

Aug. 6, 1940.

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2,210,464

MEANS FOR TAKING WELL CORES

Filed Sept. 20, 1937

2 Sheets-Sheet 1

Fig. 1.

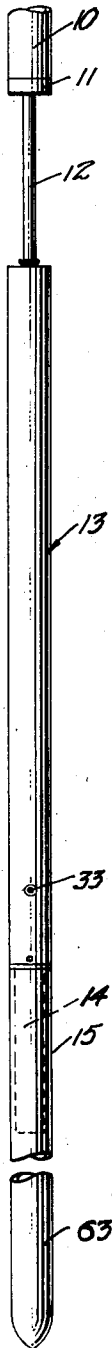


Fig. 2.

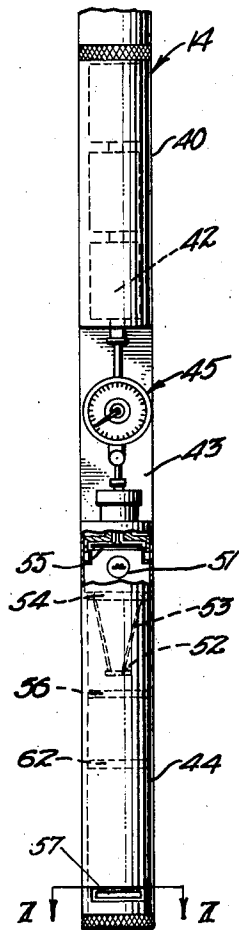


Fig. 5.

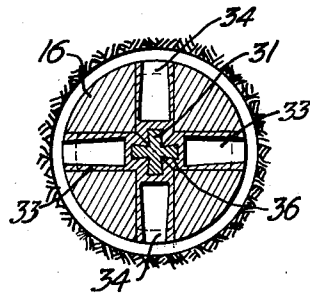


Fig. 6.

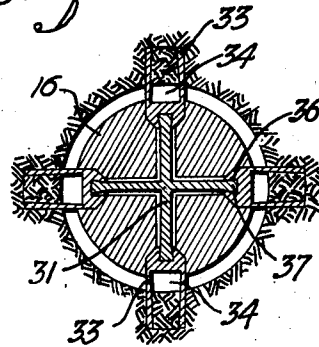
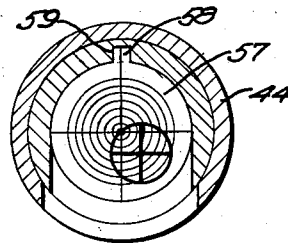


Fig. 7.



