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[54] **APPARATUS FOR THE DIFFUSION OF VOLATILE PRODUCTS**

11 Claims, 10 Drawing Figs.

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 239/309

[51] Int. Cl. B65d 45/16

[50] Field of Search 239/47, 44,
 49, 50, 57, 58, 309; 222/187

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ABSTRACT: An apparatus for diffusion of volatile liquids into the atmosphere by evaporation is disclosed which comprises a reservoir containing the liquid to be evaporated into which dips a feeder wick joined to an evaporator mounted on a wall of this reservoir; a tube surrounding the wick for at least part of its height, and a destructible closure device interrupting the communication of the interior orifice of the wick tube with the atmosphere before use and means such as a blade operable from the outside to destroy the closure device at the moment of putting the apparatus to use.

The reservoir preferably also carries a tube communicating the gaseous volume inside to the atmosphere, which is preferably sealed off before use in a similar manner as the wick tube and must be opened together with the latter.

In another modification of the apparatus, the closure device is nondestructible and comprises a sealing plug located in the projection of the feeder wick and which crosses the evaporator, the unit formed by the plug and the wick being slidable between a closure position at which the plug obturates the wick tube and an open position in which the plug is pulled beyond the evaporator, this latter being then in contact with the feeder wick. The entire apparatus can be covered by a hood containing a diffuser wall.

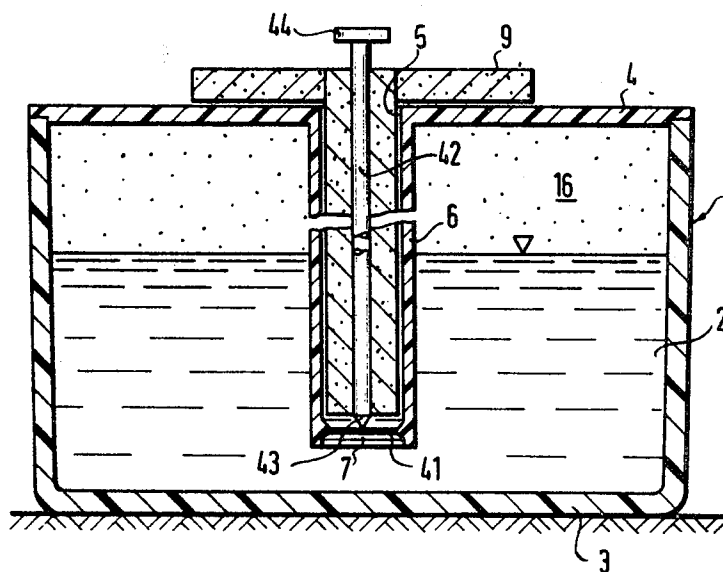


Fig. 1

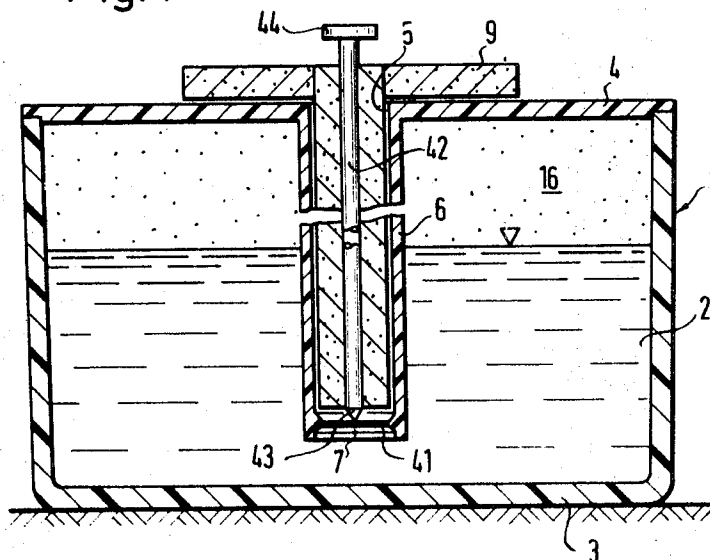


Fig. 2

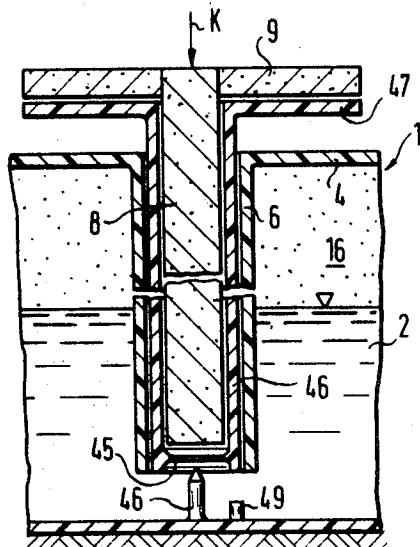
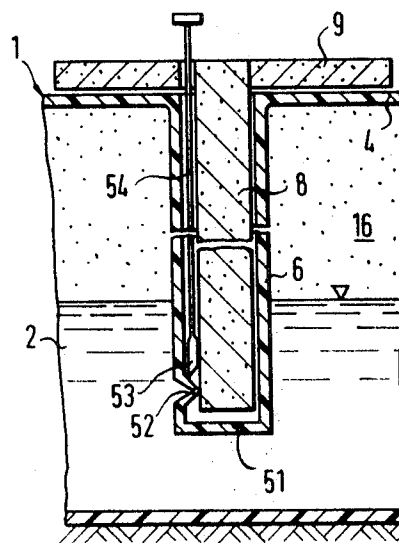


