

July 16, 1940.

H. SHAPIRO

2,208,550

LIQUID DISPENSING APPARATUS

Filed July 9, 1938

2 Sheets-Sheet 1

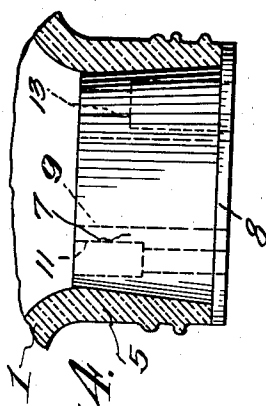
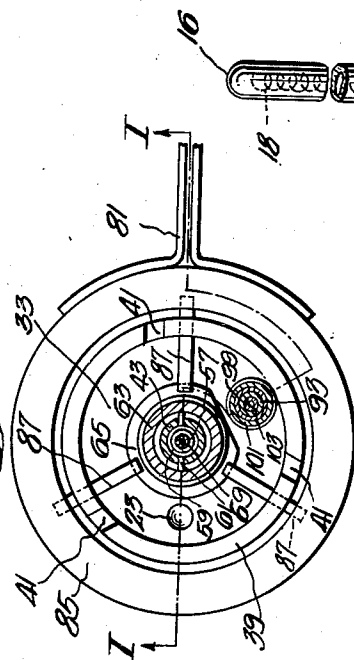


Fig. 4.

Fig. 3.



July 16, 1940.