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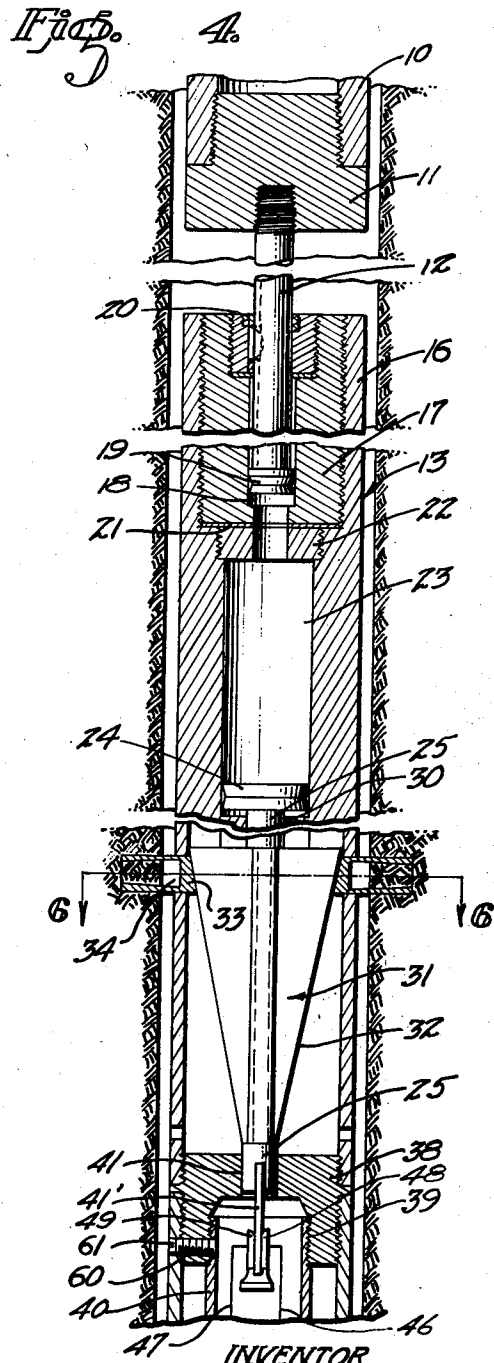
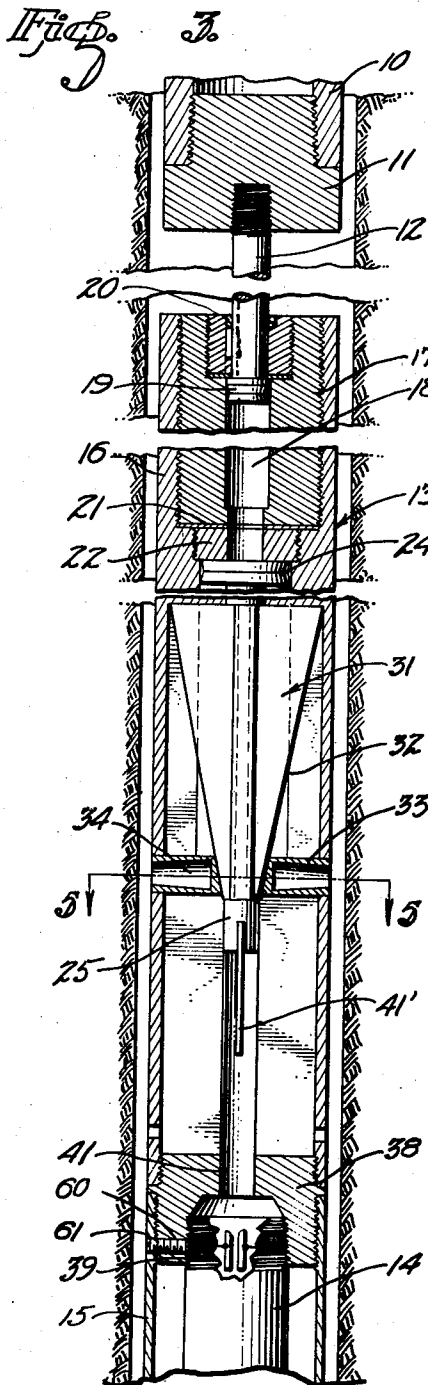
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2 Sheets-Sheet 2



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MEANS FOR TAKING WELL CORES

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11 Claims. (Cl. 255—1)

This invention relates to a method and apparatus by which data is obtained relative to the formation being penetrated in drilling a well, and particularly pertains to a means for taking well cores.

In the drilling of wells, and particularly oil wells which penetrate the earth to a great depth, various devices have been provided to explore the geological formation being penetrated and to ascertain the inclination of the formation and the declination of the well bore. It has also been usual practice to obtain samples of the formation known as cores, which cores are taken from the bottom of the well bore. It is the principal object of the present invention to provide a method and means whereby cores may be taken at any point in the depth of a well bore and from the side wall thereof, and a record obtained to be read in connection with the cores recovered so as to determine the declination of the well bore and to properly orient the cores with relation to magnetic north and to the aforesaid declination.

The present invention contemplates the provision of a core taking structure which projects a series of core receiving elements radially of the longitudinal center of the drill string and the structure carried thereby, and which device embodies a well surveying instrument by which a record is made simultaneously with the taking of the cores to indicate the oriented position of the cores taken, as well as the direction and degree of deviation of the well bore from the vertical.

