United States Patent

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[73] Assignee **Western Tool Corporation**

[54] **WELL BORE SIDEWALL SAMPLER TOOL**
6 Claims, 5 Drawing Figs.

[52] **U.S. Cl.** **175/77, 175/58**
[51] **Int. Cl.** **E21b 9/34**
[50] **Field of Search** 175/311, 77

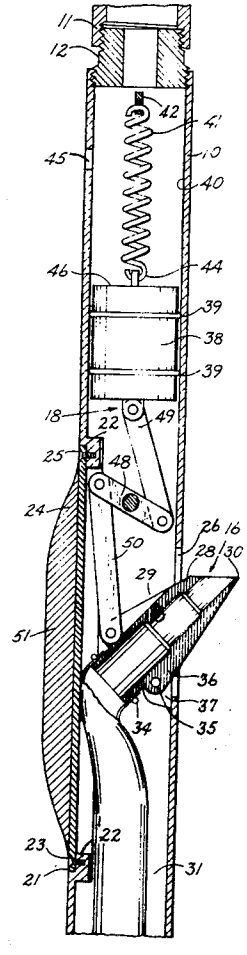
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ABSTRACT: A well bore sidewall sampling tool comprises a casing secured to the end of a drill pipe and mounting therein a sample core cutter head carrying a flexible collection receptacle. An actuating mechanism within the casing, operated by fluid pressure applied through the drill pipe, extends the cutter head outwardly into sampling engagement with the sidewall of the well bore. The drill pipe is lifted to cause the head to bite into and dig a channel in the sidewall and obtain a sample therefrom.



