

July 21, 1953

J. KOHL ET AL

2,645,940

SNAP SAMPLER

Filed May 14, 1952

2 Sheets-Sheet 1

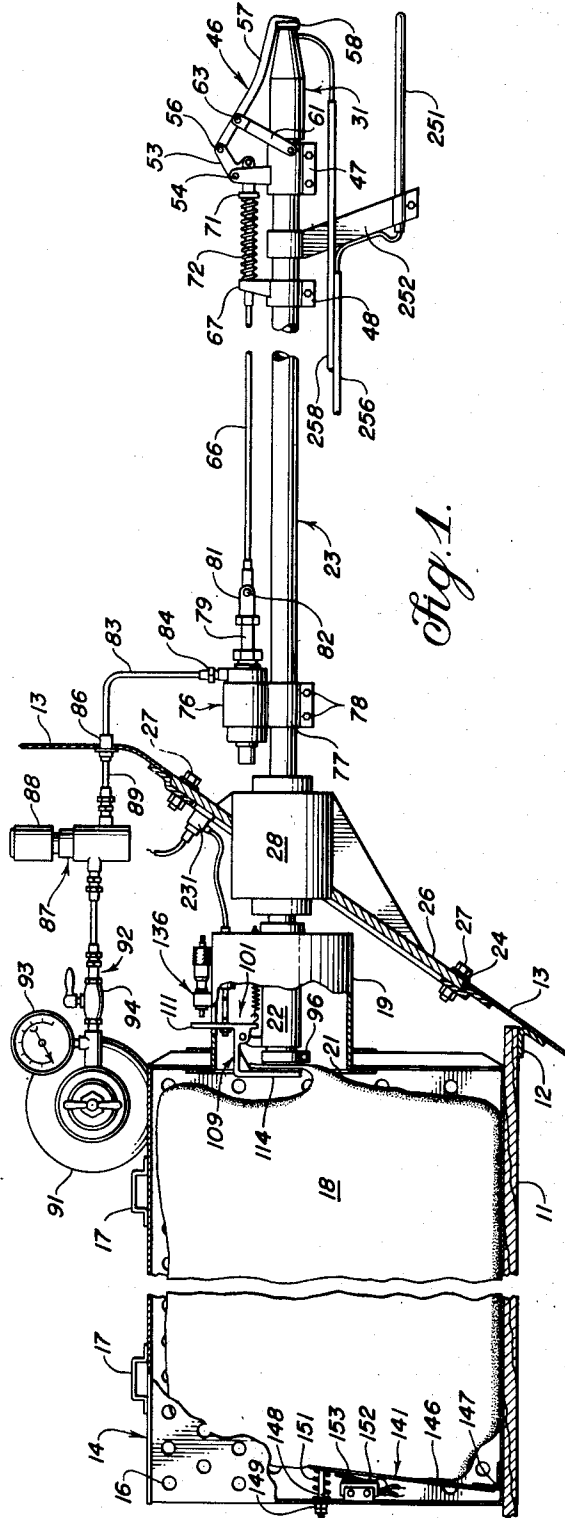


Fig. 1.

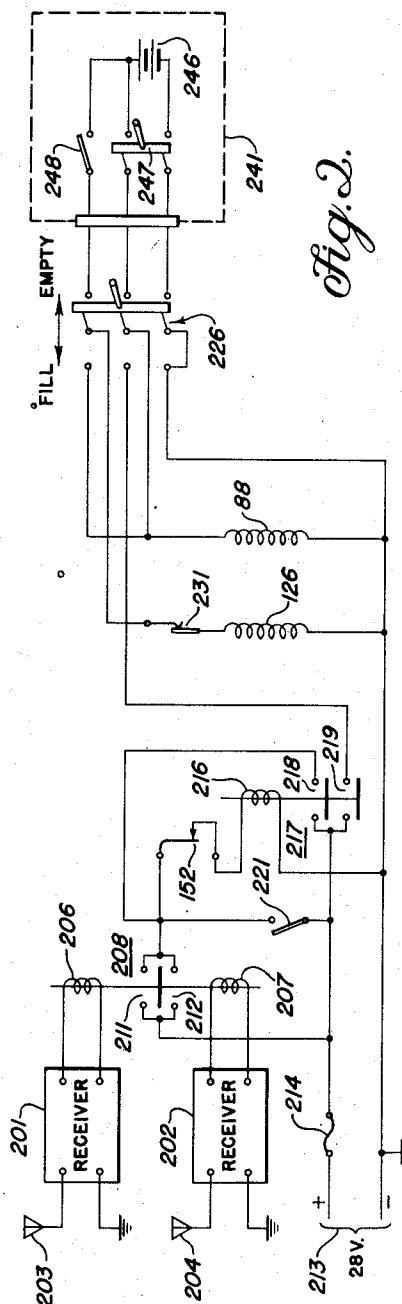


Fig. 2.

