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Schafer et al.

[11] **3,786,877**

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[54] **SOIL SAMPLER APPARATUS**

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[52] **U.S. Cl.** **175/249**

[51] **Int. Cl.** **E21b 9/20,** E21b 25/00

[58] **Field of Search**..... 175/249, 239, 236, 263–266

[56] **References Cited**

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[57] **ABSTRACT**

Apparatus for taking soil samples that includes a drive head attachable to the drill rod of a drill rig having a drive hammer, a sample receiving barrel of longitudinally split barrel sections having a reduced diameter end portions extended into the drive head, one of the sections being pinned to the drive head, and a drive shoe threaded on the other end portions of the barrel sections. When the drive shoe is removed, the unpinned barrel section is hingedly movable relative the other barrel section.

11 Claims, 4 Drawing Figures

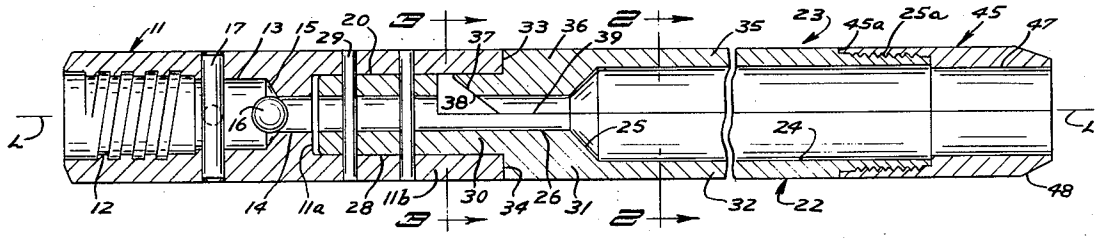
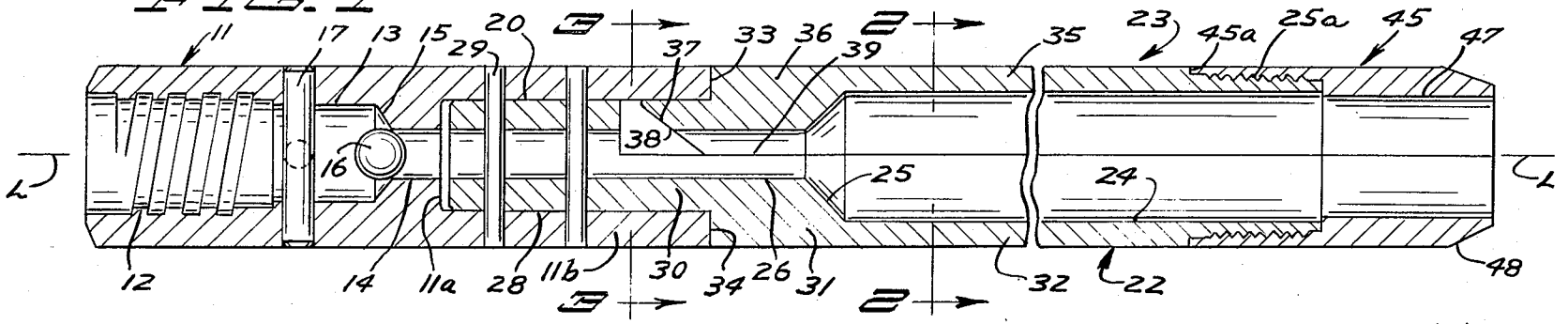