The invention is illustrated by way of example in the accompanying drawings in which:

Figure 1 is a view in elevation showing the assembled tool with which the invention is concerned and which tool is suspended from a drill string and into a well.

Fig. 2 is an enlarged view showing a well surveying instrument used as part of the present invention.

Fig. 3 is an enlarged fragmentary view in central longitudinal section and elevation showing the details of construction of the core taking unit of the device with the core cutting members in their retracted positions.

Fig. 4 is a view similar to that shown in Fig. 3, indicating the core cutting elements in their projected position while obtaining a formation sample.

Fig. 5 is a view in transverse section, as seen on the line 5—5 of Fig. 3, and as showing the core cutters in their retracted position.

Fig. 6 is a view in transverse section, as seen on the line 6—6 of Fig. 4, and shows the core cutters in their projected position.

Fig. 7 is an enlarged view through the well surveying instrument, as seen on the line 7—7 of Fig. 2, and discloses the means by which the record disc is oriented with relation to the surveying instrument.

Referring more particularly to the drawings, 10 indicates a drill string to the lower end of which a pin 11 is threaded. This pin carries an operating rod 12 which supports the core taking unit 13 at the lower end of which a magnetic type well surveying unit 14 is carried within an armored casing 15. The core taking unit comprises a barrel 16 into the upper end of which is threaded a cylinder block 17. This cylinder block is formed with a central bore 18 therein to receive a piston 19 which reciprocates within the bore 18. The piston 19 is carried at the lower end of the operating rod 12 and moves therewith. A splined bushing 20 is mounted in the upper end of the cylinder block 17 and provides a keyed guide for the operating rod 12. At the lower end of the cylinder block 17 is a packing washer 21 which seals the lower end of this block with relation to the barrel 16. An extension 22 is formed as a part of the cylinder block 17 and projects into the upper part of a relatively large cylinder bore 23 which is in longitudinal alignment with the cylinder bore 18. This bore receives a piston 24. The piston 24 at its lower end carries a piston rod 25 which extends downwardly through an opening 30 in the lower part of the barrel 16 and carries a set of expanding cams 31. These cams as shown particularly in Fig. 6 of the drawing are in the shape of radially disposed blades. As shown in Fig. 4 of the drawings these blades have downwardly and inwardly tapered edges 32 which rest against the ends of radial core barrels 33 which barrels are formed with a core receiving bore 34 preferably undercut to receive and hold a core. The inner ends of the barrels 33, as indicated at 35 are formed with a dove-tail groove 36 which extends vertically and receives the dove-tail end 27 of a blade 31. By this arrangement it will be evident that vertical reciprocation of the blades 31 will act to advance the core barrels 33 to the positions indicated in Fig. 6, and to retract them to the positions indicated in Fig. 5. The lower end of the piston rod 25 when in its lowermost position extends into a guide block 38. The guide block 38 is threaded into the barrel 16 and its lower end is threaded

into the armored housing 15. A central threaded bore 39 of the guide block 38 receives the upper threaded end of the casing 40 of the surveying instrument 14. A reduced bore 41 at the upper end of the bore 39 in the guide block 38 accommodates the lower end of the piston rod 25 and allows a contact blade 41' to project downwardly into the casing 40 of the surveying instrument to complete an electric circuit which will be hereinafter described.

