

Sept. 28, 1965

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3,208,639

SEALED FLUID DISPENSING SYSTEM FOR OXIDIZABLE FLUIDS

Filed May 6, 1964

2 Sheets-Sheet 1

FIG. 1

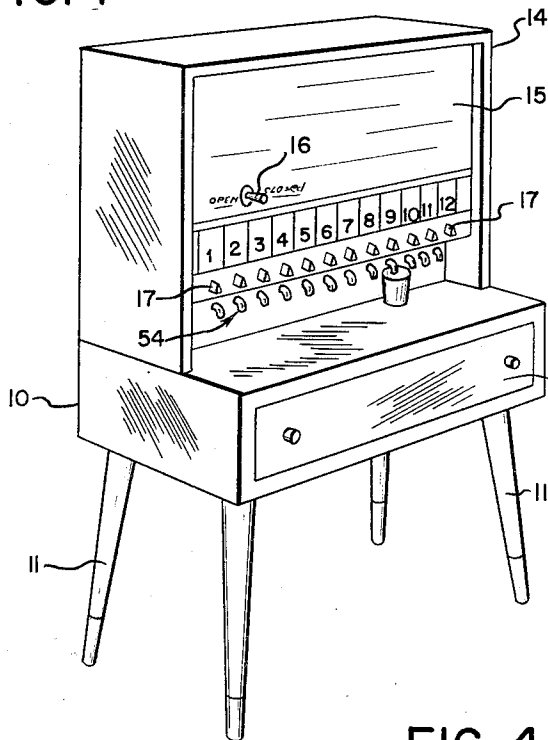


FIG. 4

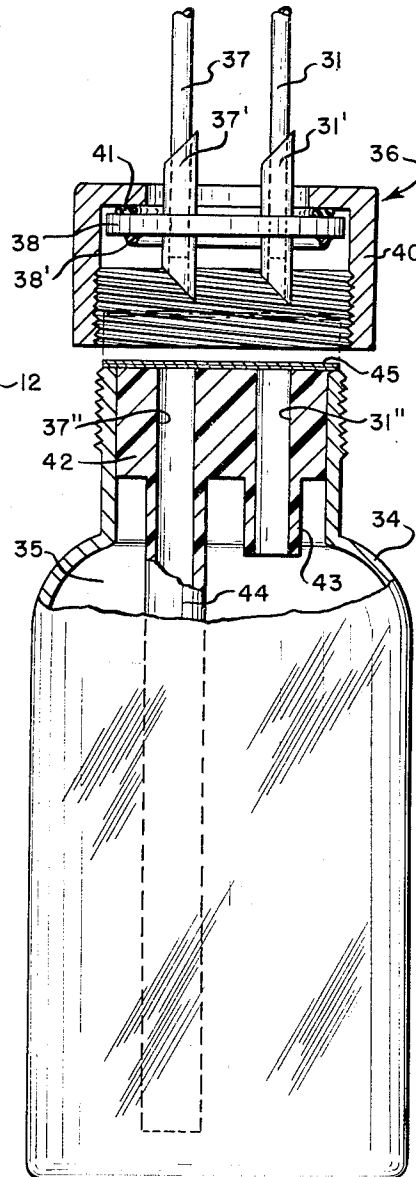


FIG. 2

	1	2	3
	C	C	C
17	2 1	2 1	2 1
	3	3	3

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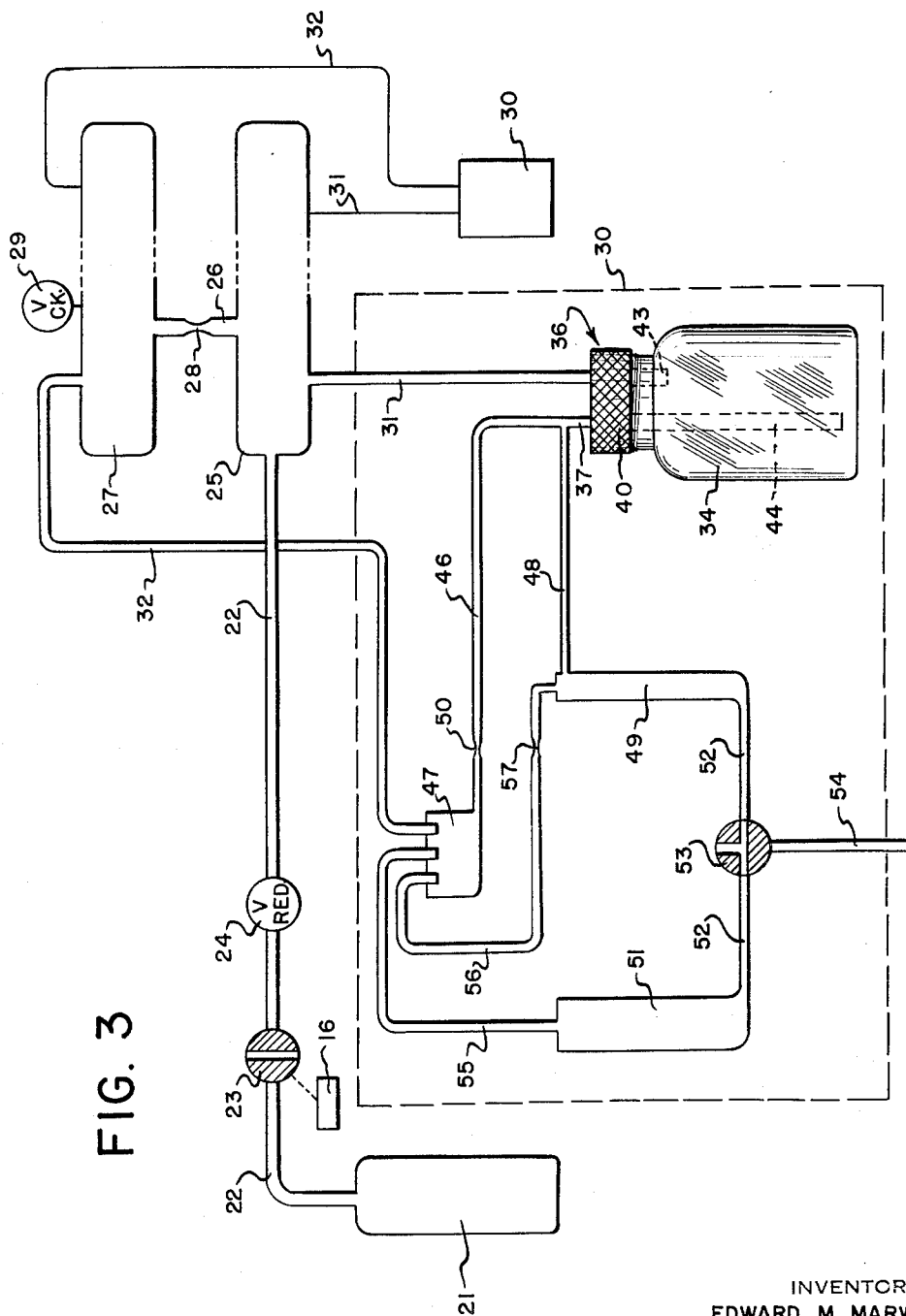


FIG. 3

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SEALED FLUID DISPENSING SYSTEM FOR
OXIDIZABLE FLUIDS

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Filed May 6, 1964, Ser. No. 365,295
14 Claims. (Cl. 222-82)

The present invention relates to a machine for metering and dispensing controlled amounts of fluids such as dyes and this application is a continuation-in-part of our application, Ser. No. 120,599, filed June 29, 1961, now Patent No. 3,133,678 entitled Gas Powered Fluid Metering and Dispensing Machine.

The machine described in the above referred to application is designed for use preferably with fluids that are not particularly affected by exposure to the atmosphere. In some situations, however, it has been found advantageous to confine the dyes against contact with the atmosphere until they are ready for their ultimate intended use. Just as an example, certain hair dyes used for dyeing or tinting women's hair contain substances which may be damaged upon any prolonged or repeated exposure to the oxygen in the air before their application to the hair. By confining these dyes against contact with the atmosphere until ready for use, their shelf or storage life may be readily increased.

According to the present invention a fluid metering and dispensing machine is especially adapted for use with dyes which may be damaged upon prolonged or repeated exposure to oxygen in the atmosphere. As will be more fully described below, all portions of the fluid conducting system of the