

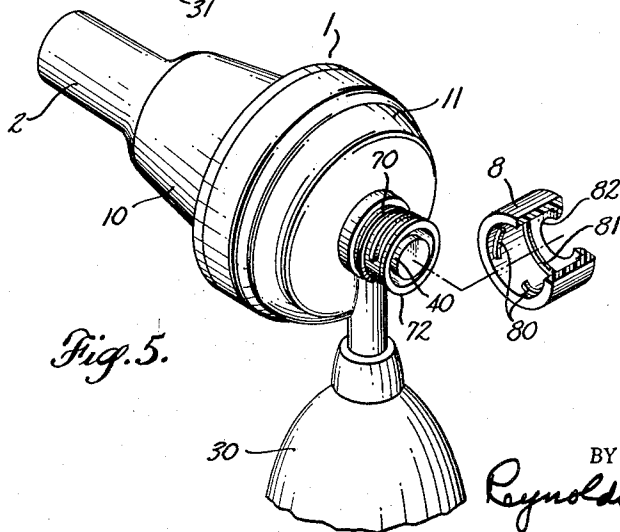
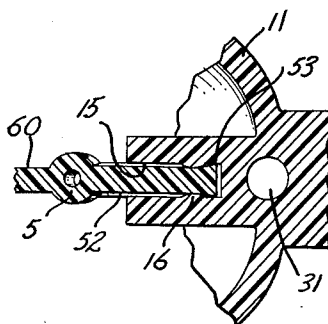
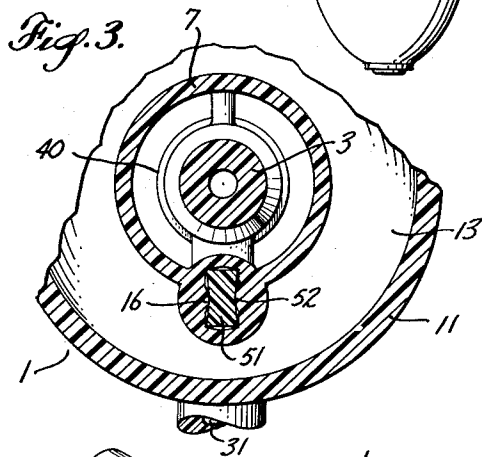
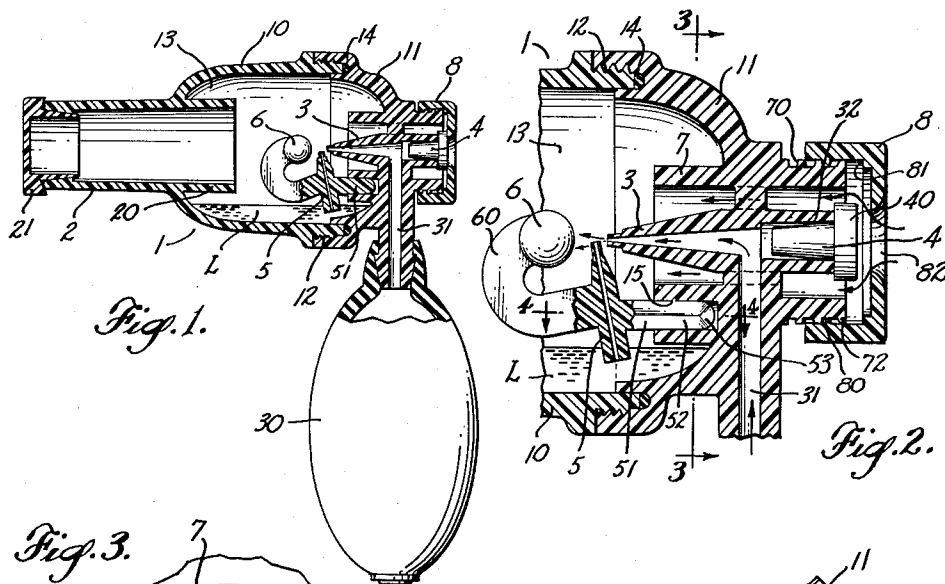
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ATOMIZER

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ATOMIZER

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The atomizer of this invention is used to break up liquid usually such as is of a medicinal nature, into small globules or particles, to form a mist, and to project that mist into a person's throat or nostrils for the alleviation of certain conditions there existing. Such atomizers are variously termed nebulizers or vaporizers, and the general type to which the present invention relates has numerous counterparts in the known art.

