March 27, 1951 W. S. DILL 2,546,632

SIDE WALL CORE TAKER

Filed June 23, 1949

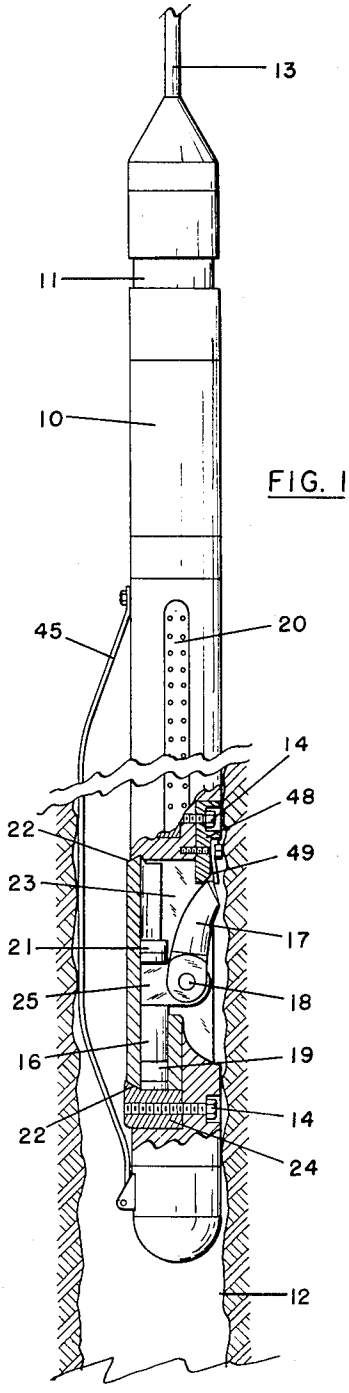


FIG. 1

FIG. 2

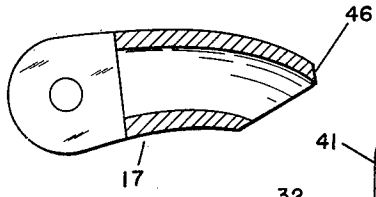
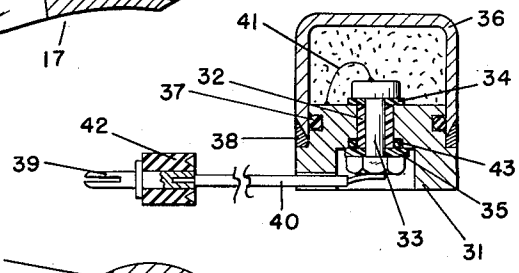


FIG. 4



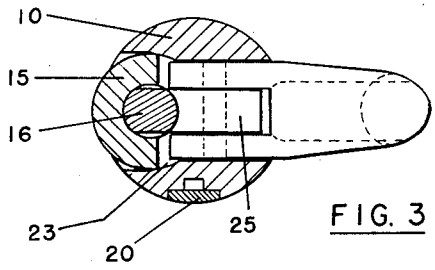


FIG. 3

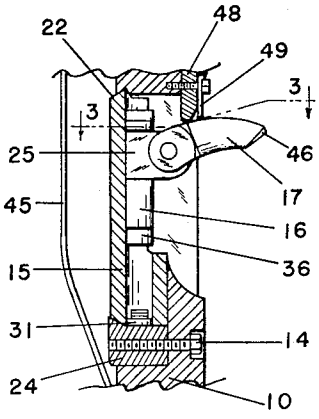


FIG. 5

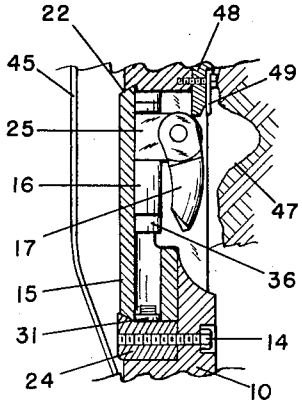


FIG. 6

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SIDE WALL CORE TAKER

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3 Claims. (Cl. 255—1.4)

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This invention relates to apparatus for use in oil wells or the like to obtain samples of rock or earth formations and more particularly to coring tools for obtaining samples from the side of the well bore.

The taking of side wall cores in wells is an old and well developed art. In the U. S. patent to Williston No. 1,683,642 for "Side Wall Sampler" an arrangement is proposed for getting portions of rock or earth formations from the side of a bore hole by rotating the core taking tube, but this exact arrangement has not come into general use because of the danger of getting the tool stuck in the well.