machine which are not otherwise filled with fluid are filled with a suitable gas which is inert with respect to the fluids being dispensed. This gas, such as carbon dioxide, is introduced into the system under some moderate pressure above atmospheric pressure and thereby not only provides a system which is maintained free of atmospheric oxygen but also provided a machine in which medium and high viscosity fluids may be readily dispensed.

It is also within the teachings of the present invention to construct a sealed, pressurized metering and dispensing machine in which fluid storage containers which have been depleted may be replaced with filled containers with a minimum exposure of the system to the atmosphere. Furthermore, in the event that the system does become contaminated through exposure to the atmosphere, the construction is such that the driving gas may be flushed through the system until the residual air is substantially removed.

The machine described in application Ser. No. 120,599, now Patent No. 3,133,678 does use pressurized propellant gas which may be inert with respect to the fluids being dispensed and this machine has been widely and successfully used with dyes which are not particularly susceptible to oxidation. Our experience with such machines has shown, however, that the arrangement of the system of fluid conduits does not always preclude the admission of oxygen into the system and that merely closing the system off from the atmosphere without further modification of the pressure system will only solve the problem of excluding air at the expense of disrupting the proper function of other phases of the system. More specifically, the mere sealing of the system described in application Ser. No. 120,599, now Patent No. 3,133,678 will tend to prevent proper flow of fluid through the fluid conduits preparatory to leaving the metering chambers filled with predetermined quantities of fluid.

