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TO: KSI/Scientific & Technical Information Division
Attn: Miss Winnie M. Morgan

FROM: GP/Office of Assistant General Counsel for Patent Matters

SUBJECT: Announcement of NASA-Owned U.S. Patents in STAR

In accordance with the procedures agreed upon by Code GP and Code KSI, the attached NASA-owned U.S. Patent is being forwarded for abstracting and announcement in NASA STAR.

The following information is provided:

U.S. Patent No.: 4,046,012

Government or Corporate Employee: U.S. Government

Supplementary Corporate Source (if applicable): 

NASA Patent Case No.: GSC-12,143-1

NOTE - If this patent covers an invention made by a corporate employee of a NASA Contractor, the following is applicable:

YES [ ] NO [X]

Pursuant to Section 305(a) of the National Aeronautics and Space Act, the name of the Administrator of NASA appears on the first page of the patent; however, the name of the actual inventor (author) appears at the heading of column No. 1 of the Specification, following the words "...with respect to an invention of ..."

Bonnie L. Henderson

Enclosure

(NASA-Case-GSC-12,143-1) FLUID SAMPLING DEVICE Patent (NASA) 9 p CSCL 14E
FLUID SAMPLING DEVICE

Inventor: David K. Studenick, Rockville, Md.

Assignee: The United States of America as represented by the United States National Aeronautics and Space Administration, Washington, D.C.

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U.S. Class.: 73/421.5 R, 421.5 A; 250/288
Field of Search: 73/421.5 R, 421.5 A; 250/288

References Cited

U.S. PATENT DOCUMENTS
2,411,157 11/1946 Fene et al. 73/421.5 R
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ABSTRACT

A fluid sampling device for selectively sampling multiple fluids including a support frame. A plurality of fluid inlet devices extend through the support frame and each of the fluid inlet devices include a longitudinal aperture extending therethrough. An opening device that is responsive to a control signal selectively opens the aperture for passing the fluid therethrough. A closing device that is responsive to another control signal selectively closes the aperture for terminating further fluid flow therethrough.

21 Claims, 6 Drawing Figures
FLUID SAMPLING DEVICE
ORIGIN OF THE INVENTION

The invention described herein was made by an employee of the United States Government and may be manufactured and used by or for the Government for governmental purposes without the payment of any royalties thereon or therefore.

BACKGROUND OF THE INVENTION

1. Field of the Invention

This invention relates generally to inlet leaks for sampling gases and more particularly to a fluid sampling device for selectively sampling multiple fluids.

2. Description of the Prior Art

Inlet leaks are highly useful and extensively used for introducing a fluid such as, for example, a gas into a mass spectrometer or other devices for analyzing a gas in a particular environment.

Present day devices utilize a single inlet leak tube constructed of glass having a capillary opening extending through the glass tube. The inlet leak is inserted into a mass spectrometer or other gas analyzers. The apparatus is placed within the gas to be analyzed and the gas is allowed to flow through the inlet leak into the gas analyzer where the characteristics of the gas can be broken down and studied. This device works exceptionally well where a single particular gas is to be analyzed.

In certain environmental situations the above device has many disadvantages because a single inlet tube can only be used once since it is contaminated by the gas that has been sampled. A use where such prior art devices are unsuitable involve sampling of multiple gases at different locations. If the above prior art devices are used, the sample taken at the first location can be analyzed correctly, however, subsequent samples taken at different locations will be contaminated by the residue gas from the first location. This will prevent a true analysis of the gases at the subsequent locations. Thus, the inlet leak tube can only be used once or only be used to analyze the same gas again and once the inlet leak tube is opened gases will continue to flow into the analyzer.

To take multiple samples of gases without contamination by the previously sampled gas it is necessary to replace the used inlet leak tube with an unused inlet leak tube and the analyzer must be pumped out to remove the residual gases or a plurality of gas analyzers may be used having a single uncontaminated inlet leak tube. In many situations the above multiple sampling technique cannot be used or are impractical and expensive. An exemplary situations is where the gas samples in a planet's atmosphere must be taken at different heights above the planet's surface. Since planet probes are unmanned, it would be difficult to provide for the replacement of the inlet leak tube after each gas sample is taken, and because of size and weight limitations on a spacecraft multiple gas analyzers having a single shot inlet leak tube cannot be used.

