

Jan. 16, 1940.

C. E. BURT

2,187,486

FORMATION TESTING METHOD AND APPARATUS

Filed Dec. 12, 1938

2 Sheets-Sheet 1

**Fig. 1.**

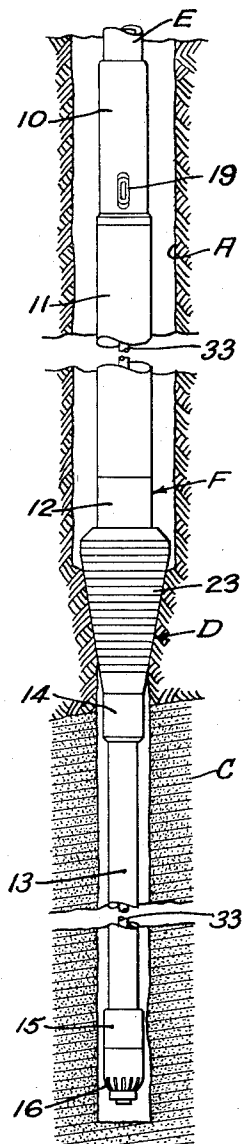


**Fig. 4.**

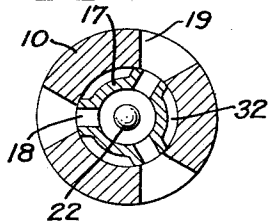


**Fig. 2.**

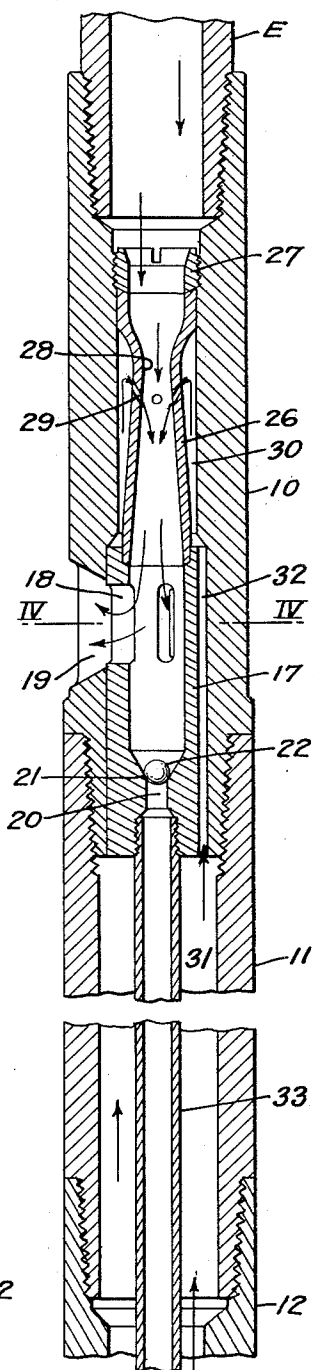
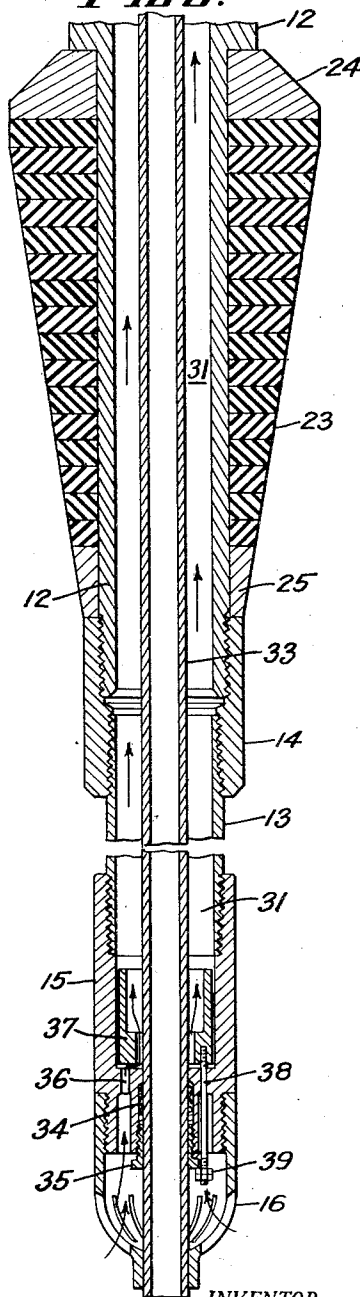