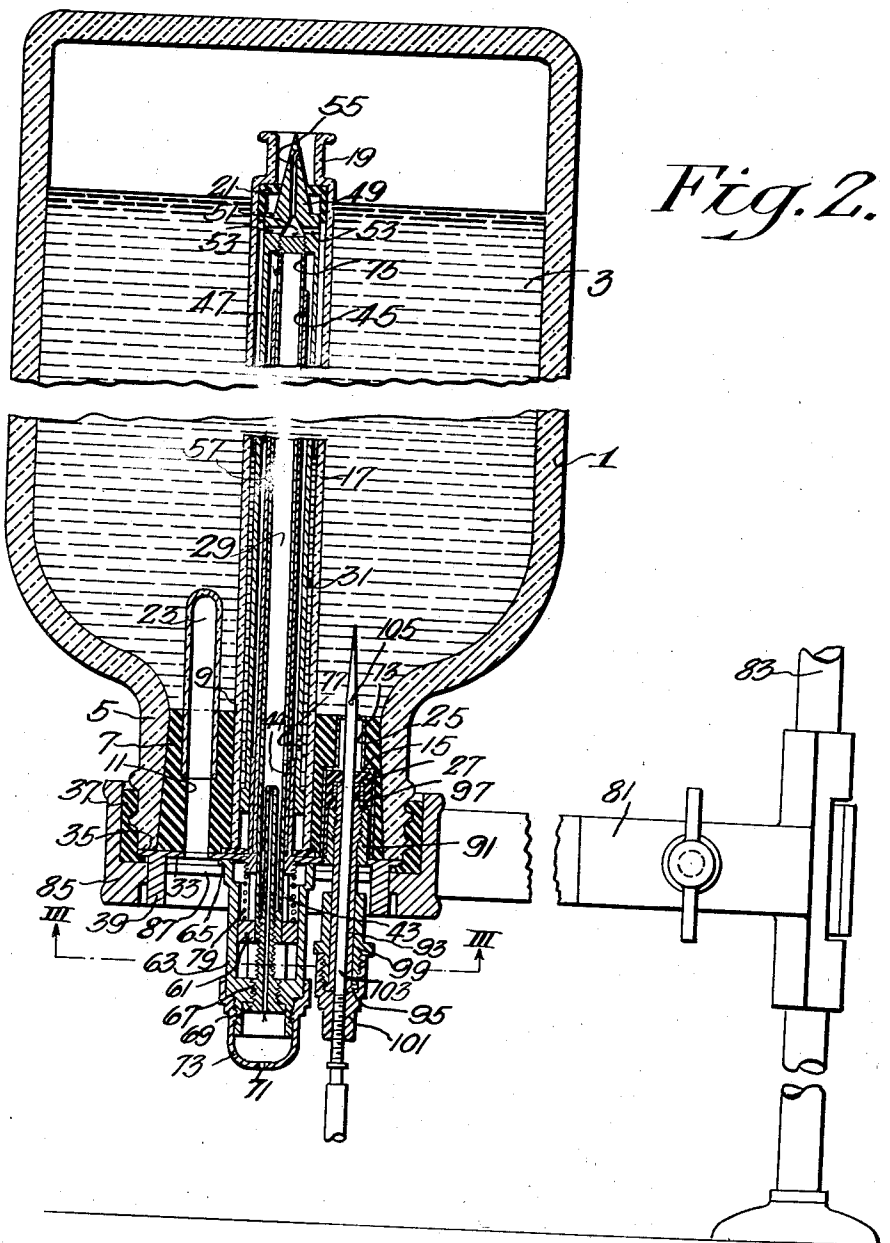
H. SHAPIRO

2,208,550

LIQUID DISPENSING APPARATUS

Filed July 9, 1938

2 Sheets-Sheet 2



Inventor

Inventor
Henry Shapiro
Morris B. Rabin

Morris B. Rabkin

Attorney

UNITED STATES PATENT OFFICE

2,208,550

LIQUID DISPENSING APPARATUS

Henry Shapiro, Philadelphia, Pa., assignor of
one-half to Samuel J. Becker, Philadelphia,
Pa.

Application July 9, 1938, Serial No. 218,444

9 Claims. (Cl. 128—214)

This invention relates to liquid dispensing apparatus, and more particularly to apparatus for dispensing aseptic medicinal fluids without danger of contaminating the same, the present invention being an improvement over that disclosed and claimed in my copending application Ser. No. 51,337 filed Nov. 23, 1935, now Patent No. 2,124,214, dated July 19, 1938.

In my said copending application, I have disclosed a medicinal dispensing apparatus comprising a bottle or other suitable container for the medicinal fluid in the neck of which is tightly fitted a stopper member having a tube extending into the container. The inner end of the tube is provided with an opening which is normally closed by a soft rubber plug or the like, and the tube is partially filled with a suitable sterilizing liquid when the device is in use. Fitted within the aforementioned tube is a venting device for admitting air from the atmosphere into the container. This venting device is formed of a plurality of relatively movable members which provide a circuitous path for atmospheric air, the venting device being so constructed and arranged that air from the atmosphere which is admitted therethrough must pass through the sterilizing solution. The venting device is also provided with a member which is adapted to pierce the tube closing plug for establishing communication between the interior of the tube and the air space in the container whereby the sterilized air may pass into the container and thereby permit withdrawal of the medicinal fluid therefrom through a suitable discharge tube or the like connected to the stopper member.

While the several forms of the invention disclosed in my said copending application all work very satisfactorily, they are open to the objection that the means therein disclosed for manipulating the venting device is of such a nature as to require the exercise of considerable care in handling the container after a period of service if contamination of the medicinal fluid by the sterilizing solution is to be avoided. For example, unless the aforementioned plug piercing member is first withdrawn from the plug so as to disestablish communication between the tube and the air space in the container, the sterilizing fluid will, upon inversion of the container prior to storage thereof, pass into the container and thus contaminate the medicinal fluid remaining therein. Occasionally, a careless operator will overlook the necessity of taking this precaution and, as a result, the medicinal fluid will become spoiled.

Another objection which may, possibly, be raised against one of the specific stopper members disclosed in my said copending application is that unless care is exercised during insertion of the venting device into the aforementioned tube and in connecting the discharge tube to the stopper prior to setting the apparatus up for use, air may be forced into the container directly from the atmosphere and the contents thereof contaminated even before any of it has been used.

The primary object of my present invention, therefore, is to provide an improved liquid dispensing apparatus which will not be subject to the foregoing and other possible objections which may characterize the apparatus of my above-identified copending application.