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2 Sheets-Sheet 2

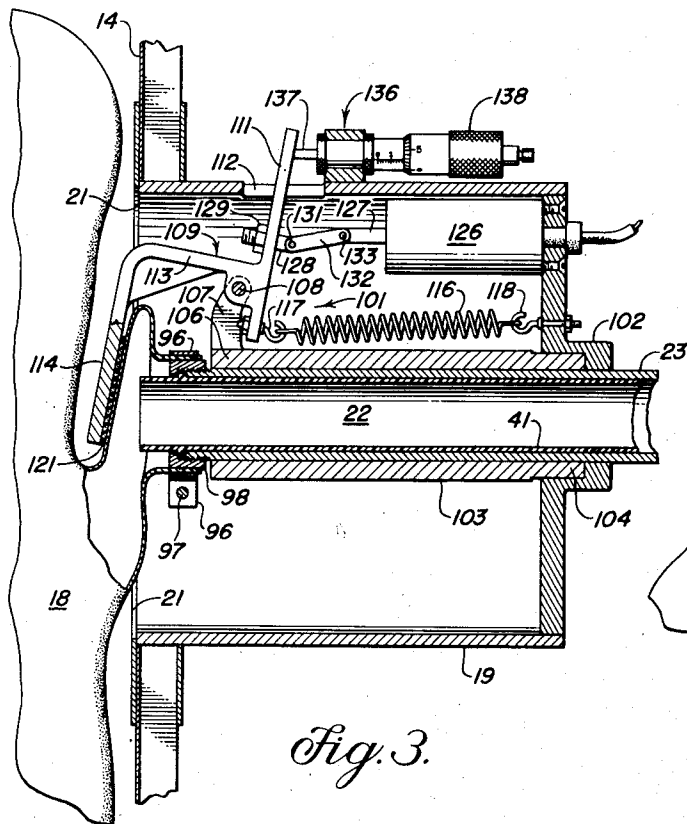


Fig. 3.

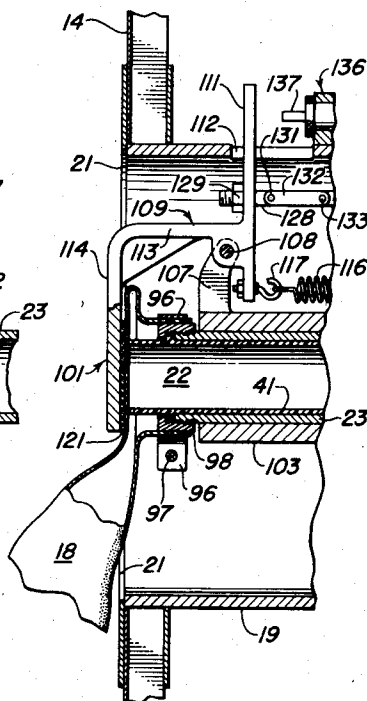


Fig. 4.