Atomizers of this type have commonly been made of glass or of molded plastic materials. It is preferred that the vaporizer of this invention be made, at least in part, of a molded material, preferably transparent or translucent, and of such a material that is somewhat resiliently deformable, such as molded plastic.

In their general characteristics such atomizers comprise, essentially, a chambered body to contain a small quantity of the medicinal liquid, a discharge nozzle leading thence for the mist or vapor, a capillary tube or like passage dipping at one end into the liquid within the chamber, its other end being positioned with relation to an air jet in such manner that air under pressure, as from a hand bulb, when discharged across the tip of the capillary tube draws up a small quantity of the liquid, projects it against a baffle, and so vaporizes it, for discharge in the form of a mist through the discharge nozzle. The hand bulb can discharge only a very limited quantity of air with each squeeze, though at pressures appreciably above atmospheric. Such limited quantities of air, by themselves, can entrain but limited quantities of medicinal liquid, and in order to project the quantity of liquid required for relief the user must squeeze the bulb repeatedly. Since users are almost invariably suffering from a disability that the medicinal liquid is designed to cure or alleviate, they often have not the strength so to squeeze the bulb to an extent to produce the needed quantity of liquid in the form of a mist. Moreover, the somewhat high pressure developed by the bulb, and the internal construction of most atomizers, produces a very fine mist, which coupled with the small quantity produced, is not as effective as a somewhat coarser mist, in larger quantity. As a means of supplementing the total quantity of air delivered with each squeeze and of reducing its pressure, and thereby increasing the coarseness of the mist and the total quantity of liquid entrained in the air, it has been customary to provide a secondary or auxiliary air intake opening into the chamber.

It is not sufficient merely to arrange for the intake of auxiliary air, but that air must be so directed that it will most thoroughly mix with the primary air from the air jet, without disturbance of the latter. This end is best achieved by making the air jet and the auxiliary air intake coaxial, thereby avoiding any cross currents. Moreover, it is not desirable to admit unlimited quantities of auxiliary air. Its quantity should be such as the actions or desire of the user, i.e., the number of squeezes of the bulb, the amount of pressure on the bulb, and the user's need for relief, may dictate. Also, the size of the mist droplets varies in accordance with the amount of auxiliary air admitted; a large volume thereof produces quite coarse droplets, and a lesser volume produces smaller droplets. The size of the droplets affects the relief produced. Too small droplets do not carry to the back of the mouth or far into nasal passages, while too large droplets collect and drip down, eventually finding their way into the

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stomach and causing undesirable reactions such as nausea, or even in some instances being toxic.

It is therefore necessary that the auxiliary air intake be properly oriented and located relative to the primary air jet, and that it be so controllable that the size and total volume of droplets be nicely regulatable by the user. This is an object of this invention.

The invention also includes novel means for completing and insuring the air-tight and liquid-tight closure of the chamber, when the same is not in use, and yet permitting opening thereof to the desired extent for entrance of controlled amounts of auxiliary air during usage of the atomizer.

Such atomizers must be capable of ready and complete cleansing, from time to time. This is often rendered difficult, particularly the interiors of the capillary tube and of the air jet, because of the necessity for precise location of the capillary tube with relation to the air jet and of both with relation to the atomizing baffle against which the primary air and liquid, at the exit of the capillary tube, are directed, and the blocking effect of this baffle adjacent an end of each such tube. The present invention incorporates a construction whereby such elements are separable to an adequate extent, as by enabling removal of the capillary tube for ready cleansing, and yet the same is capable of reinstallation with relation to the air jet in precise location, relative to the latter, and to the atomizing baffle. Such means, furthermore, are provided in a manner that will prevent unintended or accidental dislocation of the capillary tube from its proper positioning, and will not be adversely affected by cold flow of the molded plastic of which the parts are made, yet by virtue of the resilience of the materials will still permit withdrawal of the capillary tube assembly for cleansing through from end to end whenever that is required. Additionally, by providing a removable plug for the end of the air jet distant from its discharge end, this too can be cleaned from end to end.