More specifically, it is an object of my present invention to provide an improved medicinal dispensing apparatus which will safeguard the medicinal fluid against contamination and which will not require the exercise of great care to insure such safety.

Another object of my present invention is to provide liquid dispensing apparatus of the type heretofore described with an improved manipulating device for the venting means which will automatically so condition the venting means when the container is removed from its supporting structure after a period of use that it will not be possible for the sterilizing liquid to enter the container.

Still another object of my present invention is to provide an improved stopper member for a container of the type previously described.

A further object of my present invention is to provide an improved container as aforesaid wherein the temperature of the contents may be controlled at will.

Still a further object of my present invention is to provide an improved liquid discharging tube for apparatus of the type set forth.

Another object of my present invention is to provide, in apparatus as heretofore set forth, improved means for controlling the rate at which the liquid contents of the container may be withdrawn.

It is also an object of my present invention to provide improved liquid dispensing apparatus which is simple and practical in construction and is comprised of a minimum number of parts consistent with the highly efficient operation of which it is capable, which provides adequate insurance for the liquid in the container against contamination, which may be manipulated with

great facility, and which is inexpensive to manufacture.

In accordance with my present invention, I provide a clamping ring which supports the container in inverted position during operation and which clamps the manipulating member for the venting device firmly against the stopper. Interposed between the manipulating member and the venting device is a coiled spring so arranged that, when the container is removed from the clamping ring prior to being set upright again, it will force the manipulating device away from the stopper to thereby automatically withdraw the piercing element which pierces the soft rubber plug or closure of the tube containing the sterilizing liquid and which during operation of the apparatus, establishes communication between the tube and the container. Thus, communication between the tube and the container is shut off and the possibility of having any sterilizing liquid enter with the container is entirely eliminated.

A further feature of my present invention consists in the provision of a novel discharge tube through which the medicinal fluid may be easily withdrawn. This discharge tube is movably carried by the stopper member and is so arranged therein that, by suitable manipulation of the discharge tube, the rate of flow of the medicinal fluid from the bottle may be readily controlled. I also provide the stopper member with a plurality of additional inwardly extending tubes one of which is adapted to receive a heating medium for heating the medicinal fluid and another of which is adapted to receive a temperature indicating instrument by means of which the temperature of the medicinal fluid can be determined.

The novel features that I consider characteristic of my invention are set forth with particularity in the appended claims. The invention itself, however, both as to its organization and method of operation, as well as additional objects and advantages thereof, will best be understood from the following description, when read in connection with the accompanying drawings, in which

Figure 1 is a sectional view of my improved apparatus taken approximately on the line I—I of Figure 3, and showing the position of the parts when the container is about to be mounted on its clamping ring and before the piercing element on the venting device has been forced through the closure in the tube containing the sterilizing liquid,

Figure 2 is a similar view showing the container mounted on its supporting or clamping ring, and showing the position of the parts after the piercing element has been forced through the closure in the tube to establish communication between the tube and the container.

Figure 3 is a view taken substantially on the line III—III of Figure 2 and showing the relation of the stopper in the container, the venting device and its manipulating element, and the clamping ring which supports the container,

Figure 4 is a view showing a modified form of stopper for the container, and

Figure 5 is a perspective view of still another form of stopper device for the container.

Referring more specifically to the drawings, wherein similar reference characters designate corresponding parts throughout, there is shown, in Figures 1 and 2, a container 1 comprising a receptacle for receiving an aseptic medicinal

fluid 3 suitable, for example, for intravenous, intramuscular, subcutaneous, or similar injections, and having a neck portion 5 which is externally threaded. Tightly fitted into the neck 5 is a rubber, cork, or other suitable stopper 7 having a substantially central opening 9 therein and at least two other openings 11 and 13 radially spaced from the opening 9, the opening 13 being, preferably, reduced to a smaller diameter at its inner end whereby to provide an annular shoulder 15 for a purpose shortly to be set forth.

