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F. CLEMENT

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LIQUID APPLICATORS

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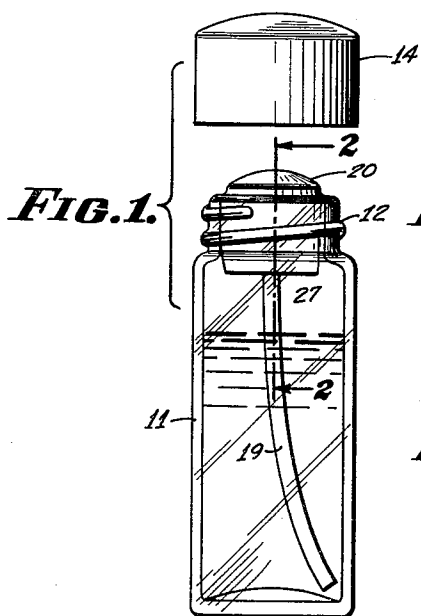


FIG. 1.

FIG. 3.

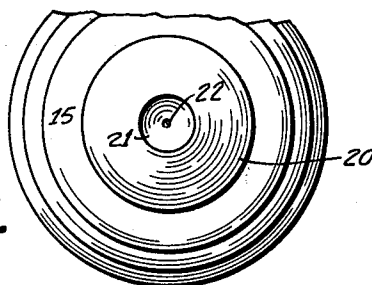


FIG. 2.

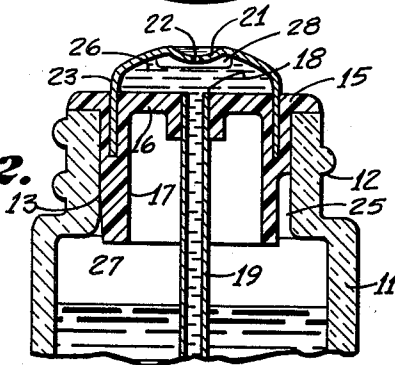
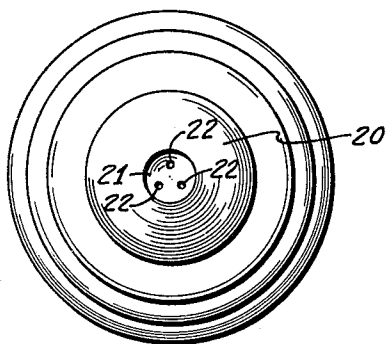


FIG. 4.

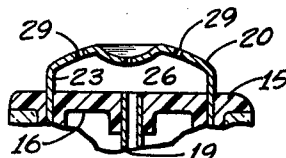


FIG. 5.

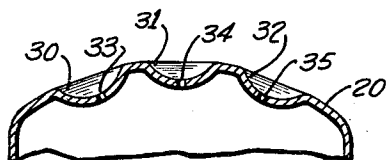


FIG. 6.

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2,949,622

LIQUID APPLICATORS

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4 Claims. (Cl. 15—133)

This invention relates to liquid applicators and more particularly to an improved applicator for applying thin films of liquid to a surface. The applicator is especially suited for applying liquid deodorants, suntan oils, insect repellants, liquid soaps and detergents, perfumes, astringents, depilatories and other liquid products to the human skin.

The present invention is an improvement on the invention set forth in a co-pending application, Serial Number 702,186, filed on December 11, 1957, which is assigned to the same assignee as the present invention. The prior application describes and claims a new type of liquid applicator which has been found to be satisfactory for applying liquid products to any surface and particularly the skin. After some reasonably extensive tests it was found desirable to improve upon the ability of the applicator to dispense liquid when first touched to the skin in order to avoid the initial dry "feel" and drag of the applicator diaphragm surface. The present invention was made to improve upon this characteristic by making the liquid more easily dispensed as soon as the diaphragm surface contacts the skin or other surface.

It is, therefore, an object of this invention to provide an improvement in liquid applicators of the character described in which the product is dispensed on initial contact with the skin or other surface.