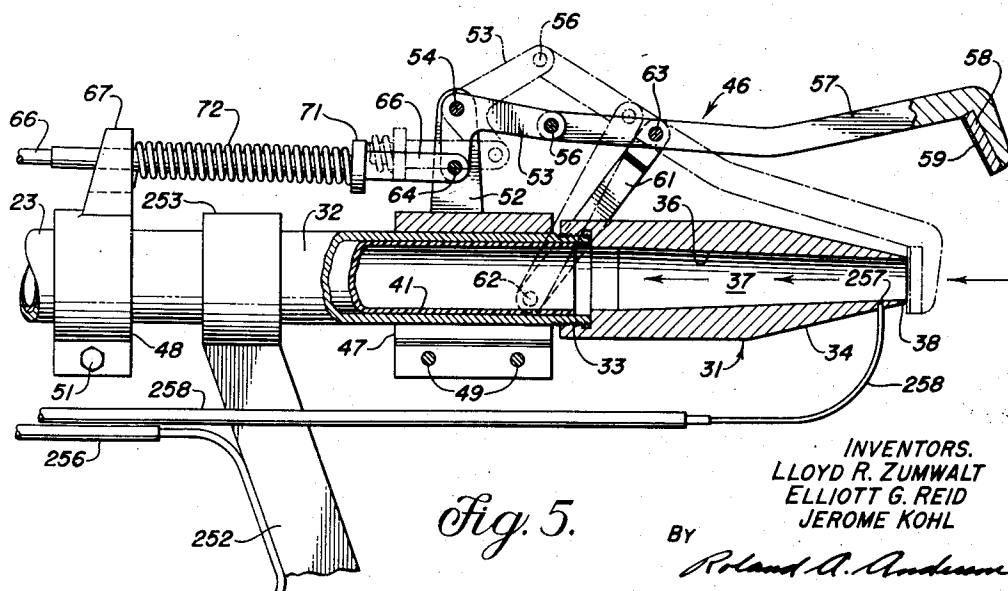


Fig. 5.

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SNAP SAMPLER

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Application May 14, 1952, Serial No. 287,662

8 Claims. (Cl. 73—170)

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This invention relates to an airborne device for sampling the gaseous and solid content of a radioactive cloud in such a way that a representative sample of the cloud is collected and retained in a form suitable for analysis.

It is well known that the collection of a representative sample of any aerosol is difficult and extremely susceptible to mechanical error. In general, sampling is undertaken with the intention of obtaining two types of information, the concentration of the aerosol, and the particle size distribution of the dispersed particles. This latter type of collection is rendered particularly complicated if the particles consist of several materials having different shapes and densities as well as a wide range of size distribution.

The source of error probably lies in the fact that as the continuous phase of sampled aerosol, i. e., either air or some other gas, is drawn into the sampling device, a plurality of velocity and pressure contours exist at the entry of the sampler. While it is not believed necessary to discuss at any length the theoretical aspects of this type of error, it will be readily seen that, because of the differences in shape and inertia of the several sizes of particles, some sizes and shapes will be drawn into the sampler more readily than others.

It will therefore be apparent that it is necessary to impart motion to either the aerosol system being sampled or the system doing the sampling, in order to bring an aliquot of that system into the sample. In the case of sampling a stationary aerosol with a moving probe, it is desirable that the sampler actually "swallow" and retain a volume of the entire system, which may subsequently be analyzed.

It has been established by theory and experiment that if the sample of gas particulate aerosol is drawn into the sampler at a velocity or rate appreciably different from the speed of the sampler entry through the system, an unrepresentative sample will be obtained, wherein both the size distribution and concentration of the aerosol will not be those of the original system. Moreover, not only must the rate of sampling be equivalent to the rate at which the unsampled system passes the sampler, but the sampler entry must be designed so that it will not favor the collection of any special component of the entire system.

To overcome the foregoing difficulties there is provided a sampler comprising a sampling nozzle, a gas tight extendible envelope for containing the sample, a tube extending from the nozzle and opening into the envelope, remotely-controlled means on the nozzle and tube for limiting the passage of air from the nozzle into the envelope,

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and automatic means controlled by the extension of the envelope operating the remotely-controlled means.

Since it is intended to mount such sampler on a drone aircraft which will pass through an "atomic" cloud, the necessity for remote-controlled and automatic operation will be immediately apparent. The sampler described above is intended to be mounted in the nose of a drone aircraft, with the nozzle and tube extending forward from the aircraft into the undisturbed air ahead of the disturbed boundary layer around the fuselage. Prior to collection, the gas-tight envelope is collapsed, within a casing in the nose of the aircraft fuselage. When the drone enters the "atomic" cloud, which consists of radioactive gases and solids, as well as other burst debris, a radio signal activates a remotely-controlled valve which opens the nozzle. The cloud components are then "swallowed" by the sampler, passing through the nozzle and tube into the collapsed envelope. The envelope then expands as it fills to a predetermined volume, and when this volume is reached, the moving envelope surface trips a switch which in turn closes the valve and nozzle. In this way the collected sample is sealed within the sampler assembly and may be removed therefrom when the drone returns to its base.

It is therefore an object of the present invention to provide a new and improved sampling device.

Another object of the present invention is to provide a sampling device which collects and retains a known volume of a system at a controlled or predetermined rate for a controlled or predetermined time.

Still another object of the invention is to provide a sampling device for collecting a sample from an aerosol system at a velocity substantially equal to the velocity at which the device moves through the system.

A further object of the invention is to provide a sampling device adapted for remote control operation.

A still further object of the invention is to provide a sampling device having automatic or remote control shut-off means, the action of which is accomplished in a manner to effectively seal the sampler and preclude loss or pollution of the collected sample.

