

[54] GAS FLUSHING SYSTEM FOR VERTICAL FORM, FILL AND SEAL MACHINES

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[58] Field of Search. 53/22 A, 112 A

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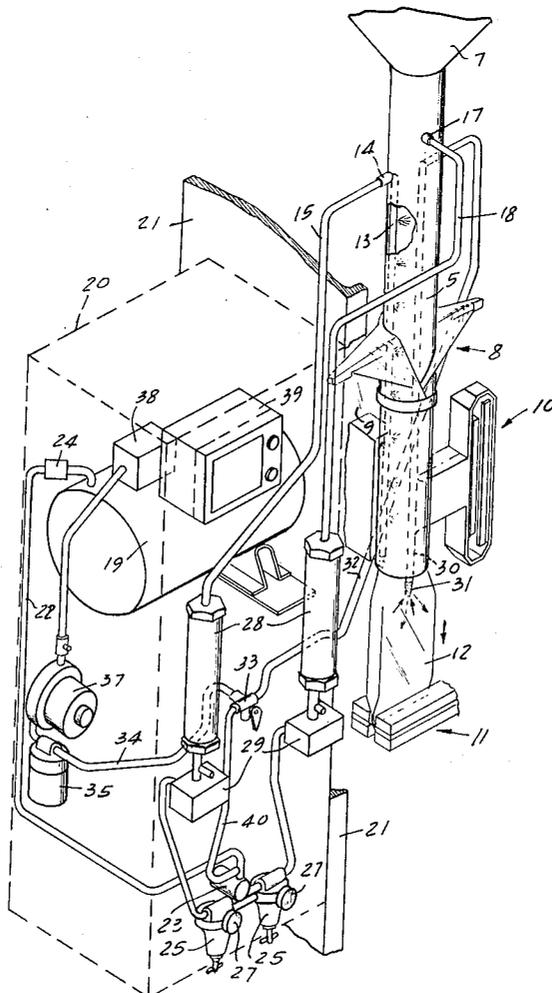
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[57] ABSTRACT