In the construction described in our copending application as well as in the construction of the present

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invention, it is necessary that the gas trapped in the system before charging be permitted to move aside to make room for the incoming fluid and it is also necessary that provision be made for equalizing the pressure acting on the fluid in the fluid reservoir with the pressure acting on the fluid disposed on the other side of the metering chambers before proper draining of excess fluid can occur and leave the metering chambers filled with the required predetermined quantities of fluid.

In the earlier machine, both of these requirements were met by venting the fluid overflow vessel to atmosphere and connecting the fluid reservoir through a restricted conduit to such overflow vessel.

When, however, the overflow vessel is sealed to the atmosphere, as in the construction of the present invention, without any further modification of the pressure system, there is no longer present the inherent pressure control feature provided by the vented overflow vessel; and the introduction of pressurized gas into the system will tend to prevent trapped gas from moving aside to accommodate the incoming fluid. This is so since the incoming gas will not only produce a pressure on the incoming side of the metering chambers in the vicinity of the fluid reservoir, but will also produce a pressure on the overflow side of the metering chambers in the vicinity of the overflow vessel preventing the gas trapped in this latter vicinity from moving aside and thereby tending to lock the machine in inoperative condition.

To overcome this undesirable condition, the sealed construction of the present invention is provided with an equalization manifold disposed between the source of pressure and the overflow side of the metering chambers which, in turn, is provided with a one way valve for limiting the pressure that can be built up in this vicinity. More specifically, the metering and dispensing machine constructed in accordance with the teachings of the present invention comprises first and second fluid metering chamber connected together at one point by a suitable dispensing valve and connected at another point to a sealed rather than vented overflow vessel. The sealed overflow vessel is, in turn, connected to an equalization manifold which is itself connected to a distribution manifold via a restricted pressure releasing conduit. The equalization manifold is provided with a one way valve for permitting escape of pressurized gas above a predetermined value, and the distribution manifold is connected on one side to a source of pressurized gas and on the other side to the fluid reservoir holding the fluid to be dispensed. As in our previous construction, the fluid reservoir is connected by fluid conducting means to the first metering chamber at a predetermined point. With this new construction, however, not only is it possible to dispense metered charges of fluid from the metering chambers but it is also possible to completely confine the fluid against contact with the atmosphere until it is finally dispensed for its ultimate use. And in addition, the specific construction of the pressure conduit means of the present invention permits proper flow of fluid through the system during charging and permits proper balancing of the pressure therein after charging so as to allow excess fluid to drain back into the fluid reservoir and leave the metering chambers filled to the desired level. In this way both chambers are filled with an accurately reproducible quantity of fluid which has not been subjected to contact with the atmosphere during its passage through the machine and which may be dispensed from the machine under a positive pressure as determined by the pressure of the gas within the system.

The foregoing and other objects and advantages of the invention will become more apparent from a consideration of the specification and drawings wherein one

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specific embodiment of the invention is described and shown in detail for illustration purposes only.

In the drawings:

FIGURE 1 is an isomeric drawing of a suitable enclosure for the novel gas powered fluid metering and dispensing apparatus;

FIGURE 2 is a detail showing an elevation of the valve selector knobs shown in FIGURE 1;

FIGURE 3 is a schematic diagram showing the essential components of the novel metering and dispensing apparatus; and

FIGURE 4 is a side elevation of the storage container and connecting means.

In FIGURE 1, a base 10 is supported by four legs 11 which are attached to the bottom of the base. The base has a drawer 12 which may be used to store supplies and color sharts. Above the base and supported thereon is a cover 14 having a front panel 15 which encloses the novel metering and dispensing apparatus illustrated in FIGURE 3.

Before proceeding with the description of FIGURE 3, a description of the operation of the device from the point of view of an operator will be presented. Mounted on the front panel 15 is a switch 16 which may be moved to the left toward a position marked "open" or to the right toward a position marked "closed." In addition, a plurality of valve position selector knobs 17 consecutively numbered 1-12 from left to right are arranged in a horizontal row on the panel 15. Each selector knob is rotatable in both the clockwise or counter-clockwise directions and has clustered about it the position designations "C," "1," "2," and "3," as shown in FIGURE 2. In a unique dye system which was created to be used in conjunction with apparatus according to the present invention over 1,200 different predetermined colors and shades of dye solution may be blended merely by combining one or more of ten basic dye color solutions and one diluent. In this dye system all of the colors and shades may be formed by combining one or more of the basic dye color solutions and a diluent in volumes which bear certain volumetric ratios to each other, for example, three, seven, ten; that is to say, a particular apparatus according to the present invention is capable of dispensing integral multiples of three unit volumes, seven unit volumes and ten unit volumes of each of the basic dye solutions and of the diluent. Thus, when a selector knob is in the "C" position the valve controlled by the knob is closed; in the "1" position three volumetric units of the color solution controlled by that valve will be dispensed; in the "2" position seven units will be dispensed; and in the "3" position ten units will be dispensed.