Fitted tightly within the opening 9 is a tubular member 17 of glass or any other suitable material, the tube 17 having an open inner end 19 of reduced diameter and a soft rubber plug or closure member 21 normally closing the end 19. Into the inner end of the opening 11 is tightly fitted a glass or other suitable tube 23 for receiving a suitable temperature indicating device, such as a thermometer (not shown), by means of which the temperature of the medicinal liquid 3 may be ascertained, while a sleeve 25, preferably of metal and of the same shape as the opening 13, is fitted tightly into the opening 13, a soft rubber plug or closure 27 being tightly fitted into the sleeve 25 and resting against the annular shoulder thereof which abuts the shoulder 15, whereby the opening 13 is closed. Thus, the combined effect of the stopper 7, the tube 17 with its closure member 21, the tube 23, and the sleeve 25 with its closure member 25 is to completely shut off and seal the contents of the receptacle 1 from the atmosphere.

The tubular member 17 is provided to receive an air venting device generally designated by the numeral 29 by means of which atmospheric air may be admitted into the container 1 for withdrawal of the liquid 3 therefrom and also to receive a sterilizing medium 31 for sterilizing and cleaning the air prior to its entry into the air space above the liquid 3. The venting device 29 has a base plate 33 with the peripheral portion 35 of which an annular screw cap 37, threaded onto the receptacle neck 5, cooperates to clamp the base 33 against the neck 5 and the stopper 7. The base plate 33 has a boss 39 thereon provided with a plurality of circumferentially spaced bayonet slots 41, and also a plurality of openings corresponding in number to and aligned with those of the stopper 7.

Fixed to the base plate 33, as by threading to its central opening, is a centrally bored and diametrically slotted cylindrical guiding member 43 on the upper end of which is formed a spacing sleeve 44 in which a stationary, intermediate tube 45 is frictionally fitted. The sleeve 44 serves to space the intermediate tube 45 from an outer tube 47 having an outer diameter materially smaller than the inner diameter of the tubular member 17. A pointed member 49 which is adapted to pierce the soft rubber closure 21 and which has a small air chamber 51 therein is either formed integrally with or may be suitably secured to the upper end of the outer tube 47, the member 49 being formed with one or more radial vents 53 which provide communication between the interior of the tube 17 and the chamber 51, and with a duct or passage 55 terminating adjacent its pointed tip and also communicating with the chamber 51. Thus, when the tip of the member 49 is forced through the closure or rubber plug 21, as shown in Figure 2, communication is established between the interior of the tubular member 17 and the interior

of the container 1 via the vents 53, the chamber 51, and the duct 55.

For manipulating the closure piercing member 49 and to provide a path for entrance of air from the atmosphere into the sterilizing tube 17, an inner tube 57 is threaded or otherwise suitably secured to the member 49 and is slidably mounted in the intermediate tube 45 for movement in a longitudinal direction normal to the base 33, the tube 57 being internally threaded at its lower end. Preferably, the tubes 45, 47 and 57 are arranged co-axially to each other and to the base plate 33, and the inner tube 57 extends down through the central bore of the guiding member 43, as clearly shown in Figures 1 and 2. Force fit onto the lower end of the tube 57 is a terminal member 59 having a pair of diametrically opposed extensions 61 which are received within the diametrical slot of the guide 43, whereby rotation of the inner tube 57 is prevented and its movement is confined only to lineal movement in a longitudinal direction.

A hollow, cylindrical manipulating element 63 is provided at one end with an outwardly extending base flange 65 and adjacent its other end with an inwardly extending flange 67 in which is fixed, as by tightly threading therein, a hollow stem 69 rather loosely threaded into the lower end of the tube 57. Upon turning the manipulating element and its threaded stem 69 one way or the other, as may be desired, it is obvious that, since the inner tube 57 cannot rotate, it will be moved longitudinally up or down, at will, relative to the intermediate tube 45 and the base 33, depending upon the direction of rotation of the manipulating element 63, and will carry with it the pointer closure piercing member 49 and the outer tube 47. In this way, the piercing member 49 may be brought into piercing relation with the closure 21, as shown in Figure 2, to establish communication between the atmosphere and the interior of the container 1, or it may be withdrawn from piercing relation with the closure 21, as shown in Figure 1, to disestablish such communication.

