Oct. 22, 1968 E. R. PFEIFFER 3,406,909

LIQUID ATOMIZER

Filed June 15, 1966

FIG. 1

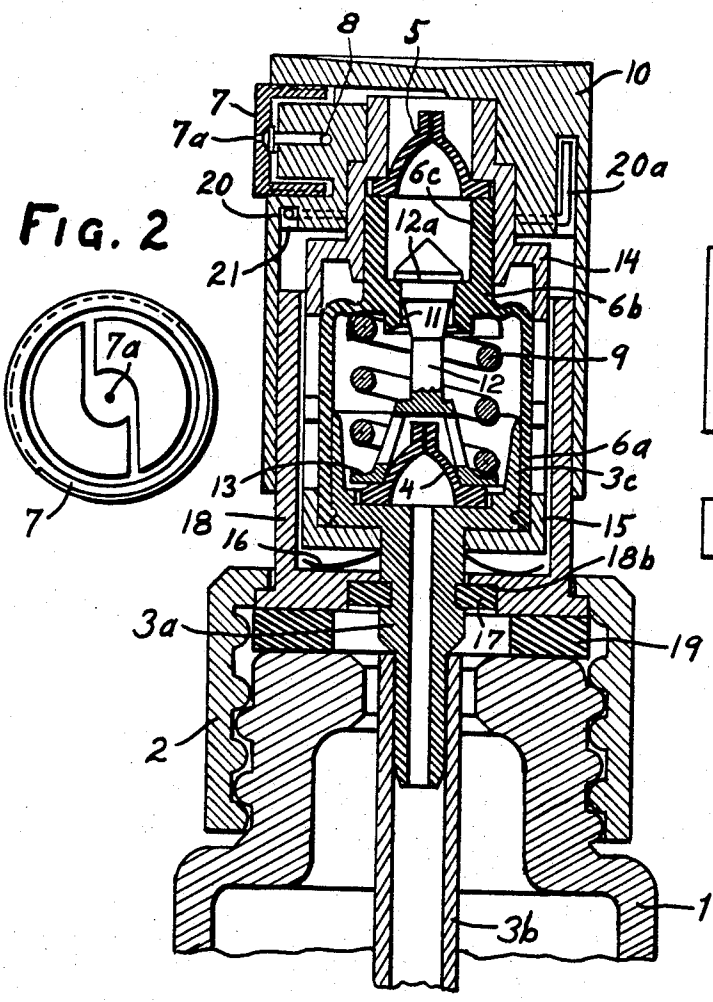


FIG. 2

FIG. 3

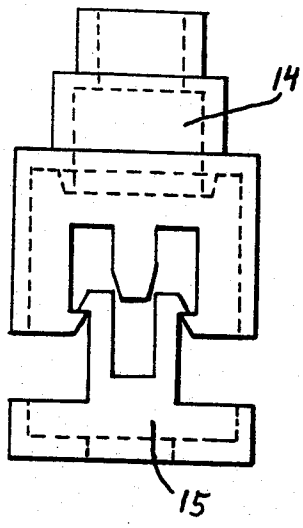
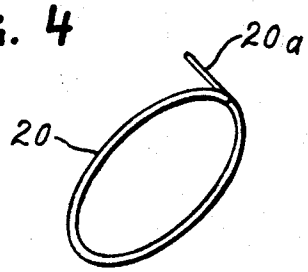


FIG. 4



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United States Patent Office 3,406,909 Patented Oct. 22, 1968

3,406,909

LIQUID ATOMIZER

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Filed June 15, 1966, Ser. No. 557,765
Claims priority, application Germany, July 3, 1965, P 37,186
7 Claims. (Cl. 239—333)

ABSTRACT OF THE DISCLOSURE

A liquid atomizer, especially for perfumes, comprising a container with a diaphragm pump mounted on it, an actuating knob on the pump and an atomizing nozzle in the side of the knob, the pump diaphragm having a stationary foot portion adjacent a suction check valve and a head portion carrying a discharge check valve and adapted to be depressed into the foot portion of the diaphragm against the force of a compression spring inside the diaphragm, and a collapsible cylindrical cage whose stationary lower portion houses the lower portion of the diaphragm while its movable upper portion houses the upper portion of the diaphragm.

Summary of the invention

The present invention relates generally to an improved liquid atomizer, and particularly to a liquid atomizer for fine sprays.