When the dye system referred to above is used, ten different color solutions are dispensed from valves controlled by knobs 17, numbered 3 through 12, and because of the considerably greater quantities of diluent used relative to the quantities of any one color solution the apparatus is arranged to dispense diluent through valves controlled by knobs numbered 1 and 2.

When it is desired to dispense a particular basic color solution and diluent combination, the machine must first be charged. This requires that all of the selector knobs first be placed in the "C" position and thereafter that the switch 16 be moved from the "closed" position to the "open" position and after a predetermined time, moved back to the "closed" position. This simultaneously charges all the metering containers or chambers with the different color solutions and diluents whereupon subsequent turning of the appropriate selector knobs 17 to the proper position will effect a dispensing of the required quantity of each color solution from the nozzles under those selector knobs. These quantities are then collected in a mixing cup and when all the component solutions of the color and shade desired have been withdrawn, they are mixed and applied to the object which

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is to be dyed. If a selector is turned to the number "1" position, a first predetermined quantity of fluid may be withdrawn; if to the number "2" position, a second predetermined quantity may be withdrawn; and to the number "3" position, the sum of the first and second predetermined quantities may be withdrawn. Diluent or some of the basic color solutions may be dispensed by more than one selector to provide additional quantities with a single charge of the dispensing apparatus.

Turning now to FIGURE 3, a cylinder 21 of pressure fluid, which in the preferred embodiment is liquified carbon dioxide, is connected by pressure conduit 22 having a flow control valve 23 and a gas-pressure reducing valve 24 to a distribution or drive manifold 25. Flow control valve 23 is connected to the switch 16 on the front panel 15 of the machine whereby when the switch is moved to the "open" position, the carbon dioxide is expanded through the pressure reducing valve 24 into the manifold 25 and at the same time changed from the liquid to the gaseous state. The length of time the switch is held in the "open" position is determined by the pressure required to fill the appropriate parts of the system with the fluid to be dispensed and for purposes of regulating this time, a suitable timer, not shown, may be provided.

Distribution manifold 25 is connected by a pressure conduit 26 to a second or equalization manifold 27. A restriction 28 in pressure conduit 26 provides a delayed pressure releasing means for regulating the flow of gas between the two manifolds and the equalization manifold 27 is provided with a bleed-off check valve 29 for purposes more fully described below. The distribution manifolds 25 and 27 are connected to a plurality of identical measuring units 30, which in the embodiment illustrated in FIGURE 1, is twelve. Each unit 30 is connected to the first manifold 25 by a single pressure conduit 31 and to the second manifold 27 by a single pressure conduit 32.

Conduit 31 conducts the pressure fluid in manifold 25 to a sealed liquid reservoir 34 which may contain dye solution or diluent 35. The conduit 31 passes through a pressure sealing cover generally designated at 36 and subjects the dye solution or diluent contained within the reservoir 34 to the gas in the manifold which provides a pumping or driving pressure for charging the metering circuit to be described. A fluid conduit 37 extends from the bottom of reservoir 34 and passes through the pressure sealing cover 36.

In the preferred embodiment shown in FIGURE 4, the two conduits 31 and 37 are fixed to the cover 36. More specifically a molded or otherwise formed puncture member 38 is provided with a sealing rim 38' and puncture tubes 31' and 37' adapted to receive, respectively, the ends of conduits 31 and 37. The puncture member 38 is received within a threaded coupling member 40 as shown in FIGURE 4, and a sealing washer 41 may be positioned between the two members for assuring proper sealing of the parts when the storage container 34 is assembled thereto. As shown, the storage container is provided with a stopper 42 having openings 31'' and 37'' for respectively receiving the tubular members 31' and 37'. The stopper 42 is further provided with a pressure conduit 43 terminating at a point above the level of fluid 35, and a fluid conduit 44 terminating at a point adjacent the bottom of the container 34. The top of the container 34 is covered with a puncturable material 45 such as foil which until broken by the insertion of the tubular puncture members 31' and 37', will maintain the container hermetically sealed. Upon partially threading the container 34 onto the coupling member 40, the lower ends of the tubular puncture members 31', 37' will be spaced from the foil 45 and the lower end of the coupling 40 will be effectively sealed against the ambient atmosphere, and thus the system so far described will be closed.

Above the cover 36 the fluid conduit 37 divides in a

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"Y" having one leg 46 thereof connected to a scaled overflow container 47 and another leg 48 connected to the upper end of a first measuring chamber 49. Leg 48 has a flow restriction 50 to assure flow of the liquid being measured into measuring chamber 49 during the charging operation. The pressure conduit 32 connects each unit with the equalization manifold 27 through its connection with each of the overflow containers 47 as shown in FIGURE 3.