Fig. 3



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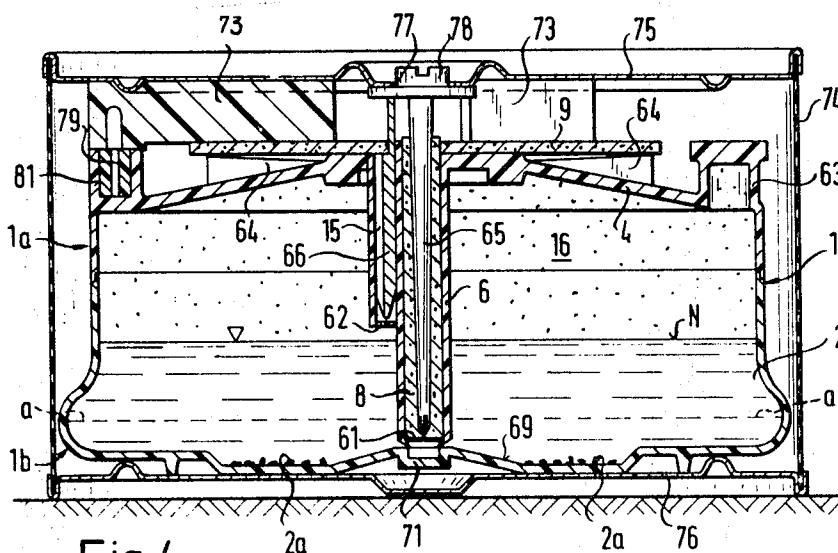


Fig. 4

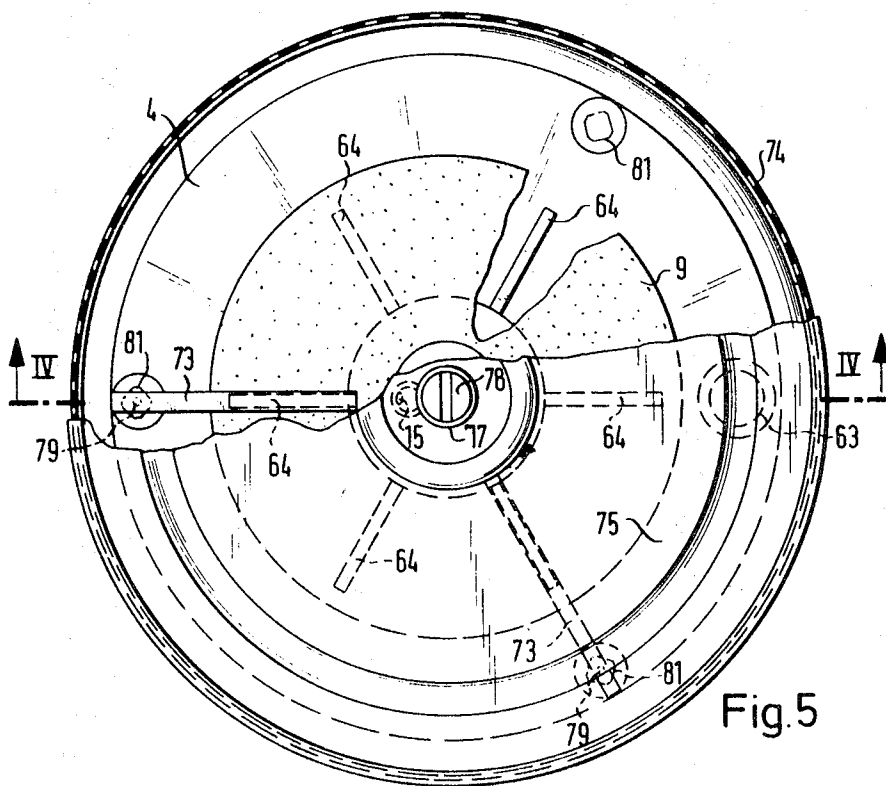


Fig. 5

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Fig. 6

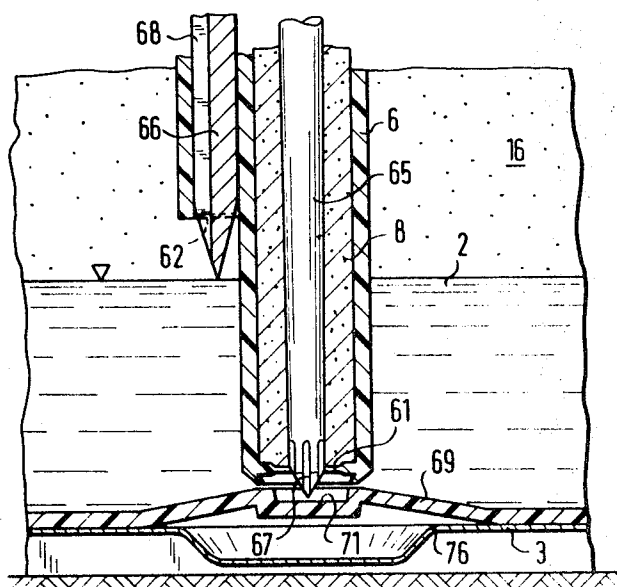
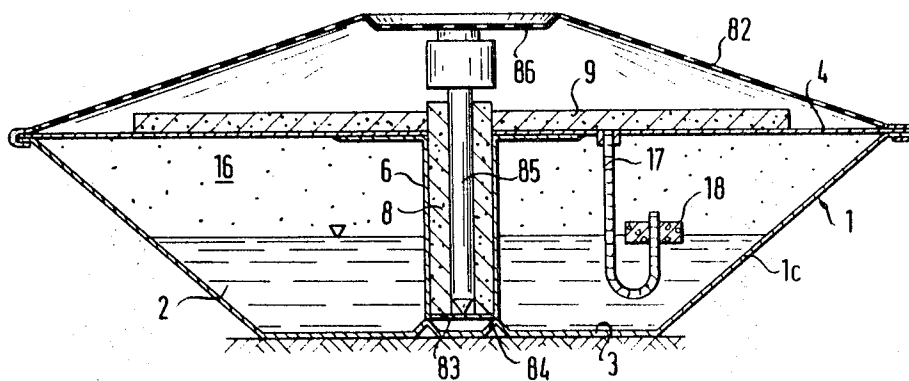


