Jan. 27, 1953 M. E. TRUE 2,626,777

SIDE WALL SAMPLING DEVICE

Filed April 17, 1950 3 Sheets-Sheet 1

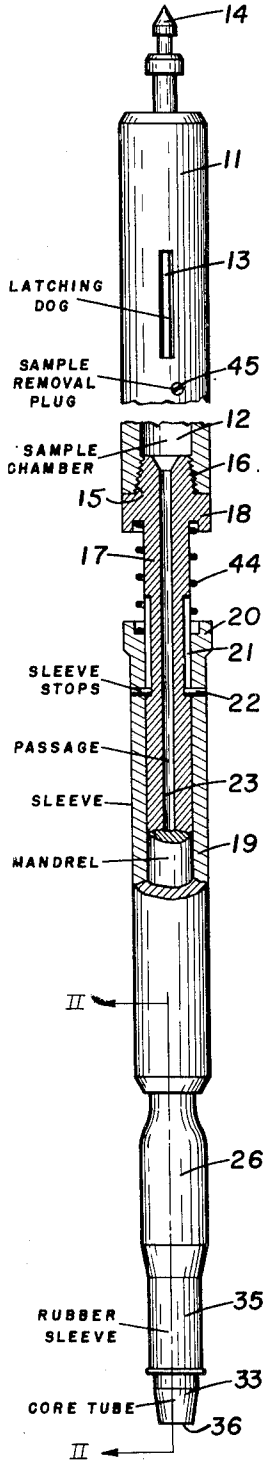

FIG. 1.

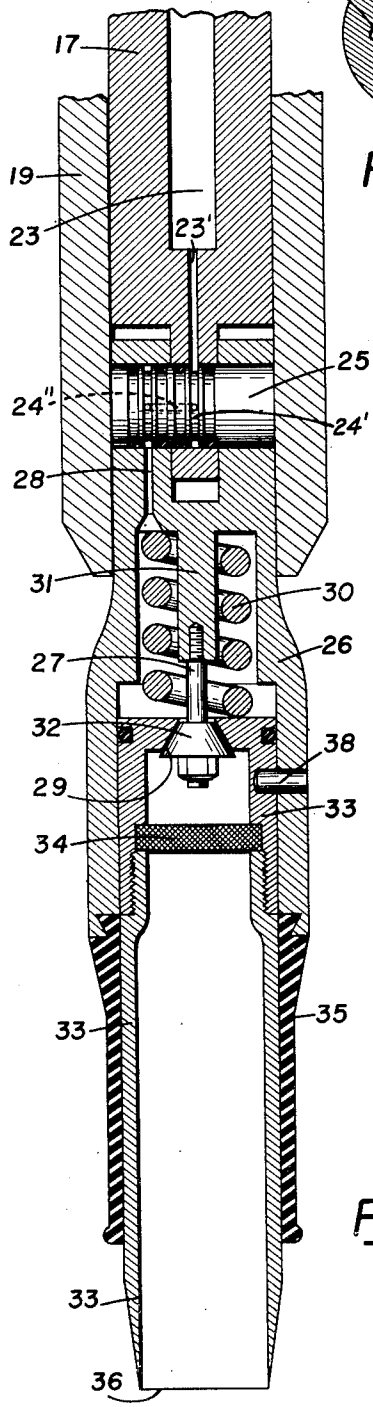

FIG. 2.

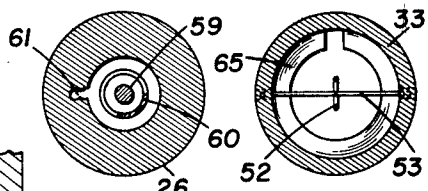

FIG. 7. FIG. 8.

