Jan. 8, 1963 E. F. BRIEGER 3,072,202

CORE TAKER DEVICES

Filed March 9, 1960

3 Sheets-Sheet 1

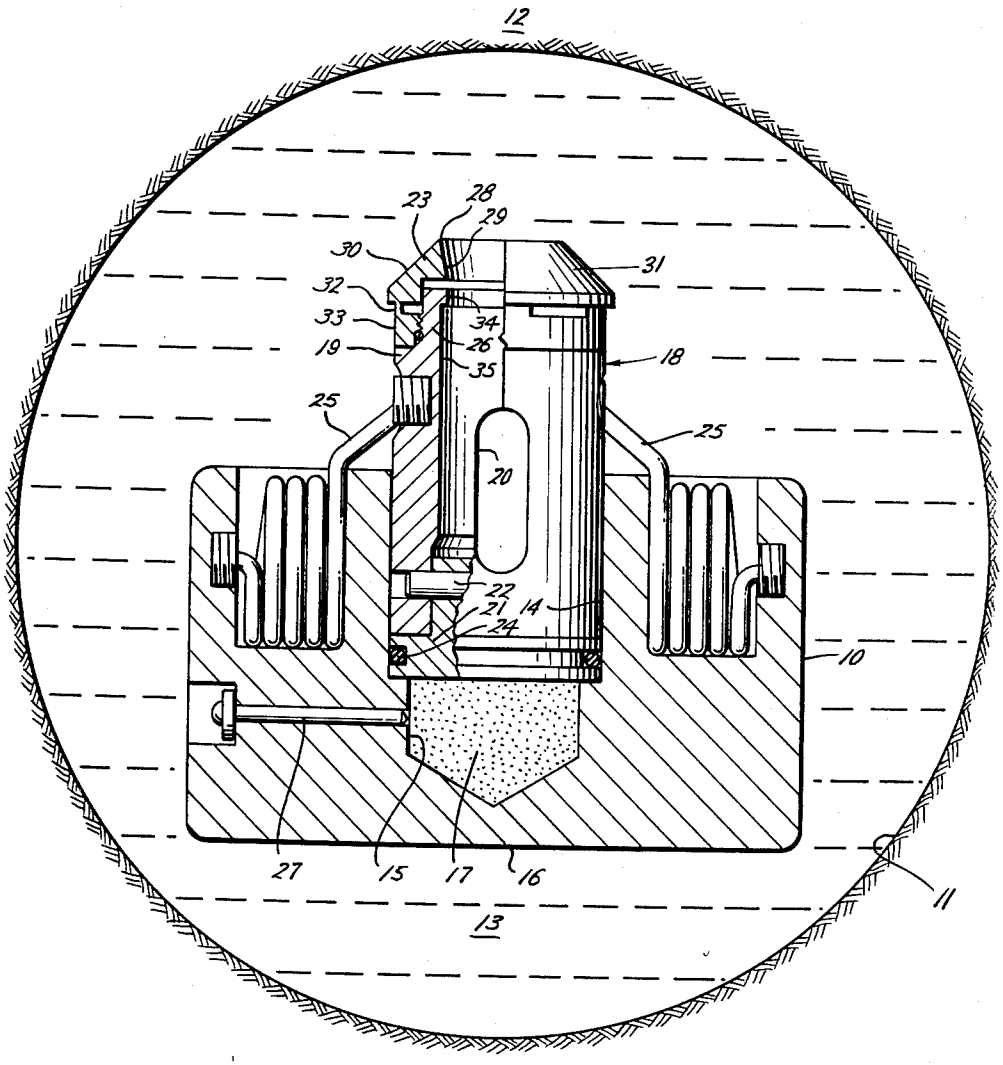


Fig. 1

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CORE TAKER DEVICES

Filed March 9, 1960

3 Sheets-Sheet 2

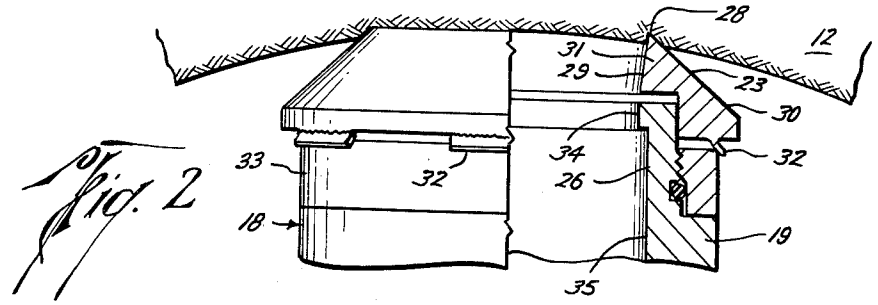


Fig. 2

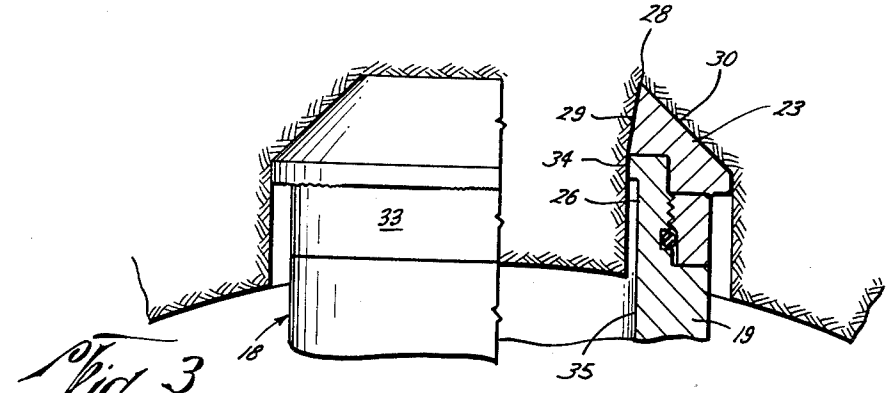


Fig. 3

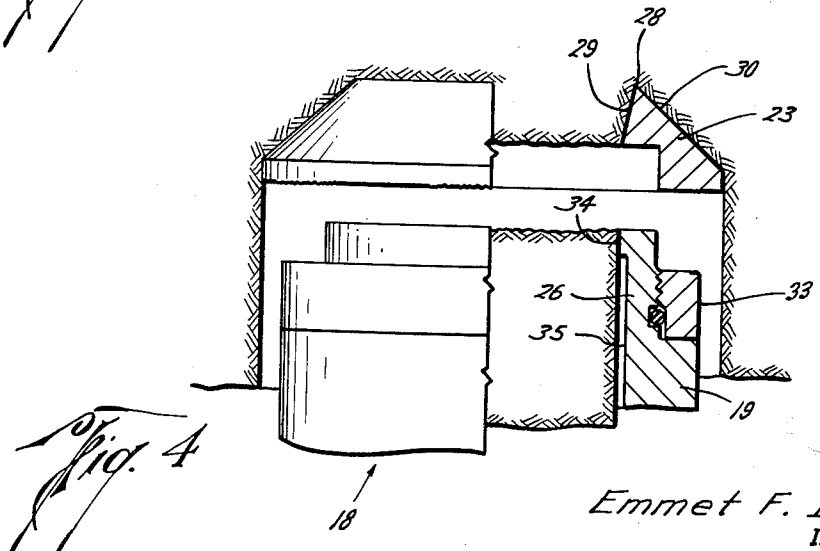


Fig. 4

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CORE TAKER DEVICES

Filed March 9, 1960

3 Sheets-Sheet 3

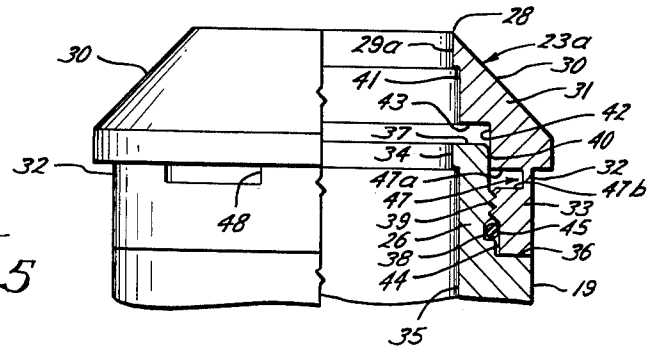


Fig. 5

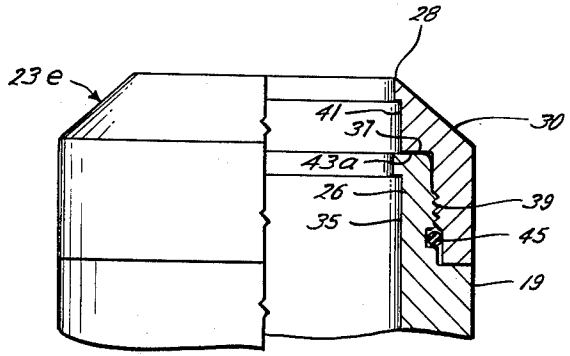


Fig. 6

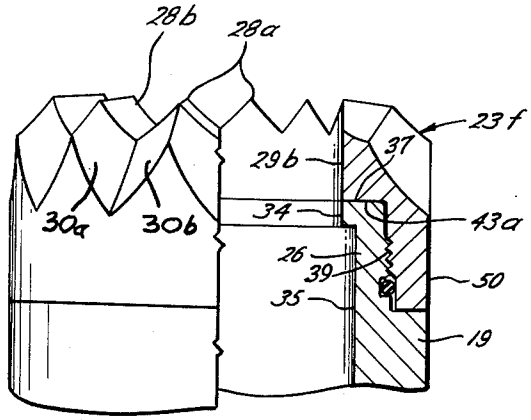


Fig. 7

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United States Patent Office 3,072,202 Patented Jan. 8, 1963

3,072,202

CORE TAKER DEVICES

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13 Claims. (Cl. 175—4)

This invention relates to apparatus for obtaining solid samples of earth formations and, more particularly, pertains to a new and improved core-taking apparatus for obtaining a solid sample of earth formation material.

Generally, cores or samples of earth formation material are obtained by lowering a sidewall sample taker assembly into the borehole to the level of the formation to be investigated. The sample taker assembly includes a gun body which receives a number of hollow core-taking bullets together with explosive means which are selectively operable so that the bullets may be impelled towards and into a formation, with the hollow interior of the bullets thereby receiving the formation material. Usually, the core bullet is secured to the gun body by one or more flexible retrieving connections so that a pull, as by raising the gun body, serves to withdraw the core bullet with a formation sample from the earth formations. Thus, a formation core sample can be retrieved to the surface of the earth for examination and testing.