Briefly stated, in accordance with one aspect of the invention, an applicator is provided which is composed of an adapter member attached to an opening of a liquid container; a thin resilient diaphragm is peripherally secured to the adapter member thereby enclosing a liquid reservoir between the adapter member and diaphragm; a draft tube is attached to the adapter member and extends into the liquid inside the container to permit flow of liquid to the reservoir; the diaphragm is provided with one or more concavities in its otherwise smooth surface and each of these concavities has one or more openings communicating with the reservoir allowing free outflow of liquid; liquid is dispensed through the openings in the diaphragm when the latter is depressed against a surface; the concavity acts to space the opening from the surface sufficiently to permit substantial outflow of liquid on initial contact of the diaphragm with the surface.

While the specification concludes with claims particularly pointing out and distinctly claiming the subject matter regarded as forming the present invention, it is believed the invention will be better understood from the following description taken in connection with the accompanying drawing in which:

Figure 1 is an elevation of a typical container including cap in which the improved liquid applicator has been installed; and

Figure 2 is a cross-section taken along the line 2—2 of Figure 1 showing the applicator assembled in the container neck; and

Figure 3 is a plan view of the liquid applicator and container of Figure 2; and

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Figure 4 is a plan view of a modified form of liquid applicator; and

Figures 5 and 6 are fragmentary elevations in cross-section showing modified forms of the applicator diaphragm.

Referring now to the drawing and particularly Figures 1—3, there is shown a container 11 having a threaded neck 12 and an opening 13. The container 11 may be of glass or any other material that is compatible with the liquid stored therein. A cap 14 is provided to close the container as by engaging the threads on the neck 12.

The liquid applicator is composed of an adapter member 15 having a relatively rigid transverse wall 16 with an integral annular wall 17 depending therefrom. The outer surface of the annular wall 17 is designed to fit snugly into the opening 13 of the container 11. The transverse wall 16 is provided with an aperture 18 having a draft tube 19 fitting snugly therein. The draft tube 19 may be heat sealed in the aperture 18, although a snug interference fit will be satisfactory for most purposes. The draft tube 19 extends substantially to the bottom of the container 11.

A thin resilient applicator diaphragm 20 is assembled with the adapter member 15. The diaphragm 20 has a concavity 21 and a relatively small opening 22. An integral annular skirt-like extension 23 depends downwardly from the upper portion of the diaphragm 20. The upper portion of the diaphragm 20 is substantially hemispherical in shape although the concavity 21 does, to some extent, break up the normally smooth contour of the diaphragm surface. In a preferred form, the diaphragm, as illustrated, is shaped like a partially flattened hemisphere or watch glass. It will be understood, of course, that other shapes can be used with satisfactory results so long as a concavity is provided with at least one opening therein as this has been found necessary to improve the ability of the applicator to dispense liquid on initial contact of the diaphragm with a surface.

The annular wall 17 of the adapter member 15 is provided with a narrow annular slot 24, which is adapted to receive the annular extension 23. The slot 24 is designed to wedge and grip the annular extension 23 in assembled relation when the adapter member 15 is pressed into the opening 13 of the container 11. A vent channel 25 for purposes described below may also be provided in the annular wall 17.

The volume bounded by the top surface of the transverse wall 16 and below the diaphragm 20 comprises a liquid reservoir 26. The maximum volume of the reservoir 26 must be greater than the volume of the bore in the draft tube 19 in order to obtain satisfactory results. Poor performance will result if these volumes are substantially equal and the device is inoperative when the volume of the draft tube bore exceeds the volume of the reservoir.

The adapter member 15 and the diaphragm 20 may be molded from typical inert plastic materials such as polyethylene, for example. Other materials can be used where they are compatible with the liquid being dispensed. The use of a molded polyethylene diaphragm 20 affords a smooth outer applicator surface which does not irritate even the most sensitive of human skin.

In assembling the applicator to a container, the annular wall 17 is pressed into the opening 13 causing compression of the air confined in the space 27 above the liquid in the container. As the adapter member 15 is forced downwardly beyond the end of vent channel 25, the air trapped in the space 27 forces liquid up through the draft tube 19 and into the reservoir 26 so that the reservoir is filled when the adapter member 15 is assembled to the container. It has been found that an air bubble 28

tends to form and remain in the upper portion of the liquid reservoir 26.

