Sept. 2, 1958 E. M. CRUTHERS 2,850,265

CORE EXTRACTOR FOR CORE DRILL

Filed Feb. 8, 1956 2 Sheets-Sheet 1

Fig. 1

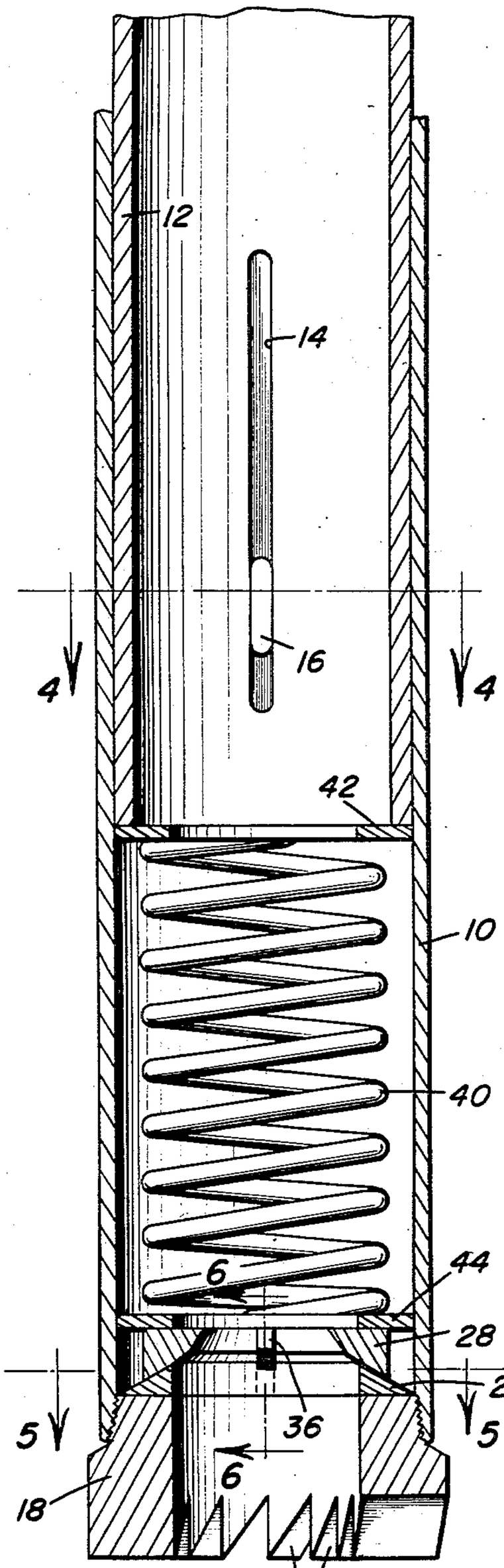
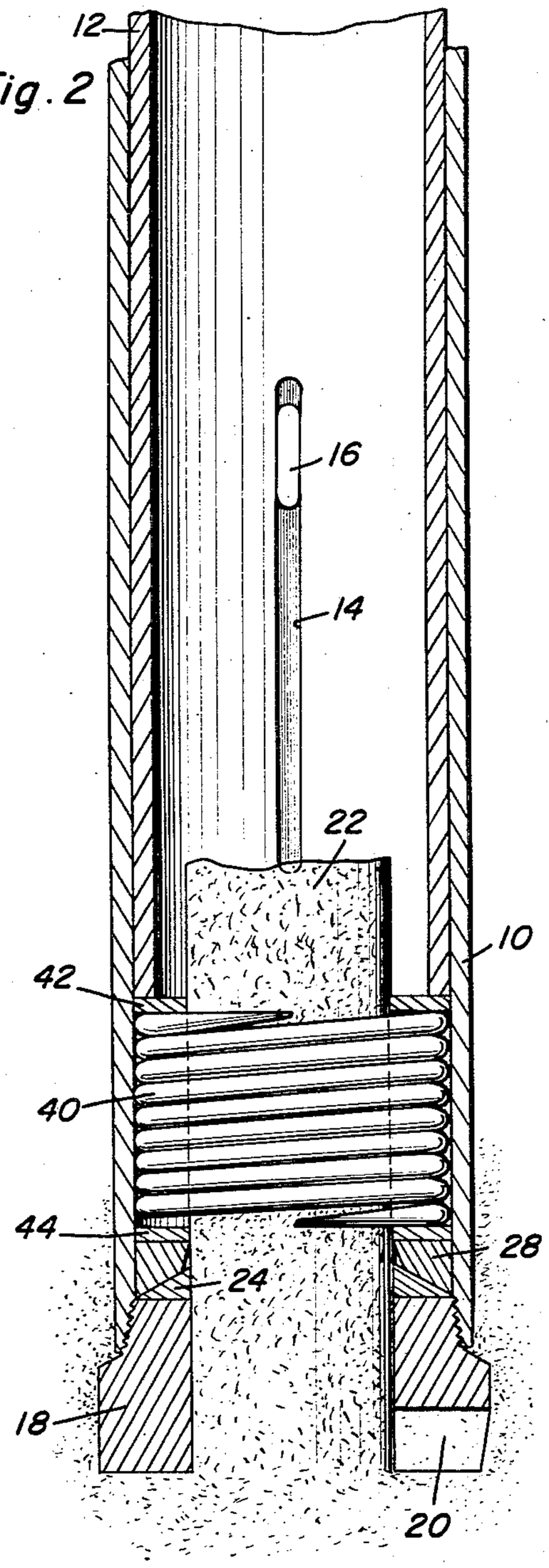