Valve means are also incorporated in the device in a form enabling the user to regulate to a fine degree the admission and volume of the auxiliary air, and for assuring sealing against leakage, in conjunction with a rearward extension of the air jet and the plug, that closes the extension, while the atomizer is being carried. According to this invention, these valve means are so connected to the chambered body with which they cooperate that the valve means are held securely against accidental complete removal, and yet can be removed when this is required for cleansing.

The above and other objects of this invention will be more fully understood as this specification proceeds, and by the reading thereof in conjunction with the accompanying drawings, wherein the invention is shown embodied in a preferred form, and will be further more fully understandable from the accompanying claims, wherein the principles of the invention are defined without restriction to any specific construction of the atomizer generally.

FIGURE 1 is a general axial sectional view through the atomizer with liquid therein in the manner in which parts would be assembled for portability, ready for use except for the removal or release of closure means which maintain the atomizer liquid-tight and air-tight while being carried.

FIGURE 2 is an enlarged sectional view, similar to FIGURE 1, but showing parts in the position for use, with the valve means regulating the admission of auxiliary air open.

FIGURE 3 is a cross-sectional view taken on the line 3—3 of FIGURE 2.

FIGURE 4 is a detail sectional view taken on the line 4—4 of FIGURE 2.

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FIGURE 5 is an isometric view, with the cap which forms the valve means removed and shown partially in section.

In its general features the atomizer of this invention resembles various other atomizers in form. It incorporates a chambered body, indicated generally by the numeral 1, and in the form illustrated including specifically a forward section 10 and a rear section 11, threadedly interconnected as at 12, and sealed at 14, enclosing a chamber 13. A discharge nozzle 2 projects from the forward section 10, and also usually extends thereinto, as indicated at 20. The nozzle can be closed at its outer end by a removable stopper 21 while the chamber 13 contains liquid, as indicated at L, and is being carried. The stopper 21 is removed when the atomizer is to be used, at which time the nozzle 2 is inserted within the mouth of the user, or a similar nozzle may be of a size for insertion within the nostril.

Within the chamber 13 is disposed an air jet 3, the discharge end whereof is directed toward and usually coaxially of the nozzle 2.

Air under pressure is conducted from a suitable source, as for example, a hand bulb 30, by way of passage 31 to the air jet 3. It is preferred that the air jet 3 be the forward branch of a T-shaped passage, the stem whereof is the passage 31, and the rearward branch or extension whereof is designated by the numeral 32, the purpose of which is to facilitate straight-through cleansing of the air jet. This rearward branch 32, opposite the discharge nozzle, must be capable of closure during use, as by a tapered removable plug 4, having a radial flange 40. During use, the plug would remain seated as in FIGURE 2, and so would constitute the closed rear end of extension 32, and the valve means mentioned is so located as to insure seating of the plug and so to produce closure of the valve means by its seating at the end of the extension 32.

A capillary tube or passage 5 is disposed uprightly within the chamber 13, with its lower end dipping into the liquid L, and its upper end precisely located with relation to the discharge end of the air jet 3. This relationship is such that the air discharged from the air jet is blown across the open upper end of the capillary tube 5, whereby the liquid is drawn upwardly through the capillary tube 5, and the air jet and liquid then impinge an atomizing surface or baffle such as the ball 6, and then after the liquid is atomized, it is blown outwardly through the nozzle 2, which is in line with the discharge end of the jet 3 and the ball 6.