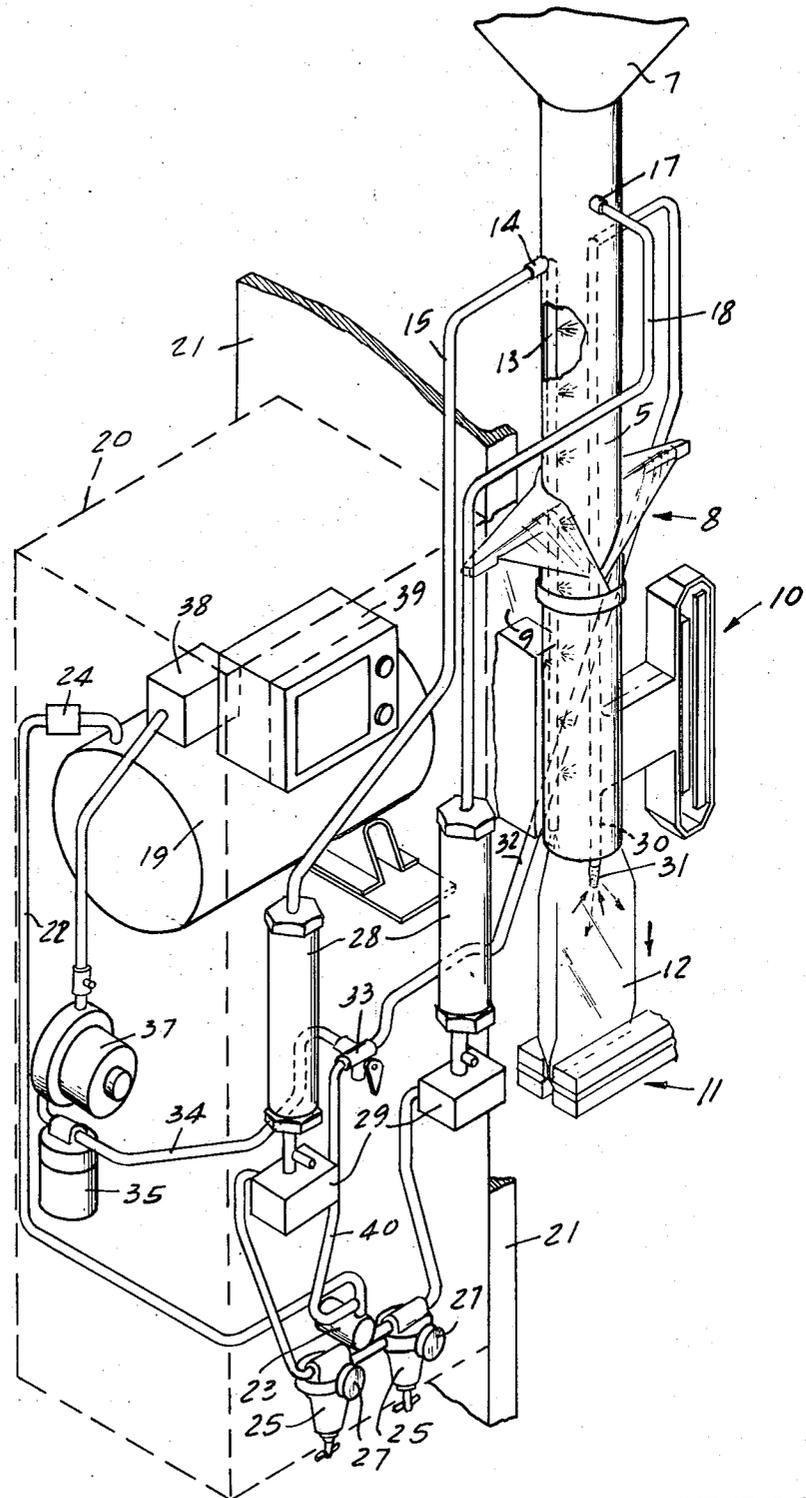
Gas flushing is effected by introducing the gas through one or more ducts into a free portion of the vertical package forming, filling and sealing tube above the area to which packaging sheet material is fed onto and tubularly formed about the tube. At least one of the ducts communicates with an extension duct nozzle depending within the tube for releasing and distributing flushing gas onto the product delivered through the tube into the formed packaging bags. Prepurging gas may be introduced into the tube upstream from the flushing gas. Gas sampling and machine start-up preflushing may be effected through a duct having a combination inlet and outlet located to extend partially downwardly into the bag to be filled or which may have been last filled when the machine is restarted after a shut-down.

12 Claims, 1 Drawing Figure



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GAS FLUSHING SYSTEM FOR VERTICAL FORM, FILL AND SEAL MACHINES

This invention relates to gas flushing to replace the atmospheric oxygen around a product to be enclosed in a sealed package, and is more particularly concerned with a novel gas flushing system for vertical form, fill and sealing machines.

Gas flushing packaged products which are detrimentally affected by atmospheric oxygen trapped within sealed bags can be preserved an appreciable length of time by substantially flushing the oxygen from the atmosphere surrounding the products within the sealed bags. Thus, oxidation and rancidity are at least greatly minimized, shelf life significantly increased and flavor and aroma are retained. By way of example and not limitation, coffee, nutmeats, potato chips and candy are typical examples.

Vacuum packaging has been practiced, but cost of gas flushing is lower and with gas flushing products with sharp points or abrasive qualities will not cause damage to the film material of the bags. Also, in contrast to vacuum packaging which causes the bag or wrapping material to cling tightly to the product and thus creates what is best termed a hard package, gas flushing can be controlled to result in a soft or substantially "pillow" package effect which is a desirable condition for ready consumer acceptance for at least some products, and avoids snugging in of the package onto the product as experienced with vacuum packaging.

Some problems have, however, been experienced in adapting the gas flushing technique to vertical form, fill and sealing machines, that is, machines in which packaging material is formed tubularly about a tube, with the lower end of the tubular packaging material sealed off and the resulting bag form filled with a product dropped or moved down thereinto from within the forming tube. Among the problems has been difficulty in securing adequate flushing during high speed operation of the machine. Another problem has been that of assuring adequate flushing of the bag to be filled or already filled and remaining in communication with the lower end of the forming and filling tube during a shut-down of the machine so that it substantially fills with air during the shut-down and the consequent shutting off of the flushing gas. This is particularly a factor where the flushing gas is lighter than air, such as nitrogen.

