

July 5, 1938.

J. R. POLSTON

2,122,991

SAMPLING DEVICE

Filed June 28, 1937

2 Sheets-Sheet 1

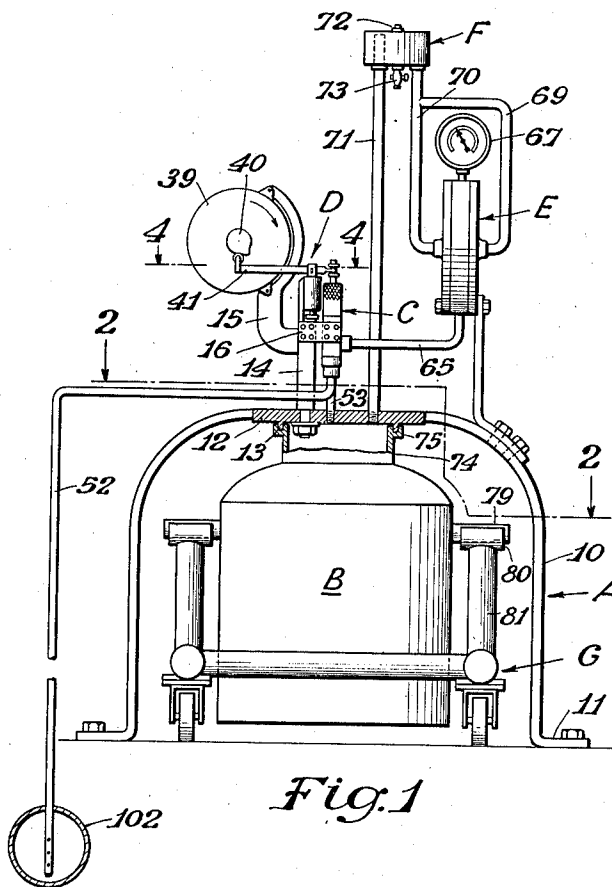


Fig. 1

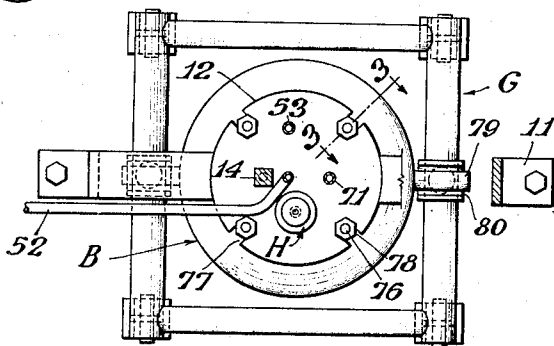


Fig. 2

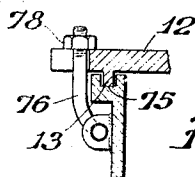


Fig. 3

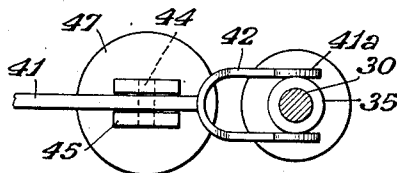


Fig. 4

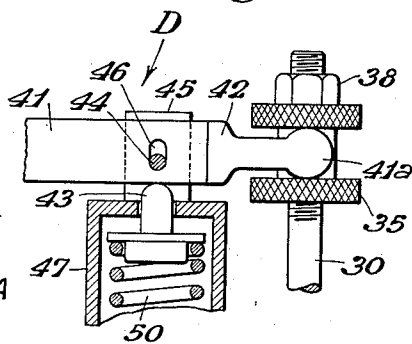


Fig. 5

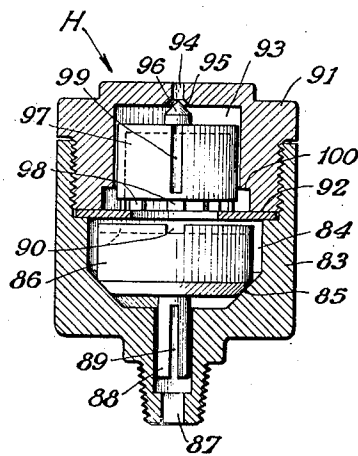


Fig. 6

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2 Sheets-Sheet 2

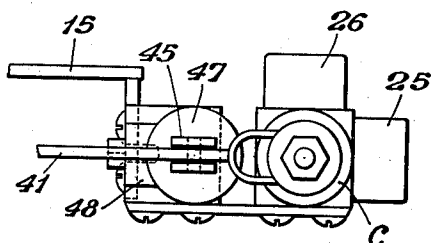


Fig. 7