It is highly important that the upper end of the capillary tube 5 be located quite precisely with relation to the discharge end of the air jet 3, and to the atomizing surface 6, both as to spacing and alignment. On the other hand, it is also important that the capillary tube 5 be capable of thorough cleaning, from time to time, and also that the air jet 3 be capable of thorough cleaning. This has often proven difficult in the past because of the close and fixed spacing between and relationship of these elements, and because of the location of the impinging surface 6 with relationship to the capillary tube and air jet. Accordingly, it has been considered desirable, in the present invention, to provide the plug 4, seated during use, for the right end of the air jet, and to make possible the dismounting of the capillary tube from its relationship to the air jet 3, yet without disturbance of the position of the capillary tube relative to ball 6. To this latter end, the capillary tube 5 has been formed integrally with the ball 6 and its bracket 60, and with a mounting shank 51, which in use is received within a socket 15 in the member 11 of the chambered body. In order to maintain the accurate positioning of the capillary tube relative to the air jet 3, this socket 15 is non-circular, and the shank 51 is of like conformation, as is best seen in FIGURES 3 and 4, so that when the shank is fully inserted within the socket, the capillary tube will not rotate to one side or

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the other of the discharge end of the air jet 3, nor will it be located too close nor too distant from the latter. In order to maintain the proper spacing between the capillary tube and the air jet 3, detent means are provided, interengageable between the shank 51 and its socket 15. Preferably these detent means include at least one shallow groove 52, or as shown two, in the shank 51, and complementary lugs 16 in the socket 15 are receivable in these grooves. Moreover, the grooves 52 are closed at their inner end, as at 53. The parts being made, as is preferred, of somewhat resiliently elastic molded material, the closed ends 53 will yield sufficiently with relation to the lugs 16, or the latter will yield with relation to the closure 53, that the two will snap past one another and so will retain the capillary tube 5 and the ball 6 in fully seated position within the socket 15, and thus will serve to insure correct positioning of the capillary tube 5 relative to the air jet 3, and against accidental withdrawal of the shank from its socket. Nevertheless, there is no pressure exerted on the lugs 16 nor the detents 53 once they have yielded and snapped past one another. Both such parts being made of molded plastic, they would be subject to the phenomenon known as "cold flow" if they were pressed tightly together while properly assembled. This would shortly produce permanent deformation of one or both such elements, with the result that looseness would result, and the needed precision of location of the upper end of the capillary tube 5, and of the baffle 6 relative to the air jet 3 could not be maintained. This is avoided by so locating cooperative detents 16 and 53 that while they must yield to pass one by the other, once past they spring back and merely obstruct reverse passage.

When, as is usually desirable, auxiliary air is to be admitted to the chamber, it may be admitted through a sleeve 7 which is formed integrally with the rear element 11 of the chambered body. This sleeve is arranged, according to the present invention, to surround, preferably coaxially, the air jet 3. By such coaxial disposition the mist is carried away forwardly from all sides of the air jet and smoothly into the discharge nozzle. The outer end of this sleeve 7 projects exteriorly from the rear end of the chambered body and surrounds and encloses the rear branch 32 of the air jet.

A cap 8 is threadedly mounted upon the exterior end of the sleeve 7, this exterior end being threaded as indicated at 70, and the cap 8 being provided with interrupted threads 80 (see FIGURE 5), which may engage the threads 70. The cap 8 is apertured centrally, but extends inwardly sufficiently to overlie the outer end of extension 32, constituted by the plug 4 or its flange 40, and thereby to form a seal against leakage of liquid when the cap 8 is in position to completely block the passage of auxiliary air, as when the atomizer is being carried out of use. A seating surface 81 of the cap seats upon the exterior end of the sleeve 7, to constitute a further seal against escape of liquid. The cap is apertured at 82, preferably coaxially of the sleeve 7, and this aperture 82 is closed when the cap is fully threaded on, but when the cap is threaded back from engagement of its seating surface 81 with the end of the sleeve 7, the aperture 82 serves as an auxiliary air inlet, as is best shown in FIGURE 2. Any desired degree of opening can be achieved by varying the extent of threading back of the cap 8 upon the threads 70.

