March 7, 1950 T. A. HUBER 2,500,125

SIDEWALL CORING DEVICE

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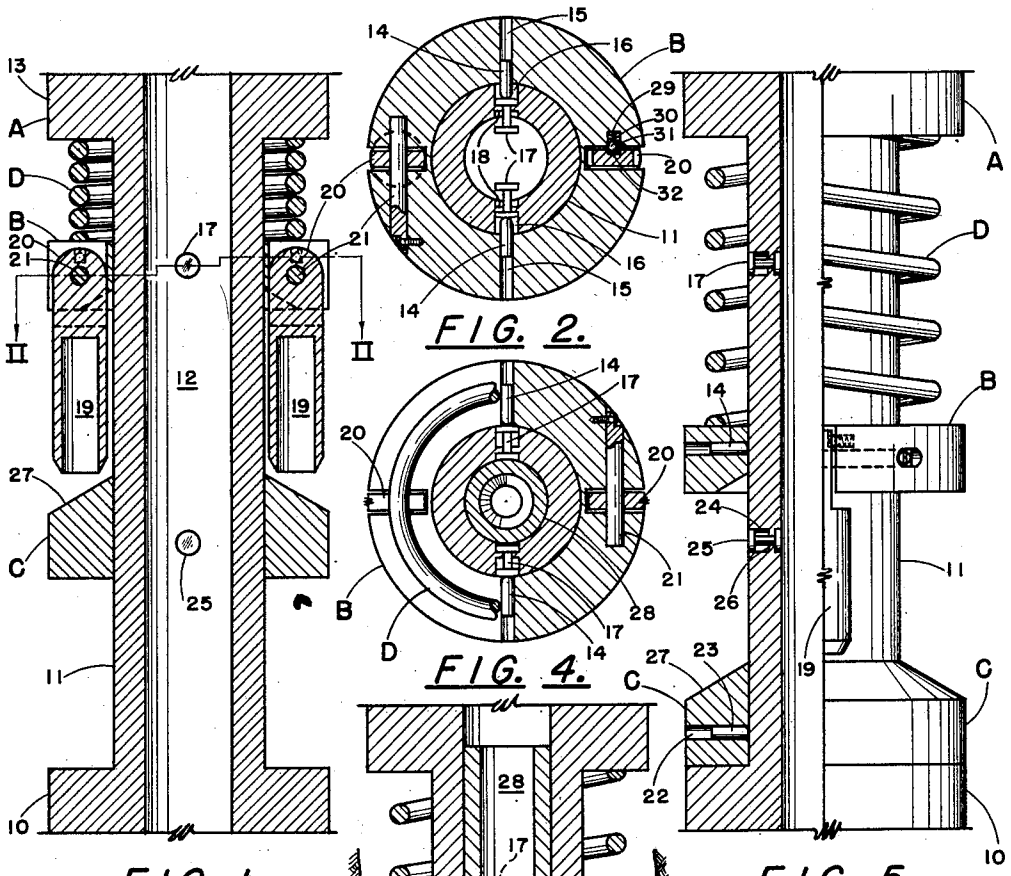

FIG. 2.

FIG. 4.

FIG. 1.

FIG. 5.

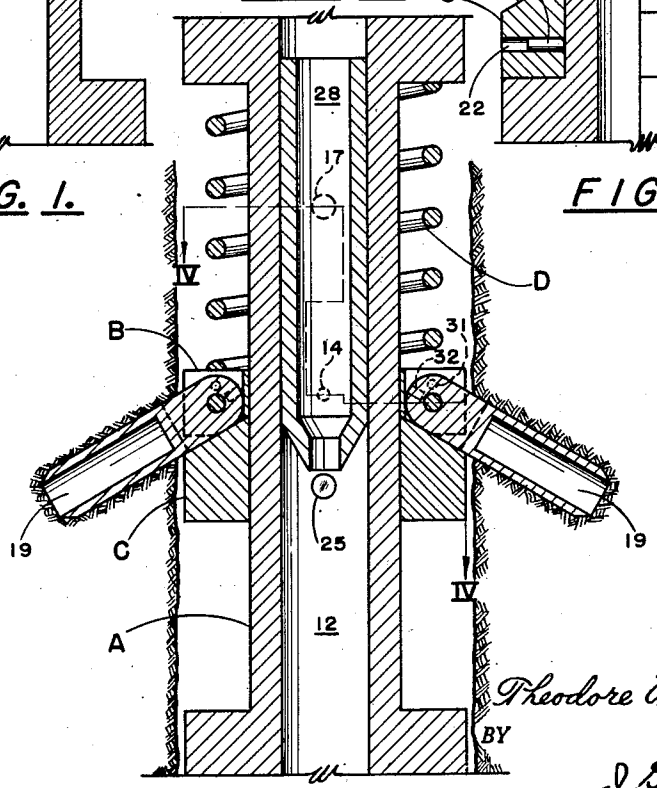

FIG. 3.