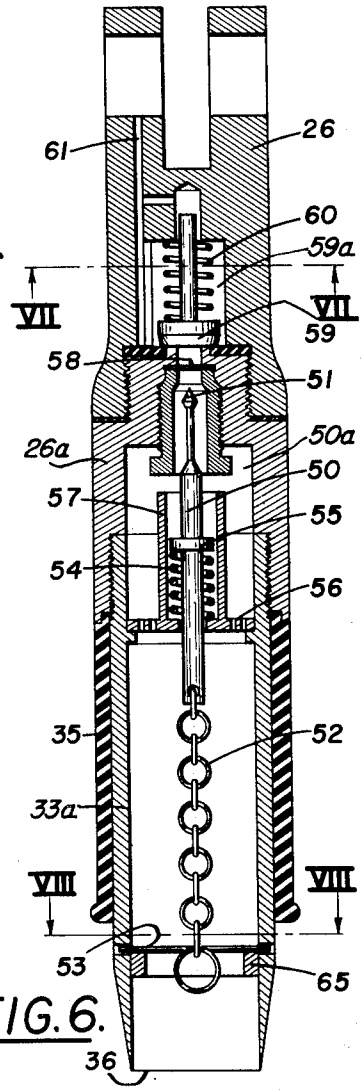

FIG. 6.

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SIDE WALL SAMPLING DEVICE

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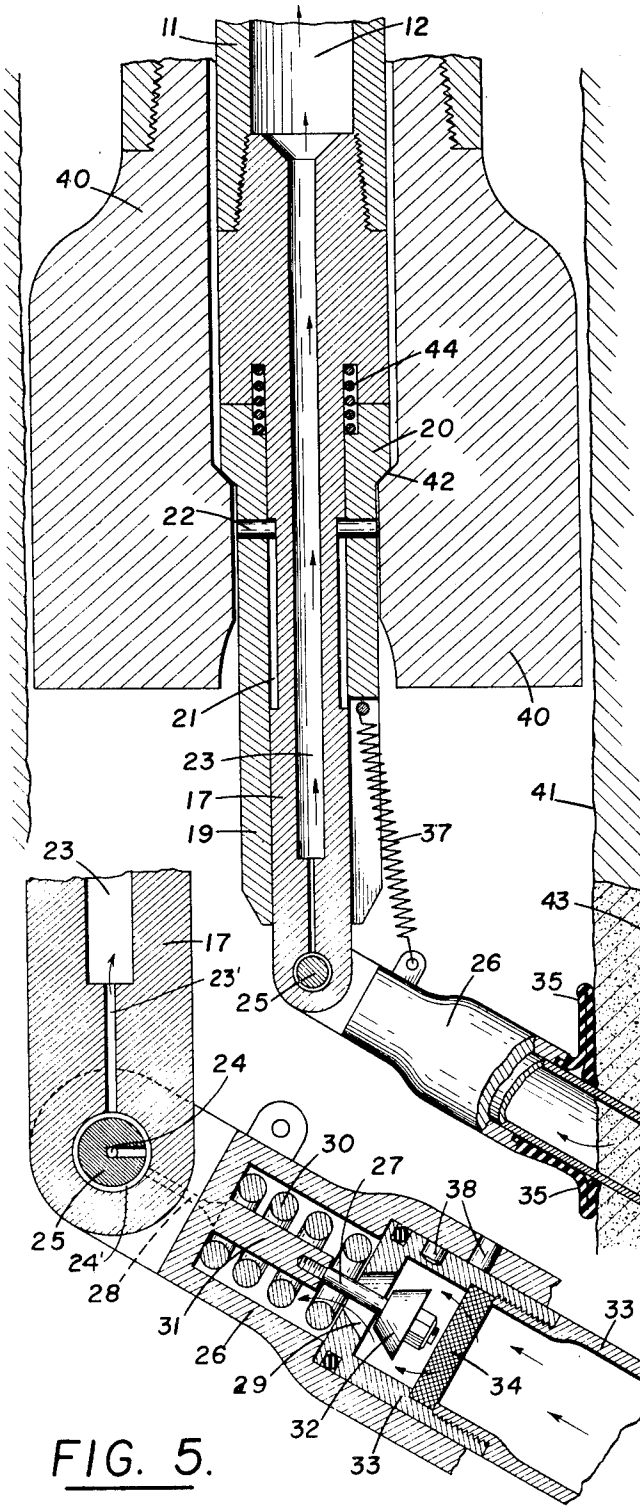

FIG. 5.

