DEVICE FOR TAKING FLUID SAMPLES FROM CLOSED SYSTEMS

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ABSTRACT OF THE DISCLOSURE

A device for extracting fluid samples from closed containers without contamination where a container is punctured through a block member placed sealingly thereon, a sample withdrawn from the container and the container resealed by a plug lowered into the puncture.

BACKGROUND OF INVENTION

It is often necessary for purposes of safety or quality control to test fluid samples in closed systems. Accurate testing requires an apparatus which will remove sample fluid from such a system without contamination. Moreover, many of the systems requiring sampling are in warehouses and distribution centers remote from the area of original production or packaging. Thus, a useful sampling device must also be easy to install, easy to operate, efficient, and inexpensive.

Still further, it is desirable in many instances to take fluid samples from discrete locations within a container. A number of devices are known which enable the sampling of fluids from closed containers. One type is illustrated by U.S. Patent 2,767,587 to Perkins wherein there is illustrated a sampling device which improved the state of the art by providing a system which prevents contamination during sampling. To prevent contamination, however, the patentee uses a sampling device which utilizes a probe unit and a receiver unit. The receiver unit must be affixed to the container. Thus, the utility of that device is limited to systems and containers to which a receiver unit is attached or can easily be attached without contamination of the contents.

Another type of sampling device is illustrated by U.S. Patent 2,994,224 to Brown. This device is simpler than the previously discussed, but the whole device must be permanently attached to the closed system to enable sampling of fluids without contamination. Such a solution is not practical where the closed systems to be sampled are drums or cans in warehouses.

Still another device which has been used to sample fluids from closed containers is that used in quality control systems connected with the canning of foods and beverages. Such an apparatus is illustrated by U.S. Patent 3,203,248. These devices are designed to be operated in conjunction with a production line, wherein the can or bottle to be sampled is placed on a vertically movable platform and is thrust upwards against a piercing needle. This system works well with cans on a production line, but is not well suited to test drums or other containers which may be located in warehouses or stockpiles as the size of such an apparatus would prohibit an efficient utilization.

OBJECTS OF INVENTION

Accordingly, it is an object of this invention to provide an improved apparatus for sampling fluids from closed systems.

Further, it is an object of this invention to provide an improved apparatus for the removal of fluid samples from closed containers.

DESCRIPTION OF INVENTION

Briefly, the present apparatus comprises a sealed chamber which is adapted to be affixed to the surface of a container, a means within said chamber to create an opening in the container and a means to insert a fluid sampling probe into the container through said opening.

The invention and its various modifications will be more fully understood when reference is made to the figures of the accompanying drawings herein:

FIG. 1 is an elevational view partly in cross section of a sampling apparatus according to the present invention which also includes a flow diagram showing a scheme of fluid flow which is obtainable using the present device.

FIG. 2 is a top view showing the chamber of the apparatus in cross section.

FIG. 3 is an elevational view showing the cross sectional detail of the probe tip.

FIG. 4 is a cross sectional view of a plug used in conjunction with the present apparatus.

FIG. 5 is an elevational view partly in cross section showing a modification of the device designed to maintain a specific pressure within the container and to prevent post sampling contamination.