However, many problems are presented by the variety of formations which are encountered in sampling operations. For example, the types of formations may be generally classified as (1) soft, (2) medium, (3) firm, (4) hard, and (5) extra hard. Thus, the problems may vary from the difficulty in getting the bullet into the extra hard formations without damage, to the difficulty encountered in soft formations in the withdrawal of the core bullet from the formation. To obtain core samples from the various types of formations, different types of core bullets have been designed to meet the various conditions arising. Aside from the problem of retrieving the core bullets, it is, of course, necessary to obtain a core sample which is representative of the formation tested.

Particularly in the soft to firm formations, recovery of core bullets has been facilitated by providing the core bullet with a separable forward portion in the form of an annular cutting ring which generally has a slightly greater outer diameter than the core barrel. Thus, the ring forms an enlarged hole relative to the body of the bullet to alleviate "sticking" of the bullet body in the formation. When a pull is exerted on the body of the bullet, it should separate from the cutting ring thereby to leave the cutting ring in the formation. It will be appreciated that a considerable problem arises in attaching the cutting ring to the bullet body so that it will remain attached until the bullet is in the formation and thereafter be easily separable from the bullet body. For example, the explosive blast and recoil resulting from the firing of one bullet of previous types sometimes displaces the ring from an adjacent bullet. Hence, the bullet, when fired without a cutting ring, typically remains "stuck" in the formation and therefore lost or, if recovered, the bullet is both damaged and empty.