The threaded cap 8 with its central aperture 82 co-operating as a valve with the outer end of extension 32, or with the plug 4 that is in effect such outer end, affords a means to obtain close regulation of the amount of auxiliary air admitted, and hence of the coarseness of the droplets. The user quickly becomes aware that a small fractional turn of the cap will produce the desired size of droplet and require but minimum effort. He will unconsciously and as a matter of habit turn the cap just this much each time the atomizer is used, but no more, thereby by his reflex action and without looking to see

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how big an opening is arranged for the secondary air insuring that no excess of air is indrawn, the droplets will be not too coarse nor too small, and that the customary number of squeezes on the hand bulb will produce the expected and intended result, with a minimum of effort.

Accidental or unintentional removal of the cap is prevented by the formation of a complete, uninterrupted radial flange 72 upon the exterior end of the sleeve 7, whereby the interrupted threads 80 may not be completely threaded off. However, since the parts are preferably of resiliently elastic molded plastic material, the threads 80 can be forced past the flange 72 for intentional removal, or reapplication, but the interengagement between them is sufficient to limit or prevent unintentional removal of the cap.

When the atomizer is to be made ready for use, the two parts 10 and 11 of the chambered body are threaded together as at 12, the sealing ring 14 serving to prevent leakage at their joint. Liquid L, in proper amount, is inserted within the chamber 13, the stopper 21 is pressed within the discharge nozzle 2, and the cap 8 is threaded fully home upon the exterior end of the sleeve 7, in turn pressing against the plug 4. No leakage can now occur, and the atomizer can be carried safely in any position. It will be understood, of course, that the capillary tube 5 and ball 6 were initially mounted, with the shank 51 fully received within its socket 15. Now when the atomizer is to be used, the cap 8 is backed off on the threads 70 to the correct amount and the stopper 21 is removed. When the hand bulb 30 is squeezed, air is forced from the air jet 3 and crosses the upper end of the capillary tube 5 to effect the withdrawal of a small quantity of liquid through the latter, to impinge against the ball 6. It is thus broken up into a fine mist. As has been indicated, the amount of auxiliary air drawn thru the aperture 82 by jet action is governed by the extent of backing off of the cap 8.

Whenever it can be desired to clean the atomizer, the two elements 10 and 11 of the chambered body 1 are unscrewed, the cap 8 and plug 4 are removed, and the capillary tube 5 with its ball 6 and shank 51 are removed by pulling the shank from its socket 15. Now, the capillary tube 5 is readily cleansed, as is the air jet 3 and all parts of the sleeve 7. Thus, the entire device is freely accessible for cleaning, yet when reassembled all parts are accurately relocated with relation to one another.

I claim as my invention:

1. An atomizer comprising a body chambered to contain a liquid, a vapor discharge nozzle directed from one side thereof, a capillary passage within the chamber dipping at its open lower end into the liquid space and open at its upper end, a tubular air jet within the chamber generally in axial alignment with the discharge nozzle and directed across the upper end of the capillary passage to entrain vapor drawn from such passage and to discharge it through said nozzle, means to deliver limited quantities of air under pressure for discharge through said air jet, an auxiliary air intake sleeve surrounding and spaced from said air jet, and open only at its outer end, located exteriorly of the chamber, and at its inner end, located interiorly of the chamber, said air jet having an extension terminating in the vicinity of the outer end of said sleeve, and such outer end of the sleeve being threaded, a cap threadably mounted upon and for axial adjustment along the outer end of said sleeve, between a closed position wherein it seats upon the air jet extension and an open position spaced from the extension, said cap having a central opening which in its closed position is blocked off by the air jet extension whereon it seats, and in its open position admits air in quantities determined by the spacing between the cap and the extension, into said sleeve and thence out the discharge nozzle with air from said air jet.

2. An atomizer as in claim 1, wherein the air jet extension is tubular, including a plug normally seated

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within but axially movable into and from the air jet extension, for closure of or access to the interior of the air jet, said centrally apertured cap being removably threaded upon the sleeve and cooperating directly with said plug to urge the latter into seated position while the cap is in position to block entrance of auxiliary air, or to afford access to the plug, for its removal, when the cap is removed.