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SIDEWALL CORING DEVICE

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5 Claims. (Cl. 255—1.4)

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The present invention is directed to a sidewall coring device. More particularly it relates to a device which may be incorporated in the drill stem on which a drill bit is mounted during normal drilling operations and which may be manipulated to obtain a sample while the drill stem remains in the borehole.

During the drilling of wells it is often desirable to obtain samples or cores of formation penetrated by the borehole after the drill bit has passed the formations from which the samples are to be secured. Such cores are usually secured by a sidewall sampling device. A number of sidewall sampling devices are known to the art for taking sidewall cores but these conventional devices usually have undesirable features. The devices employed at present almost always require the withdrawal of the string of drill pipe prior to the introduction of the sidewall coring device in the borehole, and for this reason it is usually customary to postpone the taking of sidewall cores until the well has been completed or until a number of formations from which it is desired to obtain the cores have been drilled through. When operating in accordance with this conventional procedure, the sidewall of the hole from which the samples are obtained may be substantially altered due to the filtration effects through the formation, and the building up of thick mud sheaths on the formation.

The device of the present invention is adapted to be inserted or incorporated in the drill string and to remain in position during the normal drilling operation. It is preferable to arrange the device of the present invention immediately above the drill bit, although it may be arranged at desired points in the drill string. The coring device of the present invention may be advantageously used to obtain sidewall samples at points immediately above the drill bit prior to the withdrawal of the drill stem during normal drilling operations, but it may be employed at any time to obtain sidewall cores at any desired point in the well. It is to be understood that the sidewall sampling device of the present invention may be used independently of the drill string if desired.

Other advantages of the device of the present invention may be seen from a reading of the following detailed description taken in conjunction with the drawing in which

Fig. 1 is an elevation in section of a preferred embodiment of the present invention arranged as in normal drilling operations;

Fig. 2 is a view taken along line II—II of Fig. 1; and,

Fig. 3 is an elevation partly in section corresponding to that of Fig. 1 but showing the device in the position occupied when securing sidewall cores;

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Fig. 4 is a view taken along line IV—IV of Fig. 3; and,

Fig. 5 is an elevation partly in section of the device showing its appearance after a core has been secured and the sample-taking tubes are in position for retracting the device from the borehole.

Turning now specifically to the drawing, a section of generally tubular shape A, which may suitably be a portion of the drill stem, is constructed with a central tubular section 11 provided with a central passage 12 and having an outwardly extending shoulder 13 at its upper end and an outwardly extending shoulder 10 at its lower end. It will be understood that section A may be a portion of a joint of the drill stem or a section of a drill collar and that at some point below shoulder 10 a conventional drill bit may be secured to the drill stem while drill string above shoulder 13 extends upwardly to the surface of the earth and is there mechanically connected with conventional drilling equipment as used in normal drilling operations. It is desirable that the drill bit be immediately below shoulder 10 but when a hole of great depth is being drilled the surface equipment may be thousands of feet above shoulder 13.

Slidably arranged on section 11 of member A are annuli B and C. A spring D of generally helical shape is arranged around section 11 of member A between annulus B and shoulder 13 with its upper end secured to shoulder 13 and its lower end secured to annulus B. In the device as shown in Fig. 1, spring D biases annulus B downwardly but annulus B is retained in position by pins 14 which are slidably arranged in laterally extending passages 15 of annulus B and have their inner ends extending inwardly into laterally extending passages 16 of section 11 of member A.

A spool shaped member 17 is arranged in each passage 16, with its outer end retained within passage 16 by shoulder 18 and its inner end projecting into central passage 12. Members 17 are slidably arranged for lateral movement with respect to member A and when forced outwardly the outer surfaces thereof come in contact with the inner ends of pins 14 and force them outwardly. In other words, members 17 may be designated as pin pushers since they serve to push pins 14 along passages 15. It will be evident that when the pins 14 are pushed outwardly, annulus B is released so that it may be forced downwardly by spring D.

Mounted on annulus or mounting means B are sample-taking tubes 19 which are of generally cylindrical shape with their lower ends terminating in a sharp edge and their upper ends terminating in rectangularly shaped portions 20 which in turn are secured to annulus B by pivots or pins 21.

It is desirable to retain the axes of sample-taking tubes 19 parallel with the axis of member A during normal drilling operations. A suitable means for accomplishing this object includes a deep socket 29 in annulus B in which is seated a coil spring 30 and ball 31; each member 20 is provided with a recess 32 in which a ball 31 is yieldingly seated.