In the U. S. patent to Losey No. 2,317,544, granted April 27, 1943, there is disclosed an arrangement for taking samples of rock from the side of a well bore in which core taking tubes are not rotated completely through the formation, but are caused to be driven out into it and then retracted when the coring tool is moved upwardly in the well bore. A core taker of this type has met with some commercial success.

Both the Williston and the Losey tools may be referred to as of the guided retraction type. That is, the core taking tubes are not only guided when they are driven into the formation, but they are also guided when withdrawn. These tools are readily distinguished, therefore, from the type of side wall core takers in which hollow slugs or bullets are shot from gun barrels and pulled out of the formation, if at all, by a wire line or flexible connector somewhat haphazardly.

In accordance with the present invention, it is proposed to provide a core taking tool in which tubes are guided throughout their path of travel somewhat in the manner of the Williston patent. At the same time a driving force is imparted to the tube in a manner similar to that employed in the Losey arrangement. The driving force is such as to cause the tube always to complete its full path of movement and cut a good core. Moreover, special provision is made as by the shape of the tube and by the use of a special positioning spring to make it extremely unlikely that the tool will ever become stuck in the well or damaged when it encounters extremely hard rock.

Accordingly, it is an object of the present invention to provide a special arrangement for taking cores in which various elements are combined in a new and special way to obtain a tool which has certain marked advantages over those heretofore proposed, particularly in the ability to obtain a good sample of rock or earth formation while minimizing the danger of sticking the tool in the well bore.

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Another object of the invention is to provide a side wall core taking tool in which a tube is guided both during penetration and retraction into the formation and in which a single driving force is imparted to the tube to cause it to penetrate and retract.

Another object is to provide a side wall core taking tool of small diameter compared with the diameter of the well bore in which it is used and in which a spring is employed to offset or eccentrically position and hold the tool in the well bore while a single driving force is imparted to its core taking tube, the dimensions of the tube and related parts and the tension in the spring being such that if the tube encounters rock which it cannot penetrate, the tool will move laterally in the well bore while the tube completes its stroke or path of travel. Hence the tool will not readily become stuck in the well bore and cannot easily be damaged.

Still another object of the invention is to provide a side wall core taking tool in which gun powder or other explosive is employed to drive a tube or barrel through its complete stroke, which includes both guided penetration into the formation and guided retraction from the formation.

Other objects and advantages reside in certain novel features of the arrangement and construction of the parts, as will be more apparent from the following description, taken in connection with the accompanying drawing, in which

Fig. 1 is a view in side elevation of a side wall coring tool embodying the principles of the invention, suspended in position in a well bore, the well bore being shown in cross-section and with certain portions of the tool being cut away better to show the interval construction thereof;

Fig. 2 is a view in longitudinal cross-section of the core taking tube or barrel used in the arrangement of Fig. 1;

Fig. 3 is a transverse cross-sectional view of the tool of Fig. 1, with the parts in a different position, the view being taken on the line III—III of Fig. 5;

Fig. 4 is a vertical cross-sectional view of the powder load assembly used in the tool of Fig. 1;

Fig. 5 is a fragmentary cross-sectional view of the core taking tube and associated parts of the tool shown in Fig. 1, this view illustrating the position of the parts just after the powder load has been fired; and

Fig. 6 is a fragmentary cross-sectional view similar to that of Fig. 5 but illustrating the posi-

tion of the parts after the core taking tube or barrel has completed its stroke.

Referring to the drawing in detail, and first to the general assembly shown in Fig. 1, it will be seen that a side wall core taking tool is there illustrated as consisting of an elongated cylindrical body 10 adapted to be lowered into a well bore 12 upon an electric cable 13.

As is well known, the upper part of the body 10 may be provided with an electrode 11 for purposes of electric logging the formation and correlating the depth in the well bore at which cores are taken with deflections on an electric log.

The lower portion of the body 10 may be made up of sections, each containing one or more core taking assemblies and the assemblies may be selectively connected to the electric conductor of cable 13 by suitable switching mechanism located within the upper part of body 10 and which may be of the type well known in the gun perforator art and hence not shown or described here. (See patent to Robidoux 2,338,872, for example.) Inasmuch as the core taking assemblies may be all alike only one is shown completely in Fig. 1 and the operation of only one will here be described, but it will be understood that as many assemblies as are needed may be provided and stacked one above the other in the tool 10.

As shown in Fig. 1, each core taking assembly is secured to the body 10 by means of a single bolt 14. The assembly includes a guide member or cylinder 15 and a traveling block or piston 16 upon which a single core taking tube or barrel 17 is hinged as at 18. A powder load 19 (shown in detail in Fig. 4) is located beneath the piston 16 and is electrically connected, when desired, to the conductor of cable 13 and to ground in body 10. A plate 20 may be used to cover the lead wires to the various assemblies. Each assembly also includes a brass cup 21 located above the piston 16 and which travels with it and acts as a shock absorber when the piston 16 has completed its upward travel after the firing of the powder load 19.

