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B. E. LINDSLY

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BOTTOM HOLE SAMPLER

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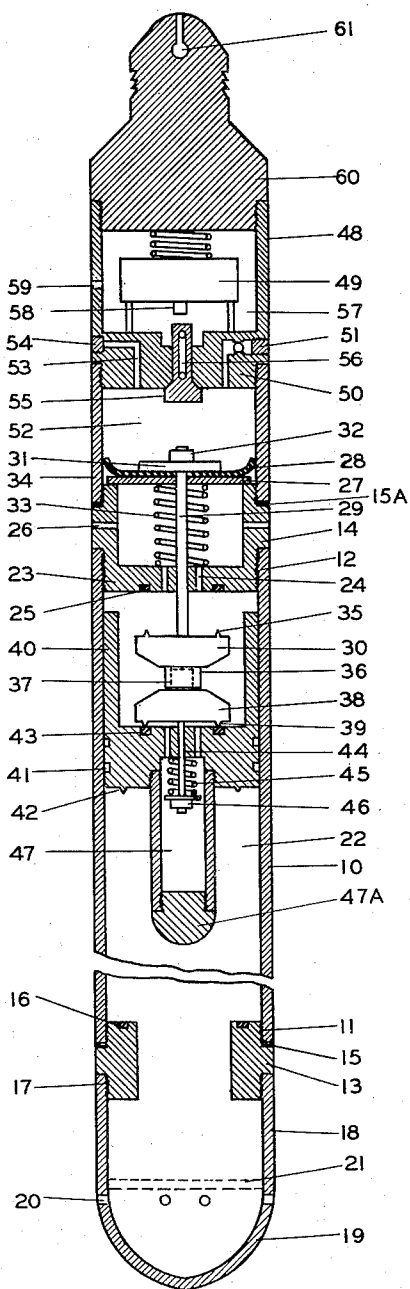


FIG. 1

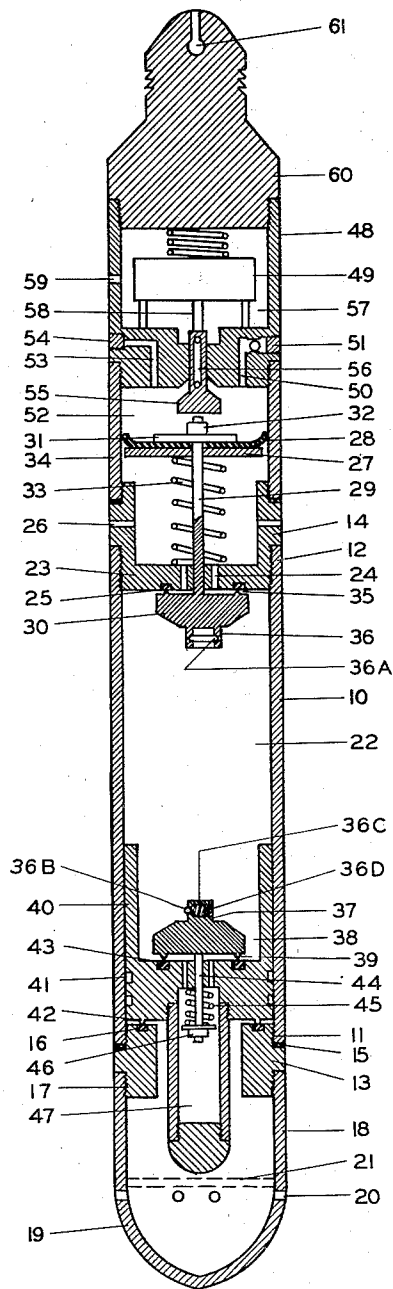


FIG. 2

INVENTOR.
B. E. LINDSLY

BY
Hudson, Young, Shaulky & Yinger
ATTORNEYS.

UNITED STATES PATENT OFFICE

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BOTTOM HOLE SAMPLER

Ben E. Lindsly, Washington, D. C.

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20 Claims. (Cl. 166—19)

This invention relates to apparatus for obtaining samples from which physical and chemical characteristics of a fluid are ascertained as the fluid exists in a natural reservoir.

The invention is moreover an improvement over my prior application Serial No. 23,903, filed May 28, 1935, maturing into Patent No. 2,103,475, granted December 28, 1937. The problems encountered and the purposes of both devices are the same, however the present invention is an improved means of obtaining the bottom-hole sample.

The object of the present invention is to provide for taking samples of the fluid directly at the bottom of the well and at substantially the temperature conditions carried within the producing formation.