Still another object of the invention is to provide a sampling device wherein the collected sample may be readily removed from the device without loss or pollution.

Other objects and advantages of the invention will be apparent in the following description and claims considered together with the accompanying drawing in which:

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Figure 1 is a side elevation, partly in section, of the invention;

Figure 2 is a schematic wiring diagram of the control circuit associated with the invention as shown in Fig. 1;

Figure 3 is a detailed illustration, partly in section, of the envelope inlet, with the closure therefor in open position, of the invention of Fig. 1;

Figure 4 is a detailed illustration of the envelope inlet of Fig. 3 with the closure therefor in closed position; and

Figure 5 is a detailed illustration, partly in section, of the nozzle of Fig. 1 together with the closure device.

Referring to the drawing in detail, Fig. 1 in particular, there is provided a deck 11 of plywood or other suitable supporting material. Such deck 11 is mounted upon brackets 12 (only one of which is shown) within an aircraft fuselage 13, which for convenience is only shown fragmentarily. Suitably mounted on the deck 11 is a container 14, the sides of which have a plurality of apertures 16 therethrough. To provide access to the interior of such container 14 the top element thereof is suitably hinged (not shown) at one side and provided with handles 17. Preferably the container 14 is fabricated of a lightweight material, such as aluminum. A flexible bag 18 of an inert resistant material is disposed within the container 14 to receive a sample of an aerosol system.

A housing 19 is mounted about an aperture 21 in the end of the container 14 extending toward the forward portion of the aircraft fuselage 13 to support the inboard end 22 of an elongated tube 23. It will be noted that, in Fig. 1, the tube 23 extends through an opening 24 in the forward portion of the aircraft fuselage 13 which is provided with a closure member 26 suitably mounted, as by a plurality of bolts 27. To brace the tube 23 as it passes through such closure member 26, there is provided a metal sleeve 28 suitably mounted between the tube and the closure member.

A nozzle 31 engages the outboard end 32 of the tube 23 (see Fig. 5) as by threads 33 to provide an intake for the device such that the velocity of gas flowing therein is substantially equal to that of the remainder of the system beyond the sampler and aircraft. To accomplish the latter, the nozzle 31 has a tapering outer surface 34 expanding back from the direction of flight and a sloping inner surface 36 expanding in the same direction. Thus, there is provided a smoothly expanding channel 37 for the entering aerosol system while the entire nozzle advances through the system with a substantially sharp forward edge 38 with the result that the retarding effect of friction and viscosity around the tube 23 and nozzle 31 assembly is overcome by creating a high back pressure in the channel 37.

A removable cylindrical liner 41 of an inert material is provided for insertion into the tube 23 to extend the entire length thereof. Such provision is necessary, since the aerosol passing through the tube 23 may leave contaminants which would pollute subsequent samples and the replacement of the tube 23 and associated elements would be a lengthy and expensive project.

To open and close the nozzle 31 a valve assembly 46 is mounted on the outboard end 32 of the tube 23. Two sleeve clamps 47 and 48 disposed in spaced-apart relation about the tube 23 at the outboard end 32 thereof are suitably mounted in

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position, as by bolts 49 and 51, respectively, to support such valve assembly 46. The foremost sleeve clamp 47 is provided with an extended portion 52 to which a bell crank 53 is pivotally and centrally mounted, as by a pin 54, for movement in a plane parallel to the axis of the tube 23. One end of such bell crank 53 is pivotally connected, as by a pin 56, to a valve arm 57, which at the foremost end thereof is provided with a head 58. To insure a tight seal between the forward edge 38 of the nozzle 31 and the head 58 a pad 59 of resilient material, such as rubber, is suitably mounted on the seating surface of the head. The movement of the valve arm 57 is restricted by a yoke 61 which is pivotally mounted at one end by a pin 62 extending therethrough to engage the foremost sleeve clamp 47 and is pivotally attached at the other end to the valve arm 57 by a pin 63. The other end of the bell crank 53 is pivotally attached by a pin 64 to one end of a connector rod 66 which is extended back toward the fuselage 13 through a support 67 on the other sleeve clamp 48.

With the foregoing elements of the valve assembly in place, it will be readily apparent that the nozzle may be opened by moving the connector rod 66 toward the fuselage 13 of the aircraft and closed by moving the connector rod in the direction of flight to force the valve arm 57 to seat the head 58 and pad 59 over the leading edge 38 of the nozzle 31.