In the Patent No. 2,923,530, granted to Roger Q. Fields, a solution to the problem of retaining the cutting ring to the bullet body is provided in the form of a rubber retainer ring to resiliently secure the cutting ring to the bullet body. However, it has been found that high temperatures or low hydrostatic pressures may sometimes affect the efficiency of this type of retainer and thus it is still possible, under certain conditions, to dislodge a cutting ring prior to its trip into the formation.

Another solution proposed for this problem is a shear pin connection between the cutting ring and bullet body,

but this has been found unsatisfactory because the cutting rings too often either separate from the bullet body prior to firing or are inseparable when in the formation. Hence, a shear pin connection gives rise to considerable uncertainty as to the reliability of the core sampling operation. Moreover, a shear pin connection is difficult and time consuming in assembly.

As the firmness of the formation increases, for example, from soft to firm the outer diameter of the cutting ring is decreased. For firm to very hard formations, the cutting ring has generally the same outer diameter as the bullet body and is integral or solidly connected with the bullet body. Also, for formations extending from firm to hard, the compaction of the core sample, as it is received by the bullet body, increases so that the core sample often cracks or fragments so as to shatter easily when it is removed from the bullet body. A shattered or cracked core sample may also be lost while retrieving the apparatus from the well bore. It is, of course, desirable to obtain an intact core sample from the retrieved bullet.