A further object of the invention resides in the improved operation of the device in the reservoir which allows for speedier and more accurate operation.

A still further object of the invention resides in the economy of manufacture, ease of operation and simplicity of design.

Other objects and advantages of the invention will be apparent during the course of the following description.

In the accompanying drawing, forming a part of this specification, and in which like numerals are employed to designate like parts throughout the same,

Figure 1 is an enlarged view in vertical section showing the sampler ready to be lowered into the reservoir;

Figure 2 is an enlarged view in vertical section showing the sampler with the sample therein and ready to be raised to the surface of the ground.

In the drawing, wherein for the purpose of illustration, is shown a preferred embodiment of my invention, the numeral 10 designates a tubular barrel or sample chamber of substantial length. The barrel 10 is internally screw threaded at each end thereof as shown at 11 and 12 to receive the nipple members 13 and 14 which are screwed into the lower and upper ends, respectively, of the barrel. Gaskets 15 and 15a are seated on the shoulders of the nipples 13 and 14 respectively to seal the joints between the barrel end and the nipple members. The nipple member 13 has a seat portion on the top thereof within the barrel and a gasket or sealing means 16 mounted therein. The opposite end of the nipple 13 is externally threaded at 17 to receive the foot piece 18. The foot piece 18 has a closed conical end 19 and openings 20 to allow the exit of oil from the sampler

which may have collected in the chamber 22 when the same is placed in a well hole. Mounted in the foot piece above the openings 20 are one or more screen members which provide a filtering means for the oil entering the sampler to keep dirt from collecting in the barrel.

The upper nipple member 14 is closed by the wall 23 on the bottom thereof except for the passages 24 therethrough. A plastic valve seat 25 is mounted in the wall 23 on the under side of the wall or facing the barrel chamber 22. Ports 26 in the side of the nipple connect the liquid in the well hole through the openings 24 with the chamber 22 in the barrel 10. A piston member 27 having a cup leather packing member 28 is mounted on top of the nipple member 14. A valve stem 29 to which is connected the valve head 30 runs through the wall 23 and is connected to the piston member 27 and cup packing 28 by means of washer 31 and nut 32. A coil spring 33 is mounted in the nipple 14 which tends to force the piston 27 and washer 28 upwardly in the sleeve 34 mounted on top of the nipple 14 which in turn carries the valve head 30 upwardly. The knife edge portions 35 on the valve head bite into the plastic valve seat 25 in the wall 23 to form a seal at this point as clearly shown in Figure 2.

On the bottom of the valve head 30 is the female member 36 of a snap-joint having an annular groove 36a which receives the male member 37 mounted on top of valve head 38 which has knife edge portion 39 on the bottom thereof. The male head 37 has a steel ball 36b mounted in a channel in the head member. The ball is backed by a spring 36c and held in place by the screw cap 36d. When the male portion 37 is placed in the female head the ball 36b will be forced into the channel to allow the male head to enter the female member and then snap out into the groove 36a when the male head is inserted into the female head that far and hold the two members in assembled relation. Mounted, so as to be freely falling in the barrel 10, is the plunger member 40. Piston rings 41 in the plunger 40 make a sealed joint with the inner wall of the barrel member. Knife edge portion 42 on the bottom of the plunger 40 seals with the plastic valve seat 16 when the plunger drops to the bottom of the chamber. Mounted in the upper face of the plunger is the plastic valve seat 43. Valve head 38 has the stem portion 44 passing through the plunger 40 with a spring 45 on the opposite or under side of the plunger to hold the knife edge 39 of the valve head 38 seated on valve seat 43. The valve stem has the washer and nut 46

on the end thereof which confines the spring 45 between the under face of the plunger and the washer. The tubular closure member 47 screws into the plunger member and protects the valve stem 45 and spring 46. Plug 47a, which screws into the end of tubular closure member 47, is removable, when the sampler has been filled and pulled to the surface of the ground, so as to connect a dispensing means to the device to empty the contents. The emptying means shown in the prior application are adaptable to the present sampler.