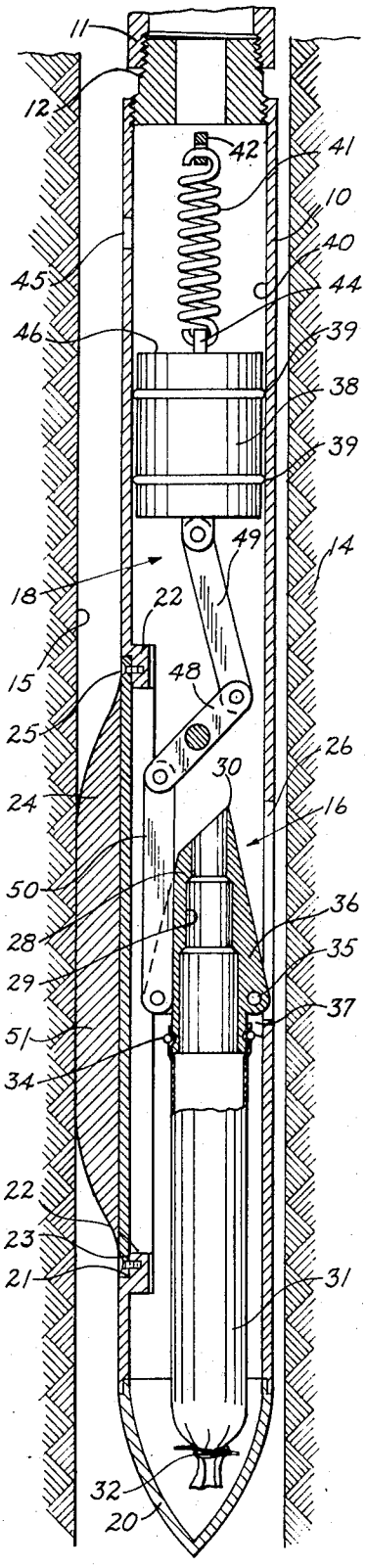


FIG. 2

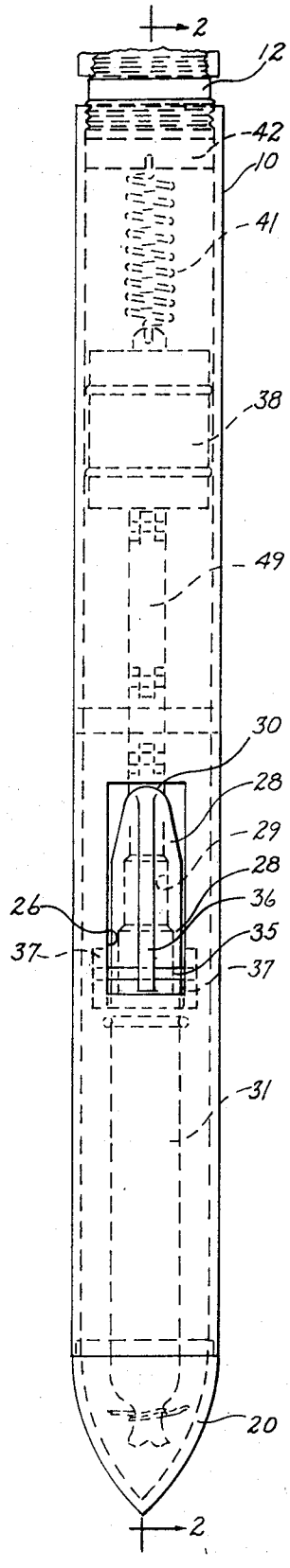


FIG. 1

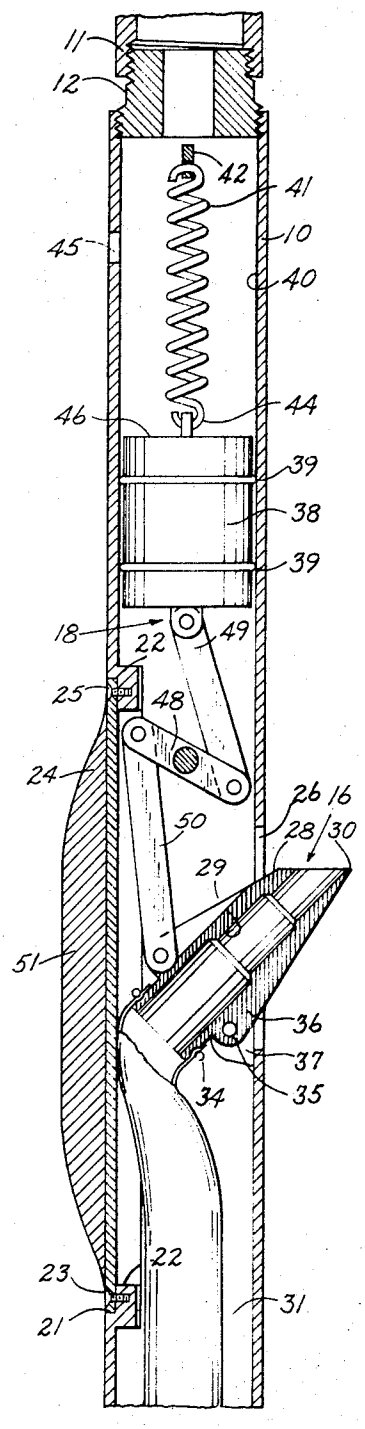


FIG. 3

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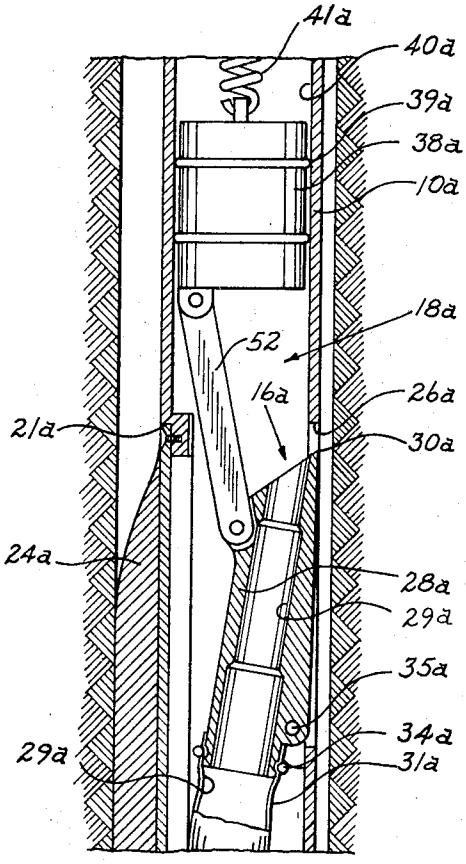


FIG. 4

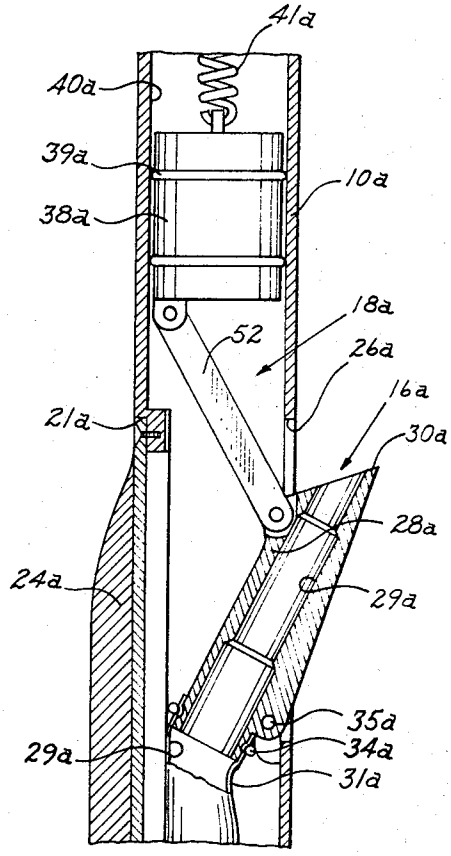


FIG. 5

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WELL BORE SIDEWALL SAMPLER TOOL