According to the present invention, the foregoing and other disadvantages, shortcomings, inefficiencies and problems are overcome by providing a new and improved method of and apparatus for replacing the atmospheric oxygen around products with an inert gas in sealed packages in vertical forming, filling and sealing machines.

An important object of the present invention is to provide a novel method of and means for gas flushing for the purpose indicated utilizing a lighter than air inert flushing gas and excluding atmospheric air in high speed operation.

Another object of the invention is to provide a new and improved multi-stage flushing system.

A further object of the invention is to provide a new and improved gas flushing system including an initial purging to prevent reentry of air to the product being packaged.

Still another object of the invention is to provide new and improved combination oxygen analysis and start-up preflushing means in a flushing system.

A yet further object of the invention is to provide a new and improved method of and means for flushing in vertical forming, filling and sealing machines which is readily adaptable for either original equipment or for installation in existing machines.

Other objects, features and advantages of the invention will be readily apparent from the following description of a preferred embodiment thereof, taken in conjunction with the accompanying drawing, although variations and modifications may be effected without departing from the spirit and scope of the novel concepts of the disclosure, and in which:

The drawing is a schematic illustration of a flushing system as applied to a vertical bag forming, filling and sealing machine.

This invention is especially applicable to vertical forming, filling and sealing machines of the so-called Zwoyer type exemplified in U.S. Pat. No. 1,986,422 and an improved version thereof exemplified in U.S. Pat. No. 3,449,888, and to the extent necessary for a more complete understanding of details of such a machine, the disclosures of these patents are incorporated herein by reference. However, to the extent necessary to a full understanding of the adaptation of the present invention to such a bag forming, filling and sealing machine the more or less schematically illustrated details in the drawing should afford adequate disclosure herein. To this end, there is shown a vertical bag forming tube 5 of such a machine including on its upper end means such as a hopper 7 into and through which product of generally discrete nature is supplied from a suitable source, generally in measured bag contents quantities in any preferred manner. At a suitable distance below the hopper 7, the tube is equipped with folding arm means 8 operative to receive from a suitable source sheet-form packaging material 9, such as a suitable thermoplastic, gas impervious film, and guide the same into tubular form about the tube 5 with side margins joined in lap seal or fin seal seam relation. Such material should be possessed of excellent impermeability characteristics and may comprise laminated films with polyvinylidene chloride (available commercially as Saran), foil, or combinations of materials such as polyethylene, polypropylene, cellophane, and the like with an important consideration being the film's ability to resist flex cracking, breaking or pinholing of the barrier material so that, after flushing, oxygen will not be permitted to migrate into the package, but the inert gas atmosphere will be reliably retained. Below the folding arm means 8, the joined margins of the material 9 are engaged by vertical heat sealing means 10 which may comprise the usual swinging arm and frame arrangement. Thence, the material travels downwardly as drawn by vertically reciprocal transverse sealing die, cut-off and pull-down mechanism 11 which is operative to heat seal across the formed tube of the material 9 to close the top of a previously filled bag and to close the bottom of a new bag 12 to be filled immediately under the lower terminal outlet of the tube 5. As each succeeding bag 12 is sealed, a predetermined quantity of product to be packaged is dropped down the passage defined within the forming and filling tube 5 to be received in the bag which, while the product is dropping thereinto, is being pulled downwardly until it is two bag lengths below the filling tube outlet, whereupon the mechanism 11 separates and releases the same and returns to its upper limit and seals the filled bag, repeating the cycle.

According to the present invention, the product is, in effect, "washed" in an inert gas atmosphere while dropping down the passage within the forming and filling tube 5. To this end, at least one flushing gas nozzle 13, which is desirably a small diameter tube duct such as on the order of one-quarter inch outside diameter, is located to extend downwardly in the passage within the tube 5 with the lower end of the duct adjacent to the lower end of the tube and with the upper end of the duct in communication through the wall of the tube 5 at a suitable point above the folding arm structure 8, as by means of a connection or fitting 14 with a delivery duct 15 by which inert gas such as nitrogen is conveyed to the nozzle 13. Depending on requirements, the gas is discharged either from the lower end of the elongated nozzle 13 or distributed through a number of holes along the length thereof, as indicated schematically. This provides an air purging, normal atmosphere excluding atmosphere within at least the intermediate portion of the passage within the tube 5 and within the successive bags 12.