On top of the sleeve 34 is mounted the sleeve member 48 which contains the timing mechanism 49. In the lower portion of the sleeve 48 is the passage 50 controlled by the check valve 51 through which lubricant or heavy grease is admitted to chamber 52. Passage 53 is in the opposite side of the sleeve and is closed by plug 54. A valve stem 55 is slidably mounted in the closed lower portion of the sleeve 48 and has a passage 56 with side openings therethrough. When the timing mechanism 49 is actuated, it forces a plunger 58 downward which in turn forces the sliding valve 56 downwardly and through the side openings of passage 56 in the valve, places the chambers 52 and 57 in communication so that the lubricant from chamber 52 can pass out through orifice 59 in the sleeve member 48. A head portion 60 is connected to the top of the sampler and a wire for raising and lowering the sampler in the well hole may be attached at 61.

The operation of the sampler is as follows:

With the sampler on the surface of the ground, it must be set so as to be in operative position when in the well hole. The plunger 40 is moved upwardly in the barrel until the male member 37 of snap-joint, engages female member 36. The foot piece 18 is now screwed on the barrel and the head portion 60 is removed and the plunger 58 is raised which in turn will allow the sliding valve 55 to seat and close off chamber 52. A lubricant, such as motor oil, or oil of suitable viscosity may be used, as determined by the temperature in the well hole, is injected into passage 50 through check valve 51. The lubricant enters chamber 52 and the pressure of the oil forces the piston 27 downwardly which in turn compresses the spring 33. The valve 30 is forced downwardly about two to two and one-half inches off its seat, thus leaving the passages 24 open to the chamber 22. In the operation of injecting the lubricant, it is advisable to permit any air that has been trapped in the chamber 52 to escape. Port 53 has been provided for this purpose and when the air is displaced this port is sealed by screw plug 54.

The sampler is now ready to go into the well hole except for setting the timing mechanism. There are a number of timing mechanisms in use for instruments which obtain sub-surface data and applicant does not make any claim to the particular timing device to be used with the sampler. Numerous timing devices are available and applicant has found by experiment that those motivated by electromagnets, solenoids, mechanical devices based on clock work principle and the slow motion grease displacement chambers will all perform the functions required of the timing device in the present sampler. However, by choice, it is preferred to use a certain mechanical clock work mechanism now in use for obtaining sub-surface data in oil wells. This is a rugged and accurate timing device and it can be set accurately for operation at any time interval up to one hour or more. The timing device is set

to allow sufficient time to get the sampler in the well hole which time may be any interval from five minutes up to half an hour. When the timing device is set, the head 60 is screwed in place, the lowering wire attached in the bail 61 and the sampler is ready to be lowered into the well. Figure 1 shows the position of the parts when the sampler is being lowered into the well and before the timing device has actuated the plunger 58.

When the sampler reaches the bottom of the well and the timing device has operated, the plunger 58 depresses the top of the valve stem 55 and holds it in unseated position, which opens the lubricant chamber 52 to the upper chamber 57 by way of channel 56. The lubricant in chamber 52 is under pressure and also is subjected to the pressure of the spring which is back of piston 27. The lubricant is forced through the orifice leading to passage 56, through passage 56 to chamber 57, thence out through opening 59 to the well. The size of the ports leading to passage 56 and the inside diameter of the hollow valve stem 55 determine the rate of movement of the piston.

When the valve 55 has been actuated and the passage 56 connects the two chambers, the spring 33 forces the piston 27 upward until the top of the plunger 40 strikes the bottom face 23 of the nipple 14 where continued upward movement of the valve will release the snap-joint member 36 from member 37 on top of the plunger 40 which in turn allows the plunger to gravitate to the bottom of the barrel. The upward movement of the piston 27 in forcing the lubricant out of chamber 52 also carries with it the valve head 30 so that the knife-edge valve 35 will seal with the valve seat 25 when the lubricant has been completely exhausted from the chamber 52.

Simultaneously with the upward movement of the valve 30, and the downward movement of plunger 40, fluid from the well enters through orifice 26 and flows into chamber 22 by way of openings 24. Chamber 22 is completely filled when the plunger 40 has fallen to the bottom of the barrel and before the knife-edge valve 42 has had time to seal on valve seat 16, as shown in Figure 2. The free falling plunger not only serves the purpose of displacing all the liquid below it but tends to create a vacuum above the plunger in the chamber 22 which facilitates the entry of the well fluid into the chamber 22. The liquid will continue to enter chamber 22 until the same is full or until the valve 30 finally closes. The falling of the plunger 40 should not require more than one minute and, therefore, if the action of the top valve is regulated to close in somewhat more than one minute, a perfect sample of the liquid in the well opposite ports 26 should be obtained.