FIELD OF THE INVENTION

The present invention relates to an improved sidewall sampler tool for obtaining wall samples from well bores, and more particularly to a sidewall sampler tool adapted to cut channel samples from the sidewalls of a drill hole.

OBJECTS OF THE INVENTION

It is the principal object of the present invention to provide an improved sidewall sampler tool which is adapted to give substantial representative samples of the material through which the drill hole passes.

Another object of the present invention is to provide a tool of the foregoing character which embodies a positive sampling action and sample collection.

A more specific object of the present invention is to provide a sidewall sampling tool of the above type in which the sampling tube may be extended from or withdrawn into the tool thereby preventing damage to the tool and reducing chances of obtaining faulty samples.

A related object of the present invention is to provide a sidewall channel sampler tool with which samples can be taken at selected levels within the drill hole without completely withdrawing the tool between each sample. A related object is to provide a tool of the above character which does not require the use of extraneous setting or actuating mechanisms, go-devils and the like.

SUMMARY OF THE INVENTION

The foregoing objects are accomplished by an improved sidewall sampler adapted to be secured on the lower end of a drill pipe. The sampler includes a tubular casing pivotally mounting therein a core cutter head and a flexible sample collection receptacle. The core cutter head is actuated to swing outwardly of the casing into sampling engagement with the wall of a well bore, by means of a piston and linkage mechanism actuated by the application of fluid pressure to the casing through the drill pipe. The actuating mechanism includes a piston slidably mounted in the casing and biased to its upper position by a retracting spring. The piston is connected to the core cutter head by a linkage which, when the piston is move downwardly, swings the core head outwardly into sampling engagement with the wall of the well bore. When the core head is extended, the drill pipe stem is lifted to pull on the sampling tool and cause the core head to dig a channel sample from the sidewall of the well bore. The sample is collected in a receptacle, such as a plastic tube or bag, for later analysis.

BRIEF DESCRIPTION OF THE DRAWING

FIG. 1 is an elevation view of a sidewall sampler tool embodying the present invention.

FIG. 2 is a longitudinal section view of the sidewall sampler taken substantially in the plane of line 2—2 on FIG. 1.

FIG. 3 is a section view like FIG. 2 but with the sampler tool cutter extended for sampling engagement with a bore hole wall.

FIG. 4 is a section view, like FIG. 2, but illustrating a modified form of the invention.

FIG. 5 is a section view, like FIG. 4, but with the sampler tool extended for sampling engagement with a bore hole wall.

DESCRIPTION OF THE PREFERRED EMBODIMENT

A sidewall channel sampler tool embodying the present invention, as shown in the drawings, comprises a tubular casing 10 secured to the lower end of a string of drill pipe 11 by means of an appropriate pipe connector 12. The tool is adapted to obtain a sidewall sample from the walls 14 of a well bore 15. For this purpose, the tubular casing 10 includes a sampler head structure indicated generally at 16, and an actuating mechanism, indicated generally at 18, for positioning the sampler head outwardly of the casing to cut a well bore sidewall sample, and for withdrawing the head into the casing when the desired sample has been obtained. In the illustrative form of the invention herein shown and described, the actuating mechanism is operated by hydraulic or other fluid pressure applied to the casing through the drill pipe 11. For example, hydraulic pressure in the range of 1,400 p.s.i. can be applied through the drill pipe to the casing to actuate the sampling mechanism.

The sampler tool casing 10 is a generally cylindrical or tubular member, threaded at its upper end for engagement with the connector 12 on the drill pipe stem 11, and having its lower end closed by a bull plug 20. An access opening 21 is provided in one side of the casing 10, and is formed by an inwardly recessed flange 22 defining a shoulder 23 for mounting a cover 24. The cover 24 is removably secured to the flange 22 by appropriate fasteners such as screws 25. In the wall of the casing 10 opposite from the access opening 21, there is defined a sample access opening 26.

