United States Patent [19]

Davis

[11] **3,794,127**

[45] **Feb. 26, 1974**

[54] **HOLLOW AUGER-DRIVER COUPLING**

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[73] Assignee: **Mobile Drilling Company, Inc.,** Indianapolis, Ind.

[22] Filed: **June 6, 1972**

[21] Appl. No.: **260,270**

Related U.S. Application Data

[63] Continuation-in-part of Ser. No. 165,197, July 22, 1971, abandoned.

[52] **U.S. Cl.** **175/58,** 175/323, 285/330

[51] **Int. Cl.** **E21b 49/00,** E21b 17/00

[58] **Field of Search** 175/58, 236, 323; 285/DIG. 14, 285/330

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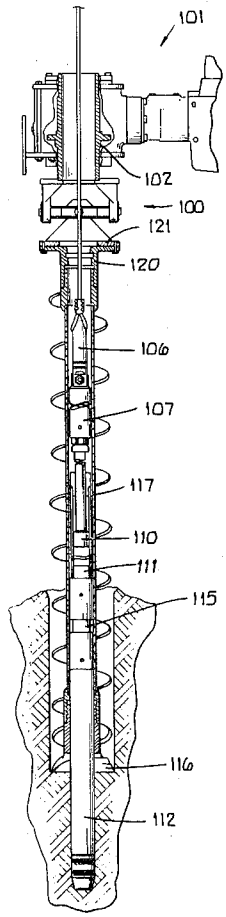
Primary Examiner—James A. Leppink

Attorney, Agent, or Firm—Woodard, Weikart, Emhardt & Naughton

[57] **ABSTRACT**

A coupling for connecting an auger to a driver so as to allow core sampling while the auger is positioned within the drilled hole and connected to the driver. One embodiment of the coupling has a ring positioned outwardly of the adjacent ends of the auger and driver. Arms are mounted to the ring and extend radially inward being bearingly received by the adjacent auger and driver ends. The driver and auger are hollow so as to allow the raising and lowering by cable of a sampling hammer with a sampler. A hollow cap is removably mounted to the top of the auger and has a pair of upstanding members which receive two of the arms of the coupling. A hollow-centered plate is removably mounted to the bottom of the driver and has a pair of depending members which receive the other two arms of the coupling. Another embodiment of the coupling includes a pair of yokes each of which is pivoted to an open centered ring member. The yokes are also coupled, respectively, to the auger and the driver. The yokes extend outwardly of the ring member and are connected through bearings to the ring member.