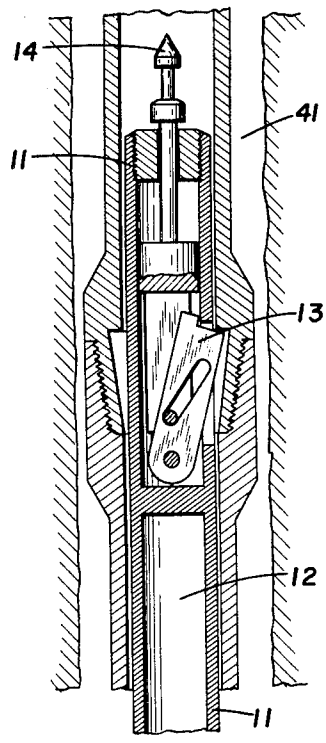

FIG. 4.

FIG. 3.

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SIDE WALL SAMPLING DEVICE

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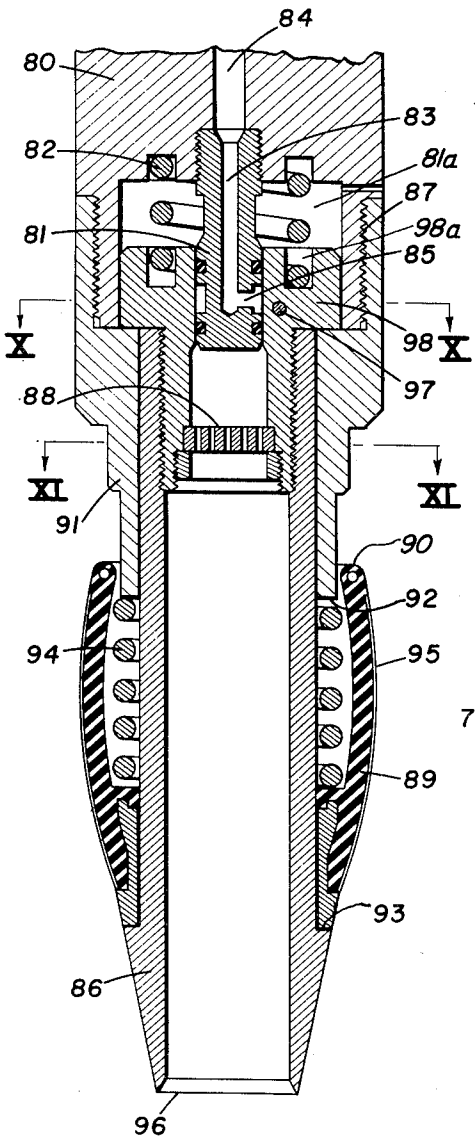

FIG. 9.

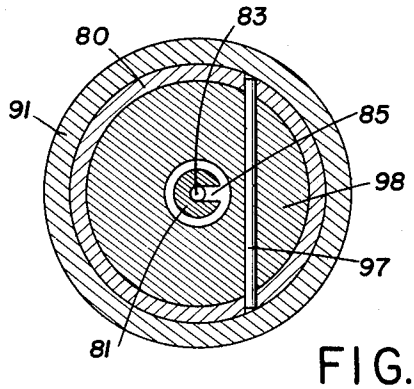

FIG. 10.

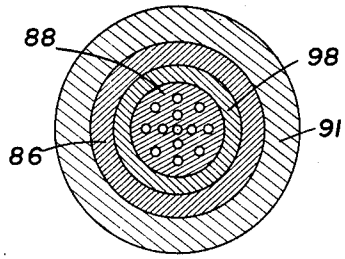

FIG. 11

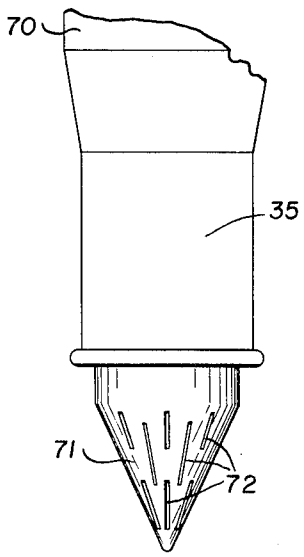

FIG. 12.

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2,626,777

SIDE WALL SAMPLING DEVICE

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Application April 17, 1950, Serial No. 156,327

5 Claims. (Cl. 255—1.4)

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The present invention is directed to a device for simultaneously taking a side wall core and a fluid sample.

An object of the present invention is to provide a device which may be operated through a conventional core bit to take a side wall core and a fluid sample and which may be retrieved by a wire line without withdrawing the core bit from the borehole.

Another object of the present invention is to provide a device which may be operated through a conventional core bit and is capable of taking a side wall core and a sample of fluid from a borehole.