Inasmuch as the bag forming and filling machine operates at a relatively high speed there may be a tendency for air to re-enter the tube 5 from the top. To afford assurance against such re-entry, an initial purging of the passage within the tube 5 is desirably effected upstream from the main flushing effected by means of the nozzle or distributor 13. Introduction of the inert prepurging gas through the wall of the tube 5 is by way of a nozzle 17 which may be, or be on, a nipple or fitting

attached to communicate through the wall of the tube 5 to the interior thereof, at a point above the member 13, and to which is connected an inert gas delivery duct 18.

Gas is supplied to the delivery ducts 15 and 18 from a suitable source such as a gas generator or a gas tank 19 which may be mounted in a cabinet 20 conveniently mounted on a frame member 21 comprising part of the machine frame. From the tank 19 the gas passes by way of a supply duct 22 to a control valve 23 which may be integrated with machine operation so as to open when the machine is operating and to close automatically when the machine is stopped or shut down. For this purpose the valve 23 may be a solenoid operated valve assembly. Where the gas source is under high pressure so that there may be a tendency toward freezing temperatures on expansion of the gas, especially where CO₂ is used, and for which the present system is adapted as well as for nitrogen flushing, a preheater 24 may be suitably mounted in or in association with the supply duct 22 to bring the gas up to a temperature which will avoid freezing anywhere in the system. From the control valve 23, the gas passes to respective flow controllers 25 for each of the delivery lines and each of which has a respective pressure gauge 27 associated therewith. From the flow controllers the gas passes on to respective flow meters 28 each of which has a pressure regulator 29 associated therewith. From the flow meters 28 the gas passes to the respective delivery ducts 15 and 18.

From time to time or continuously, it is desirable to monitor the effectiveness of the oxygen flushing or purging action, and herein this is effected by withdrawing and analyzing a small amount of gas from within selected or each of the bags 12, as may be preferred. To this end, gas sampling means are provided comprising a sampling duct 30 which is desirably located to extend downwardly within the tube 5, but which may if there is sufficient clearance within the bag material tube to accommodate the same be located outside and contiguously parallel with the tube 5 and which duct has its lower or suction end extending below the discharge end of the tube 5 so as to project downwardly within the upper portions of the freshly filled bags 12. Means for filtering the withdrawn gas desirably comprise a prefilter 31 on and across the entry end of the sampling duct 30. At its upper end, above the folding device 8, the sampling duct 30 is connected with a conduit 32 leading to a three-way valve 33 by which the duct 32 can be opened to atmosphere or connected to a sampling line 34 leading to a filter 35 such as a water filter and thence to a vacuum pump 37 from which the sample gas is delivered by continuation of the sampling line to an oxygen analyzer probe or sensor 38 connected to a readout oxygen analyzer meter 39 conveniently located on and in respect to the cabinet 20 for ready reading. Through this arrangement it can be readily determined whether the system is functioning properly to maintain the residual oxygen content within the packages at a desirable level, for instance 1 percent. Any adjustments can be made immediately. As a result, necessity for taking sample packages somewhere else, such as to a testing laboratory, to analyze for oxygen level is eliminated, and avoiding lost time and lost production, but assuring that the bag contents will have as nearly as practicable uniform low oxygen level optimum for the particular product being packaged throughout a production run. The internal pressure within the bags can also be controlled for most desirable results as to contents cushioning, bag protection, handling facility, packing space occupied, attractiveness to touch such as softness, and the like.

After the filling machine has been shut down, and the flushing gas supply closed off by the valve 23, so much of the flushing gas may have escaped, or an undesirable amount of air re-entered the tube 5 and the last package formed, that if no means were provided to reflush the package, it should be discarded as not up to the standards of the properly flushed and atmosphere conditioned preceding packages. To obviate such loss of package material and product at the start-up of the machine after a shut-down, the sampling duct 30 herein also serves as a prepurge or start-up flushing nozzle since it ex-

tends down into the package which has been dormant during the shut-down. To this end, a branch duct 40 connects the conduit 32 through the valve 33 with the gas supply duct 22. By having the duct 40 upstream from the shut-off valve 23, it is possible to divert sufficient of the flushing gas through the valve 33 and the conduit 32 into the sampling duct 30 now serving as a preflush nozzle to purge the package 12 and start the flushing of the tube 5 before the machine is started. Thereupon, the machine can be started and the flushing system operated in the normal manner. By operating the valve 33, the duct 30 can be made to resume its sampling function before or after startup. Thereby, not only while the machine is running but also at or before start-up the amount or percent of bag content oxygen can be monitored and adjustably controlled.