FIG. 1



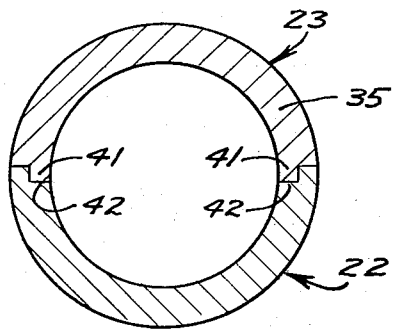


FIG. 2

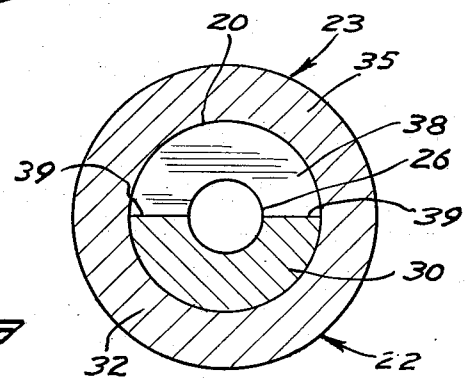


FIG. 3

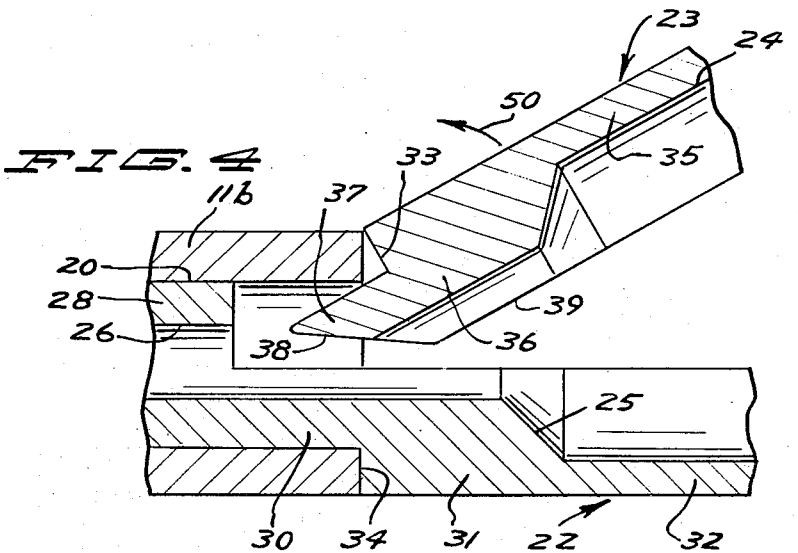


FIG. 4

SOIL SAMPLER APPARATUS

BACKGROUND OF THE INVENTION

Soil sampler apparatus having axially split barrel sections. Prior art soil samplers include those such as disclosed by U.S. Pat. No. 2,795,395 to Acker and U.S. Pat. No. 3,180,438 to Dickenson et al. With the Acker apparatus, in removing the sample both the drive shoe has to be unthreaded from the barrel and the barrel has to be unthreaded from the head before the barrel sections can be separated. Thus, frequently more time for disassembling and reassembling the apparatus is required than desired. In Dickenson both of the split liner sections have to be removed from the barrel, the axial outer ends fitting in a narrow annular groove between the barrel and head. However at times, dirt and etc. is pushed into the groove when reassembling the apparatus which has to be cleaned out before the apparatus of Dickenson can be properly reassembled. Also, in the prior art it is old to provide a soil sampler having a drive head having a barrel mounting portion with a barrel mounting bore of an inner diameter larger than the maximum outer diameter of the barrel, split barrel sections of substantially constant outer radii of curvature throughout the axial length thereof from the axially outer terminal ends to the threaded axially inner end, the barrel sections extending into the head mounting portion and one of the sections being pinned thereto, and a drive shoe threaded on the barrel sections. Thus the axially inner terminal annular edge of the head of the last mentioned soil sampler is of larger diameters than the maximum diameter of the barrel. If the last mentioned soil sampler is driven sufficiently deep that the head terminal annular edge is forced downwardly against the soil, errors are introduced into certain types of conventional test procedures. In order to overcome problems of the above mentioned nature, this invention has been made.

SUMMARY OF THE INVENTION

Soil sampler apparatus having an annular head that has a reduced diameter, axially intermediate bore portion providing an axially inwardly facing shoulder, a barrel threaded at one end, and having an axially opposite reduced diameter end portion extending into the head bore, providing a shoulder abutting against axially inner edge of the head and providing a slip fit with the head bore, said barrel having a pair of longitudinally split barrel sections and a maximum outer diameter substantially the same as the outer diameter of the head, and an annular drive shoe threaded on the barrel.