16 Claims, 11 Drawing Figures



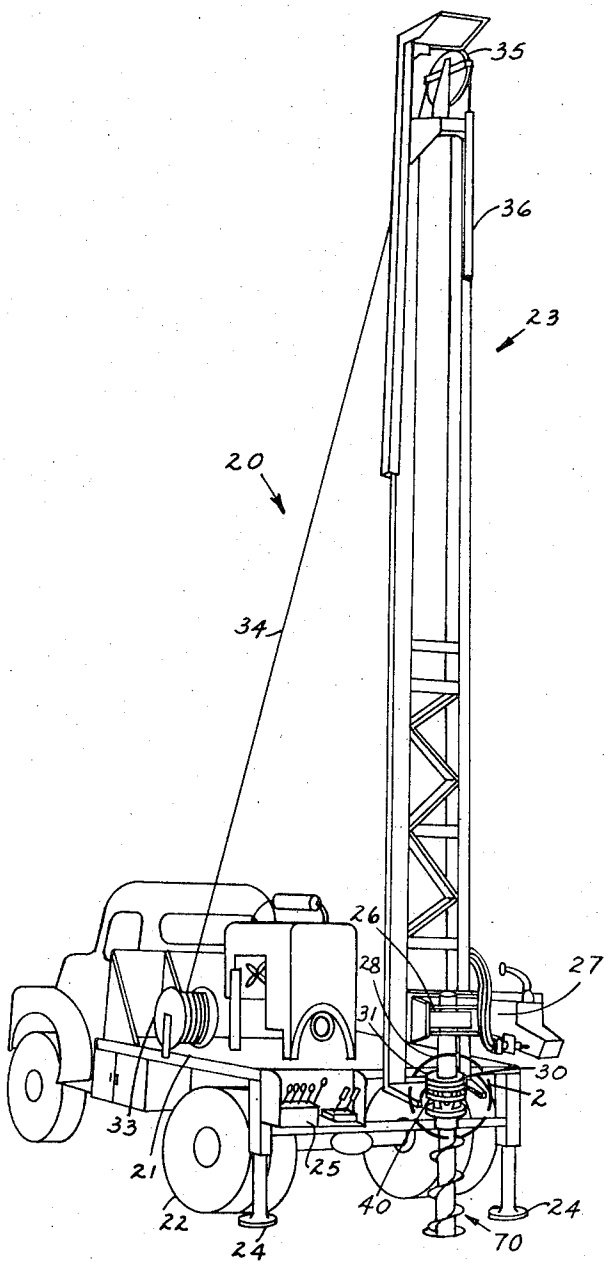


Fig. 1

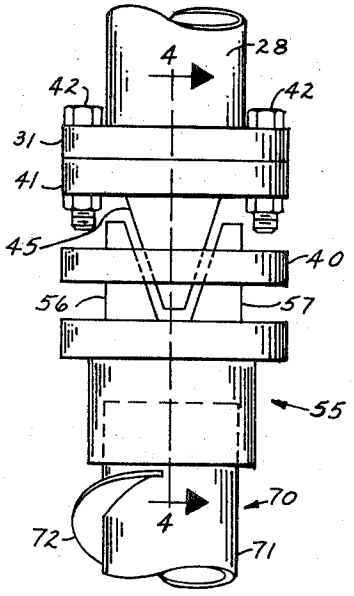


fig. 2

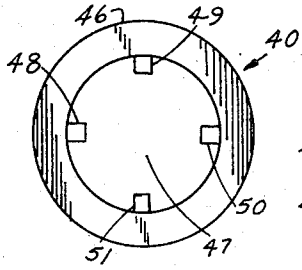


fig. 3

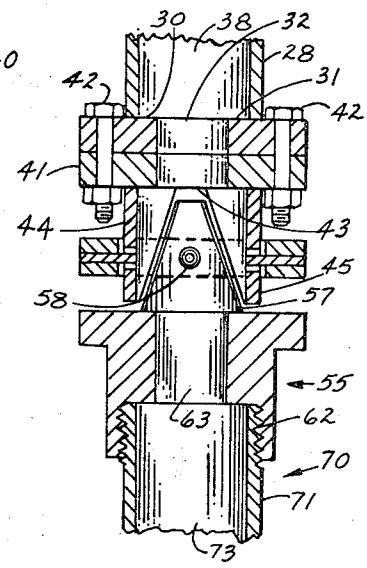


fig. 4

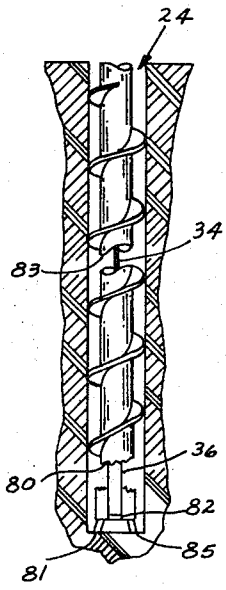


fig. 5

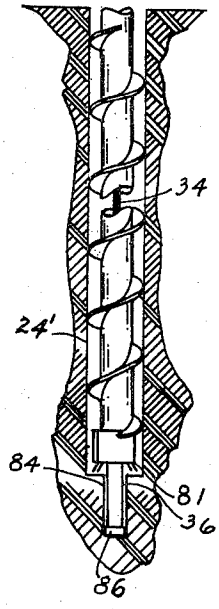


fig. 6

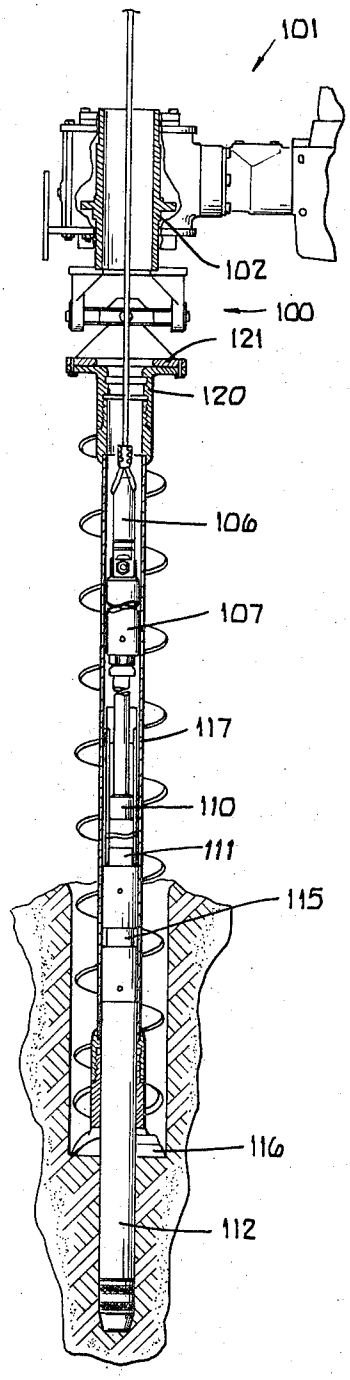


Fig.7

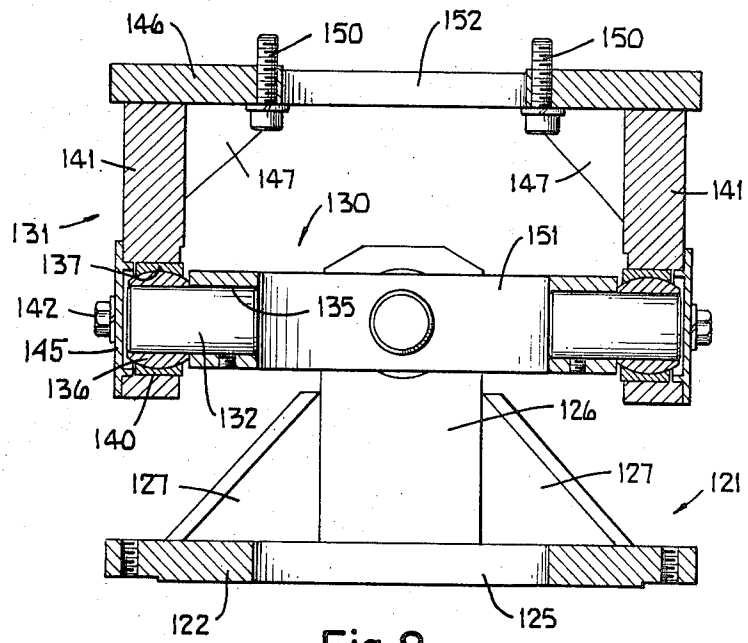


Fig.8

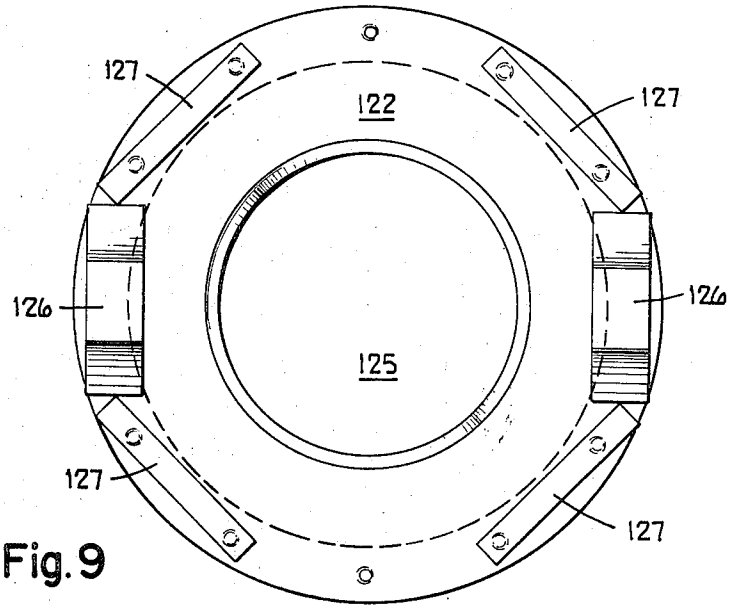


Fig.9

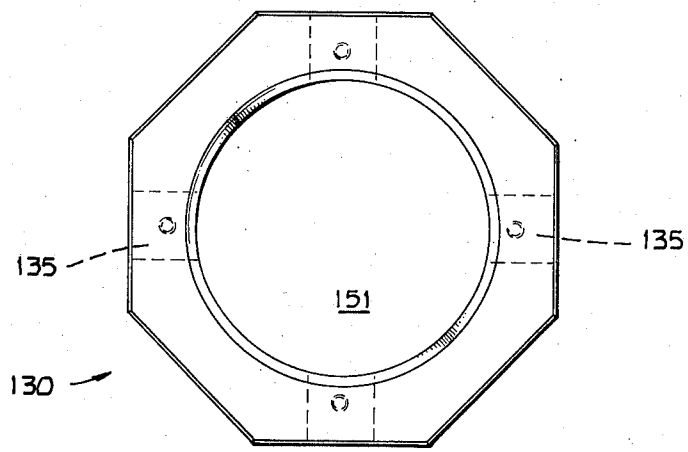


Fig. 10

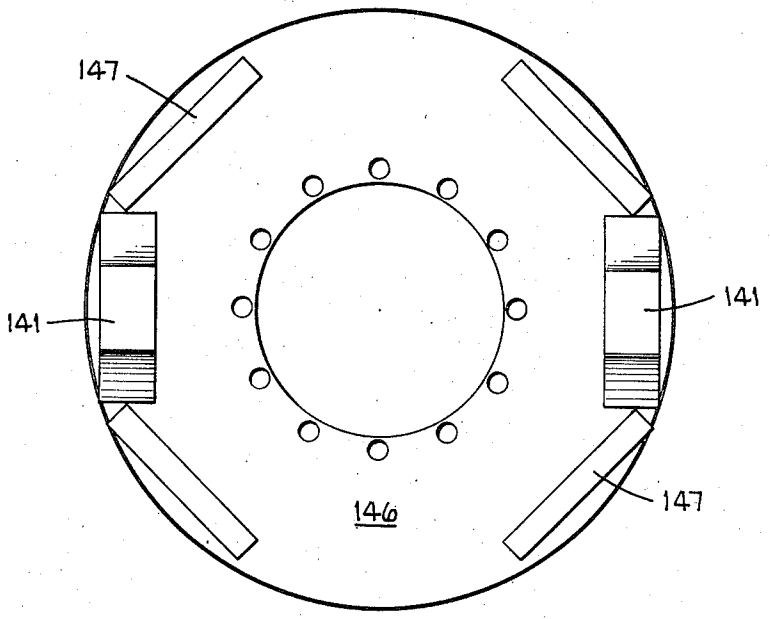


Fig. 11

HOLLOW AUGER-DRIVER COUPLING

CROSS REFERENCE TO RELATED APPLICATION

This application is a Continuation-In-Part of my U.S. Pat. application Ser. No. 165,197 Filed July 22, 1971, now abandoned.

BACKGROUND OF THE INVENTION

1. Field of the Invention

This invention relates to core sampling and auger couplings.

2. Description of the Prior Art

In many ground drilling operations, a driver is coupled to the top end of a rotatable auger. Some of the prior art couplings connecting the drivers and augers together consist of a hexagonally configured socket welded to the bottom half of an automotive type universal joint whose upper half is bolted or pinned to the driver.