The foregoing problems presented by various types of formations often raise field operational dilemmas because the kind or type of formations expected to be encountered in a well may not be known until just prior to running a core taker apparatus in the hole. Hence, costly delays are encountered when a core taker apparatus loaded with the wrong type of bullets is at the well, since a reloading of an apparatus involves considerable time and generally must be accomplished at a remote location.

Accordingly, it is an object of the present invention to provide new and improved core-taking apparatus to obviate the aforementioned types of difficulties in core sampling operations.

Another object of the present invention is to provide new and improved core-taking bullets in which a separable cutting ring is maintained on a bullet body in fixed spatial relation and is separable after the bullet is embedded in an earth formation.

Yet another object of the present invention is to provide new and improved core-taking bullets, including separable portions which, prior to embedding in a formation, are in a positively stable, unitary assembly thereby eliminating the possibility of inadvertent separation.

A further object of the present invention is to provide new and improved core-taking bullets which are simple and inexpensive in arrangement as well as versatile, efficient, and reliable under a variety of field operations.

Apparatus for investigating earth formations according to the present invention includes a gun body for receiving a plurality of core sampling bullets disposed adjacent one another lengthwise of the gun body and adapted to be impelled toward and into the formation by explosive means. The bullet body is tubular with a threaded portion set in at an annular shoulder and extending to the forward end of the body, the shoulder and forward end thus providing spaced annular abutment surfaces of different diameter. A cutting ring of type suited to the formation to be sampled is releasably secured to the body by means including threads engageable with the threaded portion of the body, one or both of the shoulders providing a supporting abutment between the ring and body. Preferably, the securing means include an O-ring received between the cutting ring and body to prevent accidental unthreading.

In another aspect of the present invention, for soft formations, a cutting ring is secured to the forward end of each bullet body and has a breakable portion interconnecting the ring and body which maintains them in essentially fixed spatial relation to one another. However, when the bullet is fired, the force at which the cutting ring engages the formation disjoints or crushes

the breakable portion so that the ring and body are easily separable thereby to permit withdrawal of the bullet body from the formation while the cutting ring remains embedded therein.

The novel features of the present invention are set forth with particularity in the appended claims. The present invention, both as to its organization and manner of operation, together with further objects and advantages thereof, may best be understood by reference to the following description taken in conjunction with the accompanying drawings in which:

FIG. 1 is a view in cross section of apparatus for investigating earth formations embodying the present invention taken in a plane perpendicular to the axis of a borehole in which the apparatus is disposed, and illustrating the apparatus in one condition of operation;

FIGS. 2–4 are partial views in cross section of portions of a cutting ring and forward end of a bullet body in a sequence of relative positions from an initial condition of impact to a final condition wherein a bullet body is being withdrawn from the formation;

FIG. 5 is an enlarged view in cross section of a forward end of a core-taking bullet which embodies the features of the present invention;

FIGS. 6 and 7 are partial views in cross section of other applications of the present invention.

In FIG. 1 of the drawing, there is shown a gun block or body **10** disposed in a borehole opposite a formation of interest **12**. Usually, borehole **11** contains a drilling mud **13**; however, the present invention may be employed in either dry or fluid-filled boreholes.

Gun block **10** has a cylindrical bore **14** adjoining a bore **15** of smaller diameter, the bore **15** forming a powder chamber which terminates short of the rear surface **16** of the gun block. Chamber **15** contains an appropriate and conventional explosive propellant **17** while bore **14** receives a generally cylindrical sample-taking projectile or bullet **18** constructed in accordance with the present invention. Although not illustrated, gun block **10** generally contains additional projectiles in respective bores distributed along a vertical axis for the gun block.

Bullet **18** is comprised of a substantially cylindrical, hollow, core barrel or body **19** provided with ports **20** in its sidewalls, a rear end or bottom closure **21** connected to the body by a connecting pin **22**, and a forward cutting ring **23** which is threadedly connected to a connector end **26** of the core barrel **19**. Near the rearward end of body **19**, an annular groove **24** receives an O-ring to provide a fluid-tight seal for the bullet **18** in the bore **14** and flexible retrieving wires **25** are secured in a conventional manner between the bullet body **19** and gun block **10** to permit the bullet body to be retrieved. A conventional igniter **27** suitably mounted in the block **10** may be employed to detonate the explosive propellant **17** and thereby propel the bullet **18** towards and into the formation.