Another situation where the above prior art devices are unfeasible is in analyzing the different gases emitted by a volcano at various heights and at different times within the volcano. Time is of the essence when working around an active volcano and it is therefore desirable to obtain and analyze the gas samples as quickly as possible. The above prior art devices do not lend themselves to such rapid sampling.

OBJECTS OF THE INVENTION

Accordingly, one object of this invention is to provide a novel apparatus for sampling a fluid.

Another object of the present invention is to provide a novel fluid sampling device capable of sampling multiple fluids.

Still another object of this invention is to provide a novel fluid sampling device capable of sampling multiple fluids without becoming contaminated.

A further object of the instant invention is to provide a new and improved fluid sampling device for selectively sampling different fluids without removing used inlet leak tubes.

A still further object of this invention is to provide a new and improved fluid sampling device that selectively and accurately samples multiple fluids with a single gas analyzer.

Another still further object of this invention is to provide a new and improved relatively inexpensive and compact fluid sampling device for selectively sampling multiple fluids.

SUMMARY OF THE INVENTION

Briefly, in accordance with one embodiment of this invention, these and other objects are attained by providing a fluid sampling device that selectively samples multiple fluids. The fluid sampling device generally includes a support frame which is attached to a single fluid analyzer such as a mass spectrometer. A plurality of fluid inlet devices extend through the support frame. Each fluid inlet device has a longitudinal aperture extending therethrough into the fluid analyzer. An opening device is responsive to a control signal for selectively opening the aperture for passing the fluid therethrough. A closing device is responsive to another control signal for selectively closing the aperture for terminating further fluid flow therethrough.

The above and further objects of the invention will appear more fully from the following detailed description when the same is read in conjunction with the accompanying drawings. It is to be understood, however, that the drawings are not intended as a definition of the invention but are for the purpose of illustration only.

BRIEF DESCRIPTION OF THE DRAWINGS

In the drawings where like parts are designated by like references:

FIG. 1 is a top view of the fluid sampling device of the present invention showing the plurality of fluid inlet devices, opening devices, closing devices, control panel, and signal generating device.

FIG. 2 is a side view, in cross section, of the fluid sampling device taken along the lines II — II of FIG. 1 showing the interconnections between the fluid inlet devices, opening devices and closing devices.

FIG. 3 is a side view, in cross section, of the fluid inlet devices taken along the lines III — III of FIG. 2 showing the internal components of the fluid inlet devices and/or shearing device of the opening device.

FIG. 4 is a side view, in cross section, of the actuator device taken along the lines IV — IV of FIG. 2 showing the cylinder, piston, rod, and expander.

FIG. 5 is a side view of the closing device of FIG. 2 showing the moveable clamping mechanism and the actuator device, in cross section.

FIG. 6 is a top view of one arm of the moveable clamping mechanism taken along the lines VI—VI of
DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring to FIG. 1, the invention generally includes a fluid sampling device, denoted generally by numeral 10, for selectively sampling multiple fluids. Fluid sampling device 10 includes a support frame, denoted generally by numeral 12, with a plurality of fluid inlet devices 14 extending through the support frame 12. Each fluid inlet device 14 has a longitudinal aperture 16 (FIG. 3) extending longitudinally therethrough. An opening device 18 is responsive to a control signal supplied by control panel 20 for selectively opening aperture 16 for passing the fluid therethrough. A closing device 22 is responsive to another control signal supplied by control panel 20 for selective closing aperture 16 for terminating further fluid flow therethrough.

Referring now to FIGS. 1 and 2, support frame 12 of fluid sampling device 10 includes a first flange 24 and a second flange 26 spaced from and connected to flange 24 so that the flanges are axially aligned. Flange 24 is preferably, circular, however, any shape may be used depending on the specific design criteria. Flange 24 is formed of a central circular support 28 having an outer diameter substantially smaller than the outer diameter of flange 24 and having an inner cavity 30. An outer surface 32 of support 28 includes a beveled surface 34 of the outer periphery. Flange 26 further includes an outwardly extending flange 36 having an outer diameter less than the diameter of flange 24. Flange 26 additionally includes a support disc 38 having an outer diameter substantially greater than the diameter of flange 24 and a central opening having a diameter substantially greater than the diameter of flange 24 and less than the diameter of outwardly extending flange 36. Support disc 38 is connected to flange 36, in a conventional manner such as by bolting or welding (not shown) so that surface 40 forms an acute angle to outwardly extending flange 36. Although support disc 38 is preferably a separate part from outwardly extending flange 36 it should be understood that it may be formed integrally with flange 36, if desired.