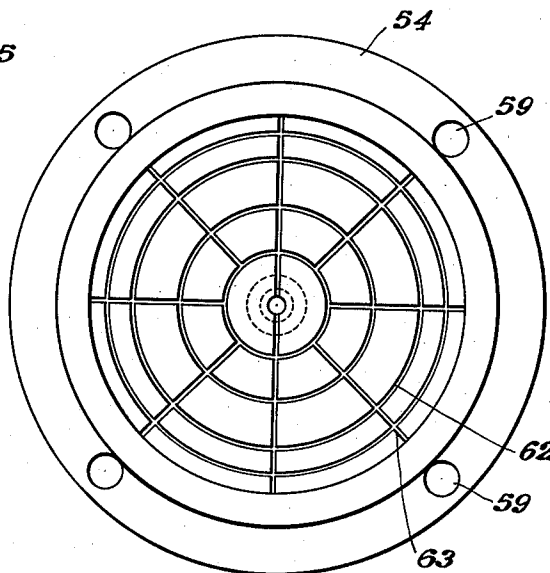


Fig. 10

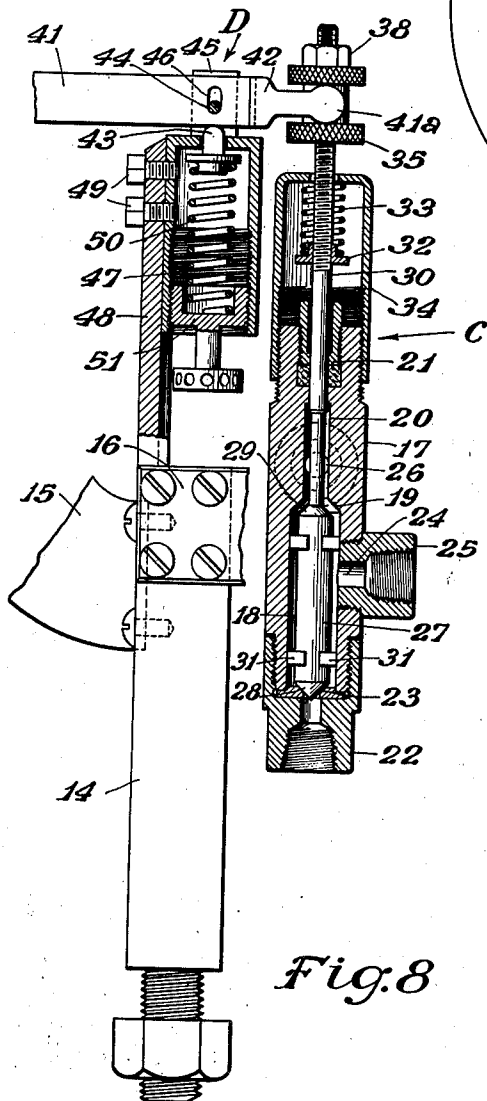


Fig. 8

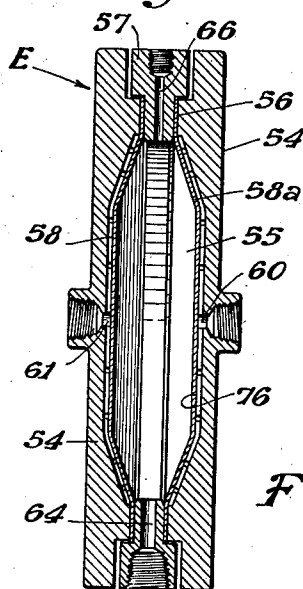


Fig. 9

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2,122,991

SAMPLING DEVICE

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Application June 28, 1937, Serial No. 150,783

8 Claims. (Cl. 73—21)

The present invention relates to a sampling device and particularly to a sampling device of the type adapted to remove samples at periodic intervals from a pipe line containing fluid under pressure.