As will hereinafter become more apparent, many types of cutting rings may be easily interchanged on the bullet body **19**. Cutting ring **23**, as shown in FIG. 1, is of a type employed in soft to firm formations where it is desired to separate the cutting ring from the bullet body after the assembly is embedded in a formation. In general, the cutting ring **23** has a forward annular cutting member **31** with a portion having an outer diameter greater than the diameter of body **19** and a forward cutting edge **28** formed between an inwardly tapered mouth surface **29** and an outwardly tapered front face surface **30**. The cutting member **31** is integrally connected by circumferentially spaced, thin walled segments or members **32** to an annular retainer member **33** which is threadedly connected to end **26** of the core body **19**.

While the specific details of the cutting ring construction will be more fully described hereinafter with respect to FIG. 5, the general principles which enable the separation of the cutting member from the bullet body are as follows: Upon impact of the bullet **18** with the borehole wall, the wall segments **32** connecting the cutting member **31** and retainer member **33** are crushed or broken (FIG. 2) and the cutting member **31** is carried into the formation by the bullet body **18** (FIG. 3) which, of course, has considerable momentum. The earth formations are cut by the cutting edge **28** and the tapered mouth surface **29** channels the formations into a forward bore **34** of the bullet body **19**. The forward bore **34** has only a short length and adjoins a bore **35** of larger diameter so that the formation core is held by the short length of the forward bore **34**. Thereafter, as shown in FIG. 4, a pull on the bullet body **19** retrieves the body from the formation with a sample core while the ring member **31** remains in the formation.

In FIG. 5, the details of the connectional end **26** of the body **19** and a cutting ring **23***a* are shown in enlarged detail. Cutting ring **23***a* is a type which is generally used in medium to firm formations.

The connectional end **26** of bullet body **19** includes a forward, outer, annular relieved portion extending between a shoulder **36** and a forward end surface **37**, the shoulder and end surface being arranged substantially parallel to one another and perpendicular to the central axis of body **19**. Intermediate of the annular shoulder **36** and the forward end surface **37** and beginning from the annular shoulder **36** are an O-ring receiving groove **38**, a threaded section **39** and a cylindrical surface **40**.

The connectional end **26** of the body **19**, as will become apparent from the discussion to follow, permits the use of a variety of cutting rings. Hence, if a sample taker is assembled with bullets having one type of cutting ring and, at the well site, another type of cutting rings is called for, the cutting rings may easily be interchanged. This is made possible by the provision of the O-ring groove **38**, threaded section **39** and forward end surface **37**.

The cutting ring **23***a* of FIG. 5 differs mainly from cutting ring **23** by the provision of a straight cylindrical mouth bore **29***a* which has a short length and adjoins a rearward bore **41** of greater diameter thereby providing a relieved portion in which the core sample is subjected to a minimum amount of compaction or rearrangement of sand grains. Hence, the two relieved sections, the one on the cutting ring and the one on the bullet body, serve to minimize the core damage. At the same time, removal of the core from the bullet body is facilitated since only a short section of the formation core is held securely by the body.

In other respects, cutting ring **23***a* is similar in construction to ring **23** and like components bear like identification numerals. Cutting edge **28** is now, however, formed between the cylindrical bore **29***a* and the outwardly tapered surface **30**. The retainer member **33** has an internal, threaded portion compatible with the threaded portion **39** of end **26** while the cutting member **31** has a cylindrical bore **42** which corresponds generally in diameter to the diameter of the cylindrical surface **40**. Hence, the cutting ring **23***a* may be threadedly connected to the connectional end **26** of the body. Cylindrical bore **42** in the cutting member **31** terminates at a downwardly facing shoulder **43** and, ideally, the spacing between the shoulder **43** and the forward end surface **37** of the bullet body **19** should be such that when the segments **32** are broken, the shoulder **43** will abut surface **37**.

To secure the cutting ring to the bullet body, the lower end of the connectional retainer ring member is provided with a relieved cylindrical surface **44** adjacent to the threaded portion and having a given clearance opposite groove **38**. An O-ring **45** inserted in the O-ring receiving groove **38** is placed under compression between the surface **44** and groove **38** to frictionally secure the cutting ring **23***a* against rotation relative to the bullet body. Standard dimensions of O-ring, groove and clearance may