Fig. 2



Ellery M. Cruthers
INVENTOR.

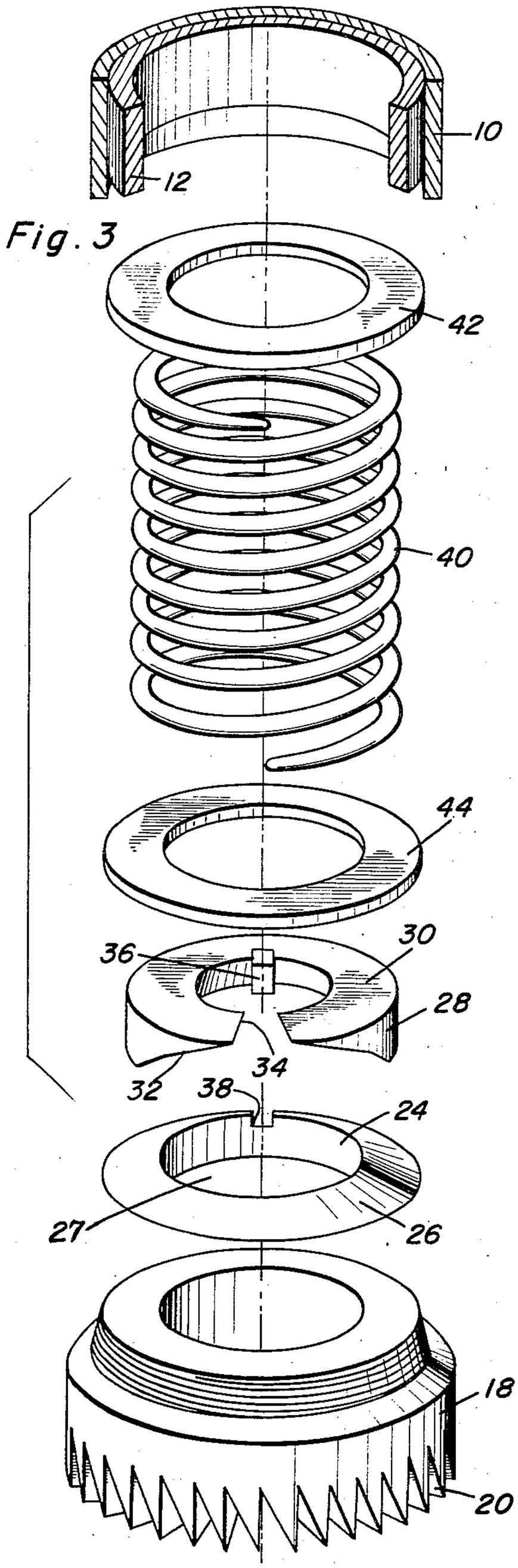
BY Clarence A. O'Brien and Harvey B. Jacobson
Attorneys