Although the invention has been disclosed in the FIGURE of the drawing as applied to a machine having one forming, filling and sealing tube assembly, it will be clear that the same may be readily adapted for multiple tube machines wherein each of the tubes will be equipped with the same gas flushing system individually or in parallel in the same system with any desirable modifications to attain uniform results in the parallel but individually functioning tube assemblies. Both single tube and multiple tube machines are known in the art.

What we claim as our invention:

1. In combination with a bag forming, filling and sealing machine including a vertical tube having communicating therewith product receiving head means, means spaced below said head means for forming bag sheet material about the tube, seam sealing means cooperative with the tube below the forming means, and combination bag sealing, cut-off and pull-down means operative below the lower discharge end of the tube:
 - an elongated nozzle member extending downwardly within said tube and operative to discharge flushing gas into the tube for purging atmospheric oxygen from product supplied through the tube into bags formed below said discharge end;
 - means for supplying said nozzle with flushing gas through the wall area of said tube between said head structure and said folding means;
 - a gas sampling duct having an inlet end extending below said discharge end of the tube to be effective within the next formed bag under said discharge end;
 - a suction line connected to said duct above said forming means including a valve; and
 - means connecting said valve with flushing gas supply for alternatively supplying gas into the next filled bag or for withdrawing a gas sample from such bag, under the control of said valve.
2. In combination with a bag forming, filling and sealing machine including a vertical tube having a product passage therein communicating with product receiving head means, means spaced below said head means for forming bag sheet material about the tube, seam sealing means cooperative with the tube below the forming means, and combination bag sealing, cut-off and pull-down means operative below the lower discharge end of the tube:
 - means for supplying flushing gas adjacent to the lower end of said passage including a nozzle and a duct leading thereto;
 - means for supplying flushing gas;
 - gas monitoring means; and
 - means for alternatively connecting said duct with said supplying means and with said monitoring means.
3. A combination according to claim 2, said means for connecting being also operative to open said duct to atmosphere.
4. In combination with a bag forming, filling and sealing machine including a vertical tube having a product passage therein communicating with product receiving head means, means spaced below said head means for forming bag sheet material about the tube, seam sealing means cooperative with the tube below the forming means, and combination bag seal-

ing, cut-off and pull-down means operative below the lower discharge end of the tube:

an elongated nozzle member extending downwardly within said tube passage and having a number of distribution holes along its length within said passage operative to discharge flushing gas into the tube passage for purging atmospheric oxygen from product as the product moves down through the passage and before the product drops from the discharge end into the bags that have been formed below said discharge end; and

means for supplying said nozzle member with flushing gas through the wall area of said tube between said head means and said folding means including a gas source and supply line duct means connecting the source with said nozzle and having therein a shut-off valve adapted to be controlled in coordinated relation with the machine, and flow-controlling means as well as pressure-regulating means and flow-metering means in said line duct means downstream from said valve.

5. In combination with a bag forming, filling and sealing machine including a vertical tube having a product passage therein communicating with product receiving head means, means spaced below said head means for forming bag sheet material about the tube, seam sealing means cooperative with the tube below the forming means, and combination bag sealing, cut-off and pull-down means operative below the lower discharge end of the tube:

an elongated nozzle member extending downwardly within said tube passage and operative to discharge flushing gas into the tube passage for purging atmospheric oxygen from product supplied through the tube passage into bags formed below said discharge end;

means for supplying said nozzle member with flushing gas through the wall area of said tube between said head means and said folding means;

initial purge gas means communicating with an upper portion of the tube passage;

a gas sampling duct having an inlet end extending below said discharge end; and

a suction line connected to said duct above said forming means.