**Fig. 3.**



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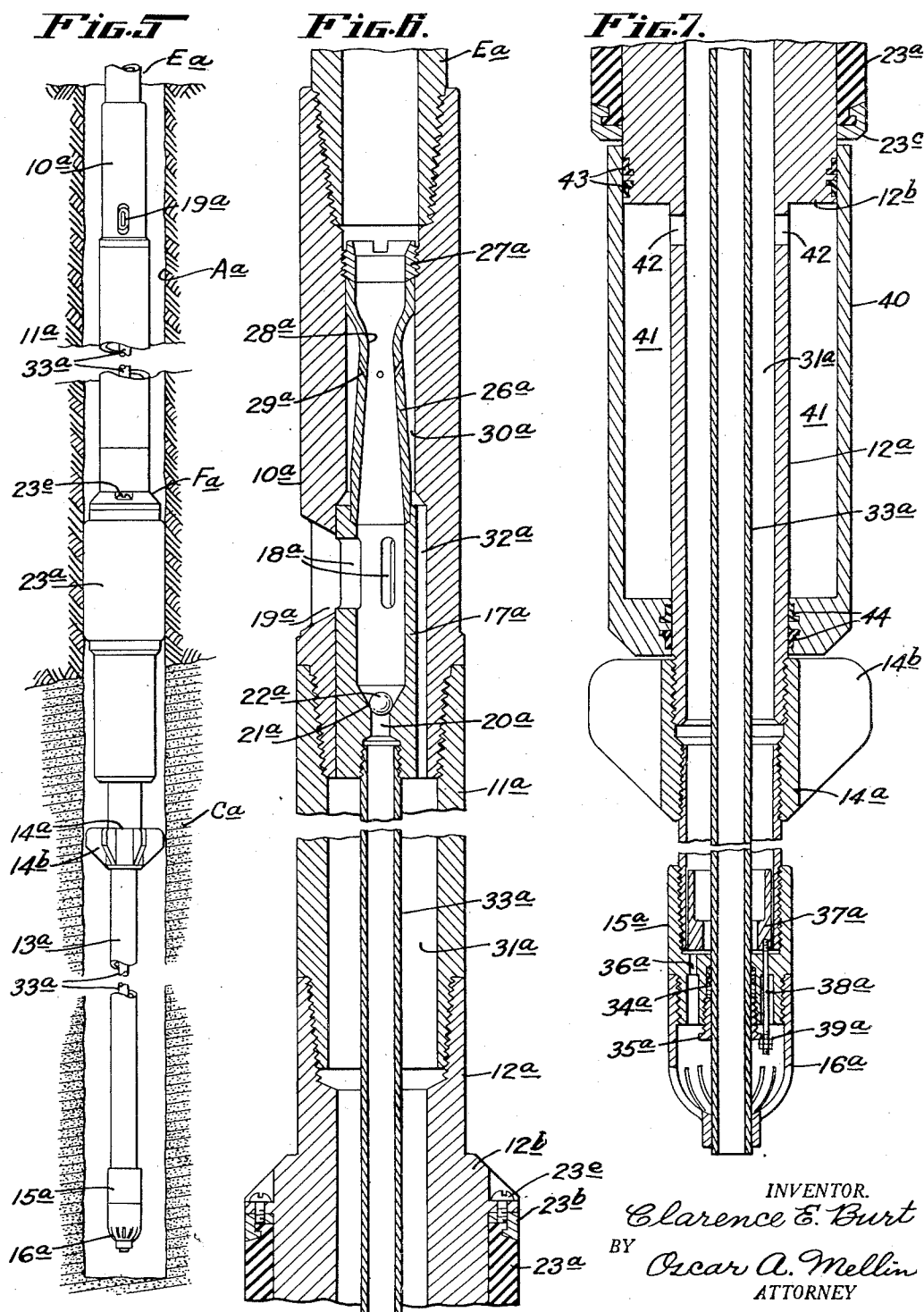
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## FORMATION TESTING METHOD AND APPARATUS

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2 Sheets-Sheet 2



## UNITED STATES PATENT OFFICE

2,187,486

## FORMATION TESTING METHOD AND APPARATUS

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Application December 12, 1938, Serial No. 245,243

19 Claims. (Cl. 166—1)

This invention relates generally to what is commonly referred to as formation testers and is more particularly directed to the provision of an improved method and apparatus for testing the potential productivity of a formation penetrated by a well bore and for obtaining a true sample of the cognate fluid thereof.