Sept. 2, 1958 E. M. CRUTHERS 2,850,265

CORE EXTRACTOR FOR CORE DRILL

Filed Feb. 8, 1956 2 Sheets-Sheet 2

Fig. 3



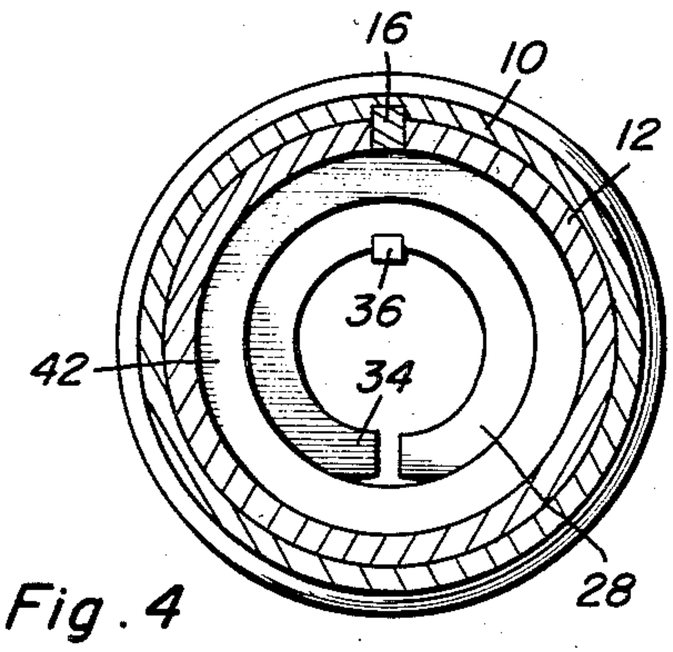


Fig. 4

Fig. 5

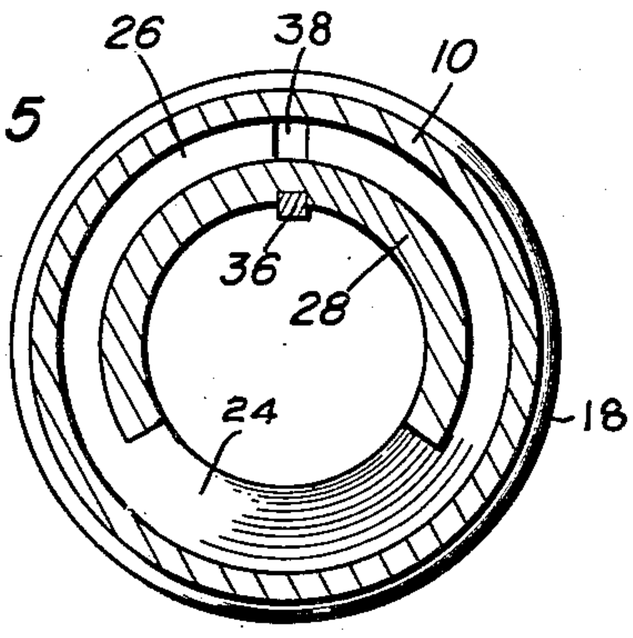
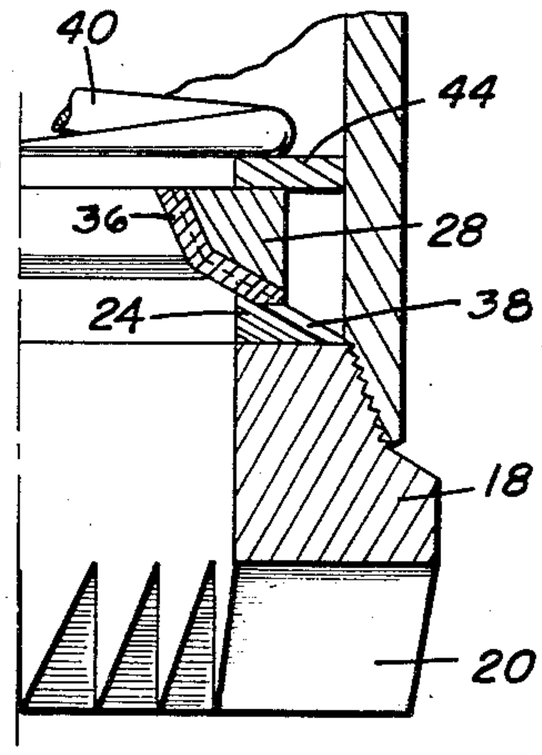


Fig. 6



Ellery M. Cruthers
INVENTOR.