It is a further object of the present invention to provide a device which may be operated through a conventional core bit to take a side wall core and a fluid sample substantially simultaneously.

Another object of the present invention is to provide an apparatus which will allow the taking of a side wall core and a fluid sample without contamination of the core or the fluid sample with the fluid in the borehole.

A still further object of the present invention is to provide a device in which a side wall core tube is provided with a sealing member to seal off the formation and the tube adjacent the area from which a sample is to be obtained.

Other objects and advantages of the invention may be seen from a reading of the following description taken with the drawing in which

Fig. 1 is an elevation, partly in section, of the apparatus of the present invention;

Fig. 2 is a cross-sectional view of the apparatus of the present invention taken along the lines II—II of Fig. 1;

Fig. 3 is a partial sectional view of the device of the present invention in the lower end of a drill stem in the act of securing a side wall core and a fluid sample;

Fig. 4 is a sectional view of the latching device and the upper end of the device of the present invention with the latch in retracted position;

Fig. 5 is an enlarged sectional view of the valve mechanism and the core head and core tube of Fig. 3;

Fig. 6 is a still further embodiment of the apparatus of the present invention;

Fig. 7 is a view taken along the lines VII—VII of Fig. 6;

Fig. 8 is a view taken along the lines VIII—VIII of Fig. 6;

Fig. 9 is a modification of the apparatus of

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Figs. 1, 2 and 3 showing an improved sealing member for sealing the formation against the core tube;

Fig. 10 is a view taken along the lines X—X of Fig. 9;

Fig. 11 is a view taken along the lines XI—XI of Fig. 9; and

Fig. 12 is a further modification of the present invention showing a sample tube substituted for the core tube of Figs. 1, 2, 3, 5, and 6.

The apparatus of the present invention may be described briefly as a wire line sampling and side wall coring apparatus. This device is adapted to be used in conjunction with a drill bit provided with a central passage, such as is conveniently used for taking cores from the bottom of the hole, and is arranged to be moved longitudinally along the longitudinal axis of the drill stem and to be locked releasably to the lower end of the drill stem adjacent the drill bit. When preparing to take a side wall core and sample, the device may be lowered on a wire line or allowed to drop under the influence of gravity through the bore of the drill pipe until it reaches its seat adjacent the drill bit. When a side wall core and sample have been taken the apparatus may be released from its position adjacent the drill bit and withdrawn to the surface of the earth by means of a wire line.

Referring now to the drawing and particularly to Figs. 1, 2, 3, 4, and 5, numeral 11 designates an elongated body which defines a sample chamber 12. Elongated body 11 at its upper end is provided with a latching means indicated generally as 13 and which is conventional to the art and employed in latching wire line core barrels to the interior surface of a pipe string. The upper end of the sample chamber 11 embodying the device of the present invention is provided with a head 14 for use in retrieving the device of the present invention or for attaching it to a suitable tool which in turn may be attached to a wire line. The elongated body 11 is attached by suitable screw threads 15 to corresponding male threads 16 to a tubular member 17 which defines with its upper end an offset portion or shoulder 18. The tubular member 17 is surrounded by a sleeve member 19 which defines a shoulder 20. Tubular member 17 defines with its outer surface a plurality of slotways 21 which are adapted to cooperate with stop members 22 to restrict the upward travel of sleeve 19 as will be described. Tubular member 17 is provided with an internal bore or passageway 23 which, at its upper end, is in fluid communication with sample chamber 12 and at its lower end with a

passageway 23' which communicates with annular passageway 24' connecting by transverse passageway 24, provided in pivot member 25, with annular passageway 24'' which communicates, as will be described, with outlet 28.

A bifurcated core head member 26 is pivotally attached to tubular member 17 by pivot member 25. Core head member 26 encloses an internal valve member 27 including an outlet 28 and an inlet 29. Outlet 28 connects with annular passageway 24. Valve 27 also includes a coil spring 30 surrounding a downwardly projecting member 31 to which valve closure 32 is attached.

Carried by core head member 26 is a core tube 33 provided with a screen 34. Core tube 33 is provided with an annular sleeve 35 of a deformable material such as natural or synthetic rubber and the like which is attached to core head 26 and is adapted to assume the position shown in Fig. 3. Core tube 33 is provided with, at its lower end, a knife edge 36 which is adapted to cut a core sample.