Fig. 7



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Fig. 8

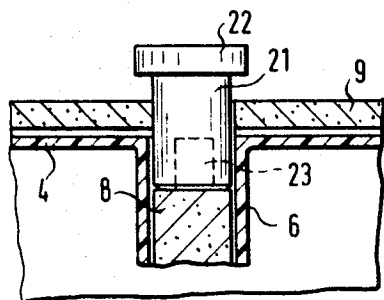


Fig. 9

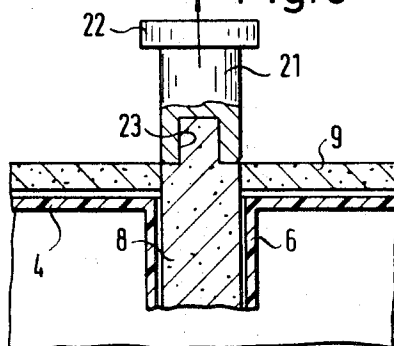
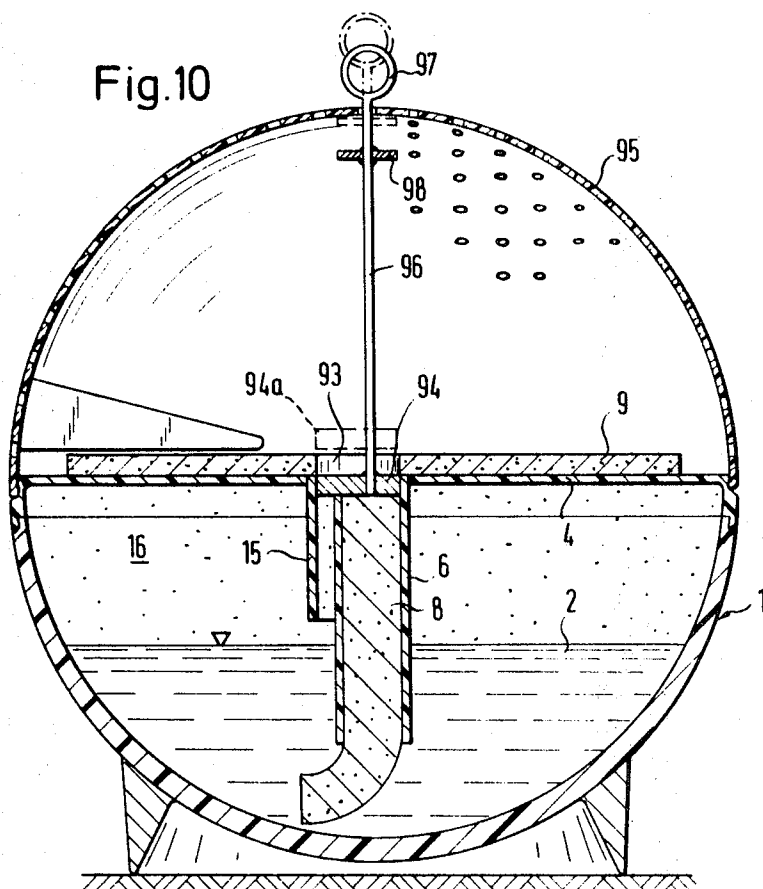


Fig. 10



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APPARATUS FOR THE DIFFUSION OF VOLATILE PRODUCTS

DESCRIPTION OF THE INVENTION

The present invention relates to an apparatus for ensuring the diffusion into the atmosphere by evaporation of volatile liquid substances such as insecticides, insect repellents, bactericides, deodorants, perfumes, sanitary products and others.

It is well known to effect the evaporation of liquids of this kind by means of apparatus comprising a reservoir containing the liquid into which dips a wick which projects outside the reservoir passing through an opening therein.

The principal advantage of these apparatus resides in the possibility, in given conditions, of obtaining evaporation rates constant in time, as opposed, for example, to apparatus constituted by an absorbate, an adsorbate or a solution in a body of solid material.

Another advantage of evaporators with wicks resides in the possibility of delivering a larger quantity of vapor when the circulation of air is greater; this property is very interesting because it is evident that for maintaining proper efficacy in an aerated room, the discharge of vapors should be larger than in a closed room, as a result of the losses due to aeration. This property permits, at the time of adjusting the apparatus, the limiting of the evaporation rates in a closed room to the quantity strictly necessary which is of economic importance when active materials of high cost are used and/or gives greater safety when toxic active materials are used. No other evaporation device possesses such a property.

A third advantage of apparatus with wicks is that they allow the total using up of the liquid to be evaporated, evaporation only ceasing on the exhaustion of the liquid; in solid compositions, on the other hand, the yield does not generally exceed 50 percent. The disappearance of liquid allows, besides, the end of use of the device to be noted, which is not possible using a solid composition.