One of the objects of the invention is to provide new and novel soil sampler apparatus having split barrel sections with one of the sections having a reduced diameter end portion hingedly extended into drive head. In furtherance of the above object, it is another object of this invention to provide the other barrel section with a reduced diameter annular end portion pinned in the head. With reference to the above objects, it is a still further object of the invention to transmit a driving force from the axially inner edge of the drive head directly to each of the barrel sections.

To facilitate describing this invention, the term "innert" refers to that portion of the soil sampler (or element of the sampler) that in position for taking s sample, position for use, is located axially further from the drill rod the sampler is mounted on than any other portion of the soil sampler (or element of the sampler) being referred to; except where the term refers to the transverse circumference, or the peripheral surface or the diameter of the sampler (or said element). The term "outer" refers to that portion of the soil sampler or element that in position for use is located axially more closely adjacent the drill rod than any other portion of the soil sampler or element being referred to; except where the term refers to the transverse circumference, or the peripheral surface, or the diameter of the sampler.

Also, in the specification, one of the barrel sections will be referred to as "fixed" and the other "removable." By this terminology, it is to be understood that the "fixed" barrel section can be removed from the drive head, but that normally in emptying the soil samples, it is not removed from the head, while the "removable" section is.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a longitudinal cross-ssctional view of the soil sampler apparatus of this invention in an assembled condition;

FIG. 2 is a transverse cross-sectional view, generally taken along the line and in the direction of the arrow 2—2 of FIG. 1 of the longitudinally split barrel of the apparatus of this invention;

FIG. 3 is a transverse cross-sectional view, generally taken along the line and in the direction of the arrow 3—3 of FIG. 1 to more clearly show the construction of the reduced diameter end portion of the barrel and the head of the sampler apparatus; and

FIG. 4 is a fragmentary longitudinal cross-sectional view of the apparatus of this invention showing the removable section of the barrel in a hinged condition as it is removed from the fixed section of the barrel.

Referring now to the drawings, the soil sampler apparatus of this invention includes a drive head, generally designated **11**, having a bore extending axially therethrough. The head bore includes an internally threaded outer end portion **12** that at its end opens to the intermediate bore portion **13**. Threaded portion **12** is adapted to be connected to a drill rod of a drill rig having a drive hammer. Axially between the intermediate bore portion **13** and the reduced diameter bore portion **14** there is provided a frusto-conical bore portion **15** that forms a seat for a ball-check **16**. One or more pins **17** are mounted by the head to extend through the intermediate bore portion **13** for retaining the ball-check **16** between the pins **17** and the seat **15**. The axially inner end portion **20** of the head bore is axially elongated, of a substantially larger diameter than bore portion **14**, opens to bore portion **14** to provide annular shoulder **11a** and is defined by a smooth cylindrical wall along the axial length thereof.

The barrel is split along the axial length thereof (other than for portion **28**) and comprises a fixed barrel section, generally designated **22**, and a removable barrel section, generally designated **23**. The barrel sections **22, 23** in an assembled condition provide an axially elongated sample bore **24** that opens at one end through the end portion of the barrel that has external threads **25***a*,the opposite end of bore **24** opening to the frustoconical bore portion **25** that is of a relatively short axial length. Bore portion **25** in turn opens to the

reduced diameter bore portion **26** which is substantially the same diameter as bore portion **14.**

The fixed barrel section has a reduced diameter end portion that includes portion **30** and an annular end portion **28** that is axially opposite the threads **25***a*, the end portion **28** being of an outer diameter to form a close fit with the adjacent part of the wall defining bore **20.** The inner wall of the annular end portion **28** in part defines bore **26.** A pair of radially extending, axially spaced pins **29** are mounted by the head and extended through the annular end portion **28** for removably mounting barrel section **22** on the head in a fixed position relative thereto to space the axially outer terminal end of portion **28** from the shoulder **11***a*. As may be noted in FIG. **1,** the end portion **28** is of a substantial axial length but at the same time of a much shorter axial length than the axial length of the head bore portion **20.** The barrel section **22** axially inwardly of end portion **28** is of a semi-cylindrical construction and includes the reduced diameter axially inner portion **30** that has one end integrally joined to end portion **28** and an opposite end integrally joined to the thickened wall portion **31** that has an outer radius of curvature substantially the same as the outer radius of curvature of the head. Portion **30** has a semi- cylindrical outer surface of the same radius of curvature as the cylindrical outer surface of end portion **28.** Thus portions **30, 31** provide a semi-annular shoulder **34** that abuts against the axially inward terminal annular edge of the head. The radial inner walls of portion **31** in part define bore portions **26, 25.** The axially inner end of portion **31** is joined to one end of the sample receiving portion **32** that has an outer radius of curvature along the axial length thereof to threads **25***a* substantially the same as the outer radius of curvature of the thickened wall portion **31.**