When plunger 40 is sealed in its lower position and valve 30 is closed, the sample is ready to be raised to the surface and tested in the laboratory as desired. Upon arrival at the laboratory of the sampler, the tail piece 18 is first removed. The closure plug 47a may then be removed and the dispensing apparatus similar in principle to that shown in the prior application attached to the tube 47 and spring 45 may also be taken off before the laboratory head is placed on the tube 47. The pressure of the liquid in the sampler will hold the valve 38 seated without the spring 45. Valve 38 is then opened by means of mercury pressure or any other pressure means being pumped against it through the laboratory head. With the valve open the fluid in the sampler flows through the ports in the plungers through the laboratory head and is tested in any way desired.

It is to be understood that the form of my invention, herewith shown and described, is to be taken as a preferred example of the same, and that various changes in the shape, size and arrangement of parts may be resorted to without departing from the spirit of my invention, or the scope of the subjoined claims.

Having thus described my invention, I claim:

1. Apparatus for taking samples of fluid from a well including a collection chamber having an inlet port, a stop valve for closing off flow from the well through the inlet port, means for closing the stop valve and means for retarding the closing movement of the stop valve.

2. Apparatus for taking samples of fluid from a well including a collection chamber having an inlet port, a stop valve for closing off flow from the well through the inlet port, means yieldingly urging the stop valve to closed position and means for retarding the closing movement of the stop valve.

3. Apparatus for taking samples of fluid from a well including a collection chamber having an inlet port, a stop valve for closing off flow from the well through the inlet port, spring means urging the stop valve to closed position and means for retarding the closing movement of the stop valve.

4. Apparatus for taking samples of fluid from a well including a collection chamber having an inlet port, a stop valve for closing off flow from the well through the inlet port, means for closing the stop valve and means for confining a body of fluid in restraining relation to said closing means to retain the stop valve open, including a bleeding port through which said fluid may escape in restricted flow to permit closing of the stop valve.

5. Apparatus for taking samples of fluid from a well including a collection chamber having an inlet port, a stop valve for closing off flow from the well through the inlet port, means for closing the stop valve and means for effecting application of pressure to said closing means to resist closing of the valve, and means for releasing the pressure means to permit closing of the valve.

6. Apparatus for taking samples of fluid from a well including a collection chamber having an inlet port, a stop valve for closing off flow from the well through the inlet port, means for closing the stop valve and means for confining fluid pressure medium in retarding relation to said closing means including an outlet for release of said pressure medium in restricted flow to permit slow closing of the valve.

7. Apparatus for taking samples of fluid from a well including a collection chamber having an inlet port, a stop valve for closing off flow from the well through the inlet port, means yieldingly urging the stop valve to closed position, means for closing the valve, means for effecting application of pressure to said closing means to resist closing of the valve, and means for releasing the pressure means to permit closing of the valve.

8. Apparatus for taking samples of fluid from a well including a collection chamber having an inlet port, a stop valve for closing off flow from the well through the inlet port, yielding means urging the stop valve to closed position and means for confining fluid pressure medium in retarding relation to said closing means including an outlet for release of said pressure medium in restricted flow to permit slow closing of the valve.

9. Apparatus for taking samples of fluid from a well including a collection chamber having an inlet port, a stop valve for closing off flow from the

well through the inlet port, a fluid check chamber yielding means urging the stop valve to closed position responsive to pressure of fluid in said chamber for retaining the stop valve in open position, and means permitting retarded outlet of fluid from said chamber to permit corresponding slow closing movement of the outlet valve in response to diminution of volume of fluid in said chamber.

10. In an apparatus for taking samples of fluid from a well, a hollow barrel including separate collecting and check chambers and inlet openings between the chambers permitting flow into the collection chamber, a stop valve for said inlet port responsive to pressure of fluid in the check chamber of opening the outlet port, means for bleeding the check chamber of fluid, and yielding means responsive to pressure of said fluid to permit the stop valve to open and for gradually seating the stop valve against diminishing pressure of said fluid.

11. Apparatus for taking samples of fluid from a well including separate collecting and check chambers having an inlet permitting flow of oil into the collection chamber, a stop valve for the inlet port, a piston in the check chamber connected with said stop valve, means for supplying pressure medium to the check chamber to move the piston in one direction in response to supply of pressure fluid to the check chamber to unseat the stop valve, means for releasing pressure medium from the check chamber to permit movement of the piston in the opposite direction to close the valve, and yielding means resisting movement of the piston to open the valve and urging the piston to close the valve.