Referring now to Fig. 3 it will be seen that the apparatus of Figs. 1 and 2 has been lowered through a drill stem and projects through a drill bit 40 in the borehole 41. The apparatus of Figs. 3 and 5 are similar views to that of Figs. 1 and 2, but rotated 90° to show a tension member 37, which is adapted to bias the core tube 33 from the longitudinal axis of the device in the borehole. It will be seen that in Fig. 2 a shear pin 38 has been shown, which holds the core tube in inoperative position as shown in Figs. 1 and 2 while in Fig. 3 the shear pin 38 has been broken, as shown in Fig. 5, allowing the core tube 33 to cause actuation of the valve 27, as will be described.

It will be noted in Fig. 3 that the shoulder 20 defined by sleeve 19 is resting on an internal abutment 42 of the drill bit 40. It will be further noted that the core tube 33 has penetrated the desired formation 43 of the borehole 41.

In the operating position shown in Fig. 3 the coil spring 44 interposed between the sleeve 19 surrounding tubular member 17 and the offset portion 18 thereof is in compressed condition which will urge the sleeve 19 downwardly when weight is picked up on the pipe string to release the core tube 33 from the formation 43 and to allow the core tube 33 to be retracted within the bit 40. The core tube 33 is thus pulled upwardly and outwardly from the formation 43, swinging in an arc to a vertical position as it is retracted into the bit 40.

In Fig. 6 the bifurcated core head 26 has been modified internally to show another arrangement of a valve member suitable for allowing the taking of a liquid sample. In this arrangement of the present invention a core tube 33*a* is provided with a plunger mechanism 50 which terminates in an upthrusting pointed member 51. Pointed member 51 is held in a loaded position by a chain or other suitable connecting device 52 which is attached to a shear pin 53. Pointed member 51 is spring loaded to be urged upwardly by a coil spring 54 which bears against a stop member 55 and the bottom portion thereof against a screen member 56. Surrounding the pointed member 51 is an annular guide member 57. Elements 50, 51, 54, 55, 56, and 57 are arranged in a chamber 50*a* enclosed by tube 33*a* and connecting member 26*a*. Immediately above the upthrusting member 51 is a sealing disk 58 which is adapted to be ruptured thereby and above sealing member 58 is a valve member 59 comprising a coil spring 60 surrounding the upper part thereof and urging the valve member 59 downwardly to cause sealing of the sample tube as will be described later. It will be seen that valve 59 is positioned in a fluid passageway 59*a* which communicates with passageway 23 by outlet 61 thereof.

Figs. 9–11, inclusive, present a still further embodiment of the core head and tube of Figs. 1–5 and show a modification of the annular sleeve of deformable material.

Referring now to Figs. 9–11, a bifurcated member 80 is provided with a valve mechanism 81 including a coil spring 82. Valve member 81 is arranged in a chamber 81*a* and the member 81 is provided with a passageway 83 which communicates with outlet 84 and thence with the lower end of passageway 23; inlet 85 when in an open position communicates with the core tube 86 in a manner which will be described further. Threadably connected to core head 80 by mating threads 87 is an extension thereof 91 which surrounds core tube 86 at an upper end thereof. This portion of the core head may, if desired, be constructed integrally therewith. Arranged in core tube 86 is a screen 88 adapted for the passage of fluid therethrough. Core tube 86 is provided with an annular sealing member 89. Member 89 is annularly connected by connections 90 to extension 91 of core head 80. Bearing against a lower end 92 of extension member 91 and member 89 which, in turn, rests on shoulder 93 of core tube 86 is a coil spring 94. Annular sealing member 89 which surrounds spring 94 is provided with a flexible metal stiffener 95 to give rigidity to it and allow the sealing member 89 to resume its unflexed position as shown in the drawing. Core tube 86 is provided with, at its lower end, a knife edge 96 adapted to cut a core on a side wall of a borehole. The core head member 80 including valve 81 is held in inoperative position by a shear pin 97 which engages member 80 and holds core tube 86 stationary with respect to member 91. Pin 97 is adapted to be ruptured at a predetermined pressure by setting down weight on the drill stem as will be described further.