The principal inconvenience of an apparatus with a wick stems from the danger of spillage of liquid, following an accidental turning over of the device, during use and/or during transportation.

This loss of liquid is particularly to be feared when the device is for the evaporation of insecticidal or bactericidal liquids, of which the content or presence in too great quantity in the atmosphere is generally harmful, and can even be fatal to man. In addition, in most cases, the liquids used can damage furniture or clothing on which they are spilt.

Another disadvantage exists, as serious as the disadvantages mentioned above. When the volatile liquid is formed by a phosphoric ester, it generally has the inconvenience of being rapidly hydrolysed when it is exposed to ambient air over a large surface area. Now, it is exposed to ambient air over a large surface area. Now, it is often possible that the ambient humidity penetrates into the interior of a wick evaporator, or that there is contact between the humidity and the phosphoric ester in the wick and all over its evaporative surface.

Apparatus with wicks which try to avoid these disadvantages are already known.

For example, according to certain constructions, the wick is movable with respect to the reservoir and can be enclosed therein with the aid of a movable cover. Such a system is relatively complex and does not stop the liquid spreading out if the apparatus is accidentally turned over.

According to another construction, an evaporator surface is fed by pressure of a propellant gas, but this construction makes the apparatus burdensome, and if the propellant gas escapes, it stops working.

There has also been described an apparatus provided with a capillary wick, fed with liquid by gravity, this wick being connected to a diffuser placed thereabove. This construction makes the protection of the evaporator surface difficult and necessitates a capillary wick of precisely measured section, which is difficult to obtain.

Other known apparatus is provided with a more or less complex valve for preventing access of atmospheric humidity during storage. These valves easily suffer from grave disadvantages on account of their complex construction and their tendency to corrosion and obstruction in use.

In addition, it is known to construct apparatus comprising a dipping wick which feeds an evaporation surface formed by a disc of absorbent material. This latter increases the possibility of diffusion of the wick and, as a result, the discharge thereof. However, it could be useful in this type of apparatus to stop the discharge at will, by means of a simple operation. Now, the evaporation surface is opposed to the return of the wick. The invention seeks also to remedy these limitations.

According to the invention, the apparatus for diffusion into the atmosphere, of volatile liquids by evaporation, comprises a reservoir containing the liquid to be evaporated into which dips a feeder wick joined to an evaporator mounted on this reservoir, and the wall of the reservoir on which the evaporator is mounted, carries a tube internal of the reservoir and directed toward the base thereof, this tube surrounding the wick for at least part of its height, this apparatus according to the invention being characterized in that it comprises a destructible closure device interrupting the communication of the interior orifice of the wick tube with the atmosphere before use, and means to destroy the said closure device at the moment of its being put to use.

According to another embodiment of the invention, the reservoir also carries a tube joining the gaseous interior volume to the atmosphere. This atmosphere communication tube prevents any escape of liquid resulting from accidental excess pressure in the gaseous phase of the reservoir.

In particular, the interior orifice of the wick tube is initially sealed by a diaphragm, and means are provided to ensure perforation of this diaphragm when the apparatus is put to use. If the apparatus comprises an atmosphere communication tube, a similar diaphragm is advantageously mounted on this tube.

Another embodiment of the apparatus according to the invention provides that the means for perforating the diaphragm comprise a piercing pin located in the wick tube, the other end of which extends to the outside to permit of manual operation.

The wick tube thus fitted out ensures the maintenance of the wick and of the evaporator joined thereto. Further, it permits stopping the rate of feed by simply turning the apparatus upside-down.

Preferably, it is also provided that, at the point of putting the device to use, the volume of liquid introduced into the reservoir should be such that, in all positions of stable equilibrium of the reservoir, other than its use position, the level of liquid in this reservoir is located below the interior orifice of the wick tube. In these conditions, any loss of liquid in the case of accidental tipping over of the apparatus is prevented.

In another simple embodiment of the apparatus according to another aspect of the invention in which a nondestructible closure apparatus is used, the communication of the wick tube with the atmosphere is prevented by means of a plug provided with a manipulatable plug which traverses the evaporator and slides sealingly in the said tube. Before use, this plug interrupts the communication between the wick in the interior of the tube and the evaporator and it is necessary to pull the plug up to establish such communication.

Other details of the invention will be apparent from the description hereafter.

In the attached drawings, which are given as nonlimitative examples:

FIG. 1 is a schematic elevational view of a first construction, the apparatus being shown in its condition before being put to use;

FIGS. 2 and 3 are partial schematics in axial section showing methods of construction of the wick tube with different closure devices and destruction means.

FIG. 4 is an elevational sectional view on lines IV-IV of FIG. 5 of a commercial construction of the apparatus;

FIG. 5 is a corresponding plan view partly cut away and partially in section;

FIG. 6 is an axial section on a larger scale of the axial portion of the apparatus shown in FIGS. 4 and 5;

FIG. 7 is an axial section of another construction of the apparatus according to the invention with a destructible closure apparatus;

FIGS. 8 and 9 are schematics on a large scale showing the wick in use and out of action according to a variant of the apparatus according to the invention with a nondestructible closure apparatus;

FIG. 10 is an axial section of another commercial construction of the apparatus according to the invention with a non-destructible closure apparatus.