If, on assembly, the reservoir 26 is completely filled with liquid, the air bubble 28 will form after the diaphragm 20 is deflected and released one or more times. The primed applicator may be used immediately. Alternatively, the cap 14 may be screwed on the primed applicator and the applicator shipped and/or stored until needed. The applicator remains primed whether used immediately or after a period of storage.

Liquid can be applied by merely rubbing and depressing the diaphragm 20 over the skin or any other surface for that matter. There is no need to invert the container. As the diaphragm is rubbed over the surface, it is depressed and some of the liquid in the reservoir 26 is forced through the opening 22 because of the downward deflection of the diaphragm 20 as it is rubbed. Liquid is applied in this manner and its application may continue indefinitely. As the liquid is discharged and applied through the opening 22, additional liquid is pumped from the container up through the draft tube 19 and into the liquid reservoir 26 each time the depressed diaphragm 20 is released and permitted to return to its original shape. Downward deflection of the diaphragm causes compression of the bubble 28 (if the concavity or concavities 21 are bridged thereby preventing outflow of liquid through the opening or openings 22) and forces portions of it (in the form of small bubbles) down the draft tube 19 where these portions rise into the air space 27. When the diaphragm 20 is released, liquid is forced up the draft tube 19 and into the reservoir 26 due to the pressure increase in the air space 27. This makes additional liquid available for application as the diaphragm is being rubbed over a surface in normal fashion. Thus, additional liquid is constantly being supplied to the reservoir 26 as the liquid is being applied through the opening 22. When the diaphragm 20 is completely released after deflection, it quickly restores itself to its original shape so that additional air is drawn into the reservoir 26 through the opening 22 to enlarge the air bubble 28. Some of the air (in the air bubble 28) is then forced out through the opening 22 as the air pressure in the space 27 tends to force additional liquid up the draft tube 19 until a condition of equilibrium is achieved.

Additional liquid may be pumped into the reservoir in this same manner, i.e. without using the device for applying a liquid film to a surface. This can be accomplished by merely placing the end of the finger or any object over the concavity 21 thereby closing the opening 22 and depressing and releasing the diaphragm 20 one or more times. With each deflection of the diaphragm 20, the air in the bubble 28 will be compressed and a portion of it (in the form of small bubbles) will be forced down the draft tube 19 to rise into the air space 27 so that additional liquid will be forced up the draft tube 19 and into the reservoir 26 each time the diaphragm 20 is released.

The improvement in liquid application on initial contact of the diaphragm 20 results from the spacing of the opening 22 away from the normal outer contour of the diaphragm 20. When the diaphragm is first touched to a surface which is to be wetted, the surface will not cover the opening 22 and restrict outflow of liquid as it might in the absence of the concavity 21. A slight deflection of the diaphragm 20 results on initial contact with a surface and this forces immediate flow of liquid through the opening 22 thus filling the concavity 21 and greatly facilitating the initial application of liquid and wetting of the diaphragm surface. The normal action of rubbing the applicator back and forth as when applying deodorant to the armpits, causes sufficient deflection and release of the diaphragm 20 to cause continuous outflow of liquid from the reservoir 26 and thereby permits continuous application to an area of any size.

The air bubble 28 serves the additional function of

preventing liquid overflow due to barometric pressure changes and/or temperature variations.

The length of the annular wall 17 may be such that an excessive quantity of liquid is forced up the draft tube 19 and into the liquid reservoir 26 by compression of air in space 27 when the adapter member 15 is attached to the container. The regulating vent channel 25 is provided in order to reduce the quantity of liquid forced into the liquid reservoir 26 on assembly. The amount of liquid forced up the draft tube 19 and into the reservoir 26 can be varied by changing the length of the vent channel 25 for a given size of adapter 15. For example, if the vent channel is as long as the annular wall 17 no liquid will be forced into the liquid reservoir 26 on assembly since the air which is displaced on insertion of the adapter member into the space 27 will all escape through the vent channel 25 when the device is assembled. Thus, by simple experiment, the optimum length of vent channel 25 can be found which will just fill the reservoir 26 when the adapter member 15 is assembled with the container 11.