Formation testing as heretofore practiced throughout the oil industry contemplates a dry-tube method which involves relieving a formation to be tested from the pressure of the circulation fluid in the well bore and connecting said formation directly with the atmosphere through the dry tube to allow the pressure in the formation to expel cognate fluid therefrom into said dry tube.

Formation testers now in general use comprise a normally empty test string of pipe having near its lower end an inlet valve normally closed to maintain an atmospheric pressure condition in said pipe and being provided with a packer spaced upwardly from its lower end, and, although commonly referred to as formation testers, they most generally are merely sampling devices which under the most favorable circumstances can do no better than trap a sample of cognate formation fluid contaminated by drilling fluid which may and often does contain gas-cut mud, water, or other foreign fluids.

In operating these dry-tube testers the general procedure is to install the tester on the bottom of a test string of drill pipe, with the inlet valve closed to prevent any fluid from entering the drill pipe while being lowered into the well. When the packer on the tester reaches the proper point above the formation to be tested, the packer is set, thus trapping the body of drilling fluid below the set packer and excluding the fluid outside the drill pipe and above said packer. The valve of the tester is then opened (usually by manipulation of the test string) to establish communication between the high pressure zone below the set packer and the low (atmospheric) pressure zone in the empty test string, the result being a sudden and powerful rush of the trapped drilling fluid and the cognate fluid of the formation into the empty test string, this result not being due to any produced suction since atmospheric pressure produces no suction, but is due entirely to fluid expelling pressure at that time existing in the formation.

Such connecting of the formation with the atmosphere effects such a sudden reduction of pressure in the well bore below the set packer to practically zero that the wall supporting value of

the trapped fluid is practically destroyed, and causes the cognate fluid to be expelled from the formation at such high velocity as to so endanger the stability of the wall of the well bore throughout the zone under test that there is ever present the probability of serious damage to the formation and of a caving thereof into the well bore.

After the tester has been allowed to remain open for a time, the valve thereof is closed, the packer unseated and the drill pipe removed from the well with its entrapped sample, and, since this sample consists in part of cognate fluid from the formation and in part of the drilling fluid trapped below the packer, such sample is not a true sample but is one which is contaminated by such drilling fluid.

It, therefore, becomes the principal object of the present invention to provide an improved method and apparatus which involve a continuous-circulation wet-tube principle and which utilizes the motive force of drilling fluid circulated in the test string and the well bore above the packer, to create a suction influence or a gradual reduction of pressure on the formation to cause a relatively slow withdrawal of the cognate formation fluid, with the circulation of the motivating drilling fluid being constantly under control of the operator to vary at will the degree of suction or pressure reduction and the flow of cognate fluid from the formation under test, such relatively slow displacement of the involved fluids preventing a breaking down or caving of the formation; my improved method and apparatus being fully capable of obtaining a true sample of cognate formation fluid uncontaminated by drilling fluid or other substances initially present in the well bore.

Two forms of embodiment of the present invention are exemplified in the following description and illustrated by way of example in the accompanying drawings, in which:

Fig. 1 is a longitudinal section through the lower portion of a rat-hole well bore showing the formation testing apparatus of the present invention positioned therein.

Figs. 2 and 3 are enlarged longitudinal sections of the upper and lower portions, respectively, of the testing apparatus disclosed in Fig. 1.

Fig. 4 is a transverse section taken on the line IV—IV of Fig. 2.

Fig. 5 is a longitudinal section through the lower portion of a full-hole well bore showing positioned therein my testing apparatus as constructed for full-hole testing.

Figs. 6 and 7 are enlarged longitudinal sections

of the upper and lower portions, respectively, of the testing apparatus disclosed in Fig. 5.

In the practice of my invention I employ a wet-tube fluid displacement method in which a continuous circulation under pressure is maintained in the well bore above the formation to be tested, and in which such circulation is utilized to create a suction influence tending to effect a pressure differential between such circulation and the formation to be tested and thus induce a gradual flow of cognate fluid from the formation and into the circulation stream to be circulated thereby out of the well bore, the apparatus employed being so constructed that, upon a discontinuation of said circulation, an uncontaminated sample of the cognate formation fluid will be trapped for subsequent analysis.

In Figs. 1 to 4 of the drawings the features of my invention are incorporated in an apparatus having a rat-hole packer and in Fig. 1 such apparatus is shown in position for conducting a production test of a formation penetrated by the rat-hole of the well bore.