As further shown in Fig. 1 the guide member or cylinder 15 has its upper and lower outer edges provided with beveled portions as shown at 22. The body 10 is suitably slotted to receive the assemblies and each slot 23 is so shaped as to permit the barrel 17 to rotate substantially 180 degrees about the piston 16 while the piston moves upwardly within the cylinder 15. Each slot 23 is also so formed as to enable the assembly to be clamped and secured conveniently therein when the bolt 14 is advanced within the special nut or wedge 24.

The particular shape of the slots 23 within the body 10 is best shown in Fig. 3. This figure also illustrates how the cylinder 15 is slotted to serve as a guide for the piston 16 which carries the barrel 17. As shown in Fig. 1, only the lower portion of the guide 15 constitutes a complete cylinder, the remainder being only substantially semi-cylindrical to accommodate the lateral projection 25 on the piston 16.

The lower portion of the cylinder 15 contains the powder load 19. As shown in detail in Fig. 4, the powder load 19 includes a base plug 31 provided with a central bore containing an insulating bushing 32 and a firing pin 33 held in place by insulating washers 34 and 35. A cup 36 is mounted upon the plug 31 and the powder is located therein, a seal being maintained by an O-ring 37 and a gas check ring 38. A pin contact 39 adapted to make connection to the conductor of cable 13, is connected by wire 40 to the firing pin 33 so that current can be supplied to the fuse wire 41 when desired. The contact 39 is provided with a fluid seal 42. An additional O-ring 43 may be provided around the bushing 32 if desired to insure that the powder remain dry.

When as many core taking assemblies as are desired are secured within a given section of the body 10, a leaf or drag spring 45 is secured to the section. As illustrated, all of the assemblies are mounted in the same vertical plane within the body 10 and the spring 45 being positioned 180 degrees from the tubes 17, causes all of the tubes of its section to be located against one side of the well bore before the firing takes place.

Each core taking tube or barrel 17 is specially designed to meet the requirements of its peculiar travel. As shown in detail in Fig. 2, the barrel is slightly curved and its upper outer edge is formed to provide a sharp gauge 46. In a sense the barrel 17 is more of a scoop or chisel than an ordinary core taking tube, for its does not cut a cylindrical core, being driven in such a manner as to cut a slot in the formation and not a cylindrical hole.

The slot cut by the barrel 17 is of the shape shown at 47 in Fig. 6. When the body 10 is being lowered into the well and until the powder load 19 is fired, each barrel 17 is held in the position shown in Fig. 1, by a retainer 48 and a spring clip 49. (It will be observed that no retainer 48 and clip 49 are shown on the lower bolt 14 in Fig. 1, the assembly there shown in cross-section being the lowest one in the body 10. All other bolts 14 on the body 10 are provided with a retainer and clip.)

The motion imparted to the barrel 17 by the explosion of the powder load 19 will be seen to be both rotary and vertical. Ordinarily there will be but little lateral movement of the body 10 when the powder load 19 is fired because its inertia is such that the reaction caused by the barrel 17 striking the formation will not move it substantially and its stability is aided by the drag spring 45. However, if a very hard formation is encountered, the drag spring will give and the body 10 will move to the left, as viewed in Fig. 1, so that the piston 16 can complete its upward travel and the barrel 17 complete its rotary stroke. Even though no core is then taken, the parts then assume the position shown in Fig. 6, and there is no danger of hanging the tool in the well bore.

As indicated above, it has long been recognized by those skilled in the art that it would be desirable to cut a core by imparting to a core barrel the type of motion indicated by Williston in Patent 1,683,642. However, as can readily be seen, the danger of sticking such a tool is great, for, unless complete rotation of the barrel can be insured, it provides a sort of toggle which drives the body against the side of the well bore until no force available could possibly pull it loose. Hence, although Williston is generally credited with being the first to propose the taking of side wall cores in a bore hole, the art has developed along different lines than he proposed, the barrels being either driven out laterally and retrieved by flexible connectors which will break before permitting the tool to become stuck or by so positioning the barrels that their initial penetration into the formation is partially in a downward direction, as in the patent to Losey No. 2,317,544 mentioned above.

In accordance with the present invention, by

the use of some force such as an explosive to impart motion to the core taking barrel, rather than pull on a cable as suggested by Williston, and by the selection of special dimensions and the use of yielding positioning means, the advantages of Williston's motion are obtained while at least minimizing the dangers of sticking the tool.