The atomizer of the present invention is particularly useful for the spraying of perfume and is capable of functioning in any position in space.

In a particular embodiment of the invention, the atomizer comprises:

(a) a container for a liquid such as perfume;

(b) a resilient deformable diaphragm such as rubber or synthetic elastomer having a foot portion and a head portion, said head portion depressible into said foot portion and having a central opening therein;

(c) a suction tube having a suction valve extending into the diaphragm;

(d) a diaphragm pump above the head portion having a discharge valve;

(e) an actuating knob with a spiral nozzle depressible upon the head portion against a spring bias; and

(f) a primary sealing member, separate from the suction and discharge valves, between the inside of the container and the outside air.

In a preferred embodiment of the present invention having new and unexpected results over the prior art, an additional sealing member is provided between the inside of the container and the spiral outlet nozzle which functions independently of the discharge valve. By using two such sealing members which can be sturdily constructed and positioned between the interior of the container and the nozzle or outside air, it is possible to prevent loss of liquid, even with considerable pressure difference between the container and the outside, except when the pump is actuated.

In the preferred embodiment of the invention, the second sealing member is advantageously in the form of a bolt which in the position of rest seals the central opening in the head portion. By using a stable bolt, very high sealing pressures are achieved.

Background of the invention

A simple prior art atomizer has a ball valve with a loosely positioned ball as a check valve, and a spring-biased ball as a discharge valve. Such prior art atomizers are disclosed in U.S. Patents 3,053,459 and 3,084,873,

the disclosures of which are incorporated herein. The pressure can build up in such a prior art atomizer, for example, when the atomizer is exposed directly to radiation from the sun. Temperatures of 40° C. can easily be reached in that manner, or in a storage compartment of an automobile or high flying airplane. In the first two cases, with a liquid-to-air ratio of, e.g., 10 to 1, there will be a possible pressure increase of about 0.8 atm., and with a ratio of 15 to 1 an increase of about 2 atm. Similar pressure increases are also possible in the last case. For example, the pressure in an atomizer carried in an airplane flying at an elevation of 10,000 m. experiences an increase of about 0.74 atm. as a result of the rarefied air. The higher it flies, the greater the pressure increase will be. If such pressure increases occur in the atomizers of the prior art, it is possible for the liquid to escape through the two valves. This is not desirable because the storage space and articles stored therein will be sprayed and some of the atomizer contents will be lost.

Description of the invention

It is therefore an object of the present invention to prevent the loss of liquid from an atomizer when not in use even when the pressure inside the atomizer container is much greater than the outside pressure.

It is another object of the invention to provide an atomizer capable of being actuated when held in any position in space.

Still another object of the invention is to provide an atomizer capable of short and well defined closure times.

A particular object of the invention is to provide an atomizer ideally suited for spraying perfume.

Another particular object of the invention is to provide for ease of cleaning the spray nozzle.

Still another particular object of the invention is to provide for carrying the nozzle cleaning device in the atomizer head.

Still further objects and the broad scope of the invention will become obvious from a detailed examination of the specification and the accompanying drawings wherein:

FIGURE 1 is a side view of the atomizer in longitudinal cross-section;

FIGURE 2 is a cross-section through the spiral nozzle;

FIGURE 3 is a side view of the cage; and

FIGURE 4 is a perspective view of the cleaning device with the nozzle needle.

In a particular embodiment as shown in FIGURE 1, the liquid atomizer comprises a container **1** having an atomizer top mounted thereon. The top comprises a diaphragm pump and an actuating knob **10**. The diaphragm pump comprises a depressible diaphragm with a foot portion **6***a* into which a head portion **6***b* with a central opening **11** can be depressed. A suction tube **3***a*, **3***b* extends into the diaphragm **6***a*, **6***b*, and carries on top of it a suction check valve **4** and a discharge check valve **5** on top of the head portion **6***b*. The actuating knob **10** contains a spiral nozzle and is actuated by depressing axially upon the head portion **6***b* against the force of the compression spring **9**. In the central opening **11** is positioned a bolt **12** which seals the head portion **6***b* while at rest and serves as a second sealing member. By means of the compression spring **9** seated in the foot portion **6***a* of the diaphragm, the head portion **6***b* of the diaphragm is pressed against a sealing surface **12***a* of the bolt **12**. The bolt **12** is rigidly connected with a footing **13** positioned in the foot portion **6***a* while the compression spring **9** is positioned between the footing **13** of the bolt **12** and the head portion **6***b* of the diaphragm. The suction and discharge valves are in the usual form of lip valves **4** and **5**. As in prior art atomizers, the suction tube **3***a*, **3***b* carries a holding portion **3***c*. Over and around the top of holding portion **3***c* a cage comprising a lower part **15**