Referring to FIG. 1 of the attached drawings, it can be seen that, in a schematic construction, the evaporator comprises basically a reservoir 1 in which is located the liquid 2 to be evaporated. The reservoir 1 is bounded by two faces 3 and 4, of which one is pierced by an orifice 5 from which an axial tube 6 extends toward the other face. In the example described, the other orifice of tube 6 is located a short way from the face 3 which serves as a base, in the normal position of use.

An absorbent element 8, hereinafter called a feeder wick, is located in tube 6 and is joined to an evaporation element 9, hereinafter referred to as the evaporator, located near to face 4.

Certain of the characteristics of the foregoing parts will now be detailed.

The shape, capacity and nature of reservoir 1 are not critical, they only depend on the desired use.

The material forming the reservoir can be, for example, glass, porcelain, a metal such as aluminum, iron, copper, or alloys thereof, or a high molecular weight material such as polyethylene, polypropylene, polystyrene, polyvinylchloride, fluorinated or chlorofluorinated polymers, polyvinyl esters, polyacrylic esters, polymethacrylic esters or copolymers thereof. It can also be, without any resulting restriction, a resin of the type called ionomeric, a bakelite, an ebonite, a ureaformaldehyde, phenolformaldehyde, melamine formaldehyde, aniline formaldehyde or phenolfurfuraldehyde condensation product or a polyamide.

The methods of manufacturing the reservoir are known ones such as stamping, moulding, blowing, injection moulding, thermoforming, extrusion, welding, soldering, assembling, and the like.

The material forming the reservoir 1 can be protected from the action of the liquid to be evaporated, particularly from corrosion, by means of a lining formed of a metal, an oxide, an enamel, a varnish, a polymer or other substance suitable for ensuring the preservation of this reservoir. The lining can be deposited by any known method such as, for example dipping, centrifugal spraying, plasma spraying, glazing, anodisation, or electrodeposition.

The shape of reservoir 1 is cylindrical in the example described. However, it can also be spherical, truncated conical, cylindroconical, biconical, ovoid pyramidal, bipyramidal, cubic or parallelepipedic; it can also, for example, be of a shape formed by the revolution of various curves and/or folded lines; the shape can also be entirely regular.

Some examples of such methods of construction will be given below.

The safety tube 6 surrounds the wick 8; the walls of tube 6 can be in contact with this wick, or, on the other hand, can be spaced therefrom. It is not necessary that the tube 6 descend as far as the base 3 of the reservoir if this is not intended to be completely filled. It is sufficient, in such a case, that the length of the tube be such as to rise above the level of the liquid when the reservoir is in the upside-down position.

The shape of the tube is not critical. Its section may be round, elliptic, oval, triangular, square, rectangular or polygonal. The shape and dimensions of the section can differ at different heights of the tube, such that the tube can, for

reasons of ease of manufacture, for example, be broader at its base than at its upper part.

The materials usable for making the safety tube 6, are, in particular, those noted for the manufacture of the reservoir. The material chosen can be the same as that of the reservoir or different therefrom.

According to a particular version of interest, the wick 8 and the tube 6 are formed by one and the same piece, of a material chosen to be suitable for the material serving as feeder, and which can be rendered impermeable about its periphery. For example, a bar of porcelain or sintered glass can be used, the outer surface of which is rendered impermeable by glazing, the two ends in contact with the liquid and with the evaporative surface having no glazing; the glazing can be replaced by any other impermeabilising treatment, such as, for example, the deposition of a varnish, of an elastomer or of a plastomer. The bar can also be replaced by a tube of which the inner wall has kept its porosity.

The feeder wick 8 has a porous or fibrous structure. For example, it can be formed by a felt, tissue, paper or unsized card, an unvarnished porcelain, alumina, terra cotta, sintered glass or metal or an agglomerate of wood, glass or stone fibers.

The shape of the feeder wick 8 is not critical. It can be, for example, of square, rectangular, circular or annular section, this section having, for example, an area of between 0.2 and 100 mm.², preferably between 2 and 200 mm.². The length of the wick depends primarily on the height of reservoir 1; it is chosen, preferably, in such fashion as to reach the base of the reservoir and can thus completely exhaust its contents. The wick 8 can also be constructed by means of a capillary tube of glass or any other material, or a bundle of such tubes.

The evaporator 9 is formed from a porous or fibrous material, such as, for example, a felt, a tissue, paper or unsized card, unvarnished porcelain, alumina, terra cotta, sintered glass or metal or an agglomerate of wood fibers.

The shape of evaporator 9 is not critical. For example, it can be a disc, square, rectangle, cone or spherical cap with walls which are smooth or not, flat, undulating, grooved, chequered, or formed in any other way suitable for allowing evaporation of the particular liquid used. The thickness of the evaporating surface is likewise not critical and can be from a fraction of a millimetre, for example in the case of paper, to a few centimeters, for example in the case of a felt. The preferred thicknesses of the invention are always between 0.5 and 5 mm.

A single face of the evaporator 9 can be used as evaporative surface, the or each other face being masked or applied to a support; on the other hand, several or all of the faces of the said material may be used.

Since the rate of evaporation, for each liquid, is a function of the size of the evaporative surface, the dimensions of this surface are chosen so as to obtain the desired evaporation rate, which, of course, varies from one liquid to another according to the volatility and vapor pressure. Generally, the evaporative surface is between 2 and 300 cm.², and preferably between 10 and 100 cm.².

The evaporator 9 can rest on the upper wall 4 of the reservoir 1 or on a separate support. It can be placed in simple contact or can be fixed at one or more points. It may be held in the chosen position by its own rigidity or by supports or a casing of any material, for example a metal or plastic material, of horn, a mineral material or a hardened rubber.