In Fig. 1 the well bore A is shown as terminating in a rat-hole B which has been drilled into a potentially productive formation C, the rat-hole shoulder above such formation having been reamed to provide a tapered packer seat D. The rat-hole testing apparatus is detachably connected to the lower end of a test string E of drill pipe which extends to the surface end, preparatory to conducting the test, will be connected to the circulation pump in the usual manner. This formation tester F provides a tubular body structure comprising a tubular pump housing 10 screw-threaded at its upper end for connection to the drill pipe E and at its lower end for connection to a length of pipe 11, a tubular packer body 12 connected by screw-threads to the lower end of the pipe 11, and a tail pipe 13 connected to the lower end of said packer body 12 by a screw-threaded coupling 14. A valve housing 15 is screwed on the lower end of the tail pipe 13 and is provided with a screen or strainer 16.

Fixed by welding or other suitable means within the lower portion of the bore of the tubular pump housing 10 is a sleeve 17 having lateral discharge ports 18 registering with companion discharge ports 19 formed in the wall of the pump housing 10. At its lower end the sleeve 17 has a restricted passageway 20 having a valve seat 21 at the point where it tapers upwardly to join the main bore of the sleeve. A ball valve 22 is adapted to be sent down the test string at the proper time to engage the seat 21 and block the downward flow of circulation fluid at this point and insure a full flow of the circulation stream through the lateral discharge ports 18 and 19 and into the well bore above the cone packer 23, which packer is carried by the tubular packer body 12 and comprises opposed ring members 24 and 25 between which is clamped a plurality of discs of rubber or any other suitable packing material.

Arranged concentrically within the bore of the pump housing 10 above the sleeve 17 is a Venturi pump nozzle 26, the lower end of which is spaced from the wall of said housing and fits in a counterbore formed in the upper end of the sleeve 17 with the discharge end of its bore coinciding in diameter with the bore of said sleeve. A gland 27, having an internal diameter coinciding with that of the intake end of the nozzle bore, screws into the bore of the sleeve 17 and 75 secures the nozzle in place. This Venturi nozzle

26 provides a restricted throat 28 and is provided with suction orifices 29 disposed immediately below said throat and communicating with the annular space 30 between the nozzle and the wall of the pump housing 10.

The pipe 11 and the hollow packer body 12 together with the tail pipe 13 form a sampling chamber 31 which, at its upper end, is in communication with the annular space 30 through vertical passages 32 formed by channels in the exterior surface of the sleeve 17 and by the inner wall surface of the housing 10, as shown in Figs. 2 and 4. These passages 32 and the annular space 30 form a suction passage between the suction orifices 29 of the pump and the sampling chamber 31.

Attached to the lower end of the sleeve 17 to communicate with the passage 20 and extending downwardly through the device is a wash tube 33 through which a portion of the drilling fluid may discharge into the well bore prior to the closing of the passage 20 by the ball valve 22, in order to wash or flush the rat-hole clear of drillings, gas-cut mud, and other foreign matter before conducting a formation test. This wash tube 33 passes through a stuffing box in the lower end of the valve housing 15 and through a bore in the lower end of the screen 16, said stuffing box containing a suitable packing 34 held in place by a gland 35.

The valve housing 15 is provided with one or more vertical inlet ports 36 leading from the interior of the screen 16 to the sampling chamber 31 in the tail pipe 13 and disposed within the valve housing is an inwardly opening back-pressure inlet valve 37 which normally rests upon the bottom wall of said housing to close the inlet ports 36. To limit the opening movement of this valve, it is provided with one or more stop rods 38 each of which depends from the valve and passes through a hole in the valve housing to extend into the interior of the screen 16 where it is provided with an abutment nut 39 positioned to abut against the lower surface of the gland 35.

In conducting a formation test with the above described formation tester, said tester F is attached to the lower end of the string of drill pipe or tubing E and lowered into the well as said string is made up in the usual manner. During the lowering of the apparatus through the drilling fluid present in the well bore such fluid will enter and completely fill all of the open spaces within the entire device. In instances where the operator believes that the lower portion of the well bore contains drillings or other undesirable substances which should be circulated out before commencing a production test, he may connect up the slush pumps and start circulating the drilling fluid immediately after the last stand of drill pipe is added to the upper end of the drill string. This pre-test circulation will tend to flush the lower end of the well bore as the tail pipe of the tester passes into the rat-hole or the test zone.

When the apparatus is lowered to engage the cone packer 23 in the tapered seat D at the mouth of the rat-hole B, the reduced pressure or suction zone of the Venturi pump becomes directly connected with the packed off test zone of the well bore and with the formation C, through the tail pipe 13 and the sampling chamber 31.