As shown in Fig. 1, the diameter of the body 10 plus the lateral projection of the barrel 17, even when fully extended, is less than the diameter of the well bore 12 in which the tool is run. By correlating these dimensions and by considering the magnitude of the powder charge, the strength of the spring 45, the mass of the body 10, the inertia of the mud in the well bore and other factors, provision can be made to insure that the body 10 will always move sufficiently to enable the barrel 17 to assume the position shown in Fig. 6, upon the firing of the powder charge 19 no matter how hard the formation encountered may be. On the other hand, these factors may be so related that the tool will obtain a core in the great majority of cases for the mass of the body 10 is such, and the motion of the barrel 17 and related parts is such as to impart a tremendous drive to the gouging edge 46 when the explosion occurs, and once the barrel has completed its stroke, the core is brought within the slot 23 of the body 10 and protected while the body 10 is brought to the surface of the ground.

The normal operation of the core taking assembly in obtaining a core from a formation is illustrated in Figs. 1, 5 and 6. As shown in Fig. 1, the barrel 17 is held in position very close to the wall of the well bore before the powder charge is fired. Upon the firing of the charge, the clip 49 yields and the barrel 17 strikes the formation. Due to the fact that the lower edge of the retainer 48 is then acting as a fulcrum for the barrel 17, the entire driving action of the explosion upon the piston 16 is then being exerted to drive the barrel into the formation. As the piston continues its upward travel, the gouging action is brought more into play, as illustrated in Figs. 5 and 6, so the forces required to retract the barrel 17 are considerably smaller than those required for penetration. Of course, the body 10 may move laterally during any part of the stroke and the slot cut in the formation will not always be of the shape shown at 47 in Fig. 6, but a good core may nevertheless be recovered if the barrel penetrates the formation at all.

While only one embodiment of the invention has been shown and described herein, it is obvious that various changes may be made without departing from the spirit of the invention or the scope of the annexed claims.

I claim:

1. In a side wall core taking tool for use in a well bore or the like, an elongated body adapted to be lowered into the well bore on a cable, an assembly mounted in said body for taking a core when desired from an earth formation along the well bore by gouging a slot therein, said assembly consisting of a vertically disposed cylinder, a piston mounted for sliding movement therein, a powder load disposed beneath said piston and adapted, when fired, to drive the piston upwardly and a core taking barrel having a gouging edge pivoted on said piston and adapted to rotate outwardly and downwardly over an angle of substantially 180 degrees through the earth formation when the piston is driven upwardly by said powder load.

2. In a side wall core taking tool for use in a well bore or the like, an elongated body adapted to be lowered into the well bore on a cable, an assembly mounted in said body for taking a core when desired from an earth formation along the well bore by gouging a slot therein, said assembly consisting of a vertically disposed cylinder removably mounted in said body, a piston mounted for sliding movement therein, an electrically fired powder load disposed beneath said piston and electrically connected to a conductor in said cable whereby said powder load can be fired when desired to cause said piston to be driven upwardly and a core taking barrel having a gouging edge pivoted on said piston and adapted to rotate outwardly and downwardly through the earth formation when the piston is driven upwardly by the firing of said powder load.

3. In a side wall core taking tool for use in a well bore or the like, an elongated body adapted to be lowered into the well bore on a cable, an assembly mounted in said body for taking a core when desired from an earth formation along the well bore by gouging a slot therein, said assembly consisting of a vertically disposed cylinder removably mounted in said body, a piston mounted for sliding movement therein, an electrically fired powder load disposed beneath said piston and electrically connected to a conductor in said cable whereby said powder load can be fired when desired to cause said piston to be driven upwardly and a core taking barrel having a gouging edge pivoted on said piston and adapted to rotate outwardly and downwardly through the earth formation when the piston is driven upwardly by the firing of said powder load, said body and said barrel being of such dimensions that the diameter of said body plus the maximum lateral extension of said barrel is less than the diameter of the well bore in which the tool is adapted to be used and said body having a drag spring on the opposite side thereof from the barrel for normally positioning said body eccentrically in the bore hole whereby said barrel readily engages the earth formation.

WINNEFRED SHELDON DILL.

REFERENCES CITED

The following references are of record in the file of this patent:

UNITED STATES PATENTS

Number	Name	Date
1,674,117	Mason	June 19, 1928
1,683,642	Williston	Sept. 11, 1928
2,058,119	Williams	Oct. 20, 1936
2,303,727	Douglas	Dec. 1, 1942
2,317,544	Losey	Apr. 27, 1943