The same material can be used to form the wick 8 and the evaporator 9, or one can employ different materials. Likewise, the assembly of wick 8/evaporator 9, can constitute one piece or, on the other hand, separate pieces.

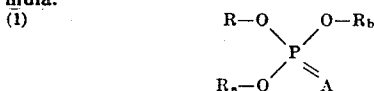
In order to allow liquid to be evaporated to pass easily from the wick 8 to the evaporator 9, when these two elements are separate pieces, it is preferred to ensure a close contact between them. This contact is established, for example, by juxtaposition, wedging, sewing, sticking, clipping or force fitting.

The volatile liquids 2 which are to be introduced into reservoir 1 of the evaporator apparatus according to the invention are substances of which the vapors possess a useful activity in the atmosphere. Such activities are, for example: insecticide, insect repellent, rodent repellent, bactericide, germicide, larvicide, disinfectant, humidifier, odorant or deodorant.

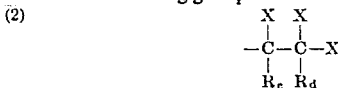
These substances can be used alone or in admixture or in the form of solutions. Among the suitable insecticidal or insect repellent substances which may be noted, but without limitation thereby, are paradichlorobenzene, trichloro-, tetrachloro-, pentachloro- and hexachlorobenzene, naphthalene, bromonaphthalene, dichloronaphthalenes, lindane, aldrin, dimethyl phthalate, citronellol and phosphoric esters such as the natural essences of vervain (citronelle) neroli or bourbon.

Among the bactericidal, germicidal and disinfectant substances there can be noted phenol, the cresols, eugenol, thymol, the chlorophenols, the chlorocresols, menthol and its esters, iodine and formaldehyde.

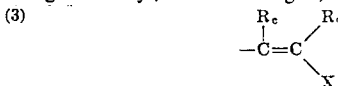
The preferred insecticidal substances are the phosphoric esters chosen from those defined by the following general formula:



wherein A is oxygen or sulfur, R is alkyl, R_a is alkyl and R_b is one of the following groups:



wherein R_c and R_d are the same or different and are hydrogen, halogen or alkyl, and X is halogen;



wherein R_c and R_d and X have the meanings given above.

As non limitative examples of compounds corresponding to the general formula, there may be noted the following phosphoric or thionophosphoric esters:

2,2-dichlorovinyl dimethyl phosphate
2,2-dichlorovinyl diethyl phosphate
2,2-dichlorovinyl dipropyl phosphate
2,2-dichlorovinyl dibutyl phosphate
2,2-dibromovinyl dimethyl phosphate
2,2-dibromovinyl diethyl phosphate
2,2-dibromovinyl dipropyl phosphate
2-bromo-2-chlorovinyl dimethyl phosphate
2-bromo-2-chlorovinyl diethyl phosphate
2,2-dichlorovinyl methyl ethyl phosphate
1,2-dibromo-2,2-dichloroethyl dimethyl phosphate
1,2-dibromo-2,2-dichloroethyl diethyl phosphate
1-bromo-2,2,2-trichloroethyl dimethyl phosphate
1-bromo-2,2,2-trichloroethyl diethyl phosphate
1,2,2,2-tetrabromoethyl dimethyl phosphate
1,2,2,2-tetrabromoethyl diethyl phosphate
1,2-dibromo-2,2-dichloropropyl dimethyl phosphate
1,2-dibromo-2,2-dichloropropyl diethyl phosphate
2,2-dichloro-2-methyl vinyl dimethyl phosphate
2,2-dichloro-2-methyl vinyl diethyl phosphate
the corresponding thiophosphonates.

The preferred phosphoric esters are those in which R_b is a -CH=CCl₂ group, i.e., the 2,2-dichlorovinyl dialkyl phosphates. Among these there is particularly 2,2-dichlorovinyl dimethyl phosphate, known under the name of DDVP and DICHLORVOS.

To ensure absolute sealing of the reservoir 1, before usage of the apparatus there is provided, according to the invention, a diaphragm obturating the wick tube 6 which is perforated at the moment of use. In the version of FIG. 1, the diaphragm is formed by a membrane 41 at the level of orifice 7, and which can be formed by moulding at the same time as tube 6. In order to enable the apparatus to be put to use there is provided a sliding piercing pin 42 located in the tube 6, for example on the axis of the wick 8.

The piercing pin 42 is formed by a rigid rod of which the lower part 43, is, preferably, sharpened or formed as a cutting edge. This end can be traversed, about its periphery, by longitudinal grooves or interiorly, by a channel ending at the lower level of the wick 8, so as to ease the passage of the liquid. The piercing pin 42 can be replaced by a cutting tube functioning in the fashion of a punch, the feeder wick 8 being located within or without the said tube. The piercing pin is preferably formed of a hard material, such as, e.g., a metal, an alloy, a high molecular weight substance or a mineral. This piercing pin can also be formed of a porous or fibrous material, wholly or in part, so as to aid the wick 8 or possibly replace it. Such a material is, for example a sintered glass, a sintered metal, or a porcelain. The other end 44 of the piercing pin 42 projects beyond the evaporator 9 to permit manual operation or operation via a tool.

In the variant of FIG. 2, the diaphragm 45 is provided at the lower part of a tube 46 slidably mounted in the wick tube 6, with sufficiently small play to make the joint sealed with respect to liquid 2. The tube 46 contains the wick 8 and supports the evaporator 9 on a flange 47, as is the case in FIG. 2.