6. In combination with a bag forming, filling and sealing machine including a vertical tube having a product passage therein communicating with product receiving head means, means spaced below said head means for forming bag sheet material about the tube, seam sealing means cooperative with the tube below the forming means, and combination bag sealing, cut-off and pull-down means operative below the lower discharge end of the tube:

an elongated nozzle member extending downwardly within said tube passage and operative to discharge flushing gas into the tube passage for purging atmospheric oxygen from the product supplied through the tube passage into bags formed below said discharge end;

means for supplying said nozzle member with flushing gas through the wall area of said tube between said head means and said folding means;

initial purge gas means communicating with an upper portion of the tube passage;

a combination prepurge and gas sampling duct having a discharge inlet end extending below said discharge end of the tube to be effective within the next formed bag under said discharge end; and

means for alternatively connecting said duct with said means for supplying gas and with a suction line.

7. A combination according to claim 6, including a filter on and across said inlet end of the duct.

8. In combination with a bag forming, filling and sealing machine including a vertical tube having a product passage therein communicating with product receiving head means, means spaced below said head means for forming bag sheet material about the tube, seam sealing means cooperative with the tube below the forming means, and combination bag seal-

ing, cut-off and pull-down means operative below the lower discharge end of the tube:

an elongated nozzle member extending downwardly within said tube passage and operative to discharge flushing gas into the tube passage for purging atmospheric oxygen from product supplied through the tube passage into bags formed below said discharge end;

means for supplying said nozzle member with flushing gas through the wall area of said tube between said head means and said folding means;

initial purge gas means communicating with an upper portion of the tube passage;

an initial purging gas supply line communicating with the upper end portion of said tube passage below said head means; and

a combination prepurging and gas sampling duct communicating with the next formed bag below said discharge end.

9. In combination with a bag forming, filling and sealing machine including a vertical tube having an upper entry end and a lower discharge end and a product passage therein with the entry end thereof communicating with head means for delivering product to be bagged into the passage, means spaced below said head means for forming bag sheet material about the tube, seam sealing means cooperative with the tube below the forming means, and combination bag sealing, cut-off and pull-down means operative below the discharge end of the passage:

means entering the tube from adjacent to said entry end for supplying product-flushing gas into said tube passage; additional means located near the discharge end of said passage for supplying initial purging gas; and means for effecting withdrawal through said additional means of atmosphere monitoring samples of the atmosphere adjacent to the discharge end of said passage.

10. In combination with a bag forming, filling and sealing machine including a vertical tube having an upper entry end and a lower discharge end and a product passage therein with the entry thereof communicating with head means for delivering product to be bagged into the passage, means spaced below said head means for forming bag sheet material about the tube, seam sealing means cooperative with the tube below the forming means, and combination bag sealing, cut-off and pull-down means operative below the discharge end of the passage:

means entering the tube from adjacent to said entry end for supplying product-flushing gas into said tube passage; additional means located near said product entry end of the tube for supplying initial purging gas; and yet additional means are operative to introduce preflushing gas near said discharge end of the passage.

11. In combination with a bag forming, filling and sealing machine including a vertical tube having an upper entry end and a lower discharge end and a product passage therein with the entry end thereof communicating with head means for delivering product to be bagged into the passage, means spaced below said head means for forming bag sheet material about the tube, seam sealing means cooperative with the tube below the forming means, and combination bag sealing, cut-off and pull-down means operative below the discharge end of the passage:

means entering the tube from adjacent to said entry end for supplying product-flushing gas into said tube passage; additional means for supplying initial purging gas at a position near one of said tube ends; and means alternatively operable to secure a sample of gas for analysis adjacent to the discharge end of said passage and to introduce preflushing gas.

12. In combination with a bag forming, filling and sealing machine including a vertical tube having an upper entry end and a lower discharge end and a product passage therein with the entry end thereof communicating with head means for delivering product to be bagged into the passage, means

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spaced below said head means for forming bag sheet material about the tube, seam sealing means cooperative with the tube below the forming means, and combination bag sealing, cut-off and pull-down means operative below the discharge end of the passage:

means entering the tube from adjacent to said entry end for supplying product-flushing gas into said tube passage; additional means for supplying initial purging gas at a posi-

tion near one of said tube ends; control valve means for disconnecting said additional means from purging gas supply; and gas analyzing means including a suction pump alternatively connectable with said additional means by operation of said control valve means.

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