A declination instrument is shown by way of example in Fig. 2 of the drawings, it being understood, however, that various other types of instruments might be used to accomplish the same result. This instrument comprises the upper casing 40 which has been threaded into the bore 39 and within which batteries 42 are placed. Below the upper casing 40 is a depending frame structure 43 carrying a cylinder housing 44 at its lower end. Between casing 40 and the housing 44 a space occurs to receive a suitable electric timing mechanism 45. This timing mechanism is included within the circuit from the batteries 42 and is suitably connected therewith by conductors 46 and 47 which control switch elements 48 and 49, yieldably held toward each other by springs 50 and between which the blade 41' may be forced to complete the circuit to the timing device. This timing device is of a type which will determine the duration of a circuit flow to an illuminating lamp 51 which is mounted within the lower cylinder housing 44. Mounted within the housing 44 below the lamp bulb 51 is a reticle ring 52 which is supported by wires 53 carried by a gimbal ring 54. A suitable lens 55 is disposed above the gimbal ring 54 and the bulb 51. A suitable lens 56 is disposed below the reticle ring 52. At a point beneath the lens 56 within the housing 44 is a film holder which receives a circular film card 57. This card, as particularly shown in Fig. 7 of the drawings, is formed with a tang 58 projecting radially over its marginal edge and which tang fits within a groove 59 formed in the edge of the film holder. The film holder is permanently set within the housing 44 so that it will not rotate. It will thus be evident that the film 57 will be positively set with relation to the film holder. A threaded opening 60 is formed through the member 38 and into the upper casing 40. A set screw 61 is threaded into the opening 60 so that the upper casing 40 will be held against rotation with relation to the core taking unit. It will thus be seen that by this arrangement the core barrels 33 will have a definite fixed oriented position with relation to the card 57 so that the combined information obtained by the readings from the film card and the arrangement of the cores taken in the barrels 33 will definitely determine the declination of the well bore, the direction of deflection, and the relative direction of inclination and degree of inclination of the strata in the geological formation from which the cores are being taken. It will be further understood that if a compass reading is also obtained upon the photographic card 57 by interposing a compass structure between the reticle ring 52 and the photographic card 57, as generally indicated at 62, complete data will be obtainable from the instrument. The point at which readings are taken may be determined by the length of an anchor pipe 63 which is secured to the lower end of the armored casing and rests upon the floor of the well bore. Thus by computing the desired length of anchor pipe required side wall

cores may be taken at any point in the length of the well. The pipe may be oriented by any reliable method where deviation is not desired or deviation of the hole may be determined and then orientation of the pipe in the hole after which cores are taken and calculations made from the information received.

In operation of the present invention an anchor pipe 63, of suitable length, is attached to the lower end of the armored casing 15. The surveying instrument 14 is mounted within the armored casing 15, and the timing structure 45 set to determine the length of duration of the electric circuit through the bulb when an exposure is to be made of the photographic card 57. The core taking unit is then attached to the armored casing 15 and is supported from a drill string 10 by the operating rod 12. The entire structure is then lowered into the well as additional lengths of drill stem are attached and until the anchor pipe 63 encounters the bottom of the well bore and interrupts further lowering movement of the anchor pipe. The cores may then be taken by lowering the drill string the operating rod 12. This will force the relatively small piston 19 down within the bore 18 and since the bore 18 and the bore 23 between piston 19 and 24 are filled with an incompressible liquid it will be seen that the downward movement of the piston 19 will force the incompressible fluid into the cylinder 23 above the piston 24 to force the operating cams 31 downwardly and to simultaneously force the core barrels 33 outwardly to impinge against the side wall of the well bore and when continued outward radially movement of the core barrels 33 is brought about to cause the barrels each to be filled with a core 64. When the drill string is lifted to pick up the small plunger 19 the hydrostatic head of fluid pressure will act against the large piston ring 24. In shallow wells mechanical means can be provided without departing from the spirit of this invention. Attention is directed to the fact that since the bores 34 of the barrels 33 are undercut the cores 64 will be retained within the barrels and will be extracted from the side walls as the barrels 33 move from their inner positions as indicated in Fig. 5 to their outer positions as indicated in Fig. 6. At the time the core barrels 33 reach the outer ends of their radial strokes the blade 41' will pass between the contacts 48 and 49. This will complete an electric circuit through conductors 46 and 47, the battery 42, and the timing mechanism 45. This circuit will also pass through the bulb 51. After a predetermined interval, as set by the timing device 45, the circuit will be broken and illumination of the bulb 51 discontinued. While the bulb 51 was illuminated it caused a shadow of the reticle ring 52 and the compass structure 62 to fall upon the photographic card 57 so that a record could be made as indicated in Fig. 7 of the drawings. The entire structure may then be withdrawn from the well and the photographic card and the cores removed and arranged so that their combined date may be correlated to indicate the deviation of the hole, direction of deviation, the character of cores, and the direction and declination of the strata of geological formation at the point and in the plane within which the cores were taken.