To maintain a normally seated position for the head 58 and pad 59 the connector rod 66 is provided with a flange 71 and a spring 72, the latter being mounted in compression on the rod between the flange and the support 67. Thus the force of the spring 72 serves to maintain the connector rod 66 in the forward position which, as set forth above, results in the head 58 being seated firmly over the leading edge 38 of the nozzle 31.

An actuating pneumatic cylinder 76 is mounted on a clamp 77 fixed on the tube 23, as by bolts 78, adjacent to and forward of the sleeve 28 through the closure member 26. A shaft 79 of the cylinder 76 is provided with a yoke 81 which is pivotally connected by a pin 82 to the connector rod 66. An air tube 83 is connected from a fitting 84 of the cylinder 76 to a fitting 86 suitably mounted through the fuselage 13. The inboard side of such latter fitting 86 is connected to a valve 87, having a solenoid 88 for control thereof, by another section of tubing 89. Air pressure is applied to such pneumatic system by a conventional tank 91 of compressed air through an air line 92 having a pressure gauge 93 and manual valve 94.

It will be readily apparent from the foregoing that, with the pneumatic system described in operation, actuation of the solenoid 88 will apply air pressure to the cylinder 76 thereby forcing the shaft 79 back toward the fuselage against the tension of the spring 72 to force the valve head 58 away from the nozzle 31 and allow gas to enter thereinto. De-energization of the solenoid 88 closes off the pneumatic system so that the air in the cylinder 76 is exhausted and the spring 72 forces the shaft 79 and rod 66 in such direction as to return the valve head 58 to a closed position over the opening of the nozzle 31.

To collect gases which enter the nozzle 31 and flow into the tube 23, the material adjacent the opening of the bag 18 is secured to the tube, as by a ring clamp 96 having a take-up bolt 97. To insure a suitable airtight connection, a bush-

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ing 98 threadably engages the inboard end of the tube 23 and the ring clamp 96 compresses the material adjacent the opening of the bag 18 therebetween, as shown in Figs. 3 and 4.

A second valve assembly 101 is provided within the housing 19 and is associated with the inboard end of the tube 23 to limit the flow of gases from the tube into the bag 18 and to confine gases therein when a satisfactory sample has been obtained. As stated previously the housing 19 serves to support the inboard end of the tube 23 and at the position of support is provided with an outwardly extended portion 102 having a diameter greater than the diameter of the tube. A sleeve support 103, having an inside diameter substantially equal to the outside diameter of the tube 23 and an outside diameter substantially equal to the inside diameter of the extended portion 102 of the housing 19, is disposed about the tube within the housing with one end 104 thereof abutting the extended portion. The innermost end 106 of the sleeve support 103 is provided with a bracket 107 extended therefrom. Pivotaly mounted, as by a pin 108, on the bracket 107 is a flapper valve 109 having a generally vertical lever portion 111 which extends through a slot 112 in the housing 19, an arm portion 113 extending normally from the lever portion near the base thereof, and a flap portion 114 extending down from the arm portion. Thus with the pin 108 mounted substantially at the juncture of the lever and arm portions, 111 and 113, respectively, of the flapper valve assembly 101, the flap portion 114 may be rotated to an open and closed position with respect to the extended inboard end of the tube liner 41. A tension spring 116, suitably disposed between hooks 117 and 118 which are mounted one at the lower end of the lever portion 111 of the flapper valve and the other at the opposing end wall of the housing 19, is provided to maintain a normally closed position of the flap portion 114. It will be noted that because of the clamped seal between the liner 41 of the tube 23 and the material of the bag 18 a layer of such bag material lies between the flap 114 and the liner when the valve assembly 101 is in the closed position. Thus to insure a tight, though abrasionless, seal a pad 121, of sponge rubber or the like, is suitably mounted on the flap 114 at its contact side.

To actuate the valve assembly 101 there is provided a solenoid 126, having a plunger 127, suitably mounted within the housing 19 substantially transverse to the lever portion 111 of the assembly. A connector arm 128 is mounted on the upper part of the lever 111, as by a nut 129, with one end thereof pivotally connected by a pin 131 to a link 132 which is, in turn, pivotally connected by a pin 133 to the plunger 127. To limit the movement of the lever 111 of the valve assembly 101, there is provided a stop mechanism 136 mounted upon the housing 19 in line with the slot 112 and having a central shaft 137 which may be adjusted in accordance with a conventional micrometer element 138. The purpose of the latter will be more fully explained hereinafter.

In operation, it will be noted that actuation of the solenoid 126 is such as to pull on the plunger 127 which rocks the valve assembly 101 about the pin 108 to force the flap 114 away from the liner 41 and allows gas to pass therefrom into the bag 18. When the solenoid 126 is de-energized the force of the spring 116 acts to close the flap 114 against the opening of the liner 41.