It is desirable when drilling into the ground to frequently sample the ground at various depths. Prior art methods of obtaining soil samples include extending a sampler attached to long rods down into the hole through a hollow stem auger or into the bore hole after a solid stem auger has been removed therefrom. When the sampler is extended through a hollow stem auger, it is necessary to disconnect and move the drilling apparatus to which the hollow stem auger was coupled because otherwise the universal joint blocks passage. Another method of obtaining soil samples is to lower a hammer with sampler attached down into the hole by cable after the hollow stem or solid stem auger has been removed. The auger is removed for the long rods removed prior to sampling in these prior art methods because of the previously described automotive type universal joint coupling the driver to the auger. Disclosed herein is a method and apparatus which not only allows sampling without requiring removal of the auger thereby eliminating the time and expense of removing and inserting the auger before and after each sampling but also makes unnecessary disconnection and movement of the drilling apparatus. This new development makes use of the hollow stem auger, the hollow driver and a new hollow coupling which connects the auger with the driver. The new coupling does not use the conventional cross assembly of the universal joint and instead substitutes a gimbal-type joint therefor. As a result, the sampler may be lowered through the driver, coupling and then into the hollow stem auger. The cross assembly of the prior art coupling was positioned in the center of the coupling thereby preventing passage of the sampler therethrough.

SUMMARY OF THE INVENTION

One embodiment of this invention is a hollow coupling between an auger driver and an adjacent auger section comprising an auger section having a hollow tube with a helical flight secured thereto, a hollow-centered cap mounted atop said auger section and having a pair of upstanding and oppositely positioned first members, a hollow-centered drive shaft having a pair of depending and oppositely positioned second membersers; and, connecting means positioned between and connecting the drive shaft and auger section, the means being bearingly connected to the first and second membes, the connecting means being hollow-centered allowing a sampling device to be passed through the drive shaft and the auger section.

Another embodiment of the present invention is a method of core sampling comprising the step of extending a sampler through a hollow stem auger while the auger is connected to a hollow driver by a hollow-centered coupling.