and an upper part **14** is positioned. The two parts **14** and **15** are connected for limited relative movement as shown in FIGURE 3 by positioning the holding portion **3***c* and the diaphragm **6***a*, **6***b* inside the cage **14**, **15**, the holding portion **3***c* which is connected to the bolt footing **13** is biased by spring **9** within limits against the lower part **15** of the cage, while the upper portion **6***b* of the diaphragm is biased against the upper part **14** of the cage. The suction valve **4** is firmly clamped in place between the bolt footing **13** and the holding portion **3***c* of the suction tube, while the discharge valve **5** is clamped between the upper part **14** of the cage and the hollow cylindrical extension **6***c* of the diaphragm head portion **6***b* in which the upper end of the bolt **12** is positioned. The cage **14**, **15** is positioned for axial movement in a cylindrical housing **18** with a plate spring **16** interposed between the lower part **15** of the cage and the inner floor **18***a* of the housing **18**. Upon the suction tube **3***a*, **3***b*, is mounted a first sealing member in the form of a disk **17** to engage the lower side **18***b* of the floor of the housing **18**. In axial alignment with the spiral bore of the nozzle, a collection hole **8** is provided. As shown in FIGURE 4, the nozzle cleaning needle **20***a* is formed with a ring-shaped handle portion **20** for seating in a channel **21** in the actuating knob **10** of FIGURE 1. The spiral nozzle is covered by a cap member **7** with a central orifice **7***a*. Between the atomizer top and the vessel **1** a sealing member **19** is clamped by the threaded cap **2**.

In actuating the atomizer of the present invention, the knob **10** is depressed with deformation of the diaphragm head portion **6***b* and the separation of surface **12***a* of sealing member **12** from the head portion. With further depression of knob **10**, the upper part **14** contacts the lower part **15** of the cage and plate spring **16** is compressed with the opening of sealing disk **17** to the atmosphere. When the pressure on knob **10** is released, the cage **14**, **15** rises and sealing disk **17** is closed. With the sealing disk **17** closed, the deformed diaphragm **6** sucks liquid through tube **3** and suction lip valve **4** into diaphragm foot portion **6***a* until the diaphragm head portion **6***b* is closed by surface **12***a*. Subsequent strokes of knob **10** compress the vaporized liquid from diaphragm foot portion **6***a* into cylindrical extension **6***c* through discharge valve **5** and orifice **7***a*.

In the atomizer of this invention, the head portion is pressed against a sealing surface of the bolt by a compression spring in the foot portion. This has the further advantage that by the use of a sufficiently strong spring, a sealing pressure is exerted which prevents any loss of liquid. Since the compression spring is located inside the diaphragm, it is possible to use a suction tube of small diameter whereby the atomizer is useful on bottles of small diameter.

It is particularly advantageous in this invention to firmly connect the bolt with a footing inside the foot portion, and to position the compression spring between the bolt footing and the head portion. This has the further advantage of causing the head portion to be additionally pressed against the sealing surface so that the action of the compression spring is supplemented to that extent. In the atomizer of this invention it is advantageous to use a known type of lip valve as the suction valve and also as the discharge valve. This has the further advantage that by the use of lip valves, short and well-defined closure times are maintained.

Furthermore, in the atomizer of this invention wherein the suction tube has connected to it a holding member for the foot portion, there is provided in the atomizer a cage consisting of a lower portion and an upper portion, both of which portions have only limited freedom of movement toward each other and only in the axial direction. By positioning the holding member and the diaphragm inside the cage, the holding member which is connected to the bolt footing is urged within limits against the lower part of the cage while the upper portion of the diaphragm is urged against the upper part of the cage. This produces the further advantage that while in the resting position the compression spring will not be able to impart too much deformation to the head portion of the diaphragm and in the depressed condition the compression spring will not be compressed so much that it will move too far into the soft head portion. It is also impossible for the diaphragm to get twisted if the actuating knob is rotated.