BY Clarence A. O'Brien and Harvey B. Jacobson
Attorneys

United States Patent Office

2,850,265

Patented Sept. 2, 1958

2,850,265

CORE EXTRACTOR FOR CORE DRILL

Ellery M. Cruthers, Jamestown, Colo.

Application February 8, 1956, Serial No. 564,274

10 Claims. (Cl. 255—72)

This invention comprises novel and useful improvements in a core extractor for core drills, and more particularly relates to a tool adapted to facilitate the drilling of core samples and of severing the sample for recovery of the same.

The primary object of this invention is to provide an improved core drill having means for automatically cutting off a core sample within the drill and for frictionally retaining the sample for withdrawal with the core drill.

A further object of the invention is to provide a core drill having improved means for cutting off or weakening a core sample whereby the same may be removed and separated from the formation, and wherein the cut-off means shall be rendered selectively operable or inoperable by varying the pressure applied to the core drill from the tool string.

These, together with other objects and advantages which will become subsequently apparent, reside in the details of construction and operation as more fully hereinafter described and claimed, reference being had to the accompanying drawings forming a part hereof, wherein like numerals refer to like parts throughout, and in which:

Figure 1 is a vertical central longitudinal sectional view showing a preferred embodiment of a core drill incorporating therein the principles of this invention, the device being illustrated in the position of the parts wherein the pressure and weight of the drill string is released from the core drill and the latter therefore has its resilient member in contracted position for gripping a core sample therein;

Figure 2 is a view similar to Figure 1 but showing the position of the parts when the weight of the drill string is applied to the tool and the resilient gripping means is expanded to release a core sample;

Figure 3 is a group perspective view, parts being broken away, showing the various elements making up the improved core drill in accordance with this invention;

Figures 4 and 5 are horizontal sectional detail views taken substantially upon the planes indicated by the section lines 4—4 and 5—5 of Figure 1; and

Figure 6 is a detail view taken in vertical transverse section substantially on the plane indicated by the section line 6—6 of Figure 1.

In the accompanying drawings, wherein one suitable embodiment incorporating therein the principles of this invention has been illustrated solely by way of example only, a core drill is illustrated consisting of a cylindrical outer barrel 10 and an axially slidable inner barrel 12 therein. Conveniently, the latter barrel may be attached to the lower end of a drill string whereby the core drill may be operated thereby.

The inner and outer barrels are provided with fastening means whereby they are secured together against relative rotation but whereby a limited axial sliding movement is permitted. For this purpose, one of the barrels, such as the inner barrel, may be provided with a longitudinally extending slot 14 therein into which projects a

projection or key 16 carried by and projecting radially inwardly from the outer barrel. The engagement of this projection in the slot thus permits a limited axial movement of the two barrels, but prevents relative rotation therebetween whereby, upon rotation of the inner barrel 12 by the drill string, the outer barrel may likewise be caused to rotate.

Any conventional form of a core drill bit 18 may be detachably received in the screw-threaded lower extremity of the outer barrel 10, the drill bit 18 being hollow and having free communication with the interior of the outer barrel whereby, upon rotation of the device, the teeth 20 of the core drill will cut out a cylindrical core sample such as that indicated at 22 in Figure 2, and as the core drill moves downwardly during its drilling operation, this core sample will be projected upwardly into the downwardly advancing outer barrel.

In accordance with the present invention, the inner and outer barrel assembly of the core drill is provided with an improved means for making a circumferential groove or cut at the base of the core sample 22 for either severing or for weakening the same whereby the undercut core sample may be readily separated from the formation; together with means for frictionally gripping the core sample and withdrawing the same with the core drill.

For this purpose, there is disclosed in the lower end of the outer barrel 10, and resting upon and carried by the upper end of the circular core drill 18, a mandrel 24 in the form of an annulus or ring having a downwardly and outwardly flaring conical bevelled surface 26, together with a central opening 27 which is of the same diameter as the opening extending through the circular core drill bit 18. Disposed within the outer barrel and resting upon the mandrel for cooperation therewith in a particular manner to be hereinafter set forth is a C-ring 28 having a flat annular top surface 30 and having a bevelled, downwardly and outwardly flaring conical surface 32 which is complementary to the bevelled surface 26 of the mandrel and which is adapted to rest thereon. At least one of the ends of the C-ring is provided with a radially inwardly projecting extremity 34 comprising a cut-off bit which is adapted to cut a circumferential groove in the core sample as above mentioned. The C-ring is of a resilient material and is inherently resiliently biased into a radially contracted position in which the cut-off bit 34 will be adapted to engage the cylindrical surface of the core sample 22 for circumferentially cutting the same upon rotation of the core drill. However, when sufficient pressure is applied to the surface 30 of the C-ring for urging the two conical surfaces together, the C-ring will be radially expanded. The inclination of the complementary bevelled surfaces 32 and 26 will radially expand the C-ring and thus cause the cut-off edge or blade 34 to be moved radially outwardly into a non-cutting position.