suitably be employed. The segments 32 which interconnect the annular ring member 33 to the forward cutting member 31 may be formed by cutting an annular, rectangularly shaped groove 47 in the ring and thereafter milling or cutting away portions of the remaining wall thickness to form openings 48 thereby minimizing the amount of metal actually interconnecting the cutting member 31 to the retainer member 33. In practice, segments 32 are three in number and equally spaced. The width of the groove 47 or the spacing between the side surfaces 47*a*, 47*b* of the groove 47 may be slightly less than the expected spacing between the forward end surface 37 of the bullet body 19 and the annular shoulder 43 of the cutting member 31. Thus, it can be insured that the cutting member 31 will move relative to the retainer member 33 on the bullet body a distance sufficient to insure the complete breaking of the linking segments 32. Of course, when the segments 32 are broken, the surface 47*a* of member 31 will abut surface 47*b* on the retainer member 33. It will be appreciated that, ideally, at this time, if the annular shoulder 43 also bears upon the forward surface 37, the cutting ring is completely reinforced by the bullet body.

Generally, the softer the formations are, the larger the diameter of the cutting ring. Hence, other types of cutting rings, having portions with successively larger diameters, may be interchangeable with the ring 23*a* on the core body 19 as the situation may dictate. The interchange is readily accomplished by the simple expedient of unscrewing one cutting ring and screwing on a different cutting ring which may be done even after the bullets have been loaded in the core-taking apparatus.

Referring now to FIG. 6, in hard formations it is necessary to have a fairly uniform outer diameter on the bullet to insure penetration of the formation and, at the same time, penetration is generally limited to a very small distance. Hence, a cutting ring which is disengageable from the bullet is totally impractical. Thus, from firm to very hard formations, a cutting ring 23*e*, which has an outer cylindrical surface in conformity with the diameter of the bullet body, may be threadedly connected to end 26 of the bullet body 19. The cutting ring 23*e* has an annular shoulder 43*a* related to threaded portion 39 on the end 26 of body 19 so that when the cutting ring is threadedly connected to the end 26, the annular shoulder 43*a* abuts upon the forward end surface 37 of the bullet body 19 and forms an effectively solid bullet assembly. As discussed previously, this type of cutting ring may be provided with a relieved bore 41 to minimize the compaction damage to the core.

Shown in FIG. 7 is a bullet assembly for very hard formations where the forward cutting edges 28*a* are formed by serrations and the penetrating end of the bullet assembly is as strong as possible to withstand the impact and penetrate the formations. The cutting ring 23*f* has cutting edges 28*a* perpendicular to a straight cylindrical bore 29*b* and formed by V-shaped notches 28*b*. Bore 29*b* is similar in diameter to bore 34 of the body 19. Outwardly tapered surfaces 30*a*, 30*b* connect the cutting edges 28*a* to the outer cylindrical surface 50. Shoulder 43*a* is arranged relative to the threaded portion 39 to abut firmly upon the forward end surface 37 of the bullet body so that maximum strength of construction of the penetrating end of the bullet is achieved.

From the foregoing description, it will be appreciated that, with one bullet body, at least four distinct types of cutting rings may be employed. Hence, once the core bullet bodies are loaded in the apparatus, it is a simple and quick operation to provide a suitable cutting ring at the well site for the operation desired.

The assembly of a cutting ring to a bullet body is simple and reliable. After an O-ring is disposed in the groove 33 of the bullet body 19, the desired cutting ring is screwed on until the retainer ring 33 abuts shoulder 36, the O-ring insuring the adequacy of the connection and the apparatus is lowered into the well bore.

For the type of cutting ring, as disclosed in FIGS. 1–5, when the impelled bullet impacts the formation, the momentum of the bullet body 19 causes the connecting segments 32 to be broken or crushed generally at their weakest point adjacent wall 47*b* of groove 47. Thereafter, the wall 47*b* of the retainer member 33 abuts the surface 47*a* of the cutting member to force the cutting member into the formation, the bullet body 19 following until the impelling force is expended. Subsequently, a pull on the bullet body 19 permits the body to separate from the cutting member 31. After retrieving the apparatus, the core sample is removed and the retainer member removed so that the bullet body is once again in condition for re-use.

As shown in FIGS. 2–4, the segments 32 actually separate from the cutting member 31 and the retainer member 33; however, it will be appreciated that the thickness of the segments 32, as well as the size of openings 48, may, of course, be varied to meet strength requirements as desired.

In FIGS. 6 and 7, the cutting ring, being integral or solid with respect to the bullet body, is also retrieved when the bullet body is extracted from the formation. After the core sample is removed, the bullet assembly is re-usable. However, it will be appreciated that should the cutting ring suffer damage it may easily be replaced by a like cutting ring thereby providing a considerable saving in eliminating the replacement of an entire bullet assembly.