Another advantage of this simple valve mounting is that the suction valve is clamped in place between the bolt footing and the holding member while the discharge valve is clamped between the upper part of the cage and a hollow cylindrical extension of the head portion of the diaphragm in which the upper end of the bolt is positioned.

The cage is advantageously positioned for axial movement in a cylindrical housing with the interposition of a plate spring between the lower part of the cage and the inner floor of the housing. Upon the suction tube there is mounted a sealing disk that bears against the outer surface of the floor of the housing so as to constitute the first sealing member. Air from the outside is thereby permitted to enter the vessel through the opening in the housing upon actuation of the actuating knob. Such an equalizing air pressure is necessary in atomizers of this kind so that the liquid in the vessel can be drawn up for atomization.

Another advantageous feature of this invention is the collection hole in alignment with the spiral bore in the nozzle, making it easy to clean the nozzle by pushing foreign material into the collection hole with a needle.

Finally, it is particularly adavntageous for the cleaning needle to be carried by a ring-shaped holder so that the ring-shaped portion can be placed in a circular groove in the actuating knob while the needle extends into the interior of the knob. This has the advantage of keeping the cleaning device always within easy reach.

It will be understood that this invention is susceptible to modification in order to adapt it to different usages and conditions and, accordingly, it is desired to comprehend such modifications within this invention as may fall within the scope of the appended claims.

I claim:

1. A liquid atomizer comprising a container for a liquid and an atomizer top mounted thereon, said top containing in it a diaphragm pump comprising a deformable diaphragm having a foot portion and a head portion, with a central opening therein, said head portion deformable into said foot portion, a discharge valve positioned above said head portion, an actuating knob having a spiral nozzle, said knob movable axially with said head portion toward and from the foot portion of the diaphragm, a suction tube having a suction valve at the end thereof positioned in said foot portion and with its opposite end extending into said container, a first sealing member between the side of the suction tube and the bottom of the atomizer top, a coiled compression spring interposed between the foot portion and the head portion of the diaphragm and contained entirely within the contour of the latter, a second sealing member in the form of a bolt head adapted to be engaged or disengaged by the head portion of the diaphragm and having a footing that is seated under the spring within the foot portion of the diaphragm.

2. The liquid atomizer of claim **1**, wherein said suction valve and said discharge valve each comprises a lip valve.

3. The liquid atomizer of claim **1**, further comprising a collection hole in axial alignment with the orifice of said nozzle.

4. The liquid atomizer of claim **1**, further comprising an annular channel in said actuating knob adapted to hold a nozzle needle having a ring-shaped portion and a needle portion extending into said knob.

5. A liquid atomizer comprising a container for a liquid and an atomizer top connected thereto, said top comprising a deformable diaphragm having a foot portion and a head portion, with a central opening therein, said head portion deformable into said foot portion, a diaphragm pump including a discharge valve positioned above said head portion, an actuating knob having a spiral nozzle, said knob movable axially against said head portion, a suction tube having a suction valve at the end thereof positioned in said foot portion and extending into said container, and a first sealing member between the inside of the container and the outside air independent of said suction valve, the improvement comprising a second sealing member independent of said discharge valve positioned between the inside of the container and said spiral nozzle wherein said second sealing member comprises a bolt having a surface sealing said central opening of the head portion when said bolt is in the rest position, said atomizer also including a compression spring positioned in said foot portion biasing said head portion against said surface of the bolt, said bolt having a firmly connected footing positioned in said foot between said bolt footing and said head portion, said suction valve and discharge valve each comprise a lip valve, and said suction tube has a holding portion fastened thereto for said foot portion, said atomizer top further comprising a cage having a lower part and an upper part having freedom for only limited axial movement relative to each other, said holding portion and said diaphragm positioned in said cage by means of said compression spring, said holding portion connected to said bolt footing biasing said lower part and

said head portion against said upper part to a limited extent only.

6. The liquid atomizer of claim 5, wherein said suction valve is clamped between said bolt footing and said holding portion and said discharge valve is clamped between said upper part of the cage and a cylindrical extension of said head portion in which said bolt is positioned.

7. The atomizer of claim 5, wherein said cage is positioned for axial movement in a cylindrical housing by a plate spring between said lower part of the cage and the inner floor of said housing, and said first sealing member comprising a sealing disk mounted on said suction tube for sealing against the outer floor of said housing.

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