Second flange 26 is spatially secured to first flange 24 by spacer sleeves 42 and bolts 44 which extend between flange 36 and flange 24. Bolts 44 extend through outwardly extending flange 36, sleeves 42 and screw into flange 24. Sleeves 42 separate flanges 24 and 26 while bolts 44 hold them rigidly together.

The plurality of fluid inlet devices 14 are shown as extending through flange 24 and circular support 28 of flange 26. As shown in FIG. 1 six fluid inlet devices 14 are spaced in a circular configuration around flange 24 and a seventh is centered in flange 24. It should be understood that the number and configuration of fluid inlet devices 14 shown is for illustrative purposes only. It is preferred that the six fluid inlet devices 14 be inclined at an angle so that the lower portion 46 of each fluid inlet device 14 extends through circular support 28 and into inner cavity 30.

As more clearly shown in FIG. 3 each fluid inlet device 14 includes a circular holder 48 having a circular disc 50 with an opening 52 extending therethrough. A first cylindrical shoulder portion 54 is secured to disc 50, such by welding, so that the shoulder portion 54 is in axial alignment with opening 52 in disc 50. A second cylindrical shoulder portion 58 is secured to the opposite side of disc 50, such as by welding, to position an opening 60 in axial alignment with opening 52 in disc 50 and opening 56 in shoulder portion 54. A deformable tube 62 is inserted within opening 60 of shoulder portion 58 and secured therein, such as by welding. Deformable tube 62 includes an opening 64 extending therethrough and in axial alignment with opening 60 of shoulder portion 58. End 66 of tube 62 extends through support 28 of flange 26 and into inner cavity 30 and is secured to support 28, such as by welding. A fluid receiving insert 66 having a capillary opening 68 extending therethrough is inserted within opening 56 of shoulder portion 54 and secured thereto in any well known and conventional manner.

It is important when bonding metal to glass, especially in inlet leaks, that a proper seal between the glass and metal be made and that the integrity of the seal be maintained over a wide temperature range and under other hazardous environmental conditions. It is therefore necessary that a metal and glass be used that have substantially the same coefficient of expansion characteristics. KOVAR metal and certain glass compositions have been found to possess substantially the same coefficient of expansion and not to degrade under harsh environmental conditions. It is preferable that circular holder 48 be made from the metal KOVAR being composed of substantially 54% Fe, 29% Ni, and 17% Co and that fluid receiving insert 66 be composed of glass having a composition range of 65 - 70% SiO₂, 3 - 7% Al₂O₃, 17 - 18% B₂O₃, 1% Li₂O, 1% - 2% Na₂O, and 2 - 8% K₂O. Although a glass insert made in the composition range above is acceptable the preferred composition of the glass insert is 70% SiO₂, 3% Al₂O₃, 17% B₂O₃, 1% Li₂O, 1% Na₂O and 8% K₂O. Further, it is preferred that deformable tube 62 be made from conventional stainless steel since it may be subjected to harsh environmental conditions. Although the above compositions are preferred it should be understood, that other materials may be used as long as the integrity of the seal is maintained over a wide temperature range and the material does not degrade under harsh environmental conditions.

Fluid inlet devices 14 further include a metal flange or ring 70 having an outer diameter substantially the same as the outer diameter of circular disc 50 and secured to surface 72 of disc 50, such as by welding. A sleeve 74 surrounds glass insert 66, holder 48, and a portion of tube 62, and has an inner diameter substantially greater than the outer diameter of disc 50 thereby forming an annular space 76. Sleeve 74 is affixed to first flange 24 of support frame 12, such as by welding, and includes an inwardly extending flange 78 secured to end 80 such as by welding. Flange 78 includes an inner diameter substantially greater than the outer diameter of tube 62 forming a space 82 therewithin. Although flange 78 is shown as a separate ring, it may also be formed integrally with sleeve 74. Sleeve 74 further includes a recessed opening 81 in end 83. A metal cylindrical bellows 84 surrounds tube 62 within space 76 and extends between flange 78 and ring 70. Bellows 84 is secured to flange 78 and ring 70 as by welding and provides a rigid base for supporting tube 62, holder 48, and glass insert 66 within sleeve 74.