The sampler head structure 16 comprises a sleevelike sample core cutter head 28, having a sample passage 29 therethrough, and terminating at its upper portion in a curved spadelike sharpened cutting edge 30. For collecting and retaining the desired samples, a sample collecting receptacle 31, is removably secured to the inner end of the core head 28. The collecting receptacle 31 is a flexible elongated receptacle such as a bag, tube or similar container of heavy polyethylene or other suitable waterproof material. The container may be sealed at its lower end, or may be closed and clamped by a closure member 32. The collection receptacle is removably secured to the cutter head 28 by a clamp such as a spring or like clamp member 34.

The core head 28 is swingably mounted within the casing so that it may be positioned completely within the casing or may be swung outwardly through the opening 26 thereof to engage the sidewall 14 of the well bore 15, as shown in FIG. 3. To this end, the core head 28 is pivotally mounted by a pivot pin 35 within the casing 10. An apertured rib 36 on the cutter head 28 engages the pin 35, and the latter is secured to pivot ears 37 on the casing.

The cutter head actuating mechanism 18 comprises a piston 38 slidably mounted within the casing 10 and having a pair of spaced O-rings or similar seal ring members 39 sealingly engaging the internal surface 40 of the casing 10. The piston 38 is positioned within the casing above the core cutter head 28, and is upwardly biased within the casing 10 by a tension spring 41 engaged between a mounting bracket 42 on the casing and an apertured projection 44 on the upper end 46 of the piston 38. For relieving fluid pressure from the upper surface of the piston 38, the sidewall of the casing is provided with a fluid relief hole 45 at a point in the upper portion thereof spaced slightly above the upper surface of the piston 38.

The piston 38 is operative connected to the swingably mounted core cutter head 28 by means of a linkage mechanism which functions to swing the core head 28 outwardly from the casing 10 through the access opening 26 as the piston 38 is urged downwardly within the casing 10 by fluid pressure applied through the drill stem pipe 11, and acting on the upper piston surface 46. One illustrative linkage mechanism is shown in the drawings and comprises a rocking lever 48 pivotally mounted in the casing 10. One end of the rocking lever 48 is connected to the lower end of the piston by means of an upper link 49 while the opposite end of the rocking lever 48 is connected to the core head 28 by a lower connecting link 50. The rocking lever, connecting links, piston and core head are pivotally connected by appropriate pivot pin connections.

In operation, the cover 24 is removed and an empty sample container 31 is mounted on the core cutter head 28 through the opening 21. The cover 24 is replaced, and the sidewall sampler tool is secured to the lower end of a drill pipe 11 and lowered into a well bore 15. During this stage of the operation, the piston 38 is held upwardly retracted by the spring 41, thereby positioning the core cutter head 28 within the casing

10. When the tool has been lowered to the desired level within the well bore 15, fluid pressure is applied to the tool through the drill pipe 11. This fluid pressure acts on the upper surface 46 of the piston 38, and because this surface is substantially larger than the relief hole 45, the piston 38 is forced downwardly within the casing 10. This downward movement of the piston 38, acting through the linkage mechanism 48, 49, 50, swings the core head 28 outwardly to the position shown in FIG. 3, so that the cutting edge 30 thereof bites into the adjacent bore wall 14. With the core head extended, the drill pipe is lifted causing the head 28 to dig into the sidewall and cut a sample therefrom. The sample is forced through the bore 29 in the core cutter head 28 and is collected in the collection receptacle 31. When the desired sample has been collected, the tool is lowered slightly and at the same time fluid pressure on the piston 38 is released. The relief hole 45 allows a rapid reduction of pressure, and the spring 41 lifts the piston 38 and thereby retracts the core cutter head 28 into the tool casing 10. The entire assembly can then be withdrawn and the sample tube removed. Alternatively, if the sample container has not been completely filled, the tool may be moved to a different location within the same bore.

Where the bore is larger than the diameter of the tool, a positioning rib 51 may be affixed to the cover 24 or other portion of the casing. This rib 51 will insure that the core head opening 26 will be positioned adjacent the sidewall of the bore, and thereby further insure that the core cutter head 28 will engage the wall 14 and obtain a proper sample.

A modified construction embodying the present invention is shown in FIGS. 4 and 5. In describing this modification, reference characters similar to those used above will be employed with the distinguishing suffix "*a*." This modification is substantially similar to the construction described above, and comprises a tubular casing 10*a* housing a sampler head structure 16*a*, and an actuating mechanism 18*a* for positioning the sampler head outwardly of the casing in position for cutting a well bore sidewall sample. As in the above construction, the sampler tool casing 10*a* is a generally cylindrical or tubular member adapted to be secured to a drill pipe stem. An access opening 21*a* is provided in one side of the casing, of a construction similar to that previously described, and is enclosed by a cover 24*a*. A sample access opening 26*a* is provided in the opposite wall of the casing, 10 *a*.