It is an object of the present invention to provide a new and improved coupling for connecting an auger and an auger-driver.

It is a further object of the present invention to provide a method of core sampling without requiring removal of the auger from the hole being drilled.

Yet another object of the present invention is to provide a method of core sampling which allows the sampler to be extended through the auger-driver and into a hollow stem auger.

Related objects and advantages of the present invention will be apparent from the following description.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a perspective view of drilling apparatus incorporating the present invention.

FIG. 2 is an enlarged fragmentary view of the coupling connecting the auger-driver and the auger being shown in the circle number 2 of FIG. 1.

FIG. 3 is a top view of coupling 40 shown in FIG. 2 with members 44, 45, 56 and 57 being removed therefrom.

FIG. 4 is a cross-sectional view taken along the line 4—4 of FIG. 2 and viewed in the direction of the arrows.

FIG. 5 is a fragmentary schematic view of an auger shown positioned in a hole.

FIG. 6 is the same view as FIG. 5 only showing the sampler extended downwardly from the bottom end of the auger.

FIG. 7 is a fragmentary schematic view of an auger and driver showing the auger positioned in the hole and showing an alternative embodiment of the invention.

FIG. 8 is an axial section of a portion of the apparatus illustrated in FIG. 7.

FIG. 9 is a top plan view of one of the parts illustrated in FIG. 8.

FIG. 10 is a top plan view of one of the parts illustrated in FIG. 8.

FIG. 11 is a bottom plan view of one of the parts illustrated in FIG. 8.

DESCRIPTION OF THE PREFERRED EMBODIMENT

For the purposes of promoting an understanding of the principles of the invention, reference will now be made to the embodiment illustrated in the drawings and specific language will be used to describe the same. It will nevertheless be understood that no limitation of the scope of the invention is thereby intended, such alterations and further modifications in the illustrated device, and such further applications of the principles of the invention as illustrated therein being contemplated as would normally occur to one skilled in the art to which the invention relates.

Referring now more particularly to FIG. 1, there is shown a perspective view of a drilling apparatus 20 which has a platform 21 mounted to the frame of a truck and extending over the rear wheels 22 thereof. A mast 23 is secured to the platform being shown in the

erect position. To increase the mobility of the apparatus, mast **23** may be retracted to a horizontal position. Stabilizers **24** are extended downward from platform **21** to provide a stable platform during the driling and sampling operations. Various controls **25** are provided to control the rotation and vertical movement of the auger and sampling device. A rotary head driver **26** is slidably mounted to a lateral shift table **27** mounted to platform **21.** Rotary head **26** drivingly rotates hollow spindle **28.** The top end of the auger section **70** is connected to the bottom end **30** of spindle **28** by coupling **40.** The rotary head with the spindle is advanced vertically downward along the length of mast **23** so as to advance the auger into the hole. Eventually, the auger is advanced sufficiently downward, as shown in FIG. **1,** so as to require the top end of the auger section to be disconnected from coupling **40** with a new section of auger being inserted and connected between the auger section in the hole and the coupling. Of course, the rotary head with spindle is advanced vertically upward along the mast when a new auger section is required.

A wheel or pulley **35** sometimes called a crown sheave is rotatably mounted to the top of mast **23** receiving a wire or cable **34** which has a hammer **36** suspended therefrom. The opposite end of cable **34** is wound on drum **33** mounted atop platform **21.** Drum **33** may be rotated so as to raise and lower hammer **36.**

FIG. **2** is an enlarged fragmentary view of coupling **40** utilized to connect spindle **28** with the top end of auger **70.** The coupling is shown enclosed in circle **2** of FIG. **1.** The auger **70** has a hollow tube **71** with a helical flight **72** secured by welding or other suitable means to the periphery thereof. FIG. **4** is a cross-sectional view taken along the line **4—4** of FIG. **2** and viewed in the direction of the arrows. Removably mounted atop auger **70** is a hollow-centered cap **55** which is of one piece construction having a bottom end removably receiving the top end of the uppermost auger section. The bottom end may have threads **62** for receiving tube **71.** The top end of the cap **55** has a pair of upstanding members **56** and **57.** A hole **63** extends longitudinally through the center of the cap so as to allow communication with the hollow center **73** of the auger section. Members **56** and **57** are oppositely positioned each having identical bearings **58** mounted therein for receiving bearing arms of coupling **40.**