It will be seen that the screen device 88 is supported by a member 98 and that spring 82 is arranged so that its lower end fits into a recess 98*a* of member 98. Member 98 functions to allow opening and closing of valve 81 as will be described further.

Referring now to Fig. 12, it will be seen that the bifurcated member 26 of Figs. 1 to 9 has been replaced by a bifurcated member 70. This embodiment may employ either of the valve members of Figs. 1–9. The device of Fig. 12 differs from that of Figs. 1–9 in that core tubes 33 and 33*a* have substituted therefore at the lower end thereof a conical member 71 which is provided with slotted perforations 72. Member 71 is provided with an annular sleeve of a deformable material 35 similar to that of Figs. 1 to 5 which functions in the same manner as the annular sleeve of Figs. 1 to 5.

The apparatus of Figs. 1 to 5 functions as follows: The device of the present invention may be lowered into a borehole 41, as shown in Fig. 3, on the end of a wire line until the shoulder 20 comes to rest against the abutment 42 of drill bit 40 which is off bottom of hole 41 as shown in Fig. 3. The weight imposed on the device causes the tubu-

lar member 17 to move downward with respect to sleeve 19 thereby causing compression of spring 44. The sleeve member 19 riding up on tubular member 17 causes extrusion thereof, in a manner of speaking, from the sleeve and allows the core tube 33 to be biased by spring 37 against the side of borehole 41. Latch dogs 13 then become operative and latch the device firmly against the inner surface of the tube string. By letting down weight on the pipe string the core tube 33 is forced into the formation 43 which causes the deformable annular sleeve 35 to ride up on core tube 33 and cause a seal between the tube and the producing formation preventing the fluid and core sample from being contaminated by material in the borehole, the sleeve 35 preventing contamination of the sample being obtained when the sleeve 35 is engaged with the wall of the borehole. The force exerted by the weight being let down on the tubing string shoves core tube 33 into formation 43 and causes rupture of shear pin 38 at a predetermined force allowing valve 27 to be opened. The member 26 moves downwardly with respect to core tube 33 which compresses coil spring 30, opening valve 27 and thus allowing fluid to pass through the screen 34 through valve inlet 29 and valve 27 and through annular passageway 24'' and transverse passageway 24 defined by pivot member 25, and annular passageway 24', and thence into the lower end of passageway 23 from whence the sample finds its way into the closed sample chamber 12. Sample chamber 12 is shown with an outlet connection 45 to allow removal of the sample from the chamber when the device is retrieved from the borehole.

When weight is released from the apparatus, spring 30 causes valve 27 to be closed by core tube 33 moving downwardly into its normal position sealing the fluid sample in chamber 12.

The apparatus of Figs. 6–8 operates in a similar fashion to that of Figs. 1 to 5. The shear pin 53 holds the plunger mechanism 50 with its upthrusting member 51 in a cocked position. As the shear pin ring 65 is forced upwardly in the core tube by the core moving upwardly therein the shear pin is ruptured and releases chain or connecting means 52 which in turn releases the plunger mechanism 50 and the upthrusting member 51 causing the sealing disk 58 to be ruptured allowing the sample to pass upwardly through screen 56, chamber 50*a* and thence through the ruptured sealing disk 58 and thence through valve 59, chamber 59*a*, and passageway 61 into passageway 23 as shown in Figs. 1 and 2 which communicates with chamber 12. Thus as the apparatus is released from the drill bit 40, as shown in Fig. 3, the spring 37 biases the sample tube out to the wall of the borehole. The operator sets down weight on the drill stem which causes the formation to be pierced. Since the formation pressure is sealed off from the well pressure and since the sample tube is at a lower pressure than the formation pressure the formation pressure will serve to open the valve and allow fluid, after puncturing of the disc 58 by the member 51, to flow into chamber 12 as has been described. Thus the valve 59 works against the spring 60 allowing fluid to pass into the sample chamber through passageways 61 and 23. After pressure has equalized on both sides of valve 59, the spring 60 closes the valve 59 and prevents leakage of the sample from the chamber 12.

The device of Fig. 12 operates similarly to the device of Figs. 1–5 with the exception that a core is not taken, but a fluid sample is taken through conical member 71, the fluid passing through perforations or slots 72 and thence upwardly through the device as has been described with respect to the taking of the fluid sample.