Figure 4 illustrates a modified form of the invention in which three relatively small openings 22 are provided inside the concavity 21. This illustrates that any number of openings 22 can be provided in the concavity 21 to obtain satisfactory dispensing and application of liquid. The number and spacing of the openings 22 being a matter of design and will depend on such variables as the physical properties of the liquid being dispensed, the rate of dispensing desired, the size of the applicator and many others as will be appreciated by those skilled in the art.

Another modified form of the invention is shown in Figure 5. In this modification, openings 29 are provided outside the concavity 21 to supplement the opening 22 inside the concavity 21. The necessity of providing the openings 29 will also depend on the dispensing requirements of a particular product.

The invention is not necessarily limited to a diaphragm 20 having a single concavity 21. For example, the use of three concavities 30, 31 and 32 each having a single opening 33, 34 and 35, respectively, is shown in Figure 6. It is thus evident that any number of concavities may be used in which each concavity has at least one opening and, in addition, any number of additional openings on the smooth diaphragm surface and outside the concavities may, of course, be provided. The number of combinations possible are quite numerous, obviously, and the particular design that might be adopted will, in most cases, be dictated by the dispensing requirements as previously indicated. The only requirement that must be met in using multiple concavities, this being a requirement for single cavities also, is that the concavities be of such size and so spaced that they are normally bridged by the skin of the user in order to obtain the proper pumping action. Such action would normally be attained when, for example, the applicator is used in applying a liquid deodorant to the armpits.

While particular embodiments of the invention have been illustrated and described, it will be obvious to those skilled in the art that various changes and modifications can be made without departing from the spirit and scope of the invention and it is intended to cover in the appended claims all such changes and modifications that are within the scope of this invention.

What is claimed as new is:

1. An applicator for a liquid container comprising an adapter member secured to the opening in said container, said adapter member having a wall with an aperture therein, a draft tube depending from said aperture and extending into the liquid inside the container body, a resilient, substantially hemispherical diaphragm peripherally secured to said adapter thereby enclosing a liquid reservoir between the diaphragm and the adapter, at least one concavity in the surface of the diaphragm, at least one relatively small opening in said concavity to permit

outflow of liquid from said reservoir whereby the application of liquid from the reservoir is facilitated on initial rubbing of said diaphragm over a surface.

2. An applicator for a liquid container comprising an adapter member having a transverse wall secured to the mouth of said container, a thin resilient diaphragm attached to said wall to enclose a liquid reservoir between the wall and the diaphragm, said diaphragm being substantially hemispherical in shape and having at least one concavity in its surface, at least one relatively small opening in each concavity to establish unrestricted fluid flowing communication between the reservoir and the outside atmosphere whereby rubbing the diaphragm over a surface causes liquid in said reservoir to flow out through the openings, said concavity being instrumental in initiating fluid application to the surface on initial rubbing.

3. An applicator for a liquid container comprising an adapter member secured to the mouth of said container, said adapter member having a transverse wall and an integral depending annular wall, a narrow annular slot extending into said depending annular wall, a substantially hemispherical diaphragm having an annular extension, said annular extension being inserted in said annular slot of said adapter member to hold the diaphragm and adapter in assembled relation and to form a liquid reservoir between the diaphragm and the transverse wall, means for feeding liquid from the container into the liquid reservoir, at least one concavity in the surface of said diaphragm, at least one relatively small opening in said concavity to permit outflow of liquid from said reservoir whereby the application of liquid from the reser-

voir is facilitated on initial rubbing of the diaphragm over a surface.

4. An applicator for a liquid container comprising an adapter member secured to the mouth of said container, said adapter member having a transverse wall and an integral depending annular wall, a narrow annular slot extending into said depending annular wall, a substantially hemispherical diaphragm having an annular extension, said annular extension being inserted in said annular slot of said adapter member to hold the diaphragm and adapter in assembled relation and to form a liquid reservoir between the diaphragm and the transverse wall, a draft tube attached to the transverse wall to feed liquid into the reservoir on deflection of said diaphragm, said diaphragm having at least one concavity in its surface, at least one relatively small opening in each concavity to establish unrestricted fluid flowing communication between the reservoir and the outside atmosphere whereby rubbing the diaphragm over a surface causes liquid in said reservoir to flow out through the openings, said concavity being instrumental in initiating fluid application to the surface on first contact.

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