The sampler head structure 16*a* comprises a sleevelike sample cutter head 28*a* having a sample passage 29*a* therethrough, and terminating at its upper portion in a curved, spadelike, sharpened, cutting edge 30*a*. For collecting and retaining the desired sample, a sample collecting receptacle 31*a* is secured to the cutter head 28*a*.

The core cutter head 28*a* is pivotally mounted within the casing by means of a pivot pin 35*a*, so that it may be swung inwardly or outwardly through the opening 26*a* in the wall of the casing 10*a*. The cutter head actuating the mechanism 18*a* is similar to that previously described, and comprises a piston 38*a* slidably mounted within the casing 10*a* and having seals rings 39*a* engaging the internal surface 40*a* of the casing 10*a*. A retracting tension spring 41*a* is provided for retracting the piston 38*a* and thereby the cutter head 28*a*. The piston 38*a* is operatively connected to the cutter head 28*a* by a link 52 which is pivotally secured between the piston 38*a* and the upper end of the cutter head 28*a* at a point adjacent the cutting edge 30*a*. The link 52 thus provides a direct operative linkage between the piston 38*a* and the cutter head 28*a*. The operation of the tool is identical to the operation previously described. FIG. 4 shows the cutter head 28*a* retracted within the causing, while FIG. 5 illustrates the cutter head in operative position for sampling engagement with a well bore wall.

While certain illustrative embodiments of the present invention have been shown in the drawings and described above in considerable detail, it should be understood that there is no intention to limit the invention to the specific forms disclosed. On the contrary the intention is to cover all modifications, alternative constructions, equivalents and uses falling within the spirit and scope of the invention as expressed in the appended claims.

I claim:

1. A well bore sidewall sampling tool for use on a drill pipe having a source of pressure fluid associated therewith, for obtaining sidewall samples from a well bore, and comprising, in combination, a tubular casing adapted to be secured to the end of the drill pipe, a sample cutter head swingably mounted in said casing and adapted to extend outwardly through an opening defined in the wall of said casing for digging a sample from the sidewall of the well bore, said cutter head having a sample receiving opening therethrough and an upwardly directed curved spade-shaped cutting edge on the upper end thereof, a flexible sample collection receptacle secured to said head and retained within the casing for collecting and protecting the sample, means operative in response to the application of fluid pressure to the casing through the drill pipe for positively extending said cutter head outwardly from said casing to engage the sidewall of the well bore and dig a sample therefrom as the drill pipe is lifted upwardly within the well, and means within said casing for retracting said cutter head in its said casing upon completion of the sampling.

2. A sidewall sampling tool as defined in claim 1 wherein said means for extending said head outwardly comprises a piston slidably mounted in said casing and operatively connected to said cutter head, and said means for retracting said cutter head comprises a tension spring connected between said casing and said piston.

3. A well bore sidewall sampling tool as defined in claim 1, wherein said casing includes an external rib adapted to position said casing against the well bore wall to be sampled.

4. A well bore sidewall sampling tool for use on a drill pipe for obtaining sidewall samples from a well bore, and comprising, in combination, a tubular casing adapted to be secured to the end of the drill pipe, a sleeve-shaped sample cutter head means mounted in said casing and adapted to extend outwardly through an opening defined in the wall of said casing for digging a sample from the sidewall of the well bore, said cutter head defining a sample receiving opening therethrough and having a cutting edge defined on the upper end thereof, sample-retaining means removably attached to said cutter head and enclosed within said casing for collecting and protecting the sample, and selectively actuable power means within said casing operatively connected to said cutter head for positively extending said cutter head outwardly from said casing to engage the sidewall of the well bore and dig a sample therefrom as the drill pipe is lifted upwardly within the well, and for positively retracting said cutter head into said casing upon completion of the sampling with the sample retained and protected within said retaining means.

5. A well bore sidewall sampling tool as defined in claim 4 wherein said selectively actuable power means comprises a piston slidably mounted within said tubular casing, sealing means for slidably sealing said piston within said casing, spring means upwardly biasing said piston within said casing, and a source of pressure fluid actuable on the upper surface of said piston for moving said piston downwardly within said casing.

6. A well bore sidewall sampling tool as defined in claim 5 including a rocking lever and linkage means operatively connecting said piston to said sample cutter head means.

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