When the venting device 29 is in the position shown in Figure 2, air from the atmosphere passes in through an opening 71 in a cap 73 which is screwed onto the outer end of the manipulating element 63 and in which a wad of cotton (not shown) saturated with a suitable sterilizing solution may be placed as an additional precaution. The air then passes up through the hollow stem 69 and the inner tube 57, through one or more small openings 75 in the upper end of the tube 57, then reverses itself and passes down between the tubes 45 and 47, and then through one or more small openings 77 in the lower region of the outer tube 47 into the space between the tube 47 and the tubular member 17 in which the sterilizing liquid 31 is located. Here, the air passes upwardly again through the liquid 31 which thoroughly cleans and sterilizes it, then through the radial vents 53 into the chamber 51 which, if desired, may also be filled with a wad of cotton saturated with the same or other suitable sterilizing solution, and finally through the duct 55 into the air space above the liquid 3. In this manner, the air coming from the atmosphere is rendered clean and sterile prior to reaching the interior of the receptacle 1 and, when reaching the air space above the liquid 3, permits the withdrawal of the medicinal fluid by means presently to be described.

The structure thus far described is fairly sim-

ilar to that set forth in my above-identified co-pending application. When a sufficient quantity of medicinal fluid has been withdrawn from the container 1, it is usually inverted to upright position and returned to its place of storage, but unless care is taken that the closure piercing member 49 is first withdrawn from the closure 21, which a careless operator is apt to omit doing sometimes, the sterilizing solution 31 will enter the radial vents 53 when the container is inverted and thence pass into the chamber 51, the duct 55 and the container 1, thereby rendering the medicinal fluid 3 unfit for further use. To eliminate this possibility, I provide a coil spring 79 within the hollow manipulating element 63 about the cylindrical guiding member 43 and the stem 69 which is co-axial therewith, the spring 79 being preferably initially placed under slight compression between the enlarged portion of the guide 43 threaded into and, in effect, constituting an extension of the base 33 and the diametrically opposed extensions 61 of the terminal member 59. Thus, the spring 79 constantly tends to force the tube 57 and its associated parts, as well as the manipulating element 63, in a downward direction, as shown in Figures 1 and 2, to move the manipulating element 63 away from the base 33 and the piercing member 49 out of piercing relation with the closure 21.

In order to maintain the manipulating element 63 in engagement with the base 33, so that the spring 79 will always be under compression, I provide a clamping member 81 which may be clamped to a suitable stand 83 and which carries a clamping ring 85 into which the screw cap 37 is adapted to fit, whereby the container 1 may be set into the clamping ring 85 when in the inverted position shown in the drawings to be supported therein. The clamping ring 85 is provided with a plurality of inwardly extending radial pins 87 equal in number to the number of bayonet slots 41 in the boss 39 and of a length sufficient to permit them to engage the base flange 65 of the manipulating element 63. On placing the container 1 in the clamping ring 85 with the shorter lengths of the slots 41 over the pins 87 and then giving the container 1 a slight turn in the proper direction, not only will the container become removably locked to the supporting ring 85 in operative position, but the pins 87 will simultaneously force the manipulating element 63 against the base 33, thereby initially compressing the spring 79 somewhat, as shown in Figure 1, and constraining the manipulating element to rotation on the base 33, or in a fixed plane. Obviously, instead of holding the manipulating element against the base 33 in the manner just described, the manipulating element may be held against some other fixed portion of the apparatus and will operate just as satisfactorily provided it is held against vertical movement and its rotation is confined to a plane parallel to that of the base 33.