The removable barrel section **23** in an assembled condition has a sample receiving portion **35** to mate with the sample receiving portion **32,** and a semi-cylindrical thickened wall portion **36** to mate with the wall portion **31.** The movable section **23** also includes an axially outer, reduced diameter end portion **37** that is joined to portion **36** to in cooperation therewith form a semi-annular shoulder **33** for abutting against the part of the axially inner terminal annular edge of the head that is not being abutted against by the shoulder **34.** Part of portion **37** defines part of bore **26.** The bore portion **25** is located a substantial distance axially inwardly of the shoulders **33, 34,** for example a dimension about equal to the outer radius of barrel section **23.** The axially outer terminal edge of portion **37,** is cut at a taper to provide inclined surface **38.** The plane of the surface **38** extends radially inwardly toward the central axis L—L of the barrel in an axially inward direction and intersects the axially extending edges **39** of portion **36** at a location radially opposite shoulder **33.** The surfaces of edges **39** are located in a common plane. The portion of the surface **38** located angularly 90° from the axially outward extension of each of the surfaces **39** most closely approaches the adjacent terminal annular surface of end portion **28** but is axially spaced therefrom. The part of portion **37** that extends the furthest into bore **20** is angularly mid-way between the plane of surfaces **39** and preferrably is of an axial length more than twice the radial thickness of wall **11***b* of the drive head. The reason for providing portion **37** with a tapered surface **38** such as described above will become more apparent hereinafter.

The axially extending edge surfaces of the thickened wall portion **31** are located in a common plane to form a close fit with the edges **39** of the thickened portion **36** while the axially extending edges of portion **30** lie in the same plane as the axially extending edges of portion **31.** The radial thickness of the walls of each portions **32, 35** is less than the wall radial thickness of the portion **11***b* of the head having bore portion **20,** while the wall radial thicknesses of the last mentioned portion of the head and portion **30** are substantially the same. The radial thickness of the walls of each portions **36, 31** is substantially the same as the radial thickness of the combination of the walls of portion **30** and portion **11***b*. Further the head and the part of the barrel from shoulder **33** to the threads **25***a* are constant outer diameters along the axial length thereof and of substantially the same diameters.

The axially extending edge portions of the sample receiving portion **35** of the barrel section **23** is provided with radially inward tongues **41** to form a matching fit with the grooves **42** of the sampler portion **32** and the radially outward part of the axially extending edge portions of portion **32** are provided with tongues for forming a matching fit with the radially outer grooves of sample receiving portion **35.** Accordingly, when the sections **22, 23** are in an assembled condition, there is provided a tight joint along the tongues and grooves, but at the same time the sections may be radially separated, assuming the barrel reduced portions are not extended into the head, and no structure is threaded on threads **25***a*. The tongues and grooves terminate axially adjacent thickened wall portions **31, 36.**

An annular drive shoe **45** at one end has internal threads for forming a mating fit with the threads **25***a* of the barrel sections **22, 23** in their assembled condition and has a drive shoe bore **47** opening axially to the barrel sample receiving bore **24.** The bore **47** is of substantially the same diameter as bore **24** or of a slightly smaller diameter such as shown in FIG. **1.** The axially inner end portion of the drive shoe has a frusto-conical outer surface that is tapered axially inward and radially toward the central axis L—L of the sampler apparatus of this invention. The axially outer annular edge **45***a* of the drive shoe abuts against an annular, axially inwardly facing shoulder of the split tube sections so that the axially inwardly driving force is transmitted from the sections **22, 23** to edge **45***a* rather than through the threads of the sections **22, 23** and the drive shoe.