Continued circulation of drilling fluid, in part above the set packer and in part through the test zone below the packer, will tend to clear the test zone of gas-cut mud and other undesirable

fluids. Such circulation may be continued until the return circulation indicates a condition satisfactory to the operator.

The ball valve 22 is then inserted into the test string and pumped down to its seat 21 to close the wash pipe 33 and thus stop circulation of the drilling fluid into the test zone which thereafter connects only with the reduced pressure or suction zone of the Venturi pump 26.

With the device positioned as shown in Fig. 1 and the ball valve seated, as shown in Fig. 2, and with circulation of drilling fluid being maintained down the test string and through the venturi to discharge into the well bore above the set packer, there will be a resulting reduction in pressure in the throat of the Venturi tube, and since this reduction of pressure is dependent upon the rate of circulation, it is at all times under control of the operator.

When the pressure in the throat of the Venturi tube falls below that of the fluid in the formation, fluid from the formation will flow into the adjacent well bore and enter the tail pipe 13 to flow through the sampling chamber 31, displacing the drilling fluid in said bore and chamber. When all of the drilling fluid has thus been displaced and combined with the circulation stream, the cognate formation fluid which follows will continue to flow into the Venturi pump and be circulated out with the circulation stream. Circulation may be continued at a known rate as long as desired, preferably until a change in the character of the return circulation indicates the presence therein of cognate formation fluid.

The volume of cognate fluid thus taken or pumped from the formation under test will be measured as an apparent increase in the volume of the return circulation, and the rate of flow of such cognate fluid can be measured as the difference between the rates at which fluid is pumped down and recovered from the well.

Obviously since the drilling fluid initially trapped in the tail pipe chamber 31 and in the well bore below the set packer is expelled ahead of the incoming cognate fluid, the presence of cognate formation fluid in the return circulation will indicate to the operator that the sampling chamber 31 then contains a true sample of the cognate fluid uncontaminated by any drilling fluid.

The test will be continued until the operator has obtained the data necessary for a calculation of the potential productivity of the formation being tested.

Obviously since the construction of the testing apparatus is known, the degree of pressure reduction or suction influence produced in the throat of the Venturi pump for any rate of circulation of the motivating drilling fluid will also be known, and since the cognate formation fluid must flow through an orifice of known area into the throat of the Venturi tube, I have as factors for the determination of the flow of cognate fluid from the formation, a volume of cognate fluid (measured as an apparent increase in the return circulation) flowing through a known orifice (the several orifices 29) into a zone of known pressure (in the throat of the Venturi tube) at a known rate dependent upon the known rate of circulation of the motivating drilling fluid.

From these factors an estimate of the potential productivity of the formation may readily be obtained. Moreover, since the rate of flow of the circulating drilling fluid is at all times under control of the operator and may be changed

at will to vary the pressure at the throat of the Venturi tube, and consequently the pressure on the formation, it follows that the rate of flow from the formation may be determined at a number of different pressures in order to more accurately estimate the productive value of the formation.

The described fluid displacement cycle is particularly advantageous in that it constantly maintains in the well bore at the formation under test, a wall supporting body of fluid, and in that it involves a relatively slow withdrawal of cognate fluid from the formation, both of these factors contributing towards the elimination of danger of damage to the formation or of caving thereof into the well bore, as does the manual control of the rate of flow of the circulation fluid, through which control there will be no sudden change of pressure on the formation or sudden displacement of fluids, nor any great reduction of pressure throughout the cycle.

When sufficient data on the potential productivity of the tested formation has been obtained, circulation of the drilling fluid will be stopped. This allows the full hydrostatic pressure of the fluid column in the well bore to be transmitted to the cognate fluid sample in the sampling chamber 31 and will close the inlet valve 37 of the tail pipe to trap the fluid contained in said sampling chamber. This trapped fluid can have come only from the formation itself and constitutes a true sample of the cognate fluid thereof, uncontaminated by drilling fluid.

The testing apparatus is then withdrawn from the well, and this uncontaminated sample of the cognate fluid is available for analysis.

If a larger sample is desired, one or more lengths of pipe 11 may be added to the test string.

While I have described a pre-test flushing of the well bore, it is to be understood that such flushing is entirely optional with the operator and may be dispensed with as unnecessary or undesirable under the prevailing conditions.