It is an object of the present invention to provide a new and improved sampling device which will operate positively to remove samples at periodic intervals irrespective of surges and changes in pressure at the source of the sample.

It is a further object of the present invention to provide a new and improved two-way clock operated valve for use in the above sampling device.

It is another object of the present invention to provide a new and improved sample receiving diaphragm drum for use in the above sampling device.

It is a still further object of the present invention to provide a new and improved sample receiving container, a supporting frame for the sample container, and a carriage for transporting the sample container.

The invention will best be understood by reference to the accompanying drawings in which:

Figure 1 is an elevation, partly in section, of an assembly illustrating a preferred embodiment of my invention.

Figure 2 is a plan view in section taken on line 2—2 of Figure 1 showing the disposition of the elements mounted on the base plate.

Figure 3 is an elevation in section taken on line 3—3 of Figure 2 showing in greater detail the hinged bolt and seal connection between the sample receiver and the base plate.

Figure 4 is a plan view in section of the two-way valve and the valve operating lever taken on line 4—4 of Figure 1.

Figure 5 is an elevation, partly in section of the structure shown in Figure 4.

Figure 6 is an elevation in section of the back pressure valve and safety check employed in my sampling device.

Figure 7 is a plan view of the two-way valve and the lever operating mechanism therefor showing a more complete assembly of parts than is shown in Figure 4.

Figure 8 is an elevation, partly in section, showing the details of the two-way valve and spring-supported fulcrum for the valve operating lever.

Figure 9 is an elevation in section of the diaphragm sampling drum, and

Figure 10 is a plan view of the saucer-like inside of one of the diaphragm plates showing the disposition of the channels therein.

Referring to Figure 1 and Figure 2 of the drawings it will be seen that my sampling device is composed of a supporting frame A, a sample-receiving container B arranged to be sealed and attached to the under side of the frame, a two-way valve C, clock and lever mechanism D for operating valve C, a diaphragm sampling drum E, a static head equalizing drum F and a back pressure and safety check valve H all mounted on the upper side of the frame A, and a carriage G for transporting the sample-receiving container B. The two-way valve C is arranged to effect in sequence, first a communication between a source of fluid to be sampled, for example a pipe line containing fluid under pressure, and the diaphragm sampling drum E, and second a communication between the sampling drum E and the sample-receiving container B. This sequence is accomplished by the clock-operated cam and lever which function at predetermined intervals to move the two-way valve C into a first position effecting communication through the line leading from the source of material being sampled to the diaphragm sampling drum, the pressure from the sample source being effective to force fluid against the diaphragms in the diaphragm sampling drum E to raise a liquid head in communication with the opposite sides of the diaphragms into the equalizer drum F. The clock-operated cam and lever at a predetermined subsequent time shift the two-way valve C to a second position cutting off communication with the source of sample supply and placing the diaphragm sampling drum in communication with the sample-receiving container B whereupon the liquid head in the equalizer drum F becomes effective on the outside of the diaphragms to force the sample contained therebetween through the two-way valve into the sample receiver.

Having thus described the general nature of my invention, I turn now to a more detailed description. A supporting frame A having a general inverted U shape is provided, comprising opposed legs 10 bent at their lower ends to form feet 11 for attaching the frame to a floor support. The upper ends of the legs 10 are attached to a base plate 12 for instance by welding. Base plate 12 is formed on its under side with a depending circular tongue 13 and a plurality of vertical perforations contained within the area defined by tongue 13 for the reception of parts hereinafter described. Two-way valve and clock supporting column 14 has a reduced lower portion for reception within an opening in base plate 12, being attached thereto by a nut received on the

lower threaded end thereof and engaging the under side of the base plate 12. Column 14 has attached thereto, laterally extending clock-receiving bracket 15 and oppositely extending two-way valve-supporting plate bracket 16.