3. An atomizer as in claim 1, the cap being also formed with a seating surface located to cooperate with the exterior end of said sleeve to seal against leakage of liquid while the cap is threaded into engagement with the air jet extension, to block entrance of auxiliary air.

4. An atomizer as in claim 1, wherein the capillary passage is formed separately from the chambered body, a non-circular mounting shank projecting laterally from said capillary passage, a correspondingly shaped socket in said body for the reception of said shank, to locate the upper end of the capillary passage accurately relative to the discharge end of the air jet, and detent means interengageable between said shank and its socket when fully interengaged, to retain the shank and hence the capillary passage precisely in the desired relationship to the air jet.

5. An atomizer as in claim 4, wherein the detent means includes relatively yieldable resilient elements permitting intentional withdrawal of the shank from its socket.

6. An atomizer of the character described comprising a body of molded plastic material chambered to contain a liquid, a vapor discharge nozzle directed from one side thereof, a tubular air jet within the chamber, spaced from but disposed generally in axial alignment with the discharge nozzle and directed thereinto, a separate unit also of molded plastic material including a capillary passage and which in its operative position terminates at its upper end in alignment with discharge from the discharge nozzle and oriented with its lower end dipping into the liquid space, said separate unit also including a non-circular shank which when the capillary passage is thus disposed and oriented is directed generally parallel to the common axis of the air jet and discharge nozzle, the body having a socket oriented and shaped to receive said shank and thereby to dispose the separate unit in its operative position, and interengageable detent means formed respectively upon the shank and within its socket and located to slip resiliently past one another into non-deformed operative relationship, and by their subsequent resistance to withdrawal to retain the shank, and hence the separate unit including the capillary passage, fixed in operative position relative to the air jet.

7. An atomizer comprising a body chambered to contain a liquid, a vapor discharge nozzle directed from one side thereof, an air jet within said chamber directed at its discharge end towards said nozzle, means for discharge of air under pressure through the discharge end of said air jet, a separate capillary tube of resiliently yieldable material, a non-circular shank projecting laterally from said capillary tube, said shank being formed with a longitudinally directed groove along at least one side, terminating short of the end of the shank, a socket within the chamber for the reception of said shank, shaped generally in correspondence with the shank to position the capillary tube's ends operatively relative to the liquid space and to the air jet, respectively, and a detent projecting from a wall of the socket in position to override the resiliently yieldable end of the shank, and to enter said groove as and when the shank is fully seated in its socket, as a detent against accidental removal of the shank from such socket, and thereby serving to retain the capillary tube in its intended relationship to the air jet.

8. An atomizer of the character described comprising a main body chambered to contain a liquid, a vapor discharge nozzle leading from said chamber, a tubular jet

for discharge of a gaseous vehicle, located within the chamber, spaced from but disposed generally in axial alignment with the discharge nozzle and directed thereinto, a separate unit including a liquid discharge nozzle formed with a capillary passage the lower entrance end whereof, in use, dips into the liquid space and the upper end whereof is located, in its operative position, adjacent the gas jet, said separate unit also including a supporting element of resiliently yieldable molded plastic and the main body including a complemental element of like material engaged during use with the supporting element of said separate unit, to orient the liquid discharge nozzle operatively relative to the gas jet and the capillary passage entrance operatively within the liquid space, and interengageable detent means formed respectively upon and integral with the separate unit and the main body, and

located to slip resiliently past one another by deformation of at least one such detent means as the separate unit moves into operative position, and then resiliently to resume the relaxed condition, and to interengage to retain said separate unit in its operative position.

References Cited in the file of this patent

UNITED STATES PATENTS

63,680	White	Apr. 9, 1867
473,672	Schrader	Apr. 26, 1892
980,718	Wells	Jan. 3, 1911
2,167,321	Abercrombie	July 25, 1939
2,351,150	Sanford	June 13, 1944
2,406,997	Curry	Sept. 3, 1946
2,726,896	McKinnon	Dec. 13, 1955
2,821,324	Hungerle	Jan. 28, 1958