Complementarily, the base 3 of the reservoir 1 comprises on the axes of tubes 6 and 46 a piercing pin 48 directed toward the diaphragm 45. It is to be understood that by pressing by any suitable method on the tube 46 to displace it according to arrow K, the piercing of diaphragm 45 is carried out by the piercing pin 48. The travel of tube 46 is limited by an abutment 49.

According to another variant (FIG. 3) the tube 6 is closed at its lower part by a partition 51, and possesses, a little above this partition, one or more internal pinched swellings 52, playing the part of a diaphragm and which are more fragile than the rest of the wall of the tube 6. A blade 53 operated by a rod 54 allows the sectioning or breaking of the swellings 52 by a sliding movement at the moment of putting the apparatus into operation. The blade 53 can also be located laterally of the swellings, sectioning then taking place by displacement of the blade 53 about the axis of the tube 6.

The sectioning of the swellings can also be carried out by means of a displaceable tube moving from top to bottom of the tube 6 or effecting a rotational movement in the interior thereof.

The construction of the apparatus according to the invention shown in FIGS. 4 to 7 is remarkable for the fact that the apparatus comprises means for allowing the maintenance of atmospheric pressure on the free surface of liquid 2. In the case of FIGS. 4-6, these means are constituted by a tube 15, suitably capillary, starting from an orifice in the face 4 of the reservoir 1 and joining the gaseous inner volume 16 of reservoir 1 to the atmosphere. Preferably the height and position of tube 15 are determined such that liquid 2 cannot escape therethrough if the apparatus is overturned. In the example of FIG. 4, the tube 15 is parallel to the wick tube 6 and located a short distance away. If the reservoir is of cylindrical shape and it is arranged that at the start it is filled to a little less than half full, the height of the tube 15 is substantially equal to half the height of reservoir 1.

According to the construction of FIG. 7, the atmosphere communication tube is formed by a supply pipe 17 starting from an orifice on face 4, and the free end of which is furnished with a loaded float 18. The end of the pipe 17 is thus located in the gaseous phase, whatever the position of the apparatus, which enables almost complete filling of the reservoir 1.

The materials usable in the construction of the pressure equalizing means are, particularly, those which have been indicated for the reservoir 1. The material may be the same as that of the reservoir 1 or different therefrom. It can also, in the case of a supply pipe, be a natural or synthetic elastomer or a metal in the form of a series of cylinders fitted together as in a telescope and sealingly articulated.

In all cases the pressure equalizing means allows the gaseous volume 16 to be maintained at atmospheric pressure, which

suppresses any efflux of liquid 2 toward the evaporator 9 if the apparatus heats up, particularly in the sun. The complete saturation of evaporator 9 could in effect generate dangerous escapes in the case of phosphorous insecticides.

The wick tube 6 also allows, as will now be seen, the assurance of extra safety by permitting the sealing closure of reservoir 1, at the will of the user, or by the destructible closure device described above, from manufacture up to the first time of use.

The different closure systems and systems for putting into operation described above for the safety tube 6 are equally applicable to the atmospheric pressure equalizing means described above when this is a rigid tube. The application of the systems of closure or putting into action can take place separately or simultaneously on the safety tube and the pressure equalizing tube. An example of a similar construction will be given with reference to FIGS. 4 to 6.

The evaporation apparatus described above can be provided with a diffuser hood or cover, with a view, for example, to protecting the evaporative surface from shocks and to prevent its accidental contact with linen, clothing, furniture or skin. Such diffusers are particularly useful when the liquid to be evaporated is toxic or when it can catch fire on the material of the evaporator. Such a diffuser can be, for example, a grill, a perforated plate, a textile or metallic tissue or an expanded metal. The shape of the diffuser is not critical and can be varied having regard to the type of protection needed and the appearance of the apparatus. Particularly the diffuser can be vertical, oblique, horizontal or along any curve. The diffuser can also form part of a unit forming a protective casing for the reservoir of the apparatus. This latter can then be constructed of a material of low density, for example a polymer or elastomer.

There will now be described, with reference to FIGS. 4 to 6, one preferred embodiment of the invention which makes use of several of the details defined above. This apparatus forms a safety evaporator particularly adapted for use with toxic liquids such as the phosphoric ester insecticides.

The reservoir 1 is of low-pressure high-density polyethylene and is made in two parts 1a and 1b assembled by welding along the line a-a. The wick tube 6 is constructed of the same material, as is also the pressure equalizing tube 15 which is integral with the tube 6. Each of the tubes 6 and 15 is obturated by a diaphragm 61 and 62 (FIG. 6) formed at the moment of moulding of the element. The unit of wick tube 6 and pressure equalizer tube 15 is welded to the inside at the top of the reservoir 1, before assembly of the two parts 1a and 1b thereof.

The reservoir 1 bears a mouth 63 to allow filling; the walls of this mouth 63 are sufficiently fine to allow closure by pinching and thermal welding after filling. The wick 8 is of felt and formed by two adjacent parallel belts. The evaporator 9 is a disc of rigid felt, and it is supported by six plates 64 of polyethylene, integral with reservoir 1. The joint between the evaporator 9 and the wick 6 is formed by a force fit of this latter in a central hole in the evaporator. The apparatus comprises a piercing pin 65 of polyamide resin passing between the two bands of felt forming the wick 6. A second piercing pin 66 of polyacetal resin is located in the pressure equalizing tube 15.

