April 13, 1943. A. M. BANDY 2,316,216

APPARATUS FOR TAKING SAMPLES OF FLUID FROM WELLS

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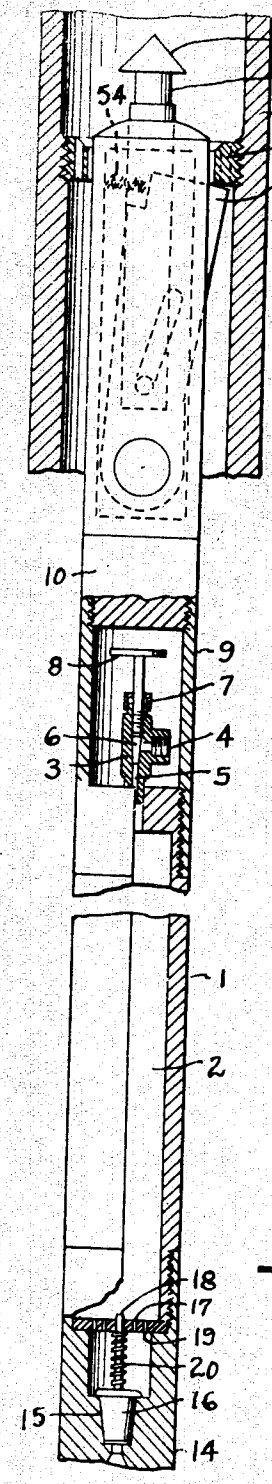


Fig. 1.

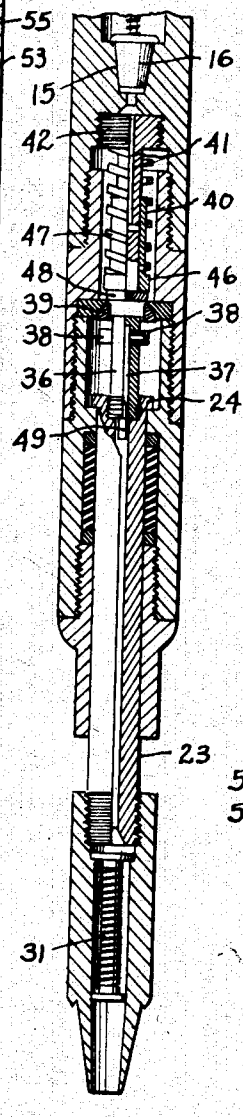


Fig. 2.

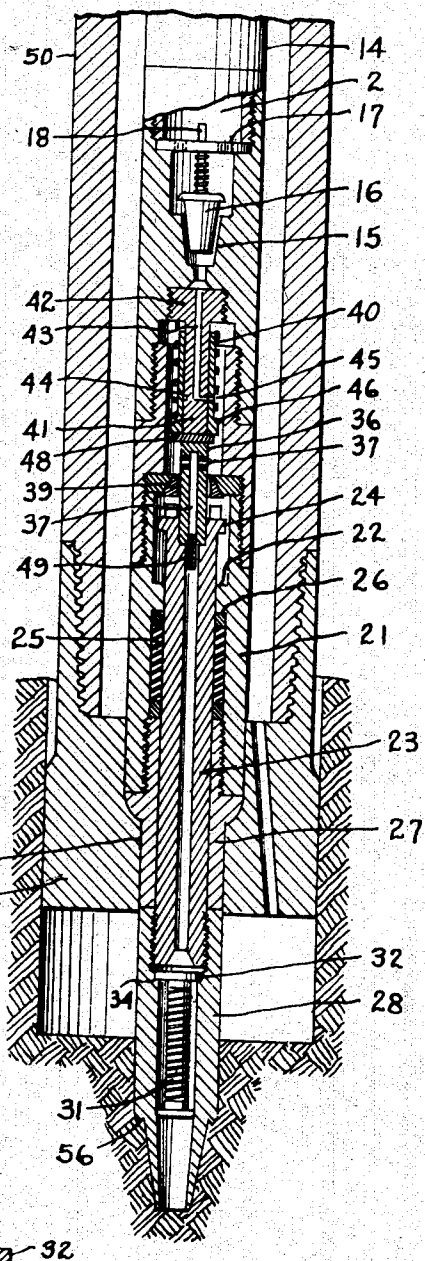


Fig. 4.

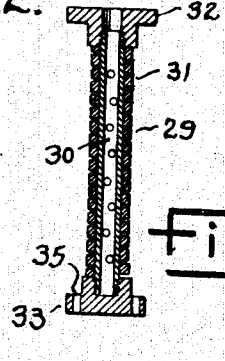


Fig. 3.

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APPARATUS FOR TAKING SAMPLES OF FLUID FROM WELLS

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2 Claims. (Cl. 255—1.4)

This invention relates to apparatus for taking samples of fluid from wells and has particular relation to means for taking samples of either liquid or gas from the stratum at the bottom of the well.