The bottom end **30** of spindle **28** has a flange **31** integrally secured thereto. A hollow-centered plate **41** is removably secured to flange **31** by standard fastening devices **42.** Another pair of members **44** and **45** are secured to plate **41** being oppositely positioned and extending through coupling **40.** Plate **41** is provided with a hole **43** which is aligned with hole **32** of flange **31.** In addition, spindle **28** is provided with a hollow center **38.** Members **44** and **45** are each provided with bearings identical to bearings **58.**

Referring now to FIG. **3,** there is shown a top view of only the coupling **40** shown in FIG. **2.** Coupling **40** has a main body **46** configured as a ring with the center **47** thereof being hollow. Four bearing arms **48** through **51** extend into bearings **58** of the adjacent ends of the upper driver and the auger. Ring **46** has an inside diameter greater than the adjacent ends of the driver and auger. That is, the horizontal distance between the outside surfaces of members **56** and **57** and between members **44** and **45** is less than the inside diameter of coupling **40.** The coupling is bearingly connected to members **44, 45, 56** and **57** and is positioned exteriorly thereof. The coupling is hollow centered so as to allow a sampling or plugging device to be passed through spindle **28** and auger **70.** It should be noted that bearing arms **48** through **51** are co-planar and are positioned at intervals of **90** degrees around ring body **46.**

The present invention allows core sampling without removing the auger from the hole being drilled. When the auger is being rotated and advanced vertically downward through the ground, and it is not desirable to obtain a sample, then a plug is positioned at the bottom end of the hollow auger to prevent material from entering the hollow stem auger through the bottom end. FIG. **5** is a schematic representation of an auger positioned in hole **24.** Attached to the bottom end of the lowermost auger section is a hollow drill head **81** which scrapes the bottom of the hole allowing the material therefrom to be conveyed upwardly along the helical flight. The lower end of the auger section as well as the drill is shown fragmented at location **80** illustrating the positioning of hammer **36** and the plug **82.** The inside diameter of the auger tube and drill is greater than the outside diameter of the hammer and plug so as to allow movement of the hammer and plug through the drill and auger. The hammer, as previously described, is suspendedly mounted from cable **34** shown at fragmented area **83.** The cable extends up through the auger section, coupling and spindle passing around wheel **35** being wound on drum **33.** The hammer with plug is lowered by cable through the spindle, coupling and auger until plug **82** rests adjacent the bottom **85** of hole **24'.** The weight of hammer **36** is sufficient to keep plug **82** immediately adjacent bottom **85** as drill **81** progresses downwardly. Plug **82** is secured to hammer **36** by any number of standard fastening means.

The auger is rotated and advanced downwardly to the desired depth subsequent to the lowering of the hammer and plug. When the desired depth is attained, the rotation and advancement of the auger is stopped. The hammer and plug are then raised by raising cable **34** with the cable, hammer and plug passing through the auger, coupling and spindle. The plug **82** is then removed from the hammer and sampler **86** is then mounted to the hammer. The hammer with sampler attached is then lowered via cable **34** down through the center of the coupling and auger until the sampler rests immediately adjacent bottom **85.** A variety of samplers are commercially available with one sampler being disclosed in the U. S. Pat. No. 3,180,438 issued to myself and Robert E. Dickinson which I hereby incorporate by reference.

The hammer is then lifted a sufficient distance so that when dropped, the sampler **86** will be drivingly forced to the desired depth, thereby forming sample hole **84.** The driving of the sampler is accomplished while the hammer is positioned within the auger and the auger remains connected to the drilling apparatus **20** in the manner illustrated in FIG. **1.** The auger is then rotated and advanced downwardly so as to free the sampler. The rotation of the auger is then stopped and the hammer and sampler are raised out of the auger, coupling and spindle so as to allow for removal of the sample from sampler **86.** The sampler is then removed from the hammer with the plug being reinstalled on the hammer. The hammer and plug are then lowered through the auger to the bottom of the hole and the method is repeated as desired. This method of core sampling pro-

vides for the extending of the sampler through the hollow stem auger while the auger is connected to a hollow driver by a hollow-centered coupling and while the drilling apparatus remains in its original drilling position. Thus, the auger is not removed from the hole and continuous access for core sampling is thereby provided without need for removal of the auger, the long rods of the prior art devices or the diconnection of the auger and driver and movement of the driver and/or drilling apparatus as previously required.