Two-way valve C (Figure 8) is composed of a valve body 17 formed with a longitudinal valve chamber 18 therein. The upper end of chamber 18 is conical in shape to provide an upper valve seat 19 communicating with a reduced passage-way 20 which terminates in a packing box including a suitable stuffing material held in place by gland 21. The lower end of valve body 17 has screwed thereon cap or bonnet 22 having a tapped concentric opening in the bottom thereof and enclosing removable lower valve seat 23. Intermediate the valve seats 19 and 23 of valve chamber 18 there is provided a lateral outlet 24 through tapped nipple 25. A second lateral outlet 26 communicates with the reduced passage 20 above upper valve seat 19. A cylindrical valve plug 27 is provided within chamber 18, having a conical shaped lower end 28 for reception in lower valve seat 23, a conical shaped upper shoulder 29 for reception in upper valve seat 19 and a reduced spindle portion 30 passing up through the packing gland 21. Cylindrical plug valve 27 is further provided adjacent each end with three spaced radially disposed wing guides 31 for sliding cooperation with the face of the cylindrical chamber 18. The upper portion of valve stem 30 is threaded and receives adjustable seat 32 for valve-operating spring 33. Valve body 17 has mounted on its upper end interiorly threaded bonnet or cap 34 having a centrally disposed opening in the top thereof large enough to permit valve stem 30 to pass therethrough but small enough to effect engagement of spring 33 by the top of the bonnet to regulate the adjustment of the spring. The upper threaded end of the valve stem 30 receives tapped adjustable fulcrum collar 35 and lock nut 38.

The mechanism D for operating the two-way valve C (Figures 1 and 8) includes a clock 39 mounted on bracket 15 and cam 40 which is formed with a raised portion for engagement with a roller mounted on the clock end of lever 41 which is bifurcated on its valve end to provide arms 42 which terminate in circular cams 41a embracing valve stem collar 35. Intermediate its ends lever 41 is supported on spring-mounted fulcrum 43 and restrained from longitudinal movement by fulcrum pin 44 supported in yoke 45 and passing through vertical slot 46 formed in lever 41.

Tubular spring housing 47 is attached to the upper end 48 of column 14 by cap screws 49, and has a vertical perforation in the top thereof for receiving fulcrum 43 for engagement with the lower side of lever 41. The lower side of fulcrum 43 is supported on spring 50, the other end of which is received in vertically adjustable plug seat 51 threaded for reception in the lower end of spring housing 47. The bonnet 22 of two-way valve C communicates with a source of fluid under pressure, which fluid is to be sampled, through conduit 52 (Figure 1). Upper lateral port 26 communicates directly with the sample receiver B through conduit 53. Lateral outlet 24 of chamber 18 communicates with a diaphragm drum E (Figures 1 and 9).

This diaphragm drum is composed (Figures 9 and 10) of a pair of similar plates 54 having concave saucer-like depressions 55 formed in one face thereof terminating in a substantially

flat rim portion 56. A ring 57, generally T-shaped in cross-section, is embraced by the outer periphery of the respective plates, the rim portion 56 of the plates being received about the stem of the T-shaped ring 57. A pair of flexible diaphragms 58 and 58a, which may be made of oil resistant synthetic rubber, when oil is being sampled, are positioned within the hollow chamber formed by the opposed concave portions of the plates 54 with the outer peripheries of the diaphragms 58 and 58a engaged between the rims 56 of the saucers and the stem of the T-shaped ring 57. It is preferable to employ two diaphragms as described but it is apparent that a single diaphragm can be used effectively. The outer peripheries of the plates and the T-shaped ring are provided with radially disposed perforations 59 for reception of bolts for fastening the assembly together. The drum thus formed is provided with lateral outlets 60 and 61 in communication with the outer sides of the respective diaphragms. The concave or saucer-like depression 55 in each of the plates is provided with grooves to prevent the occurrence of a vacuum behind the diaphragms. These grooves are shown as comprising a plurality of concentric circular grooves 62 intersected by radially extending grooves 63. The lower portion of T-shaped ring 57 is provided with outlet 64 for attachment to conduit 65 (Figure 1) leading to lateral outlet 24 of two-way valve body 17, and the upper portion of the T-shaped ring is formed with outlet 66 for attachment to a pressure gauge 67 or pressure relief means (not shown). Lateral outlets 60 and 61 connect with vertically extending pipes 69 and 70 respectively, pipe 69 joining pipe 70 which is connected to static head equalizer drum F, for supplying a static fluid head to the outsides of the diaphragms.