It is an object of the invention to provide a sample taking apparatus that may be lowered into and withdrawn from a well bore by means of a flexible line such as a cable and which contains a sample receiving chamber wherein the liquid or gas flowing into the well bore from the stratum being tested may be entrapped and withdrawn from the well to the ground surface and whereby drilling fluid will be positively excluded from the entrapped sample so as not to contaminate the same.

The invention embodies improvements over that type of sample taking device for wells disclosed in my Patent No. 2,176,240 issued by the United States Patent Office on October 17, 1939, and one of the principal features embodying the improvements over the construction disclosed by said patent consists of valve means for automatically closing the passageway into the sample receiving chamber after the sample has entered said chamber and the apparatus has been lifted off of bottom.

The invention also embodies a novel type of point or probe adapted to penetrate into the formation to be tested and the passageway through which is protected by a novel type of screen.

With the above and other objects in view the invention has particular relation to certain novel features of construction, operation and arrangement of parts, an example of which is given in this specification and illustrated in the accompanying drawing, wherein:

Figure 1 shows an elevational view of the upper end of the apparatus shown partly in section and showing the sample receiving chamber closed.

Figure 2 shows a vertical, sectional view of the lower end of the apparatus showing the parts in the position they will occupy while being lowered preparatory to obtaining a sample.

Figure 3 shows a vertical, sectional view of the type of screen employed, and

Figure 4 shows a vertical, sectional view of the lower end of the apparatus shown in active position to admit a liquid or gas sample.

Referring now more particularly to the drawing, wherein like numerals of reference designate the same parts in each of the figures, the numeral 1 designates a tubular container having the sample receiving chamber 2.

The upper end of the container is closed and threaded into said end there is a connection 3 having the internally threaded side opening 4 and also having an axial duct 5 leading from the chamber 2. The upper end of this duct is opened and closed by the needle valve 6 which has a threaded connection with the upper end of the connection 3 and which is surrounded by the stuffing box 7. The upper end of the needle valve has a hand wheel 8 fixed thereon. The connection and needle valve are enclosed by a tubular housing 9 which is threaded to the upper end of the container 1 and whose upper end is closed by a head 10 which is threaded thereto. This head has an upstanding neck 11 whose upper end terminates in a cone 12 with which a grappling tool may be engaged when it is desired to remove the apparatus from the well. Any conventional type of grappling tool may be employed and it may be lowered into the well and withdrawn by means of a cable in the well known manner.

Attached to the lower end of the container 1 there is a tubular barrel 14 whose upper end is formed with a downwardly converging valve seat 15 with which the upwardly opening check valve 16 cooperates.

Secured in the barrel above said check valve there is a spider 17 having a central bearing through which the valve stem 18, on the upper end of the valve, works. The spider also has the side ports 19 for a purpose to be hereinafter stated. The valve is normally maintained closed by means of the coil spring 20 which surrounds the stem and is interposed between the valve and spider.

A tubular packing housing 21 is threaded into the lower end of the barrel 14 and its upper end is enlarged internally forming the inside, annular, upwardly facing shoulder 22.

A tubular stem 23 is located within and extends beneath the packing housing 21. The upper end of this stem has an outwardly extending, annular flange 24 which may normally rest on the shoulder 22. A packing 25 is located within the housing 21 around the stem and is confined by the inside, annular, downwardly facing shoulder 26 in the housing 21 and the gland 27 which is screwed into the lower end of the housing and which abuts said packing.

The lower end of the gland 27 is reduced so as to fit within the central bore of the drill. It is to be understood that the apparatus will usually be lowered through the drill stem with its

lower end projecting through the central bore of the drill and resting on the bottom of the bore.

The stem 23 extends beneath the gland 27 and a tubular point, or probe, 28 is screwed onto the lower end of the stem and contains a screen designated generally by the numeral 29. This screen, in the present instance, consists of a perforated tube 30 which is wrapped by a screening wire 31 and which has the external, upper and lower, flanges 32, 33 screwed thereon. The upper flange 32 rests on an internal, annular shoulder 34 within the probe 28 and the lower flange has the perforations 35 so that the oil or gas in the formation being tested may flow up through the perforations 35 and through the spaces between the wire 31 to exclude solid material and on up through the stem 23.

With the flange 24 resting on the shoulder 22 the probe 28 will be spaced beneath the lower end of the gland 27. A nipple 36 is screwed into the upper end of the stem 23 and has an axial duct 37 extending therethrough but terminating beneath the upper end thereof.

Screwed into the side of the nipple 36 and extending outwardly therefrom there are the hollow plugs 38, 38 which communicate with the duct 37 and whose outer ends are closed. These plugs are formed of material which may be readily sheared or broken.

The upper end of the nipple 36 works closely through a central bearing of the ring 39. This ring is secured in the barrel 14 above the plugs 38.

Above the ring 39 there is a valve assembly which comprises a sleeve valve 40 slidably mounted on the valve core 41. The upper end of this core is enlarged and forms a head 42 which is screwed into the barrel 14 beneath the seat 15. It has an axial duct 43 leading from its upper end and whose lower end is turned laterally and terminates in an external, annular groove 44 around said core. The valve has a side port 45 adapted to move into and out of registration with the groove 44. The lower end of the sleeve valve 40 has an external, annular shoulder 46.