In describing the use of the apparatus of this invention, it will be assumed that it is in an assembled condition and that a soil sample has been taken in a conventional manner and is now located in the barrel bore portion **24.** In order to remove the soil sample, the drive shoe is unthreaded from the barrel sections, and with the barrel section **23** facing upwardly, the inner axial edge of section **23** is moved upwardly relative to section **22.** Since at this time shoulder **33** bears against the head, barrel section **23** pivots about a point at the juncture of the outer cylindrical surface of the head and the inner terminal annular edge thereof at a location substantially angularly half-way between the plane of the axially extending edges of portions **30, 31** of the barrel section **22.** The portion **37** is of different axial lengths and portion **38** is cut at an angle such that it will not abut against section **22** as section **23** is pivoted in

the direction of arrow **50** in the aforementioned manner to a position extending about 90° relative section **22** from the positions illustrated in FIG. **1** and the inner peripheral wall section **23** will not disturb the soil sample contained radially between sections **32, 35** in the assembled condition. After section **23** has been pivoted in a direction of the arrow **50** to a position such as illustrated in FIG. **4** or somewhat angularly past such a position, section **23** may be moved axially away from the head and radially outwardly from section **22** (or pivoted to the 90° position) to withdraw portion **37** from within the confines of the head while not bringing the section **23** into abutting contact with the sample. Thence the sample in section **22** may be removed therefrom. Thereafter, section **23** has portion **37** extended to the head and pivoted to move tongues **41** into grooves **42,** and subsequently the drive shoe is threaded onto the barrel section.

With the soil sampler of the construction mentioned above, section **23** may be easily axially and radially aligned relative the head, and may be moved to an assembled condition much more readily than if threads were provided on the axial outer end of portion **23.** At the same time, the advantages of having split tube section are retained as the drive force on the drive head is exerted directly to the thickened wall portions of the barrel sections rather than through threads or through pins **29.** Additionally the maximum outer diameter of the head and barrel are the same. Further, if it is desired to use barrel sections of different axial lengths, the pins **29** may be driven out of the head, and different length barrel sections mounted in the head. With the pins **29** removed, the barrel sections in an assembled condition may be axially slided (slip fit) in and out of bore portion **20.**

It is to be mentioned that the diameters of the apertures of the barrel section annular portion **28** through which the pins extend are slightly greater than the outer diameter of the pins in order to provide a sufficiently loose fit that the drive force exerted on the drive head for forcing the sampler apparatus into the soil is transferred directly from the dirve head to the shoulders **33, 34** of the barrel sections rather than through the pins to the barrel sections. By providing the barrel section **22** with an annular end portion **28** within the head, greater stability is imparted to the barrel (still permits hinged movement of section **23**) than if said end portion were only semi-circular.

Even though the barrel sections are illustrated as being integrally formed pieces, it is to be understood that the thickened wall portions **31, 36** and the sample receiving portion **32, 35** may be made of two separate pieces and respectively joined together by, for example, welding.

What is claimed is:

1. Soil sampler apparatus comprising a drive head having a bore extending axially therethrough and an axial inner terminal annular edge, a barrel having first and second axially split barrel sections, each of said barrel sections having axially outer, reduced diameter end portions extending into the head bore and providing a shoulder abutting against the drive head inner terminal edge, and an axially opposite threaded end portion, and an annular drive shoe threaded on the barrel sections threaded end portions, the first barrel section reduced diameter end portion having an axially outer, annular end portion substantially axially spaced from the first barrel section shoulder and the second barrel section reduced diameter end portion terminating in the head bore axially intermediate and axially spaced from the first section annular portion and the second barrel section shoulder, and transversely extending means for removably securing the first section annular portion to the head.