While particular embodiments of the present invention have been shown and described, it is apparent that further changes and modifications may be made without departing from this invention in its broader aspects, and therefore, the aim in the appended claims is to cover all such changes and modifications as fall within the true spirit and scope of this invention.

What is claimed is:

1. A core taker of the projectile type for obtaining core samples of earth formations comprising a tubular body member having an annular shoulder therealong and a threaded surface portion offset at said shoulder and extending towards the forward end of said body member, a cutting ring having a forward cutting portion and a rearward retaining portion, said rearward portion having an outer diameter substantially equal to that of said body member and a threaded interior for threaded engagement with the threaded portion of said body member with said rearward portion received by said body member in confronting relation to said shoulder, said forward portion having a rearwardly directed shoulder confronting the forward end of said body member for abutment therewith, and means for releasably securing said cutting ring on said body member against accidental unthreading.

2. A core taker of the projectile type for obtaining core samples of earth formations comprising a tubular body member having an annular shoulder therealong and a threaded surface portion offset at said shoulder and extending towards the forward end of said body member, a cutting ring having a forward cutting portion and a rearward retaining portion, said rearward portion having an outer diameter substantially equal to that of said body member and a threaded interior for threaded engagement with the threaded portion of said body member with said rearward portion received by said body member in confronting relation to said shoulder, said forward portion having a rearwardly directed shoulder confronting the forward end of said body member for abutment therewith, and a resilient rotation-resisting member received between said cutting ring and said body member.

3. A core taker of the projectile type for obtaining core samples of earth formations comprising a tubular body member having an annular shoulder therealong and a threaded surface portion offset at said shoulder and

extending towards the forward end of said body member, a cutting ring having a forward cutting portion and a rearward retaining portion, said rearward portion having an outer diameter substantially equal to that of said body member and a threaded interior for threaded engagement with the threaded portion of said body member with said rearward portion received by said body member in confronting relation to said shoulder, said forward portion having a rearwardly directed shoulder confronting the forward end of said body member for abutment therewith, and a resilient O-ring received in compressed relation between said butting ring and said body member and retained in a groove provided by one of said cutting ring and said body member for resisting relative rotation between said cutting ring and said body member tending to unthread their connection.

4. A core taker of the projectile type for obtaining core samples of earth formations comprising a tubular body member having a threaded surface portion adjacent its forward end, a cutting ring having a forward cutting portion, a rearward retaining portion, and a breakable portion extending in connecting relation between said forward and rearward portions and integral therewith, said rearward portion having a threaded engagement with the threaded portion of said body member, said forward portion having a rearwardly directed shoulder confronting the forward end of said body member and spaced therefrom a distance substantially the same as the spacing between said forward and rearward ring portions maintained by said breakable portion prior to its breaking.

5. A core taker of the projectile type for obtaining core samples of earth formations comprising a tubular body member to receive a core sample, an integral cutting ring having a forward cutting portion and a tubular rearward portion received at the forward end of said body member, said tubular portion having a breakable section of substantially reduced cross section of a length to space said cutting portion from the front end of said body member until broken by impact, and means for securing said cutting ring to said body member.

6. A core taker of the projectile type for obtaining core samples of earth formations comprising a tubular body member for receiving a core sample, said body member having a forward end, a cutting ring disposed on said forward end of said body member and having a forward cutting portion, a rearward retaining portion, and circumferentially spaced breakable portions defined between said forward and rearward portions by an internal annular groove in said cutting ring having a width less than the spacing between said cutting portion and the forward end of said body member, and means for releasably securing the rearward portion of said cutting ring to said body member.

7. A core taker of the projectile type for obtaining core samples of earth formations comprising a tubular body member for receiving a core sample, and having a forward end, a cutting ring disposed on said forward end and having a forward cutting portion, a rearward retaining portion, and circumferentially spaced breakable portions defined between said forward and rearward portions by an internal annular groove in said cutting ring having a width less than the spacing between said cutting portion and the forward end of said body member, and means for releasably securing the rearward portion of said cutting ring to said body member, the weakest point in the connection between said rearward and forward ring portions provided by said breakable portions and being located at the juncture of said breakable portions and said rearward portion whereby said breakable portions are broken outwardly from the region between said forward and rearward portions upon impact, and means for releasably securing said cutting ring to said body member.

8. A core taking device comprising: a tubular body member adapted to be forced into a wall of a well bore; said body member having a forward connector end; an annular cutting ring having a mouth opening sized to admit a core sample into the body member and an external diameter greater than the diameter of said body member and including a forward cutting member, a rearward retainer member arranged for connection to the connector end of said body member, and an intermediate, thin walled, breakable connecting portion coupling said forward cutting member to said rearward retainer member in a spaced relationship and breakable upon impact of said forward cutting member with the wall of well bore.