As indicated best in Figure 5, the C-ring 20 is provided with an inwardly projecting, axially extending key or rib 36 which is received in a corresponding channel or keyway 38 formed in the mandrel 26 to thereby prevent relative rotation between these members.

A resilient member 40, which, as illustrated, is in the form of a spiral spring, is provided, this member being disposed in the outer cylinder 10 and operatively interposed between the lower end of the inner barrel and the C-ring for yieldingly urging these members apart. A pair of thrust washers 42 and 44 are provided to abut the opposite ends of the resilient member 40 and to seat respectively against the lower end of the inner barrel and the top surface 30 of the C-ring.

The resilient member 40 is sleeve-like in shape and is provided with a central passage therethrough which is of such size that when the resilient member is uncom-

pressed or free of the weight of the drill string, the wall or circumference of the resilient member will be radially contracted to thereby frictionally grip and retain a core sample disposed therein by the operation of the core drill. Thus, after the core sample has been broken off, and the core drill is withdrawn, the frictional gripping action of the member **40** upon the core sample will assist in retaining the same in the core drill for removal therewith. However, the arrangement is such that when the weight of the drill string is applied to the resilient member **40**, the latter will be axially compressed as shown in Figure 2 and radially expanded to thereby loosely receive and be disengaged from the enclosed core sample.

The operation of the device is as follows. When the tool is lowered into a formation to extract a core therefrom, and the weight of the drill string is applied to the core drill bit **18** as the latter rests upon the bottom of the bore, the inner barrel **12** will move downwardly and compress the spring **40**, this downward movement being permitted by sliding of the projection or key **16** in the slot **14**. With the weight of the drill string now disposed upon the spring **40**, the force will be transmitted to the C-ring **30** and by pressing the lower surface **32** of the same upon the bevelled surface **26** of the mandrel, the C-ring will be radially expanded, its cut-off edge **34** will be radially expanded into non-cutting position, so that the entire cross-sectional area of the opening through the core drill bit **18** and the opening **28** of the mandrel will be unobstructed. In this position, rotation of the tool by the drill string will be effective to drill a core sample **22**. It will be observed that during this operation both the resilient member **40** and the cut-off edge of the C-ring are out of contact with the core sample **22**.

When the desired length of core sample has been drilled, the drill string is elevated, thereby withdrawing its weight from the spring member **40**. This permits the spring to expand, causing the same to frictionally grip the cylindrical exterior surface of the core sample **22**, and also permits the C-ring to contract, and thus press its cut-off edge **34** radially inwardly against the exterior surface of the core sample adjacent its base. In this position, the tool is again rotated by the operation of the drill string, causing the cut-off edge to cut a circumferential groove or channel at the base of the core sample **22** and either sever or sufficiently weaken the same whereby the sample may be readily broken off either through or assisted by the gripping action of the resilient means **40**. Accordingly, the core severed may be removed from the bore with the tool.

When the core drill has been brought to the surface and it is desired to disengage the core sample therefrom, it is merely necessary to again apply the weight of the drill string to the core drill bit **18**, thus expanding the resilient member during axial compression of the same and expanding the C-ring, permitting the core sample to be released.

It should be noted that although the resilient member is disclosed in the form of a spiral spring, it is obvious that the same may be formed with various shapes, as of material which is round, square or of other cross-sectional shape. Moreover, in some instances a radially expansible and contractable sleeve may be employed of any desired construction, it being merely necessary for the purpose of this invention that the resilient member shall be capable of radial expansion and contraction under the application of or removal of the weight of the drill string therefrom; and shall be capable of transmitting this weight to the C-ring for expanding the same.