A coil spring 47 surrounds said valve and is interposed between the shoulder 46 and the head 42 and normally holds the port 45 out of registration with the groove 44 as shown in Figure 2.

Between the upper end of the nipple 36 and the lower end of the valve 40 there is a floating disc 48 forming a stop to limit the downward movement of the valve 45.

If desired a flow bean or choke 49 may be screwed into the lower end of the duct 37 having a restricted fluid passageway therethrough so as to reduce the pressure of the liquid flowing through said choke.

In operation the apparatus is assembled as shown in Figures 1 and 2 with the valve 6 closed. The drill stem 50 should then be lifted so as to lift the drill 51 off of bottom. The apparatus shown in Figures 1 and 2 may then be dropped through the drill stem and it will pass down through the drilling fluid therein and its lower end will project through the central bore 52 of the drill 51. The head 10 has a latch 53 seated in a slot in said head and whose lower end is pivoted in the head with its upper end held projected out by the spring 54. The drill stem 50 has an inside, inwardly projecting ring 55 through which the head passes and when the latch clears said ring it will be forced outwardly into the position shown in Figure 1 and will engage underneath the ring 55 to lock the apparatus in place.

The probe 31 projects beneath the drill 51 and its lower end tapers downwardly so as to readily penetrate the formation to be tested and it may also have an external, annular, downwardly directed edge 56 which forms a close fitting seal with the formation as shown in Figure 4. The drill stem is now lowered until the probe lands on the bottom of the well and as the drill stem is further lowered the ring 55 will engage the latch 53 and will force the housing 9, the container 1 and the tubular barrel 14 on downwardly causing the ring 39 to engage with and shear the plugs 38 and the lower end of the gland 27 will land on the upper end of the probe 28 as shown in Figure 4 with the sheared plugs 37 above the ring 39.

The tapered lower end of the probe will be forded into the formation at the bottom of the well by the weight on them thus sealing the lower end of the probe 28 against the entrance of the drilling fluid, as shown in Figure 4, so that the gas or oil in the formation beneath the probe 28 may pass up through said probe and stem 23 and on up through the choke 49 and nipple 36 and out through the sheared plugs 37. Upon this downward movement of said barrel 14 as above explained the lower end of the sleeve valve 40 will land on the disc 48 which is then supported on the upper end of the nipple 36 and the valve core 41 will move on downwardly until its lower end also contacts said disc 48 at which time the duct 43 will communicate with the groove 44 and the liquid or fluid will flow on through the port 45, the duct 43 and on up through the seat 15 lifting the valve 16 and passing on up through the ports 19 into the chamber 2. When the pressure in the chamber 2 is equalized with that beneath the valve 16, said valve will close and entrap the sample of the liquid or gas, in the chamber 2.

A grappling tool may then be lowered into the drill stem by means of a cable and engaged with the cone 12 and upon an upward pull the latch 53 will be retracted and the apparatus may then be withdrawn to the ground surface for inspection of the sample.

In some cases the pressure of the drilling fluid in the well may exceed the pressure of the entrapped sample. Upon elevation of the probe 28 from the formation the parts move into the position shown in Figure 2, the stem 23 moving downwardly relative to the housing 21 and barrel 14. Upon such relative, downward movement the spring 47 expands and moves the sleeve valve 40 downwardly relative to the valve core 41 thus carrying the port 45 out of registration with the groove 44 and closing the duct 43 so that the drilling fluid will be positively cut off from the chamber 2 thus insuring that none of the drilling fluid will enter and contaminate the sample.

When the apparatus has been withdrawn from the well the housing 9 may be removed from the container 1 and a gage screwed into the tapped opening 4 and the needle valve 6 opened and the pressure contained in the chamber 2 thus ascertained and with the gage detached the valve 6 may then be opened and the contents of the chamber 2 drained out for inspection.

The drawing and description are illustrative merely and are not intended to restrict the invention to the precise form shown or otherwise than defined by the appended claims.

What I claim is:

1. In a sample taking device having a sample chamber and provided with a channel entering said chamber; a tubular probe through which said channel extends and having a tapered lower end adapted to penetrate into the earth stratum to be tested and to form a seal therewith, an annular downwardly directed edge around the probe above the tapered lower end thereof and a tubular screen in the probe across said channel.

2. A sample taking device for wells shaped to be lowered into a well and to land on the bottom and comprising a container having a sample chamber therein, a barrel attached to the container, a stem slidable in the barrel and having an inlet conduit therethrough, a probe on the lower end of the barrel adapted to penetrate into the formation at the bottom of the well and to form a seal therewith around the inlet end of the conduit, means normally closing the conduit and adapted to be broken, said stem being movable upwardly relative to the barrel, means effective to break said closing means to open the conduit upon such upward movement to admit fluid from the well, said container having an inlet valve through which the admitted fluid may enter, and be trapped in, the chamber, a sleeve valve on the stem arranged to be opened upon said upward movement of the stem and a yieldable member normally tending to hold the sleeve valve closed to prevent the entrance of fluid from the well through said inlet conduit.

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