2. The apparatus of claim **1** further characterized in that the barrel sections reduced diameter portions have smooth radially outer surfaces of radii of curvature to form a close fit with the radial adjacent portions of the wall defining the head bore, the portions of the head bore wall radially adjacent the barrel section reduced diameter portions defining a smooth cylindrical surface.

3. The apparatus of claim **2** further characterized in that the axially outward terminal end of the second barrel section is planar and inclined radially inwardly in an axially inward direction, the angle of taper being sufficiently great to permit the second section pivoting about a point, closely adjacent the juncture of the head axially extending surface and the head inner terminal edge, relative the head and barrel first section when the dirve shoe is removed from the barrel sections.

4. The apparatus of claim **3** further characterized in that the barrel sections have soil sample receiving portions axially inwardly of the barrel sections reduced diameter portions of inner radii of curvature greater than the radii of curvature of the radially outer surface of the barrel reduced diameter portions, the axially extending terminal edges of the barrel sections having interfitting, axially extending tongues and grooves.

5. The apparatus of claim **3** further characterized in that the head is of a substantially constant outer diameter along the axial length thereof and that the barrel sections axially between the reduced diameter portions and their threads are of a substantially constant outer diameter and of substantially the same outer diameter as the outer diameter of the head.

6. Soil sample apparatus comprising an axially elongated drive head having a substantially constant diameter outer cylindrical surface, a bore extending axially therethrough, and an axially inner terminal edge, a barrel having first and second axially split barrel sections each of said barrel sections having reduced diameter end portions extending a substantial distance into the head bore and providing a shoulder abutting against the drive head inner terminal edge and opposite externally threaded end portions, the diameter of the barrel sections axially extending outer surfaces axially between the barrel reduced diameter portions and the threads being substantially the same as the head outer diameter, the reduced diameter barrel sections portions having axially extending, radial outer surfaces that are smooth along the axial lengths thereof and form a close fit with the radially adjacent part of the head bore, the axial length of the first section reduced diameter portion being substantially greater than the axial length of the second section reduced diameter portion, transverse means for removably securing the first section reduced diameter portion to the head, the second section reduced end portion being freely slidably located in the head bore, and an annular drive shoe threaded on the barrel sections threaded end portions, the barrel sections axially inwardly of the reduced diameter portions having axially extending terminal edge portions having interfitting tongues and grooves.

7. The apparatus of claim 6 further characterized in that the second section reduced diameter end portion has a generally semi-circular terminal edge that is tapered radially inwardly in an axially inward direction at an angle to permit the second section being pivoted about an axis closely adjacent the intersection of the head cylindrical surface and the head terminal edge from a position in which the tongues and grooves are in interfitting relationship to a position nearly 90° relative thereto when the drive shoe is removed from the barrel sections.

8. The apparatus of claim 7 further characterized in the first section reduced diameter end portion has an axially outer, annular end portion, of an outer diameter to form a close fit with the radially adjacent part of the head bore, and a semi-annular portion joined to and extending between the annular end portion and the first barrel section shoulder.

9. The apparatus of claim 7 further characterized in that the second section reduced diameter end portion has an axially outer terminal end that is inclined radially inwardly in an axially inward direction at an angle of taper that is sufficiently great to permit the second section being freely pivoted up to about 90° about a point adjacent the juncture of the head cylindrical surface and the head inner terminal edge from a position the tongues and grooves are interfitted when the drive shoe is removed from the barrel sections.

10. The apparatus of claim 7 further characterized in that the barrel sections have an axially elongated sample receiving bore portion opening to the drive shoe, and an axially elongated, reduced diameter bore portion of a substantially shorter axial length than the sample receiving bore portion axially between the barrel section shoulders and the sample receiving bore portion providing thickened wall portions, said thickened wall portions having planar, axially extending edges forming mating fits, and that the second section inclined surface intersects the second section thickened wall axial extending edges in substantial radial alignment with the second section shoulder.

11. The apparatus of claim 7 further characterized in that the barrel sections and the drive shoe respectively have an axially inwardly facing shoulder and an axially outer edge abutting against the last mentioned shoulder to directly transmit an axially inwardly driving force from the sections to the drive shoe at the shoe outer edge.

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