Annulus C is provided with laterally extending passages 22 in which are arranged pins 23. Section 11 of member A is provided with laterally extending passages 24 and within each of these is arranged a spool shaped member 25 which is retained in position by shoulder 26. Pins 23 serve to retain annulus C in position with respect to member A in the same manner that pins 14 retain member B in position. Similarly, spool shaped members 25 act as pin pushers and serve to move pins 23 outwardly and release member C.

The upper surface 27 of annulus or deflecting body C slopes outwardly and downwardly. This surface is adapted to cooperate with sample-taking tubes 19 to force their open ends outwardly.

By dropping a suitable weight or go-devil down the drill stem, pin pushers 17 may be moved outwardly to disengage pins 14 from member A and release annulus B and pin pushers 23 may be moved outwardly to disengage pins 22 from member A and release annulus C. A go-devil 28 of suitable design for operating pin pushers 17 and 25 is shown in Figs. 3 and 4. In these figures the go-devil is illustrated in the position of dropping down the drill stem for the purposes of releasing annuli B and C. It will be seen that go-devil 25 has an elongated body of tubular shape with its lower end tapered inwardly. This arrangement insures the proper centering of the go-devil as it passes through member A so that its lower end will pass between the opposite faces of members 17 and 25. As the go-devil passes between the faces of pin pushers 17, it drives them outwardly and as it subsequently comes in contact with the faces of pin pushers 23 it drives them outwardly in turn. The central passage through go-devil 25 allows the circulation of fluid through the drill stem while the go-devil is in the drill stem and is often advantageous in operations incident to the taking of sidewall cores. It will, of course, be obvious that go-devils or weights other than that shown in the drawing may be employed for activating the core-taking operation, for example, a rod having a tapered end may be used instead of a tubular member.

The device shown in the drawings is usually arranged with member A in the drill stem immediately above the drill bit. When going into the hole, preparatory to conducting drilling operation, the parts of the device are arranged as shown in Fig. 1 in order to allow it to be activated at the option of the operator for taking a sidewall core along the wall of the borehole. When a sidewall core is to be taken, as immediately before pulling the drill stem to change the drill bit, go-devil 28 is dropped down the drill stem and allowed to pass into section A and as it passes through this section it forces pin pushers 17 outwardly to disengage pins 14 from section A and release annulus B and subsequently forces pin pushers 25 outwardly to disengage pins 22 from section A and release annulus C. The instant annulus B is released, it is driven downwardly by spring D and even though annulus C is released almost immediately after annulus B,

the lower ends of core-taking tubes 19 are driven downwardly into contact with surface 27 of annulus C and the core-taking tubes are deflected into the formation to take sidewall cores. In Figs. 3 and 4, the device is shown with annulus B driven downwardly by spring D and core-taking tubes 19 deflected outwardly by members C, the inertia of member C having prevented it from moving downwardly any appreciable distance. For simplicity in the drawing of Fig. 4, the core-taking tubes 19 have not been illustrated but it will be understood that these tubes extend outwardly from rectangular members 20 and annulus B as illustrated in Fig. 3.

Although, upon the release of annulus C, its inertia retains it momentarily in such a position as to deflect sample-taking tubes 19 and allow cores to be taken, it moves downwardly under the influence of gravity and comes to rest on shoulder 10. This downward movement of annulus C allows core-taking tubes 19 to be released from contact with the formation and to resume their original position with their longitudinal axes parallel to the longitudinal axis of member A. A view of the device showing the position of the several parts after sidewall cores have been taken is shown in Fig. 5. In this figure the lower surface of annulus C is resting on shoulder 10 and core-taking tubes 19, containing cores, are hanging with their longitudinal axis parallel with the longitudinal axis of member A so that the device may be readily withdrawn from the borehole for recovery of the sidewall samples.

If the core tubes become fast in the formation after they have been driven therein to take a core, they may be readily released. The drill stem including body A may be slowly raised until the surface 24 of the deflector body C is brought into contact with the sidewall of the core-taking tubes and the core-taking tubes may then be released by placing an additional strain on the drill stem or by a jarring action. Upon the release of core-taking tubes 19, spring D will pull annulus B upwardly to the position shown in Fig. 5 with the core-taking tubes hanging free.

While I have described the arrangement of a single device of the present invention in a drill stem, it will be obvious that any number of devices may be incorporated in a drill stem, if desired. For example, if it is desired to take sidewall cores from two or more formations, additional members corresponding to member A may be arranged in the drill stem. It will also be obvious that instead of dropping a go-devil within the drill stem to activate the core-taking device, other means for activating it may be used, for example, a releasing member may be lowered through the drill stem by means of a wire line; this arrangement may be found useful when a number of sections A are incorporated in a drill stem and it is desired to control the depth at which the several sidewall core taking tubes are to be activated.