The apparatus of Figs. 9–11 operates in a similar manner to the previous embodiments. In this embodiment of the invention the bifurcated member 80 is forced out of the sleeve 19 by the latter moving upwardly on the tubular member 17 which allows the spring member 37 to bias the core tube 86 against the wall of borehole 41 and into producing formation 43 as shown in Fig. 3. Assuming that the apparatus has been locked in the tubing string, as has been described, by letting down weight on the drill stem, the core tube 86 is forced into the formation. As the core tube 86 is forced into formation 43, it moves upwardly with respect to member 91 which forces member 98 upwardly with respect to member 81 on shearing of pin 97 when a predetermined pressure is exceeded. Thus inlet 85 is exposed by upward movement of member 98 allowing fluid to pass from the formation 43 into sample tube 86, through screen 88 and thence into inlet 85, passageway 83 and to outlet 84 which communicates with sample chamber 12.

As core tube 86 is forced upwardly rupturing shear pin 97, annular sealing sleeve 89 is flexed outwardly against the producing formation 43 and causes a seal between it and core tube 86. When the core tube 86 is withdrawn from formation 43 on picking up of the pipe string, coil spring 94 forces member 86 downwardly with respect to member 91 which causes member 89 to resume its unflexed position. At the same time as pressure is relieved from spring 82, member 98 is urged downwardly with respect to member 81 which closes inlet 85 and seals the sample in chamber 12.

It will be seen that the device of the present invention may be used to obtain a fluid sample and a core sample from the producing formation. It will also be seen that the device of the present invention is particularly adapted to be lowered through a core bit to obtain a sample. The apparatus of the present invention with the modification of Fig. 12 is adapted also to take only a fluid sample.

Numerous modifications of the present invention will suggest themselves to the skilled workman. It is intended that these modifications embracing the various embodiments shown in the description taken with the drawing may be made without departing from the spirit and scope of the present invention such as altering the sizes, shapes and relative positions of the various structural members.

I claim:

1. A device for taking a sample from the sidewall of a borehole through a drill stem comprising, in combination, an elongated body defining a sample chamber, a tubular section provided with a passageway communicating at an upper end with said chamber, a pivot member having a passageway communicating with a lower end of the passageway in the tubular section, a sleeve slidably surrounding said tubular section, said tubular section being adapted to move downwardly with respect to said sleeve, a head member pivotally attached to said tubular section by said pivot member, a valve enclosed by said head member communicating with the passageway in the pivot member, a sample tube carried by said head member adapted to communicate with said

chamber, an annular deformable sleeve surrounding said sample tube adapted to provide a seal between an exterior surface of the sample tube and the wall of the borehole on penetration thereof by the sample tube on setting down weight on the drill stem, said valve being opened by downward movement of the drill stem and penetration of the wall of the well bore by the sample tube, and a tension member attached to said elongated body and said head member adapted to bias said sample tube from the longitudinal axis of said device on downward movement of said tubular section relative to said sleeve.

2. A device in accordance with claim 1 in which the sample tube is provided with a knife edge on a lower end thereof adapted to cut a core.

3. A device in accordance with claim 1 in which the sample tube is provided with a conical member on a lower end thereof having at least one opening therein adapted for the flow of fluid therethrough.

4. A device for taking a fluid sample and a core from the sidewall of a borehole through a drill stem comprising, in combination, an elongated body defining a sample chamber, a tubular section provided with a passageway communicating at an upper end with said chamber, a pivot member having a passageway communicating with a lower end of the passageway in the tubular section, a sleeve slidably surrounding said tubular section, said tubular section being adapted to move downwardly with respect to said sleeve, a core head pivotally attached to said tubular section by said pivot member, a valve enclosed by

said core head communicating with the passageway in the pivot member, a core tube provided with a knife edge on a lower end carried by said core head adapted to communicate with said chamber, an annular deformable sleeve provided with a flexible metal stiffener surrounding said core tube adapted to provide a seal between an exterior surface of the core tube and the wall of the borehole on penetration thereof by the core tube on setting down weight on the drill stem, said valve being opened by downward movement of the drill stem and penetration of the wall of the well bore by the core tube, and a tension member attached to said elongated body and said core head adapted to bias said core tube from the longitudinal axis of said device on downward movement of said tubular section relative to said sleeve.

5. A device in accordance with claim 4 in which the tension member is a coil spring.

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