The bottom end of chamber 49 is connected to the bottom end of a second measuring chamber 51 by a fluid conduit 52 having a four-position T-valve 53 which connects the two measuring chambers whenever selector 17 is in the "C" or "3" position. In FIGURE 3 valve 54 is shown in the "C" position which connects chambers 49 and 51. When the selector knob is moved to the "1" position, chamber 49 is connected to a spout 54 and the dye or diluent contained therein is withdrawn to a mixing cup. When the selector knob is turned to the "2" position, chamber 51 is connected to spout 54 and when selector knob 17 is turned to the "3" position, chambers 49 and 51 are both connected to spout 54. In the preferred embodiment, chamber 51 contains seven units of volume and chamber 49 contains three units, thus, chamber 49 provides three units of measure; chamber 51, seven units of measure; and chambers 49 and 51, ten units of measure. It should be noted that these ratios are not critical and may be varied to suit any particular application of the apparatus constructed according to the teaching of the present invention. The upper end of chamber 51 is connected by a fluid conduit 55 to the overflow container 47. Another fluid conduit 56, having a restriction 57 connects the upper end of chamber 49 to the overflow container 47.

The system is normally charged with the valve 53 in the closed or "C" position shown in FIGURE 3. When pressure fluid is admitted to reservoir 34, the dye or diluent in the reservoir is forced through conduits 37 and 48 into chamber 49 and from there through valve 53 into chamber 51. At the same time, conduits 46, 55 and 56 are also filled with the dye. During this charging of the fluid chambers and conduits, pressure fluid is leaked from the distribution manifold 25 through the conduit 26 to the equalization manifold 27 with the restriction 28 providing a pressure release means proportioned so that the pressure in the distribution manifold 25 and the reservoirs 34 will be reduced to a predetermined value after sufficient time has elapsed to charge all of the fluid conduits and chambers with dye or diluent, as the case may be.

The bleed-off check valve 29, referred to above, is provided for controlling the value of the reduced pressure in the distribution manifold 25 and for further controlling the pressure in the remaining portion of the system. In order to effect a proper filling of the chamber 49 and 51, they and the associated conduit must be drained after charging and preparatory to dispensing. Accordingly, the pressure in the overflow container 47 and the storage container 34 of each unit as well as the associated pressure conduits must be equalized; and this is advantageously effected by the equalization manifold 27, check valve 29 and their connection into the system. As long as the pressure within the system is maintained at a value slightly above atmospheric the machine will operate properly. The check valve 29 may however, be set to any value above atmospheric depending on the viscosity of the fluid to be dispensed and upon the pressure under which it is desired to dispense such fluid. As described above, the connection of the equalization manifold 27 to the sealed overflow container 47 completes the pressure circuit of each of the units. As fluid is pumped through the system, this will permit the gas trapped in the overflow container to escape to the equalization manifold 27 and bleed off to the atmosphere through the bleed-off check valve 29 until it equals that in the remaining portions of the system.

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After the system is charged and the pressure in the distribution manifold 25, equalization manifold 27, storage container 34, overflow container 47 and pressure conduits 31 and 32 are reduced to the value set by the bleed-off check valve 29, the fluid in the charged system starts flowing under its own weight back into the reservoir 34 with the connection between the reservoir and overflow container 47 via the two manifolds maintaining the pressure at these two points equal. All of the fluid, however, does not return to the reservoir since the conduits 55 and 56 break the continuity of flow as soon as the level of the fluid in the overflow container 47 falls below the ends of these conduits. After this occurs, the fluid still in these conduits 55 and 56 and the chambers 49 and 51 will continue to drain until the level of the fluid lowers to the junction of conduit 48 with chamber 49. Since the two chambers are connected together by the conduit 52, the height of both columns of fluid in the chambers 49 and 51 will be equal when this junction is reached. The juncture point itself may be selected to provide a specific volume of fluid by taking into consideration the cross-sectional area of the chambers.

After the machine has been operated for a period of time and it is found that one or more of the fluid storage containers 34 are near depletion, their replacement with full containers may be readily accomplished in the following manner. First, the depleted container 34 is removed, thus allowing the gas under pressure in the system to escape until its pressure equals atmospheric. Next a new container is threaded onto the cap member 40 to the position shown in dotted lines in FIGURE 4. At this stage of the assembly, the tubular puncture members 31', 37' will not have punctured the foil covering 45; however, an effectively closed system will be provided. If it is desired to flush the machine to remove any air in the area enclosed by the cap 40 and bottle 34 or to clean any fluid remaining in the fluid conduits and particularly in the dispensing valve 53 and spout 54, the switch 16 may be moved to the "open" position and held there until gas has filled the entire unit. Excess gas applied to the unit will escape through the bleed-off check valve and effect a thorough flushing of the unit.

When the machine has been adequately cleaned in this manner, the storage container 34 may be threaded the remainder of the way into the cap 40 so as to puncture the foil covering 45, seal the stopper 42 against the rim 38' and thereby position the container for further dispensing of fluid.

While only one embodiment of this invention has been shown and described, it is apparent that various changes may be made without departing from the scope of the invention as set forth in the following claims.