9. A core taking device comprising: a tubular body member adapted to be forced into a wall of a well bore; said body member having a forward end portion with a lesser outer diameter than the main portion of said body, said forward end portion thereby being defined between a forwardly facing shoulder and a forwardly facing end surface, an annular cutting ring having a mouth opening sized to admit a core sample into the body member and an external diameter greater than the diameter of said body member and including a forward cutting member, a rearward retainer member arranged for connection to the forward end of said body member, and an intermediate, thin walled, breakable connecting portion coupling said forward cutting member to said rearward retainer member in a spaced relationship and breakable upon impact of said forward cutting member with the wall of well bore.

10. A core taking device comprising: a tubular body member adapted to be forced into a wall of a well bore; said body member having a forward end portion with a lesser outer diameter than the main portion of said body, said forward end portion thereby being defined between a forwardly facing shoulder and a forwardly facing end surface, said forward end portion having a threaded section intermediate of said shoulder and said end surface; an annular cutting ring having a mouth opening sized to admit a core sample into the body member and an external diameter greater than the diameter of said body member and including a forward cutting member, a rearward retainer member internally threaded for connection to the threaded section of said body member, and an intermediate, thin walled, breakable connecting portion coupling said forward cutting member to said rearward retainer member in a spaced relationship and breakable upon impact of said forward cutting member with the wall of well bore.

11. A core taking device comprising: a tubular body member adapted to be forced into a wall of a well bore; said body member having a forward end portion with a lesser outer diameter than the main portion of said body, said forward end portion thereby being defined between a forwardly facing shoulder and a forwardly facing end surface, said forward end portion having a threaded section intermediate of said shoulder and said end surface; an annular cutting ring having a mouth opening sized to admit a core sample into the body member and an external diameter greater than the diameter of said body member and including a forward cutting member having a bore forming a rearwardly facing shoulder, a rearward retainer member internally threaded for connection to the threaded section of said body member, and an intermediate, thin walled, breakable connecting portion coupling said forward cutting member to said rearward retainer member in a spaced relationship substantially equal to the spacing between said rearwardly facing shoulder and said forwardly facing end surface and breakable upon impact of said forward cutting member with the wall of well bore.

12. A core taking device comprising: a tubular body member adapted to be forced into a wall of a well bore; said body member having a forward end portion with a lesser outer diameter than the main portion of said body, said forward end portion thereby being defined between a forwardly facing shoulder and a forwardly facing end

surface, said forward end portion having a threaded section intermediate of said shoulder and said end surface; an annular cutting ring having a mouth opening sized to admit a core sample into the body member and an external diameter greater than the diameter of said body member and including a forward cutting member, having a bore forming a rearwardly facing shoulder, a rearward retainer member internally threaded for connection to the threaded section of said body member, and an intermediate, thin walled, breakable connecting portion coupling said forward cutting member to said rearward retainer member in a spaced relationship substantially equal to the spacing between said rearwardly facing shoulder and said forwardly facing end surface and breakable upon impact of said forward cutting member with the wall of well bore; and a resilient member disposed between said retainer member and said body member to restrain relative movement therebetween said threadedly connected members.

13. A core taking device comprising: a tubular body member adapted to be forced into a wall of a well bore; said body member having a forward end portion with a lesser outer diameter than the main portion of said body, said forward end portion thereby being defined between a forwardly facing shoulder and a forwardly facing end surface, said forward end portion having a threaded section intermediate of said shoulder and said end surface; an annular cutting ring having a mouth opening sized to admit a core sample into the body member and an external diameter greater than the diameter of said body member and including a forward cutting member, having a bore forming a rearwardly facing shoulder, a rearward retainer member internally threaded for connection to the threaded section of said body member, and an intermediate, thin walled, breakable connecting portion coupling said forward cutting member to said rearward retainer member in a spaced relationship substantially equal to the spacing between said rearwardly facing shoulder and said forwardly facing end surface and breakable upon impact of said forward cutting member with the wall of well bore; said forward end portion having a groove intermediate of said threaded section and said forwardly facing shoulder; and a resilient member disposed in said groove between said retainer member and said body member to restrain relative movement between said threadedly connected members.

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2,917,280	Castel	Dec. 15, 1959
2,937,005	Porter	May 17, 1960
2,944,791	Le Bus	July 12, 1960