Attention is directed to the fact that since the core taking members move radially and freely through the side wall of the device and the operating cam is mounted for free movement with

relation thereto, the longitudinal thrust imposed upon the housing and drill string will be relatively small and will prevent the creation of undesirable strain on the various parts. It will also be evident that the operation of the core taking barrels is not dependent upon any great amount of longitudinal strain which might be produced by lowering the entire weight of the drill string onto the core taking apparatus, but that the amount of thrust necessary for this purpose is only the amount of thrust required to force the shaft 12 and its piston 19 downwardly within the cylinder 18 to effect the subsequent movement of the cams 31.

It will thus be seen that the structure here disclosed comprises convenient means and method whereby cores may be taken from the walls of a well at any point in the length of a well bore, and that the exact condition of the formation and the character of formation may be determined with reference to a plane which may be definitely ascertained.

While I have shown the preferred form of my invention, and the method of practicing the same, it will be understood that various changes in the apparatus and steps of the method may be made by those skilled in the art without departing from the spirit of the invention as claimed.

Having thus described my invention, what I claim and desire to secure by Letters Patent is:

1. A device for taking side wall cores, which comprises a core taking unit including means penetrating the side walls and extracting a core, a well surveying unit associated therewith for recording the direction and deviation of the well bore from the vertical, an anchor pipe for positioning the structure at a desired depth in a well, means operable through the drill string for actuating the core taking unit to penetrate the side wall of the well bore and to extract the core, and an electrical circuit operable simultaneously with the core actuating means for producing operation of the declination recording device.

2. A device for exploring a well bore, which comprises a core taking unit having means to move laterally of the well bore and extract a core from the side wall thereof, a supporting element upon which the unit is mounted and by which it is lowered into the well, actuating means controlled by the supporting element for actuating the laterally moving core extracting members, an anchor pipe for determining the position within the well bore at which the core extracting members operate, and a declination instrument operable simultaneously with the actuation of the core extracting members for taking a reading of the direction and degree of deviation of the well bore from the vertical at substantially the level at which the core is taken.

3. A device for exploring a well bore, which comprises a core taking unit having means to move laterally of the well bore and extract a core from the side wall thereof, a supporting element upon which the unit is mounted and by which it is lowered into the well, actuating means controlled by the supporting element for actuating the laterally moving core extracting members, anchor pipe for determining the position within the well bore at which the core extracting members operate, a declination instrument adapted to take a reading of the direction and degree of deviation of the well bore from the vertical at substantially the level at which the core is taken, and common cooperating means actuated by the supporting element to operate

the core extracting members and simultaneously initiating operation of the declination unit.

4. A device for exploring an oil well which comprises a core taking unit, said unit including a plurality of radially movable core barrels to be forced into the side wall of a well bore and to extract cores therefrom, a supporting element upon which said unit is supported and by which it is lowered into the well, a dash-pot actuated by said supporting member whereby the core barrels are radially advanced and retracted, said dash-pot limiting the downward movement of the core taking unit, thus determining the point at which the core barrels will be projected into the wall of the well bore to obtain a core, and a well surveying unit operable simultaneously with the operation of said core taking unit for making a record of the direction and degree of deviation of the well bore at substantially the point at which the core taking unit is operated.