We claim:

1. A fluid metering and dispensing system comprising:
 - (a) a closed fluid reservoir;
 - (b) closed metering chamber means positioned with the upper extremity thereof above the fluid level in said reservoir;
 - (c) fluid conduit means connecting said reservoir at a level below the fluid level therein to said metering chamber means at a predetermined level;
 - (d) pressure conduit means connecting said metering chamber means at the upper extremity thereof to said reservoir at a level above the fluid level therein;
 - (e) means for selectively applying a predetermined pressure above atmospheric on the fluid in said reservoir to force said fluid through said fluid conduit means and to said metering chamber means to fill said chamber means to at least said predetermined level;
 - (f) means for equalizing the pressure in said reservoir and metering chamber means and in said pressure

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- conduit means connecting said metering chamber means with said reservoir at a pressure above atmospheric after said chamber means has been filled to at least said predetermined level; and
- (g) valve means for selectively withdrawing the fluid retained in said metering chamber means.
2. A fluid metering and dispensing system according to claim 1 wherein:
- (a) the metering chamber means comprises first and second metering chambers interconnected by fluid conduit means at a level below said predetermined level; and
- (b) the fluid conduit means connected to said reservoir below the fluid level therein is connected to one of said metering chambers.
3. A fluid metering and dispensing system comprising:
- (a) a closed fluid reservoir;
- (b) a closed overflow collector vessel positioned above said reservoir;
- (c) closed metering chamber means positioned with the upper extremity thereof above the fluid level in said reservoir;
- (d) fluid conduit means connecting the upper extremity of said metering chamber means to said overflow vessel.
- (e) fluid conduit means connecting said fluid reservoir at a level below the liquid level therein to said metering chamber means at a predetermined level;
- (f) fluid conduit means connecting said fluid reservoir to said overflow vessel;
- (g) a source of pressurized gas;
- (h) pressure conduit means connecting said source to said fluid reservoir above the level of fluid therein;
- (i) valve means for selectively admitting pressurized gas through said pressure conduit means from said source to said reservoir to apply a first predetermined pressure above atmospheric on said fluid to force said fluid through said fluid conduit means to said metering chamber means to fill said chambers to at least said predetermined level;
- (j) pressure conduit means connecting said overflow vessel at a level above the liquid level therein to said reservoir;
- (k) means for reducing the pressure in said fluid reservoir and said overflow vessel after said chamber means has been filled to at least said predetermined level to a second predetermined pressure above atmospheric; and
- (l) valve means for selectively withdrawing the fluid retained in said metering chamber means.
4. A fluid metering and dispensing system according to claim 3 wherein:
- (a) the metering chamber means comprises first and second metering chambers interconnected by fluid conduit means at a level below said predetermined level; and
- (b) the fluid conduit means connected to said reservoir at a level below the fluid level therein is connected to one of said metering chambers.
5. A fluid metering and dispensing system according to claim 4 wherein:
- (a) the pressure conduit means connected to said overflow vessel at a level above the liquid level therein is connected to the pressure conduit means extending between said source and said reservoir; and
- (b) the means for reducing the pressure in the reservoir and overflow vessel comprises:
- (i) a restricted opening between the last two mentioned fluid conduit means, and
- (ii) valve means in the pressure conduit means connected to said overflow vessel for bleeding off pressure in excess of said second predetermined pressure.

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6. A fluid metering and dispensing system comprising:
- (a) a closed fluid reservoir;
- (b) a closed overflow collector vessel positioned above said reservoir;
- (c) closed metering chamber means positioned with the upper extremity thereof above the fluid level in said reservoir;
- (d) fluid conduit means connecting the upper extremity of said metering chamber means to said overflow vessel;
- (e) fluid conduit means connected to said metering chamber means at a predetermined level and extending away therefrom;
- (f) fluid conduit means connected to said overflow vessel below the fluid level therein and extending away therefrom;
- (g) a source of pressurized gas;
- (h) pressure conduit means connected to said source and extending away therefrom;
- (i) pressure conduit means connecting said overflow vessel above the fluid level therein to the pressure conduit means extending away from said source;
- (j) coupling means for connecting said fluid reservoir to said system in a first position in which said fluid conduit means are connected directly to said pressure conduit means and in a second position in which said fluid conduit means are connected to said pressure conduit means through the fluid in said reservoir;
- (k) valve means for selectively admitting pressurized gas from said source through said pressure conduit means connected thereto when said reservoir is in said first position to force said pressurized gas through said system and for admitting pressurized gas from said source to said reservoir when said reservoir is in said second position to apply a first predetermined pressure above atmospheric on the fluid therein to force said fluid through said fluid conduit means and to said metering chamber means to fill said chamber means to at least said predetermined level;
- (l) means for reducing the pressure in the system when said reservoir is in said first position and for reducing the pressure on the fluid in said reservoir and in said overflow vessel when said reservoir is in said second position and said metering chamber means has been filled to said predetermined level to a second predetermined pressure above atmospheric; and
- (m) valve means for selectively withdrawing the fluid retained in said metering chamber means.
7. A fluid metering and dispensing system according to claim 6 wherein:
- (a) said metering chamber means comprises first and second metering chambers interconnected by fluid conduit means at a level below said predetermined level; and
- (b) said fluid conduit means extending away from said metering chamber means is connected to one of said metering chambers.
8. A fluid metering and dispensing system according to claim 7 wherein:
- (a) the fluid conduit means extending away from said metering chamber and said overflow vessel are connected to a first puncture tube;
- (b) the pressure conduit means extending away from said source is connected to a second puncture tube;
- (c) said reservoir includes:
- (i) a breakable sealing member covering one portion thereof,
- (ii) fluid conduit means in said reservoir extending from said sealing member to a point below the liquid level therein, and
- (iii) pressure conduit means in said reservoir extending from said sealing member to a point above the liquid level therein, and