The equalizer drum F has a second conduit 71, one end of which protrudes through the bottom of the drum and extends to a point short of the top of the drum and the other end of which communicates with sample-receiving container B through a perforation in base plate 12. Equalizer drum F is provided on its top with a removable plug 72 for the introduction of liquid and on the under side thereof with a pet cock 73 for adjusting the level of the liquid therein.

Sample-receiving container B is formed on its upper end with neck portion 74 terminating in a circular upwardly presented groove 75 for cooperation with circular tongue 13 depending from base plate 12 to form a seal therewith. The neck portion 74 of sample-receiving container B is provided with hinged bolts 76 arranged to be swung into slots 77 (Figure 2) of base plate 12 for drawing the circular groove into sealed relationship with depending circular tongue 13 by means of the nuts 78. Trunnions 79 extend laterally from the upper portion of the outer wall of the sample receiver B and are supported by bearings 80 formed in the upper ends of tubular members 81 of the carriage G for supporting and transporting the sample-receiving container when not in engagement with base plate 12.

Back pressure and safety check valve H (Figure 6) is mounted on base plate 12 (Figure 2) for communication with the sample-receiving container and comprises a body 83 formed with a float-receiving chamber 84 having a conical-shaped lower periphery 85 which acts as a seat for weighted float valve 86 having a conical-shaped lower end. Body 83 has a centrally disposed vertical outlet 87 counter-bored to receive

stem 88 depending from float valve 86, the stem 88 being sufficiently smaller than the counter-bored opening to permit of a sliding fitted guide therein and being provided with a longitudinal slot 89 the top of which extends above the bottom of chamber 84 when the conical face of float valve 86 rests upon its seat 85 to provide an air passageway. The top face of float valve 86 is provided with diametrically disposed grooves 90 for insuring ample space for the passage of air thereabout. Body 83 of back-pressure safety check valve H is provided with a cap or bonnet 91 which screws into the top thereof and serves to hold a centrally perforated disc partition 92 between body 83 and cap 91. Cap 91 is formed with a cylindrical chamber 93 concentrically disposed with respect to chamber 84 in valve body 83. This cap is further provided with a vertical outlet 94 having a conical lower face portion 95 for cooperation with an upwardly extending conical valve 96 concentrically mounted on a hollow piston 97 closely fitted within the cylindrical chamber 93. The piston 97 normally rests upon radially disposed feet 98 and is further provided with radially disposed vertical grooves 99 in the outer periphery thereof which grooves extend slightly below the shoulder 100 of bonnet 91 when the piston is resting upon its feet. This permits air discharged past lower float valve 86 to pass by piston 97 when the piston is resting upon its feet. However, should the sample-receiving container become filled to capacity with liquid and overflow through outlet 87, then hollow piston 97 would be lifted off its feet by the buoyancy of the liquid and escape of liquid would be blocked by the resultant closure of conical valve 96 against conical valve seat 95.