In Figs. 5 to 7 of the drawings there is disclosed a full-hole formation testing apparatus which is designed for full-hole testing and which also operates on a fluid displacement principle comparable in all essential details with the fluid displacement cycle previously described in connection with the disclosed rat-hole testing apparatus. Elements similar to those of the apparatus disclosed in Figs. 1 to 4 will be designated in Figs. 5 to 7 by similar reference characters, with an added suffix.

In Fig. 5 is shown a well bore Aa which has been drilled into a potentially productive formation Ca, the formation tester Fa being positioned in said well bore preparatory to conducting the formation test. In this formation tester Fa, the tubular packer body 12a is provided with an enlarged portion 12b which is surrounded by an expansible packing sleeve 23a formed of rubber or other suitable resilient material. Said sleeve is at opposite ends reinforced by ring members 23b and 23c, respectively, each of which is provided with an internal lip engaging within a companion external groove in the packing sleeve.

The upper ring member 23b is secured by screws 23c to an external flange formed on the enlarged portion 12b while the lower ring member 23c is slidably mounted on said enlarged portion of the packer body. A packing expanding cylinder 40 has a lower end which slidably engages the packer body 12a below the enlarged portion 12b thereof

and an upper end which slidably engages said enlarged portion and is normally positioned immediately below the lower ring member 23c of the packing sleeve, this cylinder forming an annular chamber 41. Ports 42 formed in the wall of the packer body 12a afford communication between the chamber 41 and the sampling chamber 31a, and suitable packing rings 43 and 44 are disposed to prevent fluid leakage from the chamber 41 past the packer body. The coupling 14a is provided with a plurality of laterally projected wings 14b which are angled at their lower ends and serve as guides for guiding the apparatus in its passage down the well bore.

In the operation of this apparatus, the pressure reduction or suction influence created in the sampling chamber 31a by the Venturi pump 26a will also be created in the communicating chamber 41 and the predominating exterior pressure will then move the cylinder 40 upward to compress the packing sleeve 23a longitudinally and effect a radial expansion thereof into packing contact with the wall of the well bore in the manner shown in Fig. 5.

With the packer 23a thus set, the production test will be conducted in the same manner as previously explained in connection with the rat-hole testing apparatus of Figs. 1 to 4.

From the foregoing it will be understood that the method forming the basis of the present invention contemplates not only the securing a sample of cognate fluid for subsequent analysis, but also a circulating of such cognate fluid out of the well to secure the data necessary to correctly estimate the potential productivity of the formation under test, and further contemplates a method by which, through the constant manual control of the rate of the motivating circulation, the fluid displacement involved in the test may be accurately controlled to protect the formation and to permit a formation test to be conducted under pressure conditions which may be varied at will by the operator, the method being carried into effect by an apparatus of the wet-tube circulating type in which continuous controlled circulation of a motivating fluid will gradually create a pressure differential between the motivating fluid and the formation tending to induce a relatively slow flow of the cognate fluid into the circulating stream of said motivating fluid.

While I have shown the apparatus of the present invention in two preferred forms, it is to be understood that various changes of structure may be made by those skilled in the art without departing from the spirit of the invention as defined in the appended claims.

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

1. In a method of ascertaining the potential productivity of a formation penetrated by a well bore, the steps comprising; packing off the well bore adjacent the formation to be tested to establish a test zone, circulating a motivating fluid in the well bore above the packer to produce a suction influence, and utilizing such suction influence to reduce the pressure in said test zone and induce a flow of cognate formation fluid into the circulation stream for conveyance thereby to the surface.

2. In a method of ascertaining the potential productivity of a formation penetrated by a well bore, the steps comprising; packing off the well bore adjacent the formation to be tested to establish a test zone, circulating a motivating fluid in the well bore above the packer to produce a suc-

tion influence, utilizing such suction influence to reduce the pressure in said test zone and induce a flow of cognate formation fluid into the circulation stream for conveyance thereby to the surface, and controlling the circulation of the motivating fluid to govern the suction influence and pressure reduction under which the test is conducted.

3. In a method of ascertaining the potential productivity of a formation penetrated by a well bore, the steps comprising; packing off the well bore adjacent the formation to be tested to establish a test zone, circulating a motivating fluid in the well bore above the packer to produce a suction influence, and utilizing such suction influence to gradually reduce the pressure in said test zone and induce a relatively slow flow of cognate formation fluid into the circulation stream for conveyance thereby to the surface.