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Thus there has been provided a valve assembly 46 for opening the normally closed end of the nozzle 31 and a valve assembly 101 for opening the normally closed inboard end of the tube 23. To close such valves 46 and 101 there is also provided a triggering mechanism 141 which is operable, at such time as a representative sample has been obtained, to close the valves and retain the collected sample. A pedal plate 146 is disposed within the container 14 at the end thereof opposing the intake end. Such pedal 146 is attached to the bottom wall of the container 14 (see Fig. 1) by a hinge 147 and is extended upward and slightly beyond a point where a limiting bolt 148 is extended transversely therethrough to engage a nut 149 at the outside of the rear wall of the container. A compression spring 151, disposed about the bolt 148 between the wall of the container 14 and the pedal 146 maintains a normal spring-loaded position for the pedal. A normally-closed single position microswitch 152, suitably mounted on the rear wall of the container 14, is disposed with the finger 153 thereof adjacent the pedal 146. From the foregoing it will be readily apparent that as the bag 18 expands to fill the container 14, the upper portion of the pedal 146 will be forced toward the microswitch 152 and eventually depress the finger 153 thereof to open the microswitch. With the solenoids 88 and 126 suitably connected in a circuit with the microswitch 152, as described hereinafter, the solenoids are de-energized to close the valve assemblies 46 and 101.

A suitable actuating or control circuit, as shown in Fig. 2, is provided for the device described in the foregoing. A pair of conventional radio receivers 201 and 202, preferably tuned to different bands of frequency, are provided with the inputs thereof connected to suitable antennae 203 and 204. While a single receiver is adequate for the purposes of the invention, an additional receiver is utilized to insure proper operation from a remote side when the device is mounted in a drone aircraft. The output of such receivers 201 and 202 is respectively connected across two solenoids 206 and 207 of a relay 208, in such a manner that an output signal of either receiver will energize the respective solenoid to close a normally open contact 211 or 212, respectively. Such contacts 211 and 212 are connected in parallel with one side thereof connected to the positive terminal of a conventional power supply 213 through a fuse 214. The other side of the contacts 211 and 212 is connected to the normally closed microswitch 152 which, in turn, is connected to a solenoid 216 of a relay 217. The other side of such solenoid 216 is connected to the grounded negative terminal of the power supply 213. Thus when either of the contacts 211, 212 are closed, a completed circuit is formed to energize the solenoid 216 of the relay 217 which thereby closes two normally open contacts 218 and 219. Such contacts 218 and 219 are connected together at one side and further connected to the positive terminal of the power supply 213. The other side of the contact 218 is connected to the junction between the contacts 211 and 212 of the relay 208 and the microswitch 152. The latter connection serves to maintain the solenoid 216 of the relay 217 energized after the termination of the signal output of the receiver 201 or 202 and only actuation of the microswitch 152 will break the circuit and de-energize the solenoid. A single pole single throw switch 221 connected in parallel with such latter connec-

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tion serves a similar purpose when manual operation is desired. The other side of the contact 219 is connected to one contact of the central pole of a triple pole double throw switch 226. The center contact of the central pole of such switch 226 is connected to one contact of an outside pole and further to one side of nozzle valve control solenoid 88, the other side of which is connected to the grounded negative terminal of the power supply 213. The center contact of the above-referenced outer pole is connected through a quick disconnect plug 231, mounted rigidly upon the closure member 26, to one side of the flapper valve control solenoid 126, the other side of which is connected to the grounded negative terminal of the power supply 213. One contact of the other outer pole of the switch 226 is connected to the center contact thereof and further to the grounded negative terminal of the power supply 213. The foregoing connections of the switch 226 should be made so that with the switch closed in one position, to be referenced as the "fill position," both of the solenoids 88 and 126 are energized to open the nozzle valve 46 and the flapper valve 109, respectively, in response to a signal to one of the receivers 201 or 202.

The remaining contacts, to be referenced as the "empty" position, of the switch 226, all at one end thereof, may then be connected to an auxiliary power supply 241 for use on the ground when the power of the plane is not available for use as the power supply 213. Such auxiliary power supply may comprise a series of batteries 246 connected to two contacts of a double pole single throw switch 247 the other two contacts of which are connected to contacts of the switch 226, the nozzle valve control solenoid 88 may be energized thereby. A single pole single throw switch 248 is connected from the batteries 246 to a contact of the switch 226 so that the flapper valve control solenoid 126 may be suitably energized.