Fluid inlet devices 14 further include an insulating coating 86 surrounding the portion of tube 62 which is surrounded by sleeve 74. Insulating coating 86 may extend beyond flange 78, as shown in FIG. 3. Insulating coating 86 may be a conventional type hav-
below the orifice ring. That glass insert 66 extends within opening 133 and is wire 116 extending through end 114 to control panel 20. Vice 92, preferably includes a V-shaped notch 144 that other arrangements can also be used. For example, a shearing device 92 fits within recess 132 of end 128 on arrangement as shown, it should be understood, however, and sleeve 74 of fluid inlet device 14. One end 134 of actuator device 90 includes a dual piston and rod arrangement between contact plate 126 of actuator device 90 and fluid inlet device 14. The center fluid inlet device 14 is not formed at an angle to end 130 to be in alignment with end 128 is not formed at an angle to cylinder 94 and surface 98 of flange 24. Colar 125 is positioned so that when actuator device 90 is activated rod 104 will slide within opening 120 and flex diaphragm 124 but collar 125 will contact surface 98 and stop further movement of rod 104 before rod 104 punctures diaphragm 124. Further, a flexible spring 127 surrounds rod 104 between surface 98 and collar 125 to maintain tension on collar 125 to keep it in contact with end 96 prior to activation of actuator device 90. Thus, rod 104 will not slide in and out of cylinder 94 prior to activation of actuator device 90.

Actuator device 90 further includes a contact plate 126 having a first end 128 connected to shearing device 92 and a second end 130 spaced from and in alignment with opening 120. End 128 includes a recess 132 wherein one end 134 of shearing device 92 is seated. End 130 has a threaded opening 136 extending there through and in axial alignment with opening 120 in flange 24. For fluid inlet device 14 which are placed in a circle around surface 122 of flange 24, end 128 is formed at an angle to end 130 to be in alignment with shearing device 92 and opening 120, respectively, since these fluid inlet tubes 14 are formed at an angle to cylinder 94. The center fluid inlet device 14 is not formed at an angle to cylinder 94 and thus end 128 is not formed at an angle to end 130. Contact plate 126 further includes an adjusting screw 138 threated into opening 136 and extends into opening 120 in flange 24 and is adjusted until it touches diaphragm 124. A guide ring 140 is secured such as by a press fit, within opening 120 above diaphragm 124 and is in sliding contact with adjusting screw 138. Guide ring 140 guides adjusting screw 138 within the enlarged portion of opening 120.

Shearing device 92 is preferably tubular having a central opening 133 extending therethrough and is connected between contact plate 126 of actuator device 90 and sleeve 74 of fluid inlet device 14. One end 134 of shearing device 92 fits within recess 132 of end 128 on contact plate 126 and is secured and sealed therein as by brazing. The other end 142 of shearing device 92 fits within recessed opening 81 of end 83 on sleeve 74 so that glass insert 66 extends within opening 133 and is secured and sealed therein as by brazing. Shearing device 92, preferably includes a V-shaped notch 144 su-
Referring to FIG. 1, control panel 20 is any well known and conventional electronic control and power supply system 210 such as, for example, a D.C. power supply. Control panel 20 includes three selector switches 212, 214, and 216. When selector switch 212 is switched to position 1, it completes an electrical circuit between power supply 210 and one heater 88 associated with the first fluid inlet device 14 to be activated for use. When selector switch 214 is switched to position 1, it completes an electrical circuit between power supply 210 and one actuator device 148 of the one closing device 22 associated with the first fluid inlet device 14 to be closed upon completion of the fluid sample taking. Selector switches 212 and 214 are switched sequentially from position 1 to 7 which selectively activates in sequence heaters 88 and actuator devices 90 for selectively opening at different times each of the seven fluid inlet devices 14. Selector switch 216 is switched sequentially from positions 1 to 6 which selectively activates in sequence the first six actuator devices 148 for selectively closing each of the first six fluid inlet devices 14 before the next fluid inlet device 14 is opened. The last fluid inlet device 14 need not be closed since no further samples can be taken by fluid sampling device 10. Selector switches 212, 214, and 216 may be switched by conventional dial switches as shown in FIG. 1 or may be activated remotely by electromagnet signals such as radio waves or by light signals such as emitted by LASERS. The only requirement being that it having switching capabilities so that each fluid inlet device 14, opening device 18, and closing device 22 can be individually and selectively activated.