Description of operation

A better understanding of my device will be had from a description of its operation in removing samples of liquid from a pipe line containing fluid under pressure. The conduit 52 (Figure 1) is placed in communication with a pipe line 102 containing, for example oil being pumped therethrough. Clock 39 can be set to depress fulcrum lever 41 at any desired periodic interval, for example once every hour, and to maintain the same in depressed position any desired length of time, for example seven minutes. Clock-operated cam 40 in performing this operation first turns lever 41 about spring-supported fulcrum 43 (Figure 8) to raise plug valve 27 out of engagement with its lower seat 23 and into engagement with its upper seat 19, thus placing the space between the two diaphragms 58 and 58a of diaphragm drum E in communication with the pipe line 102 through conduit 52, plug valve chamber 18, lateral outlet 24 of chamber 18, conduit 65 and inlet 64 of diaphragm drum E. The space between the diaphragms 58 and 58a thus becomes filled with liquid from the pipe line 102 since the latter is under pressure.

It is important to note that cam 40 first moves lever 41 about its spring-supported fulcrum 43 to move plug valve 27 into contact with its upper seat 19 thus compressing valve spring 33, the cam then continuing the movement of lever 41 to depress fulcrum 43 against the upward urging effect of its somewhat stronger supporting spring 50, this operation being permitted by the vertically disposed slot 46 in lever 41. This relationship makes possible the proper functioning of the two-way valve C since it always assures a spring-urged contact between the upper seat 19

and the conical valve shoulder 29 of plug valve 27.

At a predetermined subsequent time, say seven minutes, clock 39 moves the raised portion of cam 40 out of contact with the roller on the end of lever 41, thus permitting spring 33 to move plug valve 27 downward to bring its conical head 28 into contact with the lower seat 23 in cap 22, thus shutting off communication between the pipe line 102 (Figure 1) and the space between diaphragms 58 and 58a of diaphragm drum E (Figure 9), and initiating communication between the diaphragm drum and the sample-receiving container B through conduit 65, lateral outlet 24 of valve plug chamber 18, upper seat 19, upper lateral outlet 26 and conduit 53. The static head contained in equalizer drum F and conduits 69 and 70 in communication with the outside of the respective diaphragms 58 and 58a then becomes effective to compress the diaphragms and thus force the fluid contained between the diaphragms into the sample-receiving container B.

It is important to note that the static head of liquid contained in equalizer drum F is in communication above its surface with the sample receiver B through conduit 71 which protrudes up through the bottom of equalizer drum F to a point above the highest level of the liquid contained therein, thus bringing about a condition wherein the pressure tending to force the liquid from between the diaphragms 58 and 58a into the sample-receiving container B is always greater than the pressure within the sample-receiving container by that amount due to the static head of liquid contained within the equalizer drum F and the conduits 69 and 70.

During the above operation back pressure and safety check valve H operates to prevent the occurrence within the sample-receiving container B of a pressure in excess of a predetermined pressure depending upon the weight of float 86, which is lifted in response to such predetermined pressure to permit the passage of air past the top of vertical slot 89, the lower portion of float 86, diametrically disposed grooves 90 in its upper face, the centrally disposed perforation in partition 92, the vertical slots 99 in fluid-actuated piston 97 and out through vertical port 94 of bonnet 91.

Should sample-receiving container B become filled to the point where liquid rises up through lower chamber 84 into contact with piston 97 it will cause this piston to float and thus raise the bottom of slots 99 therein above the shoulder 100 of bonnet 91 and shut off further communication through upper port 94 thus preventing any further flow of liquid. Conical valve 95 carried on piston 97 further insures the shut-off of liquid flow.

While I have described my invention in connection with a specific embodiment thereof it is to be understood that this is by way of illustration rather than by way of limitation and I do not mean to be limited thereby except as indicated by the scope of the appended claims which should be construed as broadly as the prior art will permit.

I claim:

1. A sampling device for removing a composite sample of liquid from a source of liquid under pressure including a sample-receiving container, means defining an expansible sample-withdrawing chamber, means for selectively and sequentially placing said chamber in communication with said source of liquid and with said sample-

receiving container, said liquid being effective to expand said chamber when said source of liquid is placed in communication with said chamber, and means for exerting a force on said chamber in opposition to the expansion of said chamber, said force exerting means being effective to cause the displacement of the sample from said expandable chamber to said sample-receiving container when said expandable chamber is placed in communication with said sample-receiving container.