As stated previously, it is necessary that the sample of gas particulate aerosol be drawn into the sampler at a rate substantially the same as the speed of the sampler through the system. To accomplish such result there is provided a static tube 251 suitably mounted on a bracket 252 suspended from a clamp fitting 253 disposed about the tube 23 between the two forward sleeve clamps 47 and 48. Such static tube 251 is disposed parallel to the nozzle 31 and extends forward of the aircraft fuselage 13 substantially the same distance. Tubing 256 is connected to the static tube 251 and extends back into the aircraft (not shown). A static pressure tap is provided at the entrance of the nozzle 31 by an orifice 257, see Fig. 5, therein which is connected by tubing 258 to an internal portion of the aircraft (not shown). Both sections of connecting tubing are then connected to a conventional manometer (not shown) to indicate pressure differential between that of the static tube 251 and the orifice 257. It will now be noted that the flapper valve assembly 109 is such that the rate of flow of gas from the tube liner 41 into the bag 18 is readily controllable. Thus, an adjustment of the micrometer stop 136, which determines the maximum open position of the flap 114 with respect to the tube liner 41, may be made to equalize the pressure at the two noted points. The position of the micrometer stop 136 may be calibrated in advance so that representative samples may be collected without adjustment thereof during the sampling process.

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In operation, the sampler is mounted in the nose of a drone aircraft, which may be of the bomber type. In this manner, the box 14 containing the bag 18 may be mounted in the bombardier's compartment in the nose of the aircraft, with the tube 23 and nozzle 31 extending forward into the undisturbed air, as previously set forth. Prior to the take-off, the nozzle valve assembly 46 and the flapper valve assembly 109 are closed, the micrometer stop 136 on the flapper valve assembly is preset, the triple pole double throw switch 226 is placed in the "fill" position, and the bag 18 is deflated. The microswitch 152 within the container 14 is closed and the relays 208 and 217 are de-energized so that the contacts thereof are open.

As the drone aircraft enters the atomic cloud, and it is desired to obtain a sample thereof, a radio signal is transmitted from a suitable transmitter (not shown) located at a safe position. Such signal is picked up by the antennae 203 and 204 and, according to the frequency thereof, passes through the receiver 201 or 202 tuned to the proper frequency. An output signal of one of the receivers 201 and 202 energizes one of the respective solenoids 206 and 207 of the relay 208 which, in turn, completes the circuit through the solenoid 216 of the second relay 217. When the contacts 218 and 219 of the second relay 217 a circuit is completed to maintain solenoid 216 thereof energized after the termination of the transmitted radio signal. The closing of the contact 219 of the relay 217 results in energization of the nozzle valve control solenoid 88 and the flapper valve control solenoid 126. The core of the nozzle valve control solenoid 88 then moves to open the pneumatic valve 87 which results in compressed air of the tank 91 forcing the shaft 79 in such a direction as to move the valve head 58 away from the opening of the nozzle 31. At the same time as the foregoing occurs, the flapper valve control solenoid moves the plunger 127 thereof to open the flapper valve assembly 109 to the limit permitted by the previous setting of the micrometer stop 136. Under such conditions gas particulate aerosol of the atomic cloud flows into the nozzle 31, at a rate substantially equal to the speed of the aircraft through the cloud, through the tube liner 41, and into the bag 18. Expansion of the bag 18 within the container 14 is permitted by the plurality of apertures 16 therein and continues until it is restrained by the walls thereof. At such time as the bag 18 is inflated to fill the container, the pressure of the bag against the pedal 146 becomes great enough to force such pedal against the arm 153 of the microswitch 152 which in turn opens the circuit energizing the solenoid of the relay 217. At such time the nozzle valve control solenoid 88 and the flapper valve control solenoid 126 become de-energized permitting the springs 72 and 116 to respectively close the valve assemblies 46 and 109 so that the sample obtained is retained.

When the drone aircraft carrying the sampler has landed at its home base, the sample may be withdrawn by connecting the auxiliary power supply 241 to "empty" position of the switch 226 in the manner previously described, closing the switch to such position, and then closing the double pole single throw switch 247. The closing of the latter switch 247 energizes the nozzle valve control solenoid 88 to open the nozzle valve assembly 46. With the nozzle 31 open, a vacuum hose and system (not shown) may be attached thereto. Next, the single pole single throw

switch 248 is closed which energizes the flapper valve control solenoid 126 to open the flapper valve assembly 109 and permit the transfer of the sample in the bag 18 to another container for analysis. Should the bag 18 and tube liner 41 become contaminated, it will be readily apparent that the same may be readily and simply removed and replaced.