In operation, fluid sampling device 10 is connected in a conventional manner to a fluid analyzer such as, for example, a gas mass spectrometer 218 so that inner cavity 30 of flange 26 is opened to gas analyzing components of the mass spectrometer. It is preferred that a conventional gas cleaning device (not shown) be incorporated with mass spectrometer 218 to purge and remove the excess sampled gas therefrom prior to introducing a new gas sample. It is also preferred that fluid sampling device 10 and mass spectrometer 218 be enclosed within a gas tight structure (not shown) whereby only surface 122 of flange 24 will be exposed to the various gases to be sampled. This will protect the various components of fluid sampling device 10 from attack by harmful environmental conditions.

When a first sample is to be taken, switch 212 on control panel 20 is turned to position 1 which causes an electrical current to flow from power supply 210 only through the electrical heating wire 88 in the first fluid inlet device 14 to be used to take a gas sample. The electrical current heats heating wire 88 which, in turn, heats insulating coating 86 and metal tube 62. The heat drives off any contaminated gases that may have adhered to opening 64 in metal tube 62. The driven off gases are absorbed by the gas cleaning device in the conventional manner.

After metal tube 62 has been purged, switch 214 on control panel 20 is turned to position 1 which sends an electrical current from power supply 210 only through wire 116 associated with actuator 90 of the first fluid inlet device 14 to cause wire 116 to ignite expander material 112 causing it to release a gas. As the gas expands it pushes on piston 97 causing it and rod 99 to slide upward in cylinder 94 until piston 97 contacts support ring 108. As rod 99 slides upward it contacts piston 100 causing it and rod 104 to slide upward in cylinder 94. Rod 104 slides upward in opening 200 of the one closing device 22 associated with the first fluid inlet device 14 to be closed upon completion of the fluid sample taking. Selector switches 212 and 214 are switched sequentially from position 1 to 7 which selectively activates in sequence heaters 88 and actuator devices 90 for selectively opening at different times each of the seven fluid inlet devices 14. Selector switch 216 is switched sequentially from positions 1 to 6 which selectively activates in sequence the first six actuator devices 148 for selectively closing each of the first six fluid inlet devices 14 before the next fluid inlet device 14 is opened. The last fluid inlet device 14 need not be closed since no further samples can be taken by fluid sampling device 10. Selector switches 212, 214, and 216 may be switched by conventional dial switches as shown in FIG. 1 or may be activated remotely by electromagnet signals such as radio waves or by light signals such as emitted by LASERS. The only requirement being that it having switching capabilities so that each fluid inlet device 14, opening device 18, and closing device 22 can be individually and selectively activated.

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When a first sample is to be taken, switch 212 on control panel 20 is turned to position 1 which causes an electrical current to flow from power supply 210 only through the electrical heating wire 88 in the first fluid inlet device 14 to be used to take a gas sample. The electrical current heats heating wire 88 which, in turn, heats insulating coating 86 and metal tube 62. The heat drives off any contaminated gases that may have adhered to opening 64 in metal tube 62. The driven off gases are absorbed by the gas cleaning device in the conventional manner.

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viders a device with a plurality of fluid sampling inlet devices that are selectively opened and closed to surrounding fluids thereby permitting sampling of numerous fluids by a single fluid analyzer.

Accordingly, the invention having been described in its best embodiment and mode of operation, that which is desired to be claimed by Letters Patent is:

1. A fluid sampling device for selectively sampling multiple fluids comprising:
   a support frame;
   a plurality of fluid inlet means extending through said support frame, each of said inlet means having an aperture extending therethrough;
   means responsive to a control signal for selectively opening said aperture for passing said fluid therethrough; and
   means responsive to another control signal for selectively closing said aperture for terminating further fluid flow therethrough.

2. The fluid sampling device of claim 1 wherein said support frame includes:
   a first flange having a plurality of openings extending therethrough for receiving a portion of each of said fluid inlet means; and
   a second flange spaced from and axially aligned with said first flange and having a plurality of openings extending therethrough for receiving another portion of each of said fluid inlet means.

3. The fluid sampling device of claim 1 wherein each of said fluid inlet means includes:
   tube means having a portion of said aperture longitudinally extending therethrough;
   fluid receiving means having another portion of said aperture longitudinally extending therethrough;
   means for maintaining a substantially axial alignment of another portion of said aperture in said fluid receiving means; and
   sleeve means surrounding said fluid receiving means, holding means and a portion of said tube means and forming an annular space therebetween.