It will be further understood that the mandrel **24** may be secured in the barrel **10** in various ways. Thus, the outer circumference of the mandrel may be externally threaded for detachable mounting upon the interior of the barrel. Alternatively, a keyed engagement or interlocking, complementary recesses and sockets between the mandrel and barrel could be provided. Since the present invention is not limited to the use of any particular fastening means for securing the mandrel in position in the barrel, a further illustration as to such equivalent features is deemed unnecessary.

The foregoing is considered as illustrative only of the principles of the invention. Further, since numerous modifications and changes will readily occur to those skilled in the art, it is not desired to limit the invention to the exact construction and operation shown and described, and accordingly, all suitable modifications and equivalents may be resorted to, falling within the scope of the invention as claimed.

What is claimed as new is as follows:

1. A core drill comprising an outer barrel and an inner barrel therein, the former comprising a driving and supporting means for the latter, means securing said barrels together for axial sliding movement but against relative rotation, a core drill bit fixedly secured to the outer barrel for rotation thereby, a spiral spring in said outer barrel for receiving a core cut by said core drill bit, a core cut-off bit in said barrel for circumferentially cutting a core, said spiral spring being disposed below said inner barrel and having operative engagement with the inner barrel whereby axial movement of the inner barrel inwardly of the outer barrel will axially compress and radially expand the spiral spring to loosely receive a core therein and axial movement of the inner barrel outwardly of the outer barrel will axially expand and radially contract the spiral spring to enable the latter to frictionally grip a core therein.

2. The combination of claim 1 wherein said securing means comprises a longitudinal slot in one barrel and a projection on the other barrel received in said slot.

3. The combination of claim 1 wherein said core cut-off bit has a radially inwardly projecting cutting edge, means operable upon axial inward movement of the inner barrel for moving said cutting edge radially outward into non-cutting position.

4. The combination of claim 1 wherein said core cut-off bit has a radially inwardly projecting cutting edge, said cutting edge being normally resiliently biased radially inward into cutting position, means operable upon axial inward movement of the inner barrel for moving the cutting edge radially outward into non-cutting position.

5. A core drill comprising an outer barrel and an inner barrel therein, means securing said barrels together for axial sliding movement but against relative rotation, a core drill bit secured to the outer barrel for rotation thereby, a spiral spring in said outer barrel fo receiving a core cut by said core drill bit, a core cut-off bit in said barrel for circumferentially cutting a core, said spiral spring having operative engagement with the inner barrel whereby axial movement of the inner barrel inwardly of the outer barrel will axially compress and radially expand the spiral spring to loosely receive a core therein and axial movement of the inner barrel outwardly of the outer barrel will axially expand and radially contract the spiral spring to enable the latter to frictionally grip a core therein, said core cut-off bit having a radially inwardly projecting cutting edge, said cutting edge being normally resiliently biased radially inward into cutting position, means operable upon axial inward movement of the inner barrel for moving the cutting edge radially outward into non-cutting position, said last means including a mandrel having a bevelled surface, said cut-off bit having a complementary surface engaging the bevelled surface for causing radially outward movement of the cutting edge when said surfaces are urged together.

6. A core drill comprising an outer barrel and an inner barrel therein, means securing said barrels together for axial sliding movement but against relative rotation, a core drill bit secured to the outer barrel for rotation thereby, a spiral spring in said outer barrel for receiving a core cut by said core drill bit, a core cut-off

bit in said barrel for circumferentially cutting a core, said spiral spring having operative engagement with the inner barrel whereby axial movement of the inner barrel inwardly of the outer barrel will axially compress and radially expand the spiral spring to loosely receive a core therein and axial movement of the inner barrel outwardly of the outer barrel will axially expand and radially contract the spiral spring to enable the latter to frictionally grip a core therein, said core cut-off bit having a radially inwardly projecting cutting edge, said cutting edge being normally resiliently biased radially inward into cutting position, means operable upon axial inward movement of the inner barrel for moving the cutting edge radially outward into non-cutting position, said last means including a mandrel having a bevelled surface, said cut-off bit having a complementary surface engaging the bevelled surface for causing radially outward movement of the cutting edge when said surfaces are urged together, said mandrel comprising an annulus disposed in said outer barrel.