By rotating the manipulating element 63 and its stem 69 in a counter-clockwise direction, the inner tube 57 will be moved upwardly to carry with it the outer tube 47 and its closure piercing member 49 until the piercing member 49 is caused to pierce and extend a suitable distance through the closure 21. It will be noted that this will also cause the spring 79 to be still more compressed, whereby its tendency to force the piercing member 49 out of piercing relation with the closure 21 will be increased. Rotation of the element 63 in a clockwise direction thereafter

will, of course, effect downward movement of the tubes 57 and 47 and of the piercing member 49 to effect withdrawal of the latter from the closure 21. Suppose, however, that the operator fails to first rotate the element 63 in a clockwise direction as above described, but instead attempts to remove the container 1 from the clamping ring 85. In such case, as soon as the clamping pins 87 are separated from the flange 65, the spring 79 will be free to expand and, upon expanding, will immediately force the piercing member 49 out of piercing relation with the closure 21.

Secured to the base 33 in any suitable manner and extending into the sleeve 25 within the opening 13 is a supporting sleeve 91 in which is fixedly supported, as by tightly threading therein, a guiding member 93 having a flange 95 on its lower end. Preferably, but not necessarily, a sleeve 97 is force fit over the supporting sleeve 91 and the adjacent, protruding end of the guide 93, the sleeve 97 being of such dimensions that it will compress the rubber plug 27 to insure a tight seal and to prevent the plug 27 from being easily withdrawn from the sleeve 25 as a discharge needle, about to be described, is worked through the plug 27. The sleeves 25 and 97 also cooperate to insure proper operation of the discharge needle without twisting the plug 27.

The flange 95 is rather loosely confined between a pair of cooperating members 99 and 101 which are tightly threaded together and which serve as operating means for the aforementioned discharge needle or tube 103. The needle 103 is threadedly received in the member 101 and slidably received in the guide 93, but it is held frictionally against rotation by the plug 27. Hence, as the operating members 99—101 are rotated counterclockwise, the discharge needle 103 is moved upwardly through the plug 27 from the position shown in Figure 1, whereas if the operating members 99—101 are rotated in a clockwise direction, the needle 103 is withdrawn from the position shown in Figure 2. The needle 103 has a central passage formed longitudinally therein and terminating in a radial bore 105. Preferably, the innermost end of the sleeve 25 is inwardly flanged at 107 to provide an opening of a diameter just sufficient to snugly accommodate the discharge needle 103. Thus, the extent of overlap between the flange 107 and the bore 105 will provide a fine adjustment for controlling the rate at which the liquid 3 is withdrawn from the container 1. Varying the overlap between the duct 55 and the closure 21, or between the openings 75 and the stationary tube 45, or between the openings 77 and the spacing sleeve 44 may also be availed of to control the rate of flow of the liquid 3 from the receptacle, but I have found that the flow of liquid may be most conveniently and most suitably controlled by merely turning the operating members 99—101 a slight bit one way or the other, since this permits much more ready and much finer adjustment.

In Figure 4, I have shown a modified form of stopper 7 for the container 1. This form of stopper is provided with a head flange 8 which fits against the periphery of the neck 5 and serves as a gasket which further helps to seal the contents of the receptacle 1 when the cap 37 is screwed onto the neck 5.

Figure 5 shows still another form of stopper which may be advantageously used in connection with my invention. In addition to the openings 9, 11 and 13, this form of stopper is provided with an additional opening 14 also radially spaced

from the central opening 9. A tube 16 is tightly fitted into the opening 14 for the reception of suitable means, such as an electric heating element, a coil through which hot water or steam may be circulated, or the like 18, for heating the medicinal liquid 3 to a desired temperature, and the temperature of the liquid 3 may be noted through the tube 23.

From the foregoing description, it will be apparent to those skilled in the art that I have provided an improved apparatus which will insure against contamination of a septic fluid placed in the container, and although I have described but one specific form thereof, I am aware that many other modifications are possible. I therefore desire that my invention shall not be limited except insofar as is made necessary by the prior art and by the spirit of the appended claims.

I claim as my invention:

1. In liquid dispensing apparatus, the combination of a container, a tubular member extending thereto and having a normally open inner end, a pierceable closure for said end, venting means within said tubular member for establishing communication between the atmosphere and the interior of said container, said venting means comprising a plurality of relatively adjustable members and including a closure piercing device on one of said members, means for adjusting said members to bring said piercing device into piercing relation with said closure, and means constantly tending to force said piercing device out of piercing relation with said closure.