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(d) said coupling means is attached to said puncture tubes for connecting said reservoir in said first position with said puncture tubes spaced from said sealing member and in said second position with said first puncture tube connected through said sealing member to the fluid conduit means disposed therein and with said second puncture tube connected through said sealing member to the pressure conduit means disposed therein.

9. A fluid metering and dispensing system according to claim 8 wherein:

- (a) the means for reducing the pressure in said reservoir and said overflow vessel to said second predetermined pressure comprises:
 - (i) a restriction in the pressure conduit means connected between said source and said overflow reservoir, and
 - (ii) valve means in the pressure conduit means disposed between said restriction and said overflow vessel for bleeding off pressure in excess of said second predetermined pressure.

10. A fluid metering and dispensing system comprising:

- (a) a plurality of metering and dispensing subsystems with each subsystem including:
 - (i) a closed fluid reservoir,
 - (ii) first and second closed metering chambers positioned with their upper extremities above the fluid level in said reservoir,
 - (iii) fluid conduit means interconnecting said metering chambers at a first level,
 - (iv) fluid conduit means connecting said reservoir at a level below the fluid level therein to one of said metering chambers at a second level above said first level, and
 - (v) pressure conduit means connecting said metering chambers at their upper extremities to said reservoir at a level above the fluid level therein;

(b) means for selectively and simultaneously applying a first predetermined pressure above atmospheric on the fluid in each of said reservoirs to force said fluid through said fluid conduit means and to the metering chambers of each subsystem to fill the respective metering chambers to at least the second level of each respective subsystem;

(c) means for simultaneously reducing the pressure on the fluid in the reservoir and metering chambers and in the pressure conduit means connecting said metering chambers with the fluid reservoir in each subsystem after the chambers of each subsystem have been filled to at least said second level to a second predetermined pressure above atmospheric; and

(d) valve means for each subsystem for selectively withdrawing the fluid retained in either of the metering chambers thereof.

11. A fluid metering and dispensing system comprising:

- (a) a plurality of metering and dispensing subsystems with each of said subsystems including:
 - (i) a closed fluid reservoir,
 - (ii) a closed overflow collector vessel positioned above said reservoir,
 - (iii) first and second closed metering chambers positioned with their upper extremities above the fluid level in said reservoir,
 - (iv) fluid conduit means connecting the upper extremities of said metering chambers to said overflow vessel,
 - (v) fluid conduit means interconnecting said metering chambers at a first level,
 - (vi) fluid conduit means connecting one of said metering chambers at a second level above said first level to said reservoir at a level below the fluid level therein, and

(vii) fluid conduit means connecting said overflow vessel to said fluid reservoir;

- (b) a source of pressurized gas;
- (c) a distribution manifold;
- (d) pressure conduit means connecting said source to said distribution manifold and said distribution manifold to the reservoir of each subsystem at a level above the fluid level therein;
- (e) an equalization manifold;
- (f) pressure conduit means connecting said equalization manifold to the overflow vessel of each subsystem at a level above the fluid level therein;
- (g) pressure conduit means interconnecting said manifolds;
- (h) valve means for selectively admitting pressurized gas from said source to said distribution manifold and simultaneously to the fluid reservoir of each subsystem to apply a first predetermined pressure above atmospheric on the fluid in each reservoir of said subsystems to force said fluid through said fluid conduit means to the metering chambers of each subsystem to fill the respective metering chambers to at least said second level;
- (i) delayed pressure releasing means in the pressure conduit means interconnecting said manifolds for reducing pressure in said distribution manifold and bleeding it to said equalization manifold;
- (j) valve means connecting said equalization manifold to the atmosphere for bleeding off pressure in excess of a second predetermined pressure which is above atmospheric and below said first predetermined pressure to reduce the pressure on the fluid in the fluid reservoir and overflow vessel of each subsystem to said second predetermined pressure;
- (k) valve means for each subsystem for selectively withdrawing the fluid retained in either or both of the metering chambers thereof.