7. A core drill comprising an outer barrel and an inner barrel therein, means securing said barrels together for axial sliding movement but against relative rotation, a core drill bit secured to the outer barrel for rotation thereby, a spiral spring in said outer barrel for receiving a core cut by said core drill bit, a core cut-off bit in said barrel for circumferentially cutting a core, said spiral spring having operative engagement with the inner barrel whereby axial movement of the inner barrel inwardly of the outer barrel will axially compress and radially expand the spiral spring to loosely receive a core therein and axial movement of the inner barrel outwardly of the outer barrel will axially expand and radially contract the spiral spring to enable the latter to frictionally grip a core therein, said core cut-off bit having a radially inwardly projecting cutting edge, said cutting edge being normally resiliently biased radially inward into cutting position, means operable upon axial inward movement of the inner barrel for moving the cutting edge radially outward into non-cutting position, said last means including a mandrel having a bevelled surface, said cut-off bit having a complementary surface engaging the bevelled surface for causing radially outward movement of the cutting edge when said surfaces are urged together, said mandrel comprising an annulus disposed in said outer barrel and supported upon said core drill bit.

8. A core drill comprising an outer barrel and an inner barrel therein, means securing said barrels together for axial sliding movement but against relative rotation, a core drill bit secured to the outer barrel for rotation thereby, a spiral spring in said outer barrel for receiving a core cut by said core drill bit, a core cut-off bit in said barrel for circumferentially cutting a core, said spiral spring having operative engagement with the inner barrel whereby axial movement of the inner barrel inwardly of the outer barrel will axially compress and radially expand the spiral spring to loosely receive a core therein and axial movement of the inner barrel outwardly of the outer barrel will axially expand and radially contract the spiral spring to enable the latter to frictionally grip a core therein, said core cut-off bit having a radially inwardly projecting cutting edge, said cutting edge being normally resiliently biased radially inward into cutting position, means operable upon axial inward movement of the inner barrel for moving the cutting edge radially outward into non-cutting position, said core drill bit comprising a resilient C-ring, at least one end of said C-ring projecting radially inward to provide said cutting edge.

9. A core drill comprising an outer barrel and an inner barrel therein, means securing said barrels together for axial sliding movement but against relative rotation, a core drill bit secured to the outer barrel for rotation thereby, a spiral spring in said outer barrel for receiving a core cut by said core drill bit, a core cut-off bit in said barrel for circumferentially cutting a core, said spiral spring having operative engagement with the inner barrel whereby axial movement of the inner barrel inwardly of the outer barrel will axially compress and radially expand the spiral spring to loosely receive a core therein and axial movement of the inner barrel outwardly of the outer barrel will axially expand and radially contract the spiral spring to enable the latter to frictionally grip a core therein, said core cut-off bit having a radially inwardly projecting cutting edge, said cutting edge being normally resiliently biased radially inward into cutting position, means operable upon axial inward movement of the inner barrel for moving the cutting edge radially outward into non-cutting position, said core drill bit comprising a resilient C-ring, at least one end of said C-ring projecting radially inward to provide said cutting edge, means securing said C-ring against rotation relative to said outer barrel.

10. A core drill comprising an outer barrel and an inner barrel therein, means securing said barrels together for axial sliding movement but against relative rotation, a core drill bit secured to the outer barrel for rotation thereby, a spiral spring in said outer barrel for receiving a core cut by said core drill bit, a core cut-off bit in said barrel for circumferentially cutting a core, said spiral spring having operative engagement with the inner barrel whereby axial movement of the inner barrel inwardly of the outer barrel will axially compress and radially expand the spiral spring to loosely receive a core therein and axial movement of the inner barrel outwardly of the outer barrel will axially expand and radially contract the spiral spring to enable the latter to frictionally grip a core therein, said core cut-off bit having a radially inwardly projecting cutting edge, said cutting edge being normally resiliently biased radially inward into cutting position, means operable upon axial inward movement of the inner barrel for moving the cutting edge radially outward into non-cutting position, said core drill bit comprising a resilient C-ring, at least one end of said C-ring projecting radially inward to provide said cutting edge, said spiral spring terminally abutting the C-ring and the inner barrel.

References Cited in the file of this patent

UNITED STATES PATENTS

643,082	Bullock	Feb. 6, 1900
1,693,789	Le Bus	Dec. 4, 1928
2,182,374	Dumble	Dec. 5, 1939
2,306,369	Anderson	Dec. 29, 1942