12. Apparatus for taking samples of fluid from a well including separate collecting and check chambers having an inlet permitting flow of oil into the collection chamber, a stop valve for the inlet port, said check chamber having a bleeding port and a piston connected with the stop valve reciprocable in the check chamber, and a spring urging the piston to close the stop valve against diminishing volume of pressure fluid escaping from the check chamber through said bleeding port.

13. Apparatus for taking samples of fluid from a well including separate collecting and check chambers having an inlet permitting flow of oil into the collection chamber, a stop valve for the inlet port, said check chamber having a bleeding port and a piston connected with the stop valve reciprocable in the check chamber, a rod connecting the piston and stop valve, and a spring engaging the piston, yieldable under pressure of fluid supplied to the check chamber to permit the stop valve to open and expand under diminishing pressure of fluid exhausting from said chamber to gradually close the valve.

14. Apparatus for taking samples of fluid from a well including separate collecting and check chambers having an inlet permitting flow of oil into the collection chamber, a stop valve for the inlet port, said check chamber being connected with the collection chamber and have a piston reciprocable therein, means connecting the piston with the stop valve, a spring for moving the piston in one direction, means for supplying fluid pressure medium to the check chamber to shift the piston against the tension of said spring and an orifice member for permitting release of said fluid pressure medium to effect slow closing movement of the stop valve under tension of said spring.

15. A sampling device of the character described including a sample fluid collecting chamber having an inlet port and a check chamber connected with the collecting chamber through
- 5 said inlet chamber, a stop valve for the inlet port, a piston in the check chamber, a rod connecting the piston with the stop valve, a spring urging the stop valve to closed position, and means for introducing pressure medium into said check chamber
- 10 to act against the piston for retaining the stop valve in open position against the tension of said spring, the check chamber having restricted outlet for releasing pressure medium from the check chamber in restricted flow to permit closing of
- 15 the stop valve by said spring.
16. Apparatus for taking samples of fluid from a well including a collection chamber having an inlet port, a stop valve for closing off flow from the well through the inlet port, a plunger mounted in said collection chamber closing the bottom
- 20 of said collecting chamber, means for closing the stop valve and means for retarding the closing movement of the stop valve.
17. Apparatus for taking samples of fluid from
- 25 a well including a collection chamber having an inlet port, a stop valve for closing off flow from the well through the inlet port, a plunger slidably mounted in the collection chamber and connected to the stop valve member, means for closing the stop valve member which in turn releases
- 30 the plunger from the stop valve, said plunger dropping to the bottom of the sampler to form a closure therefor and means for retarding the closing movement of the stop valve.
- 35 18. Apparatus for taking samples of fluid from a well including separate collecting and check chambers having an inlet between the chambers permitting flow of oil into the collection chamber, a stop valve for the inlet port, said check
- 40 chamber having a bleeding port and a piston connected with the stop valve reciprocable in the check chamber, a plunger slidably mounted in the collection chamber and connected to the lower portion of the stop valve, a spring urging the pis-

ton to close the stop valve against diminishing volume of pressure fluid escaping from the check chamber through said bleeding port, said closing of the stop valve releasing the plunger from the stop valve and said plunger dropping to the bottom of the sampler to form a closure therefor.

19. Apparatus for taking samples of fluid from a well including separate collecting and check chambers having an inlet between the chambers permitting flow of oil into the collection chamber, a stop valve for the inlet port, said check chamber having a valve controlled bleeding port and a piston connected with the stop valve reciprocable in the check chamber, means for opening the bleeding port valve when the sampler is in the well hole, a plunger slidably mounted in the collection chamber and connected to the lower portion of the stop valve, a spring urging the piston to close the stop valve against diminishing volume of pressure fluid escaping from the check chamber through said bleeding port, said closing of the stop valve releasing the plunger from the stop valve and said plunger dropping to the bottom of the sampler to form a closure therefor.

20. Apparatus for taking samples of fluid from a well including separate collecting and check chambers having an inlet between the chambers permitting flow of oil into the collection chamber, a stop valve for the inlet port, said check chamber having a valve controlled bleeding port and a piston connected with the stop valve reciprocable in the check chamber, a timing means for opening the bleeding port valve when the sampler is in the well hole, a plunger slidably mounted in the collection chamber and connected to the lower portion of the stop valve, a spring urging the piston to close the stop valve against diminishing volume of pressure fluid escaping from the check chamber through said bleeding port, said closing of the stop valve releasing the plunger from the stop valve and said plunger dropping to the bottom of the sampler to form a closure therefor.

BEN E. LINDSLY.