4. In a method of ascertaining the potential productivity of a formation penetrated by a well bore, the steps comprising; packing off the well bore adjacent the formation to be tested to establish a test zone, circulating a motivating fluid in the well bore above the packer to produce a suction influence, utilizing such suction influence to reduce the pressure in said test zone and induce a flow of cognate formation fluid into the circulation stream for conveyance thereby to the surface, and measuring the relative volumes of the ingoing and return circulation to determine the volume of cognate formation fluid circulated out of the well.

5. In a method of ascertaining the potential productivity of a formation penetrated by a well bore, the steps comprising; lowering into the well bore a test string carrying a packer and provided with a suction pump discharging above said packer, setting said packer above the formation to be tested to establish a test zone adjacent said formation and connecting with the suction orifice of said pump, and circulating a motivating fluid through said pump to create a suction influence tending to reduce the pressure in said test zone and induce a flow of cognate formation into the circulation stream for conveyance thereby to the surface.

6. In a method of ascertaining the potential productivity of a formation penetrated by a well bore, the steps comprising; lowering into the well bore a test string carrying a packer and provided with a suction pump discharging above said packer, setting said packer above the formation to be tested to establish a test zone adjacent said formation and connecting with the suction orifice of said pump, circulating a motivating fluid through said pump to create a suction influence tending to reduce the pressure in said test zone and induce a flow of cognate formation into the circulation stream for conveyance thereby to the surface, and controlling the circulation of the motivating fluid to govern the suction influence and pressure reduction under which the test is conducted.

7. In a method of ascertaining the potential productivity of a formation penetrated by a well bore, the steps comprising; lowering into the well bore a test string carrying a packer and provided with a suction pump discharging above said packer, setting said packer above the formation to be tested to establish a test zone adjacent said formation and connecting with the suction orifice of said pump, and circulating a motivating fluid through said pump to create a suction influence tending to gradually reduce the pressure in said test zone and induce a relatively slow flow of

cognate formation into the circulation stream for conveyance thereby to the surface.

8. In a method of ascertaining the potential productivity of a formation penetrated by a well bore, the steps comprising; lowering into the well bore a test string carrying a packer and provided with a suction pump discharging above said packer, setting said packer above the formation to be tested to establish a test zone adjacent said formation and connecting with the suction orifice of said pump, circulating a motivating fluid through said pump to create a suction influence tending to reduce the pressure in said test zone and induce a flow of cognate formation into the circulation stream for conveyance thereby to the surface, and measuring the relative volumes of the ingoing and return circulation to determine the volume of cognate formation fluid circulated out of the well.

9. In a method of ascertaining the potential productivity of a formation penetrated by a well bore, the steps comprising; lowering into a well bore containing drilling fluid a test string normally open to receive said drilling fluid and carrying a packer, said test string being provided with a suction pump discharging above said packer and a sampling chamber communicating with the suction orifice of said pump and having an inlet below said packer provided with a back-pressure valve, setting said packer above the formation to be tested to establish a test zone adjacent said formation and trap a body of drilling fluid in said test zone, and circulating a motivating fluid down the test string and through said pump to discharge into the well bore above said set packer and create a suction influence inducing flow of the trapped drilling fluid from the sampling chamber and the test zone and into the circulation stream in advance of a concurrent flow of cognate formation fluid tending to fill the sampling chamber with an uncontaminated sample of such cognate fluid.

10. In a method of ascertaining the potential productivity of a formation penetrated by a well bore, the steps comprising; lowering into a well bore containing drilling fluid a test string normally open to receive said drilling fluid and carrying a packer, said test string being provided with a suction pump discharging above said packer and a sampling chamber communicating with the suction orifice of said pump and having an inlet below said packer provided with a back-pressure valve, setting said packer above the formation to be tested to establish a test zone adjacent said formation and trap a body of drilling fluid in said test zone, circulating a motivating fluid down the test string and through said pump to discharge into the well bore above said set packer and create a suction influence inducing flow of the trapped drilling fluid from the sampling chamber and the test zone and into the circulation stream in advance of a concurrent flow of cognate formation fluid tending to fill the sampling chamber with an uncontaminated sample of such cognate fluid, and stopping the circulation to effect a closing of the back-pressure valve to trap the uncontaminated sample in said sampling chamber for subsequent analysis after the test string is removed from the well.

11. A wet test-string method of formation testing which comprises packing off the test string above the formation to be tested and circulating a motivating fluid down the test string to discharge into the well bore above said pack-off to create a suction influence tending to reduce the

pressure on the formation and induce a flow of cognate formation fluid into the circulation stream for conveyance thereby to the surface.