2. A device as defined in claim 1 wherein said means for exerting a force on said chamber in opposition to the expansion of said chamber comprises a liquid head in communication with said expandable chamber, including an equalizer drum and means connecting said equalizer drum above the surface of the liquid therein with said sample-receiving container, whereby the force exerted on said expandable sample-withdrawing chamber effective to discharge the contents thereof into said sample-receiving container is always equal to the value of said liquid head irrespective of the pressure in said sample-receiving container.

3. A sampling device for removing a composite sample of liquid from a source of liquid under pressure, including a sample-receiving container, means defining an expandable sample-withdrawing chamber, valve means for selectively and sequentially connecting said chamber in communication with said source of liquid and with said sample-receiving container, for causing first a flow of liquid from said source into said chamber and second a flow of liquid from said chamber into said sample-receiving container, said liquid being effective to expand said chamber when said source of liquid is placed in communication with said chamber, and means exerting a force on said chamber in opposition to said expansion, said force-exerting means being effective to cause the displacement of the sample from said expandable chamber into said sample-receiving container when said valve means is operated to connect said chamber with said sample-receiving container.

4. A sampling device for removing a composite sample of fluid from a source of fluid under pressure including a sample-receiving container, means defining an expandable sample-withdrawing chamber, said chamber being provided with means dividing it into a first compartment and a second compartment, means effective to selectively and sequentially place said first compartment in communication with said source of fluid and subsequently with said sample-receiving container, said dividing means being displaceable in response to the fluid introduced into said first compartment from said source, and energy-storing means associated with said second compartment responsive to said displacement of said dividing means, said energy-storing means being effective when said first compartment is placed in communication with said sample-receiving container to effect the discharge of fluid from said first compartment into said sample-receiving container.

5. A sampling device for removing a composite sample of fluid from a source of fluid under pressure including a sample-receiving container, a chamber, means dividing said chamber into a first compartment and a second compartment, means for selectively and sequentially placing

said first compartment in communication with said source of fluid and subsequently with said sample-receiving container and a head of fluid in communication with said second compartment, said dividing means in said chamber being displaceable in response to the introduction into said first compartment of fluid from said fluid source, said displacement of said dividing means being effective to raise said fluid head to render it effective when said first compartment is subsequently placed in communication with said sample-receiving container, to effect the discharge of said fluid from said first compartment into said sample-receiving container.

6. A sampling device for removing a composite sample of fluid from a source of fluid under pressure including a sample-receiving container, a chamber, means for dividing said chamber into a first compartment and a second compartment, means for selectively and sequentially placing said first compartment in communication with said source of fluid and subsequently with said sample-receiving container, said dividing means being displaceable in response to the introduction of fluid into said first compartment, a head of liquid in communication with said dividing means in said second compartment, said displacement of said dividing means being effective to raise said liquid head, means placing said liquid head in communication above its surface with said sample-receiving container, whereby said fluid is discharged from said first compartment by the pressure of the liquid head irrespective of the pressure within said sample-receiving container, and means responsive to a predetermined excess pressure in said sample-receiving container for venting the same, said means being further responsive to the liquid level in said sample-receiving chamber for cutting off said vent.

7. A liquid sampling device for removing a composite sample from a liquid source under pressure comprising a two-way clock-operated valve in communication with said source, a drum containing a diaphragm in communication on one side with said valve and on the other side with a liquid head, and a sample-receiving container, said two-way valve having a first position and a second position, said clock being operable successively to move said valve into said first position to effect communication between said liquid source and said diaphragm drum through said valve while shutting off communication between said diaphragm drum and said sample-receiving container to cause flow of liquid into said diaphragm drum and subsequently to move said valve to said second position to effect communication between said diaphragm drum and said sample-receiving container through said valve while cutting off communication between said liquid source and said diaphragm drum, said liquid head being effective to force said liquid contained on the opposite side of said diaphragm through said valve and into said sample-receiving container.

8. A device as defined in claim 7 wherein said drum is provided with two diaphragms spaced apart to receive a sample therebetween and wherein each diaphragm is in communication on its outer side with said liquid head.