While the salient features of the present invention have been described in detail with respect to one embodiment it will, of course, be apparent that numerous modifications may be made within the spirit and scope of the invention to the exact details shown except insofar as they may be defined in the following claims.

What is claimed is:

1. In an airborne device for sampling the gaseous and solid content of a radioactive cloud, the combination comprising an air-tight bag disposed within an aircraft, an elongated tube extending from said aircraft into undisturbed atmosphere in front thereof, said bag being attached to said tube at the inboard end thereof, a tapered nozzle mounted on the outboard end of said tube, a movable closure member mounted on said nozzle, and means mounted at the inboard end of said tube for controlling the rate of flow of gas into said bag.

2. In an airborne device for sampling the gaseous and solid content of a radioactive cloud, the combination comprising a container mounted within an aircraft, an air-tight bag disposed within said container and having a single opening, an elongated tube supported at one end by said container with the opening in said bag sealed about such tube end, said tube projecting forward of said aircraft to atmosphere undisturbed thereby, a nozzle having an inwardly and outwardly tapered forward portion mounted on the outboard end of said tube, a movable closure member mounted on said tube for opening and closing said nozzle, and an adjustable valve mounted at the inboard end of said tube to provide control of the rate of gas flow into said bag.

3. In an airborne device for sampling the gaseous and solid content of a radioactive cloud, the combination comprising a vented container adapted to be mounted within an aircraft, a collapsible air-tight bag disposed within said container having an opening therein, an elongated tube supported at one end by said container with the opening of said bag sealed to such tube end, said tube being extended forward of said aircraft into air undisturbed thereby, a nozzle mounted on the outboard end of said tube and having the forward portion thereof divergently tapered, a movable closure mechanism mounted on said tube for opening and closing said nozzle, an adjustable valve mounted at the inboard end of said tube to provide control of the rate of gas flow into said bag, remotely actuated means connected to said mechanism and said valve for opening the same, and means disposed within said container and connected to said mechanism and valve for closing the same in response to the degree of inflation of said bag.

4. In an airborne device for sampling the gaseous and solid content of a radioactive cloud, the combination comprising a vented container adapted to be carried by an aircraft, a collapsible air-tight bag disposed within said container and having an opening therein, an elongated tube supported at one end by said container and extended forward of said aircraft into undisturbed

air, a removable liner disposed within said tube for the length thereof, means for sealing the opening of said bag about the inboard end of said liner, a nozzle mounted on the outboard end of said tube and having an inner and outer divergently tapered leading portion, a movable closure mechanism mounted on said tube for opening and closing said nozzle, an adjustable valve mounted at the inboard end of said tube to control the rate of gas flow into said bag, remotely controlled means connected to said mechanism and said valve for opening the same, and means disposed within said container and connected to said mechanism and valve for closing the same in response to the degree of inflation of said bag.

5. In an airborne device for sampling the gaseous and solid content of a radioactive cloud, the combination comprising an air-tight bag disposed within an aircraft, an elongated tube extending from said aircraft into undisturbed air in front thereof, said bag being attached to said tube at the inboard end thereof, a nozzle mounted on the outboard end of said tube, valve means mounted on said tube and including a head bearing arm adapted to seat said head over the opening of said nozzle, piston means coupled to said valve means for opening said nozzle, a source of compressed air, a solenoid actuated valve interconnecting said source of air and said piston for control of the latter, a solenoid operated flapper valve mounted at the inboard end of said tube for controlling the rate of gas flow into said bag, circuit means including said solenoids and adapted to be remotely operated.

6. The combination of claim 5 wherein said circuit means is further characterized by a first relay adapted to be energized by a signal received from a remote position, a second relay adapted to be energized in response to energization of said first relay and having means connected thereto to maintain such energized state, said solenoids being connected to contacts of said second relay for energization thereof.

7. The combination of claim 5 wherein said valve means and said solenoid operated flapper valve are further characterized by a compression spring mounted to return said valve means from an open to a closed position, and a tension spring mounted to return said flapper valve from an open to a closed position.

8. The combination of claim 7 wherein said solenoid operated flapper valve is further characterized by a pivotally mounted arm bearing a flap adapted to close the inboard end of said tube and having an extended portion, and an adjustable stop mounted adjacent the extended portion of said arm to limit the open position of said flap with respect to the inboard end of said tube and thereby control the rate of gas flow into said bag.

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