Referring to FIG. 1, the invention is seen as comprising a solid holding block 1 having fitted to its under surface an O ring 50 or other sealing means and having drilled within its body merging passages 2 and 3 which are threaded at their divergent ends 10 and 11, and which combine at the bottom of solid holding block 1 to form opening 4. Communicating with passage 2 is passage 5 which is threaded at 6 to receive a pressure gauge 7 or a plug (not shown). In like manner, passage 8 which is threaded at 9 communicates with passage 3. Threadedly engaged in divergent ends of passages 2 and 3 are Swage- lokks 12 and 13 which similarly comprise glands 14, threaded portions 15 and caps 16. Slidishly fitted within Swage-loks 12 and 13 are drill 17 and probe 18, respectively. Probe 18 comprises probe tip 19 having inlet holes 20 to receive fluid. Also part of probe 18 is tubing 21 which extends from probe tip 19 through Swagelok 13 to coupling 22 to which is attached a T fitting 46, one portion of which is connected to a Swagelok fitting 23 and line 24, and the other portion of which is connected to coupling 25. Coupling 25 is seen to be threadedly attached to Swagelok 26 in which is slidishly fitted rod 27. Swagelok 26 comprises a gland 70, bushing 71 which is threadedly attached to coupling 25 and cap 72 which is connected to bushing 71. One end of rod 27 is attached to a smaller diameter rod or wire 28 and the other end to handle 29. The apparatus as shown has two fluid outlets; the first being passage 8 which communicates with passages 2, 3 and 5 and the second line 24 which communicates via tube 21 to probe tip 19. These outlets may be connected to a variety of fluid collection systems. The system as depicted in FIG. 1 comprises line 30 leading via one-way valve 31 and valve 32 to collection chamber 33, line 24 leading to pressure gauge 34 and then via one-way valve 35 and valve 36 to collection chamber 37 with interconnecting lines 38 and 39 communicating between lines 24 and 30 having within them valves 40 and 41, and 42 and 43, respectively. The first of said interconnecting lines 38 has a connection 44 located between valves 40 and 41 which leads to a source of purge gas and the second interconnecting line 39 has a connection 45 located between valves 42 and 43 leading to a variable pressure source.
Referring now to FIG. 2, there is shown in cross section a top view of solid holding block 1 taken along line designated by arrows A—A in FIG. 1. Here, solid holding block 1 is seen as having a base portion 21 and an upper portion 52 (also shown in FIG. 1). Drilled in upper portion 52 are threaded passages 5 and 8 (also shown in FIG. 1), threaded openings 53 and 54, which can be used to hold the device on the surface of a closed container, passage 3, passage 2, and drill 17 (all also shown in FIG. 1).

Referring now to FIG. 3, there is shown in cross section the detail of probe tip 19. As shown here, probe 19 comprises an outer hollow casing 60 having fluid inlet holes 20. The casing is threaded connection to tube 21. Within tube 21 is rod or wire 28 which is operably connected to valve 61 which is fitted within casing 60 and which may be of the ordinary tire- valve type as shown.

FIG. 4 illustrates in cross section a type of plug which may be used in connection with the present sampling device. The plug 90 comprises head portion 80, flange 81, threaded portion 82, body 83 and foldable wing-nut 84.

After all of the gas samples have been taken, plug 90 is inserted into the opening formed by drill 17 with wingnut 84 in a folded position. The head portion is turned to draw wing-nut 84 up on threaded portion 82 and to seal the opening.

To operate the sampling device, drill 17 and probe assembly 18 are initially raised within passages 2 and 3. Solid holding block 1 with O ring 50 is then secured, by clamping means not shown, to the surface of the closed container containing the fluid to be sampled, which may be a tank, drum, can or the like. Valves 36, 42, 43 and 32 are opened and valves 40 and 41 are closed. The whole system, including holding block, probes and collection zones can be evacuated to a desired degree. Valves 42 and 43 are closed and drill bit 17 is lowered through Swagelok 12 until it touches the surface of the container. A driving means (not shown) is attached to the drill bit and an opening is formed through the wall of the container. The vacuum in the system and/or the pressure in the fluid container forces fluid up into passage 3 and out passage 8 through one-way valve 31 to collection chamber 33 which had been previously evacuated. Valve 32 is then closed and the sample is removed from the system. Drill bit 17 is raised to allow for the probe assembly 21 to be lowered through Swagelok 13 allowing probe tip 19 to enter the container through the opening formed by drill 17 to a predetermined depth.

Fluid samples are taken from the container by applying pressure to handle 29 which activates one-way valve 61 as shown in FIG. 3. Fluid in the container is drawn through holes 20 in probe tip 19, up to tube 21 to T 46 where it enters line 24, passes through one-way valve 35, and finally collects in chamber 37, which had previously been evacuated. Valve 36 is then closed and the sample is removed from the system.