An additional and preferred embodiment of the invention is illustrated in FIGS. **7, 8, 9, 10** and **11**. FIG. **7** shows an alternative coupling **100** which is also within the scope of the invention. FIG. **7** also shows standard apparatus described above in connection with FIGS. **5** and **6**. Thus in FIG. **7** there is illustrated commercially available apparatus **101** for exerting a downward force upon and for rotating the spindle **102**. This commercially available apparatus may be, for example, a Mobile Model B–50 manufactured by Mobile Drilling Company, Inc. of Indianapolis, Indiana. The Model B-50 is provided with an Open Drill Spindle 4.625" (117–5mm) I.D. which is the spindle **102**. The cale **105** corresponds to the cable **34** and extends from the crown sheave (not shown) corresponding to the pulley **35** to the hammer swivel **106** to which the cable is attached. The hammer swivel is pivoted to the hammer **107** corresponding to the hammer **36**. The hammer **107** has a hammer head **110** which strikes an anvil **111** connected to the core sampler **112** by rod **115**. Also illustrated is the auger cutter head **116** corresponding to the drill head **81** and threadedly attached to the lower end of the hollow auger **117**. The hollow auger **117** is in turn threadedly secured to the coupling **100**.

FIG. **7** illustrates as does FIG. **1** and accompanying description above that the sampling step is carried out while the drilling apparatus **101** is in its original drilling position. In other words, there is no necessity to move the drilling apparatus **101** or the driver **102** to some other location while sampling is taking place; nor is it necessary to detech the auger **117** from the apparatus **101, 102, 120** and **121** while such sampling is taking place.

FIG. **8** shows the coupling **100** in greater detail than FIG. **7**. An annular member **120** (FIG. **7**) is internally threaded at its lower end and has its upper end bolted to a lower yoke **121** which includes a plate **122** having a cylindrical opening **125** therethrough. Fixed to the plate are two upright members **126** which are braced by supporting members **127**. FIG. **8** shows the lower yoke pivotally connected to a cross member **130** and shows in greater detail the connection of the cross member **130** to the upper yoke **131**. The bearing connection of the upper yoke to the cross member is identical to the connection between the lower yoke and the cross member and will be described as representative.

As shown in FIG. **10** the cross member has an externally octagonal configuration and an internally cylindrical configuration. A pin **132** is press fit in each of the bores **135**. The pin **132** has bearing **136** push fitted thereon. Bearing **136** rides within bearing **137** press fitted within the bore **140** in each depending member **141**. Cap screws **142** are attached to the depending members **141** and secure retainer cap **145** in position. The two depending members **141** are fixed to plate **146** and braced by supporting members **147** which are connected to the plate **146** and the depending members **141**. The upper yoke including plate **146** is fixed to the spindle **102** by bolts **150**. Both the cross member **130** and plate **146** have large cylindrical openings **151** and **152**, respectively, therethrough.

It will be evident that the embodiment of FIGS. **7, 8, 9, 10** and **11** gives substantial freedom of pivoting movement in all directions but that it also provides in the openings **125, 151** and **152** an open center through which objects may be passed.

While the invention has been illustrated and described in detail in the drawings and foregoing description the same is to be considered as illustrative and not restrictive in character, it being understood that only the preferred embodiment has been shown and described and that all changes and modifications that come within the spirit of the invention are desired to be protected.

The invention claimed is:

1. A hollow coupling arrangement comprising:
an auger section having a hollow tube with a helical flight secured thereto; said auger section having secured thereto a pair of upstanding and oppositely positioned first members;
a hollow-centered drive shaft having a pair of depending and oppositely positioned second members; and,
connecting means positioned beween and connecting said drive shaft and auger section, said means being bearingly connected to said first and second members, said connecting means being hollow-centered allowing a sampling device to be passed through said drive shaft and said auger section.

2. The coupling of claim **1** wherein:
said means is a circular ring with four arms projecting radially inward into said first and second members and said ring is positioned exteriorly of said first and second members.

3. The coupling of claim **2** wherein:
said first and second members have bearing means receiving said arms; and,
said arms are co-planar and positioned at intervals of 90° around said ring;
said drive shaft has a flanged lower end and a hollow-centered plate removably secured thereto, said second members being secured to said plate and extending down through said ring; and,
a cap threadedly received onto said auger section and securing said first members to said auger section.

4. The coupling of claim **1** wherein:
said means includes an annular ring positioned inwardly of said first and second members;
said means further includes four bearing arrangements positioned at 90 degree intervals around said ring, two of said bearing arrangements connecting said first members and said annular ring and two of said bearing arrangements connecting said second members and said annular ring.

5. The coupling of claim **4** wherein:
said drive shaft has a hollow centered plate secured thereto, said plate securing said second members to said drive shaft.