12. In a formation testing apparatus of the character disclosed, the combination of a body adapted to be attached to the lower end of a test string of pipe down which a motivating fluid may be pumped, said body having at its upper end a pump housing providing a flow passage disposed to receive said motivating fluid and a lateral port through which to discharge said fluid, a packing carried by the body below said discharge port, a suction pump having a suction orifice and comprising a flow nozzle disposed axially in said flow passage above said discharge port, the body below said pump housing providing a sampling chamber communicating at its upper end only with the suction orifice of said pump and being extended below said packer to form a tail pipe having an inlet, and a back-pressure valve controlling said inlet.

13. In a formation testing apparatus of the character disclosed, the combination of a body adapted to be attached to the lower end of a test string of pipe down which a motivating fluid may be pumped, said body having at its upper end a pump housing providing a flow passage disposed to receive said motivating fluid and a lateral port through which to discharge said fluid, a packing carried by the body below said discharge port, a suction pump having a suction orifice and comprising a Venturi nozzle disposed axially in said flow passage above said discharge port, the body below said pump housing providing a sampling chamber communicating at its upper end only with the suction orifice of said pump and being extended below said packer to form a tail pipe having an inlet, and a back-pressure valve controlling said inlet.

14. In a formation testing apparatus of the character disclosed, the combination of a body adapted to be attached to the lower end of a test string of pipe down which a motivating fluid may be pumped, said body having at its upper end a pump housing providing a flow passage disposed to receive said motivating fluid and having a lateral port through which to discharge said fluid and an annular valve seat at the lower end of said passage, a packing carried by the body below said discharge port, a suction pump having a suction orifice and comprising a flow nozzle disposed axially in said flow passage above said discharge port, the body below said pump housing providing a sampling chamber communicating at its upper end only with the suction orifice of said pump and being extended below said packer to form a tail pipe having an inlet, a back-pressure valve controlling said inlet, a wash pipe communicating with the lower end of said flow passage and extending downwardly through the body to discharge below the apparatus, and a valving element adapted to be sent down the test string and through said suction pump to engage said annular seat and close said wash pipe to cause the entire flow of motivating fluid to discharge above the packer.

15. In a formation testing apparatus of the character disclosed, the combination of a body adapted to be attached to the lower end of a test string of pipe down which a motivating fluid may be pumped, said body having at its upper end a pump housing providing a flow passage disposed to receive said motivating fluid and a lateral port through which to discharge said fluid, an expansible packing carried by the body below said

discharge port, a suction pump having a suction orifice and comprising a flow nozzle disposed axially in said flow passage above said discharge port, the body below said pump housing providing a sampling chamber communicating at its upper end only with the suction orifice of said pump and being extended below said packer to form a tail pipe having an inlet, a back-pressure valve controlling said inlet, and pressure actuated means rendered effective by the suction influence of said suction pump to expand the packing.

16. A formation testing apparatus having a packer adapted to pack off a well bore to isolate a test zone adjacent a formation to be tested, and means for circulating a motivating fluid in said well bore above said packer, said means providing a suction pump having a suction orifice communicating with said test zone, said pump functioning to induce a flow of cognate fluid from said formation and into the stream of motivating fluid for conveyance thereby to the surface.

17. In a method of well testing, the steps comprising; lowering into a well bore a test string, packing off the well bore about said test string above the formation to be tested to establish a test zone, circulating a motivating fluid in the well bore through the test string above the packer to produce a suction influence in the test zone, and utilizing such suction influence to reduce the pressure in said test zone and induce a flow of

cognate formation fluid into said test string and thereafter trapping such cognate formation fluid in said test string.

18. In a method of well testing, the steps comprising; lowering into a well bore a test string having a sampling chamber, packing off the well bore about said test string above the formation to be tested to establish a test zone, circulating a motivating fluid in the well bore through the test string above the packer to produce a suction influence in the test zone, and utilizing such suction influence to reduce the pressure in said test zone and induce a flow of cognate formation fluid into said chamber and thereafter trapping such cognate formation fluid in said chamber.

19. In a method of well testing, the steps comprising; lowering into a well bore a test string having a sampling chamber, packing off the well bore about said test string above the formation to be tested to establish a test zone, circulating a motivating fluid in the well bore through the test string above the packer to produce a suction influence in the test zone, and utilizing such suction influence to reduce the pressure in said test zone and induce a flow of cognate formation fluid into said chamber and thereafter stopping the circulation of said motivating fluid to cause a sample of cognate formation fluid to be trapped in said chamber.

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