5. A device for exploring an oil well which comprises a core taking unit, said unit including a plurality of radially movable core barrels to be forced into the side wall of a well bore and to extract cores therefrom, a supporting element upon which said unit is supported and by which it is lowered into the well, a dash-pot actuated by said supporting member whereby the core barrels are radially advanced and retracted, said dash-pot limiting the downward movement of the core taking unit, thus determining the point at which the core barrels will be projected into the wall of the well bore to obtain a core, a well surveying unit operable simultaneously with the operation of said core taking unit for making a record of the direction and degree of deviation of the well bore at substantially the point at which the core taking unit is operated, and means effected by the operation of the core taking unit to simultaneously initiate the operation of the surveying unit.

6. A core taking device comprising a main barrel adapted to be lowered into a well, a plurality of radially moving core barrels slidably mounted in the main barrel, and means longitudinally movable within the main barrel to advance and retract said core barrels to and from their core taking positions, said means including cam members acting to advance and retract the core barrels, and a piston connected therewith, a cylinder within which said piston reciprocates, a second cylinder in communication therewith, a piston within said cylinder, and means actuated from the top of the well for moving said last named piston.

7. In combination with a drill string, a core taking device comprising a tubular housing having lateral openings therein, walls providing upper and lower communicating cylinders in said housing adapted to contain an incompressible fluid, a primary piston operable in the upper cylinder and having a rod connected to the lower end of said drill string, a secondary piston operable in said lower cylinder and having a rod extending downwardly therefrom, a plurality of core barrels slidably mounted in said lateral openings, a cam member connected to said second mentioned piston rod and having a plurality of radially disposed blades adapted to advance said core barrels into core taking positions and for retracting said barrels within said housing, and said drill string being adapted for reciprocation to cause displacement of the incompressible fluid from one cylinder to another whereby said blades

will advance and retract said core barrels relative to said housing.

8. In combination with a drill string, a core taking device comprising a tubular housing associated with said drill string, walls providing upper and lower cylinders in said housing and a bore communicating between said cylinders, said cylinders being adapted to contain an incompressible fluid, a primary piston operable in said upper cylinder and connected to said drill string, a secondary piston operable in said lower cylinder and having a rod extending downwardly therefrom, walls providing a plurality of lateral openings in said housing, a plurality of core barrels slidably mounted in said openings, a cam member connected to said second mentioned piston rod and having a plurality of radially disposed blades adapted for engagement with said core barrels, and means for causing displacement of fluid from one cylinder to the other so as to advance and retract said core barrels relative to said housing.

9. A device for exploring a well bore which comprises a supporting element adapted to be lowered into a well, a core taking unit, said supporting element supporting the core taking unit on the lower end thereof, operating means for said core taking unit comprising a dash-pot structure interposed between the supporting element and the core taking unit, said dash-pot means being actuated by the manipulation of the supporting element, a well surveying instrument associated with the core taking means, and cooperating means consisting of an electrical circuit between the core taking means and the well surveying instrument to actuate the well surveying instrument simultaneously with the operation of the core taking unit.

10. A device for exploring a well bore which comprises a supporting element adapted to be lowered into a well, a core taking unit, said supporting element supporting the core taking unit on the lower end thereof, a dash-pot interposed between the supporting element and the core taking unit, said dash-pot being operable by manipulation of the supporting element, a well surveying instrument associated with the core taking unit, said well surveying instrument adapted to take a single exposure of known orientation, and cooperating means comprising an electrical circuit associated with the core taking unit and the well surveying instrument to actuate the well surveying instrument simultaneously with the operation of the core taking means.

11. A device for exploring a well bore which comprises a supporting element adapted to be lowered into a well, a core taking unit, said supporting element supporting said core taking unit on the lower end thereof, a dash-pot interposed between the core taking unit and the supporting element, said dash-pot unit being actuated by the manipulation of the supporting element to operate the core taking unit, a well surveying instrument associated with the core taking unit, an electrical circuit associated with the core taking unit and the well surveying instrument, said well surveying instrument adapted to take a single exposure on a photographic plate, said exposure being of known orientation and inclination, and means actuated by the core taking unit for making and breaking the circuit between the core taking unit and the well surveying instrument whereby operation of the core taking unit will simultaneously actuate the well surveying instrument.

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