2. In liquid dispensing apparatus, the combination of a container, a tubular member extending thereto and having a normally open inner end, a pierceable closure for said end, venting means within said tubular member for establishing communication between the atmosphere and the interior of said container, said venting means comprising a plurality of spaced, co-axial members adjustable relative to each other in a longitudinal direction, a closure piercing device on one of said members, means associated with said last named member for adjusting it longitudinally relative to another of said members to bring said piercing device into piercing relation with said closure, and means acting in opposition to said last named means constantly tending to force said piercing device out of piercing relation with said closure.

3. The invention set forth in claim 2 characterized in that said adjusting means comprises a hollow manipulating element, and characterized further in that said means which constantly tends to force said piercing device out of piercing relation with said closure comprises a coil spring within said element and interposed between a portion of said element and a portion of said venting means.

4. In liquid dispensing apparatus, the combination of a container, a tubular member extending thereto and having a normally open inner end, a pierceable closure for said end, venting means within said tubular member in spaced relation thereto for establishing communication between the atmosphere and the interior of said container, said venting means comprising a plurality of spaced, co-axial members adjustable relative to each other in a longitudinal direction and including a pointed closure piercing device on one of said members, said members providing a series of reversely directed successive passages having communication with the space between said vent-

ing means and said tubular member, and said closure piercing device having a duct therein terminating adjacent the point of said piercing device and also communicating with said space, means for longitudinally adjusting said members to cause said piercing device to pierce said closure whereby communication may be established between said duct and the interior of said container, and means acting in opposition to said last named means constantly tending to force said piercing device out of piercing relation with said closure whereby to disestablish communication between said duct and the interior of said container.

5. In liquid dispensing apparatus, the combination of a container, venting means associated therewith for admitting air from the atmosphere into the container, said venting means including a base and a member adjustable relative to said base, means associated with said member for imparting movement thereto relative to said base in either of two directions at will, and means constantly tending to impart movement to said member in only one of said directions.

6. In liquid dispensing apparatus, the combination of a container, venting means associated therewith for admitting air from the atmosphere into the container, said venting means including a base and a member adjustable in either of two opposite directions along a path normal to said base, a manipulating element having a centrally disposed stem threadedly connected to said member, said element having a flange thereon, a clamping device engaging said flange and holding it against said base whereby to confine said element to rotary movement on said base and thereby to effect movement of said member along said path in either of said directions at will depending upon the direction of rotation of said element, and spring means within said element arranged to constantly urge said element away

from said base whereby, upon separation of said clamping device from said flange, said spring will cause said element to move away from said base and thereby effect movement of said member in only one of said directions.

7. The invention set forth in claim 6 characterized in that said spring means is constituted by a coil spring disposed about said stem and interposed between said base and the end portion of said manipulating element.

8. In liquid dispensing apparatus, the combination of a container adapted to receive a liquid therein and having a normally open neck, a flexible stopper fitted into said neck and having an opening therein, a rigid sleeve lining said opening, a pierceable closure within said sleeve normally closing said opening, a discharge tube adjustably mounted in said sleeve, said discharge tube having a pointed end adapted to pierce said closure, guide means at least partially within said sleeve for guiding the movement of said discharge tube within said sleeve, and means for adjusting said discharge tube to either cause it to pierce said closure and pass therebeyond into said container or to withdraw said discharge tube from said container and from piercing relation with said closure at will.

9. The invention set forth in claim 8 characterized in that said sleeve has a reduced inner end of a diameter just sufficient to snugly accommodate said discharge tube and characterized further in that said discharge tube is provided with a central passage and a radially extending bore in proximity to its pointed end communicating with said passage, said discharge tube being adjustable in said sleeve to cause said bore and said reduced end to more or less overlap and thereby control the rate of discharge of the liquid from said container.

HENRY SHAPIRO.