6. A hollow coupling for connecting a hollow auger-driver and an adjacent hollow auger section comprising:
a hollow centered cap adapted to be mounted atop the auger section and having a pair of upstanding oppositely positioned first members;

a hollow centered plate adapted to be mounted to the lower end of the driver and having a pair of depending oppositely positioned second members; and

connecting means positioned between and connecting said cap and plate, said means being bearingly connected to said first and second members, said connecting means being hollow centered whereby a sampling device may be passed through said coupling.

7. The coupling of claim **6** wherein:

said connecting means is a ring and said connection to said first and second members is accomplished by four bearing arrangements;

a first pair of said bearing arrangements is coaxial with one another and connects said ring to said first members;

a second pair of said bearing arrangements is coaxial with one another and connects said ring to said second members;

said bearing arrangements being positioned at 90° intervals around said ring.

8. The method of core sampling comprising the steps of:

positioning a drilling apparatus having a rotary power means and a hollow driver in a position at a drilling site;

connecting the hollow driver to the drilling apparatus for driving thereby;

connecting a hollow auger to the hollow driver by a hollow centered coupling;

operating said drilling apparatus and power means to rotate the hollow driver to rotate the hollow auger and cause the hollow auger to drill into the earth; and

extending a sampler through the driver, coupling and auger to take a sample while the driver is connected to the drilling apparatus and to the hollow auger and while the drilling apparatus is still in its original position.

9. The method of claim **8** wherein:

said extending step includes raising and lowering said sampler by reelable cable.

10. The method of claim **9** and comprising the additional steps of:

lowering by cable a sampling hammer with plug means through said driver, said coupling and said auger until said plug means rests atop ground;

rotating and advancing said auger to a desired depth subsequent to said lowering of said hammer with plug means;

next, stopping rotation and advancement of said auger;

raising by cable said hammer and plug means through said auger, said coupling and said driver subsequent to said stopping step; and,

mounting said sampler to said hammer immediately prior to the lowering of said sampler.

11. The method of claim **10** and comprising the additional step of:

driving said sampler with said hammer to the desired depth while said hammer is positioned within said auger and subsequent to the lowering of said sampler.

12. The method of claim **11** and comprising the additional steps of:

rotating said auger subsequent to said driving step so as to free said sampler subsequent to said driving step;

stopping rotation of said auger immediately prior to the raising of said sampler; and,

removing said plug means from said hammer subsequent to the raising of said hammer and plug means.

13. A hollow coupling arrangement comprising:

a hollow tube having secured thereto a pair of upstanding and oppositely positioned first members;

a hollow-centered drive shaft having a pair of depending and oppositely positioned second members; and,

connecting means positioned between and connecting said drive shaft and hollow tube, said means being bearingly connected to said first and second members, said connecting means being hollow-centered allowing a sampling device to be passed through said drive shaft and said hollow tube.

14. A hollow coupling arrangement comprising:

a hollow tube;

a hollow centered drive shaft; and,

connecting means connecting said drive shaft and hollow tube, said connecting means being hollow-centered allowing a sampling device to be passed through said drive shaft and said hollow tube, each of said hollow tube and said hollow centered drive shaft having an axis about which the respective tube and drive shaft are rotatable;

said connecting means positively connecting said drive shaft and said hollow tube whereby rotation of said drive shaft about its axis produces rotation of said hollow tube about its axis, said connecting means permitting inclination of said tube to said drive shaft whereby said axes are at an angle to one another.

15. Earth sampling apparatus comprising:

drilling apparatus having rotary power means;

a hollow driver connected to the drilling apparatus for driving thereby;

a hollow tube for drilling into the earth;

connecting means connecting said hollow driver and said hollow tube, said connecting means being hollow centered;

and a sampling device mounted on said drilling apparatus and movable through said hollow driver and through the hollow center of said connecting means and through said tube for taking samples.

16. The earth sampling apparatus of claim **15** wherein:

said tube is part of an auger which also includes a helical flight secured to said tube.

* * * * *

UNITED STATES PATENT OFFICE

CERTIFICATE OF CORRECTION

Patent No. 3,794,127 Dated February 26, 1974

Inventor(s) Henry E. Davis

It is certified that error appears in the above-identified patent and that said Letters Patent are hereby corrected as shown below:

In Column 1, Line 34 change [for] to --or--.

In Column 5, Line 23 change [cale] to --cable--.

In Column 5, Line 41 change [detech] to --detach--.

Signed and sealed this 18th day of June 1974.

(SEAL)
Attest:

EDWARD M.FLETCHER,JR.
Attesting Officer

C. MARSHALL DANN
Commissioner of Patents