retainer, should not rotate for the reason that a core is often times made up of alternate hard and soft sections which may be fractured from each other and rotated away from their natural positions with respect to each other by the friction of the core retainer wall, should the core retainer be permitted to rotate. If the core retainer should rotate before the core is cut from the formation, spring fingers 44 will make scratches upon the surface of that portion of the core which is still solidly connected to the adjacent formation. Thus a core might be secured which would be in two or more sections, each showing scratches indicating one or more revolutions. The sections of the core can be restored to their proper position by orienting them at the surface of the well. The spring 18 cushions the core retainer 9 against the chattering of the drill bit as it rotates over the formation being cut, thus assisting in producing an unbroken core. When a core of sufficient length has been formed, the core barrel is pulled upward. The core retainer tends to remain stationary due to the vacuum created and also because it is held by the fingers 44 gripping the core. The spring 18 permits the outer barrel to be raised a short distance, while the core retainer remains stationary. The shoulder 38 on the bit strikes the lower edges of the dogs 32, thereby driving the dogs inwardly against the core and, as the core barrel is pulled still higher the dogs grip tighter

until the core is finally fractured and the core barrel can be withdrawn from the well.

If it is desired to know the direction of the dip and strike of the formation being cored, a compass and compass setting device is placed in the housing 11 before the core barrel is lowered into the well. The setting device, which may be any suitable mechanism, as set forth in my prior application, is set to clamp the magnetic needle of the compass at a predetermined time. For instance, if it is expected to require three hours to cut out the core, the clamping mechanism is set to operate at three and a half hours. When the core has been cut, it is not fractured until after three and a half hours have elapsed after the lowering of the core barrel. The core barrel is then raised, the core fractured and the apparatus is withdrawn from the well. The coupling 6 is unscrewed from the core barrel 7 and the core retainer unscrewed from the coupling member 26. The position of the magnetic needle with respect to the position of the core retainer, is noted, and the core retainer is then opened by separating the two longitudinal sections, to permit the core to be removed. If the core has rotated with respect to the core retainer, scratches made by the fingers 44 will appear upon the surface of the core. Any such scratches are noted and allowance made for them when computing the original position of the core in the well. A device for readily determining the angle and direction of the dip and strike of the formation in the core in its original position in the earth is disclosed in my prior application above mentioned.

I claim:

1. A device of the class described comprising a rotatable core barrel, a core retainer, and cushioning means for operatively supporting said retainer within said barrel during normal rotation of said barrel.

2. A core barrel comprising an outer rotatable barrel, an inner barrel adapted to receive the core, said inner barrel being movable axially with respect to the outer barrel, means carried by the inner barrel for holding the inner barrel fixed with respect to the core, independent means carried by the inner barrel for fracturing the core and means for causing upward movement of the outer barrel to move said fracturing means into engagement with the core.

3. A core barrel comprising an outer rotatable barrel, an inner barrel adapted to receive a core movable vertically with respect to the outer barrel, pivoted dogs carried by the inner barrel and normally held from fracturing contact with the core, upward movement of the outer barrel with respect to the inner barrel serving to drive said dogs into the core.

4. A core barrel comprising an outer rotatable barrel, an inner barrel adapted to re-

ceive a core, said inner barrel being rotatable and movable vertically with respect to the outer barrel, pivoted dogs carried by the inner barrel and normally held from fracturing contact with the core, and a shoulder on the outer barrel adapted to engage said dogs when the outer barrel is moved with respect to the inner barrel, to drive the dogs into the core.

5. A core barrel comprising an outer barrel, an inner barrel adapted to receive a core, said inner barrel being rotatable and movable vertically with respect to the outer barrel, pivoted dogs carried by the inner barrel and normally held from fracturing contact with the core, a shoulder on the outer barrel adapted to engage said dogs when the outer barrel is moved with respect to the inner barrel to drive the dogs into the core, and means for preventing rotation of the inner barrel with respect to the outer barrel.

6. A core barrel comprising an outer barrel, a vertically movable bearing member in said barrel, an inner barrel mounted on said bearing member, ball bearings interposed between the inner barrel and the bearing member, and ball bearings carried by the inner barrel at its lower end arranged in bearing engagement with the outer barrel.

7. A core barrel comprising an outer barrel, a stem depending into said barrel, a collar mounted on said stem and movable vertically with respect thereto, an inner core receiving barrel suspended on said collar and ball bearings interposed between the collar and the inner barrel and means carried by the inner barrel for fracturing the core received therein.

8. A core barrel comprising an outer barrel, a stem depending into said barrel, a spring mounted on said stem, a collar mounted on said spring to have a vertical movement with respect to the stem, an inner barrel suspended on said collar, and ball bearings interposed between the collar and the inner barrel.

9. A device of the class described comprising an outer core barrel, an inner core retainer within said core barrel and rotatable with respect thereto, means for permitting limited movement between said barrel and retainer upon lifting said barrel, core severing dogs mounted upon said retainer, and means for striking a blow upon said core severing dogs upon lifting said barrel to force said dogs into a core which has been formed.

In testimony whereof, I have hereunto set my hand.

WILLIAM I. McLAUGHLIN.