4. The fluid sampling device of claim 3 wherein each of said fluid inlet means further includes:
   an insulating coating surrounding said portion of said tube means within said sleeve means; and
   an electrical heater surrounding a portion of said insulator coating and responsive to an additional control signal for removing contaminated fluids from said tube means.

5. The fluid sampling device of claim 4 wherein:
   said holder means includes an outwardly and circumferentially extending flange within said annular space; and
   said sleeve means includes an inwardly and circumferentially extending flange axially spaced from said flange on said holder means.

6. The fluid sampling device of claim 5 wherein each of said inlet means further includes a bellows within said annular space and surrounding said tube means, said bellows being connected between said outwardly extending flange and said inwardly extending flange for providing thermo isolation of said tube means to reduce heat loss from said electrical heater.

7. The fluid sampling device of claim 3 wherein said fluid receiving means and said holder means have substantially the same coefficient of expansion.

8. The fluid sampling device of claim 7 wherein said fluid receiving means is formed from a material having
a composition in the range of 65-70% SiO$_2$, 3-18% B$_2$O$_3$, 1% Li$_2$O, 1-2% Na$_2$O and 2-8% K$_2$O.

9. The fluid sampling device of claim 7 wherein said fluid receiving means is formed from a material having a composition substantially of 70% S$_2$O$_3$, 3% Al$_2$O$_3$, 17% B$_2$O$_3$, 1% Li$_2$O, 1% Na$_2$O and 8% K$_2$O.

10. The fluid sampling device of claim 7 wherein said holder means is formed from a material having a composition substantially of 54% Fe, 29% Ni, and 17% Co.

11. The fluid sampling device of claim 1 wherein each of said opening means includes:

   - actuator means adjacent to each of said fluid inlet means and responsive to said control signal; and
   - shearing means in sealing engagement between said actuator means and said fluid inlet means, said shearing means being separated upon activation of said actuator means by said control signal for exposing said aperture to said fluid.

12. The fluid sampling device of claim 11 wherein said actuator means includes:

   - a cylinder;
   - a first movable piston within said cylinder;
   - a first rod connected to said piston;
   - a second movable piston within said cylinder axially aligned with and spaced from said first rod;
   - a second rod connected to said second piston and having a portion thereof within said cylinder and another portion thereof extending from a first end of said cylinder;
   - an expander within said cylinder between said first piston and a second end of said cylinder and being responsive to said control signal; and
   - a contact plate having one end in sealing engagement with said shearing means and another end spaced from and in alignment with said second rod.

13. The fluid sampling device of claim 12 wherein said fluid inlet means and said shearing means are formed at an angle to each of said actuator means.

14. The fluid sampling device of claim 11 wherein said shearing means is tubular.

15. The fluid sampling device of claim 14 wherein said shearing means includes an intermediately located weakened portion.

16. The fluid sampling device of claim 15 wherein said shearing means is formed of ceramic.

17. The fluid sampling device of claim 1 wherein each of said closing means includes:

   - actuator means adjacent to each of said fluid inlet means and responsive to said another control signal; and
   - movable clamping means responsive to said actuator means and having a portion thereof overlapping a portion of said fluid inlet means for deforming said portion of said fluid inlet means and closing said aperture upon activation by said actuator means.

18. The fluid sampling device of claim 17 wherein said actuator means includes:

   - a bellows; and
   - an expander within said bellows which is responsive to said another control signal for expanding said bellows upon activation by said another control signal.

19. The fluid sampling device of claim 17 wherein said portion of said fluid inlet means is a deformable tube.

20. The fluid sampling device of claim 18 wherein said movable clamping means includes:

   - a first arm having a first end overlapping said deformable tube;
   - a second arm pivotably connected to said first arm and having a first end overlapping said deformable tube oppositely positioned from said first end of said first arm;
   - a first linking bar pivotably connected at one end to a second end of said second arm;
   - a second linking bar pivotably connected at one end to a second end of said second arm; and
   - a support platform abutting said actuator means and pivotably connected to the other ends of said first and second linking bars.

21. The fluid sampling device of claim 20 wherein said first end of said first arm includes a substantially flat surface adjacent to said deformable tube and said first end of said second arm includes a land adjacent to said deformable tube and having the longitudinal axis of said land transverse to the longitudinal axis of said deformable tube.