Having fully described the present invention, what I desire to claim is:

1. A device adapted for taking sidewall cores comprising, in combination, an elongated tubular member providing a substantially unobstructed vertical passage therethrough and defining with its upper and lower ends first and second outwardly extending shoulders, an annulus mounted on said member and adapted for movement along said member from an upper position to a lower position, an open ended core-taking tube pivoted

to said annulus with said open end facing downwardly, tension means mounted on said tubular member above said annulus and below said first shoulder and arranged to bias said annulus from its upper to its lower position, a deflecting body mounted on said tubular member below said annulus and adapted for movement from an upper to a lower position, the upper surface of said deflecting body being arranged to deflect outwardly the open end of said sample-taking tube when said deflecting body is in its upper position and releasable means adapted to secure the annulus in its upper position and the deflecting body in its upper position.

2. A sidewall core-taking device comprising, in combination, a tubular member adapted to be placed in a borehole in the vertical position defining a central vertically extending passage in communication with first and second vertically spaced laterally extending passages, a first annulus provided with a laterally extending passage mounted on said tubular member and adapted for movement from an upper position adjacent the first lateral passage to a lower position, a spring mounted on said tubular member and arranged to bias the first annulus from its upper to its lower position, a core-taking tube having an open end and a closed end, means pivotally fastening said tube to the first annulus with its open end facing downwardly and its longitudinal axis parallel to the axis of the tubular member, a second annulus having its upper surface defining a frustum of a cone mounted on said tubular member and arranged for slidable movement thereof from an upper position adjacent the second laterally extending passage to a lower position, the surface of the second annulus serving as a deflector for the core-taking tube upon movement of the first annulus from its first to its second position while the second annulus is adjacent its first position, a pin slidably arranged in the first lateral passage and the lateral passage of the first annulus and a second pin slidably arranged in the second lateral passage and the lateral passage of the second annulus.

3. A device for taking sidewall cores in a borehole comprising, in combination, a tubular member defining with its upper and lower ends a first and second outwardly extending shoulder adapted to be arranged in a drill stem and to provide a substantially unobstructed vertical passage therethrough, a mounting means slidably mounted on the tubular member and adapted for movement along the longitudinal axis thereof from an upper position to a lower position, tension means mounted on the tubular member above said mounting means and below said first shoulder adapted to bias said mounting means from its upper to its lower position, a sample-taking tube having an open end adapted for receiving a sidewall core, means securing said sample-taking tube to said mounting means with said open end downwardly and said tube being pivotally arranged for lateral movement away from the tubular member, a deflecting body mounted on the tubular member below the open end of the core-taking tube when the mounting means is in its first position and adapted to deflect the open end of the core-taking tube laterally away from the tubular member upon movement of the mounting means from its upper to its lower position, releasable means securing said mounting means in its upper position and releasable means securing the deflector

body against longitudinal movement along said tubular member.

4. A device for taking side wall cores comprising, in combination, an elongated body defining a central passage and adapted to form a portion of a drill stem and a first and second outwardly extending shoulder arranged on the upper and lower ends of said elongated body, a mounting member slidably mounted on said elongated body, a core taking tube, means pivotally attaching the upper end of the core taking tube to the mounting member, a deflecting member slidably mounted on the elongated body below the mounting member, a first releasable locking means adapted to secure the mounting means against movement with respect to the elongated body, a second releasable locking means adapted to secure the deflecting member against movement with respect to the elongated body and below the lower end of the core taking tube when the mounting means and deflecting member are locked into position, said first and second releasable locking means each including a member projecting within the central passage when locking the mounting member and deflecting member respectively against movement and each adapted to be released respectively when its projecting means is moved radially outwardly and tension means mounted on the elongated body above said mounting means and below said first shoulder adapted to bias downwardly the mounting member.

5. A device for taking side wall cores comprising, in combination, an elongated body defining a central passage and adapted to be arranged in the drill stem to form a portion thereof and a first and second outwardly extending shoulder arranged on the upper and lower ends of said elongated body, a mounting member slidably mounted on the elongated body, a core taking tube, means pivotally attaching the upper end of the core taking tube to the mounting member, a deflecting member slidably arranged on the elongated body below the mounting member, a first releasable locking means adapted to secure the mounting means against movement with respect to the elongated body, a second releasable locking means adapted to secure the deflector below the lower end of the core taking tube against relative movement with respect to said body, said first and second releasable locking means operable to release the mounting means and deflecting member respectively upon movement of a body along the central passage defined by the elongated body and tension means mounted on the elongated body above said mounting means and below said first shoulder adapted to bias downwardly the mounting member.

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