At this point more sample collecting chambers could be added to the system and a plurality of samples could be taken from discrete portions of the container or the container could be purged and filled with any desired fluid by using valves 31 and 32.

After the desired number of samples have been taken, the device is removed from the container and the opening is closed, as described above, by a plug such as 90 shown in FIG. 4.

In many applications it is desirable to keep the container free from contamination before, during and after sampling. The device of the present invention is adapted to be modified to meet such ends. An example of such a modification is illustrated in FIG. 5. In that figure, the sampling device is seen as comprising solid holding block 100, having fitted in its outer surface an O ring 101 or other sealing means. Drilled within the body of solid holding block 100 are merging passages 102, 103 and 104 which are threaded at their diverging ends 105, 106 and 107, respectively, and which combine at the bottom of solid holding block 100 to form opening 108. Communicating with passage 102 is passage 109 threaded at 110 to receive a pressure gauge or plug (not shown). In like manner passage 103 has communicating therewith passage 111 which is threaded at 112. Threadedly engaged in divergent ends of 102, 103 and 104 are Swageloks 113, 114 and 115, respectively, having structures similar to that of Swageloks 12 and 13 of FIG. 1. Slidably mounted within Swagelok 113 is drill 116 and is deducted through opening 108. In a like manner, Swagelok 114 houses a probe assembly 117 such as the one described in FIGS. 1, 3 and 4. The center Swagelok houses a slidably positioned turning device 118 which is friction fitted to a plug 119 of the type shown in FIG. 4.

The operation of the modified device shown in FIG. 5 is similar to the unmodified embodiment with the exception that after all of the samples have been taken and probe 117 is withdrawn from opening 106, and before solid holding block 100 is removed from the sampled container, a tool or turning device 118 with attached drill 119 is lowered to seal opening 108 while chamber 100 is held at a predetermined pressure. In this manner it is possible to return the container to its previous pre-sampling condition, fill it with a purge fluid, or seal it under a partial vacuum.

It should be appreciated that the invention as described may be further modified to meet the requirements of specific testing conditions and goals. For example, under surface of the sampling device may be easily adapted to seal to different contours and shapes, the drill as shown could be replaced by a punch or needle where the walls of the sample container are easily pierced, the probe tip may have adapted to it a flexible tubing to enable the sampling of fluids from specific locations within the container, the turning means shown in FIG. 5 may be operated manually or automatically, and the probe tip may comprise a rotating valve assembly.

Still further modifications, adaptations, and alterations which will become apparent to those of ordinary skill in the art are possible within the spirit and scope of the invention.

As used in the above disclosure, the term "fluid" means either gas or liquid as the present invention is adapted to sample either form.

What is claimed is:

1. An apparatus for sampling fluids from closed containers comprising:
(a) a substantially solid holding block having a first surface, means to seal said first surface in a fluid-tight relationship with the surface of a closed container, said holding block further comprising three primary passage means, said passage means converging at said first surface to form an opening therein, the divergent ends of said primary passage means extending through one or more surfaces of said holding block, and secondary passage means providing fluid communication from at least one of said primary passage means to the exterior of said block;
(b) a hole-forming means slidably mounted in one of the primary passages;
(c) means to seal said hole-forming means within said passage;
(d) fluid collecting means connected to a second of said primary passages through said secondary passage means, said collecting means comprising a fluid passage means slidably mounted within said second primary passage, mean to seal said fluid passage means within said second primary passage, a fluid inlet valve in said secondary passage means, and means to remotely actuate said valve;
(e) a tool slidably mounted within the third said primary passage and adapted to hold and insert a sealing plug into an opening formed by said hole-forming means, and means to seal said tool within said third primary passage.
2. The apparatus of claim 1 wherein said third primary passage is substantially normal to said first surface.

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