12. A fluid metering and dispensing system comprising:

- (a) plurality of metering and dispensing subsystems with each subsystem including:
 - (i) a closed fluid reservoir,
 - (ii) a closed overflow collector vessel positioned above said reservoir,
 - (iii) first and second closed metering chambers positioned with their upper extremities above the fluid level in said reservoir,
 - (iv) fluid conduit means connecting the upper extremities of said metering chambers to said overflow vessel,
 - (v) fluid conduit means interconnecting said metering chambers at a first level,
 - (vi) fluid conduit means connecting one of said metering chambers at a second level above said first level to a first puncture tube,
 - (vii) fluid conduit means connecting said last mentioned fluid conduit means to said overflow vessel below the fluid level therein,
 - (viii) a breakable sealing member covering one portion of said fluid reservoir,
 - (ix) fluid conduit means in said reservoir extending from said sealing member to a point below the liquid level therein, and
 - (x) pressure conduit means in said reservoir extending from said sealing member to a point above the liquid level therein,
- (b) a source of pressurized gas;
- (c) a distribution manifold;
- (d) pressure conduit means connecting said source to said distribution manifold;
- (e) pressure conduit means connecting said distribution manifold to a second puncture tube in each of said subsystems;
- (f) coupling means in each of said subsystems attached to the puncture tubes thereof for connecting

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the respective reservoir in one position with said puncture tubes spaced from said sealing member and in another position with said first puncture tube connected through said sealing member to the fluid conduit disposed therein and with said second puncture tube connected through said sealing member to the pressure conduit disposed therein;

- (g) an equalization manifold;
- (h) pressure conduit means connecting said equalization manifold to the overflow vessel of each subsystem at a level above the fluid level therein;
- (i) pressure conduit means interconnecting said manifolds;
- (j) valve means for selectively admitting pressurized gas from said source to said distribution manifold for simultaneously admitting pressurized gas to the fluid reservoir of each subsystem when the reservoirs thereof are in said second position to apply a first predetermined pressure above atmospheric on the fluid in each of said subsystems to force fluid through said fluid conduit means and to the metering chambers of each subsystem to fill the respective metering chamber to at least said second level;
- (k) delayed pressure releasing means in the pressure conduit means interconnecting said manifolds for reducing pressure in said distribution manifold and bleeding it to said equalization manifold after the metering chambers of each subsystem have been filled to at least said second level;
- (l) valve means connecting said equalization manifold to the atmosphere for bleeding off pressure in excess of a second predetermined pressure which is above atmospheric and below said first predetermined pressure to simultaneously reduce the pressure on the fluid in the fluid reservoir and overflow vessel of each subsystem to said second predetermined pressure after said chambers have been filled to at least said second level; and
- (m) valve means for each subsystem for selectively withdrawing the fluid retained in either or both of the metering chambers thereof.

13. In a fluid metering and dispensing system having a source of pressurized gas, a fluid reservoir, fluid metering chamber means, fluid conduit means connected to said fluid metering chamber means and adapted to be connected at its end to said reservoir, and pressure conduit means connected to said source and adapted to be connected at its end to said reservoir, the improvement comprising:

- (a) coupling means attached to said fluid and pressure conduit means with a portion thereof extending outwardly of said ends for connection to said fluid reservoir in a first position in which said fluid conduit means are connected directly to said pressure conduit means and in a second position in which said fluid conduit means are connected to said pressure conduit means through the fluid in said reservoir

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whereby admission of pressurized gas to said pressure conduit means forces pressurized gas through said system when said coupling means is in said first position and forces fluid from said reservoir into said metering chamber means when said coupling means is in said second position.

14. In a fluid metering and dispensing system having a source of pressurized gas, a fluid reservoir, fluid metering chamber means, fluid conduit means connected to said fluid metering chamber means and adapted to be connected at its end to said reservoir, and pressure conduit means connected to said source and adapted to be connected at its end to said reservoir, the improvement comprising:

- (a) a first puncture tube connected to the end of said fluid conduit means;
- (b) a second puncture tube connected to the end of said pressure conduit means;
- (c) a breakable sealing member covering one portion of said fluid reservoir;
- (d) fluid conduit means in said reservoir extending from said sealing member to a point below the liquid level therein;
- (e) pressure conduit means in said reservoir extending from said sealing member to a point above the liquid level therein;
- (f) coupling means attached to said fluid and pressure conduit means in surrounding relationship with respect to said puncture tubes and having a portion thereof extending outwardly of said conduit means beyond said puncture tubes for connection to said reservoir in one position with said puncture tubes spaced from said sealing member and in a second position with said first puncture tube connected through said sealing member to the fluid conduit means disposed therein and with said second puncture tube connected through said sealing member to the pressure conduit means disposed therein; and
- (g) means for feeding pressurized gas from said pressure conduit means directly through said first puncture tube and into said fluid conduit means when said coupling means is connected to said reservoir in said one position and for feeding pressurized gas into said reservoir through the pressure conduit means contained therein when said coupling means is connected to said reservoir in said second position to force fluid within said reservoir through said fluid conduit means.

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