The pointed end of the piercing pin 65 has an array of grooves 67 while the piercing pin 66 has a lateral channel 68 extending from one end to the other (FIG. 6).

A slope 69 is provided in the base 3 of reservoir 1 to collect the impurities which may be precipitated. The base 3 of reservoir 1 has at its middle a little basin 71 for reception of the point of piercing pin 65.

The whole apparatus is located vertically by the crosspieces 73 in a cylindrical metallic diffuser casing formed by an expanded metal grille 74 fixed by insertion into two discs 75 and 76 of folded sheet metal. The upper disc 75 is pierced at its center by a hole 77 allowing the operation of the common head 78 of the piercing pins 65 and 66. The crosspieces 73 are fixed by tenons 79 engaged in mortices 81 of the wall 4. The

filling with the liquid 2 to be evaporated is done via the mouth 63 up to the level N, chosen so as to permit no overflow of liquid whatever the position of the apparatus in use.

Putting the apparatus into action is effected by simple pressure on the head 78 of the piercing pins, which has the effect of piercing the two diaphragms 61 and 62 and of permitting the liquid 2 to reach the base of the wick 8.

On turning the apparatus upside down, cessation of functioning is obtained.

By way of example, the following numerical details are given:

The reservoir of the preceding apparatus has a total capacity of 450 ml. and is filled to 40 percent of its volume with the following solution:

DDVP	7.5%
2-octanol	3.0%
Isoper L	89.5%

Isoper L is a mixture of a branched chain aliphatic hydrocarbons made by ESSO STANDARD, consisting of a mixture of decanes, undecanes and dodecanes.

The apparatus is equipped with a felt disc 9 of rayon, 40 mm. across. Putting it to use is carried out as noted, and the apparatus is placed in a constantly ventilated room kept at $21 \pm 1^\circ \text{C}$.

A regular evaporation of 1.1 ± 0.15 gm., corresponding to 82 ± 10 mg. of DDVP, is noted over a period of 120 days.

In a test designed to determine the efficacy of of the apparatus, house flies were introduced into a normal living room of volume about 30 m^3 , the doors and windows of which were closed throughout the test, the temperature of which was kept at $25 \pm 1^\circ \text{C}$.; an apparatus such as defined above was placed in the room; the percentage of flies fallen (KD) was noted with respect to the elapsed time in minutes. The following average results on ten tests were noted:

KD 50	37 ± 5 minutes
KD 90	65 ± 7 minutes

The same test was repeated in the same room, but with one window open, but provided with a mosquito net. The following average results on ten tests were noted:

KD 50	52 ± 6 minutes
KD 90	98 ± 6 minutes

Tests were, on the other hand, carried out in the same conditions with a commercial evaporative composition on the basis of DDVP and a high molecular weight resin, the results observed with closed and open window respectively were as follows:

KD 50	35 ± 5 minutes	105 ± 30 minutes
KD 90	63 ± 7 minutes	200 ± 35 minutes

These various results illustrate the property of the apparatus of compensating by stronger evaporation the losses due to the aeration of the room at the same time as showing their good efficacy.

Tests carried out in various positions of the apparatus showed that, on the other hand, no overflow of toxic liquid was to be feared. Likewise, tests carried out between -15°C . and $+55^\circ \text{C}$. showed that no overflow due to increased pressure was to be feared.

The apparatus shown in FIG. 7 is formed entirely of aluminum, the reservoir 1-diffuser 82 unit comprises three pieces assembled by fitting together; the lower part 1c is in the form of a truncated cone; the upper part of the reservoir 1 is a disc pierced at its center to allow the passage of the wick 8. The diffuser 82 is of perforated sheet metal. The safety tube 6 is welded to the wall 4 and acts as cross piece. Its base 83 is closed and rests on the annular ridge 84 on the base of reservoir 1.

The wick 8 is form of a tube of bleached unsized cellulose card set in a disc of identical material. A piercing pin 85 of steel passes through the inside of wick 8. Putting it into use takes place by a light tap with a hammer on the top 86 of the diffuser 82. The elasticity thereof allows the driving of the piercing pin through the base 83 of tube 6 and the liquid then comes into contact with wick 8.

The maintenance of the interior of reservoir 1 at atmospheric pressure is ensured by a flexible pipe 17 crossing wall 4 and bearing float 18.

The reservoir 1 of such an apparatus has a total capacity of 300 ml. and is filled to 45 percent of its capacity with a 2 percent solution in 2-butoxyethanol of a volatile floral composition. The apparatus is equipped with an evaporative surface of area 30 cm.² and the various pieces are assembled by setting them together. The apparatus is put to use and placed in a living room where the temperature is maintained at 20–22° C. The perfume is rapidly liberated and extends throughout the atmosphere of the room.

Daily weighings showed a regular evaporation of 1.1 ± 0.1 grams per day.

Whatever the position of the apparatus, no outflow of the liquid inside took place.

The apparatus underwent temperature changes of 25° C. without any overflow of its contents.

FIGS. 8 and 9 show a construction of the apparatus according to the invention with a nondestructible closure device, which is nevertheless much simpler and surer in its functioning than the known valve apparatus.

In this embodiment the communication of the tube 6 with the atmosphere is interrupted by means of a plug 21, provided with a manipulation head 22 which extends across the evaporator 9 and which slides sealingly in the tube 6. The plug 21 is located in the projection of wick 8 to which it is fixed, e.g., by engagement and adherence at 23.

Naturally, the wick 8 is likewise slidably mounted in tube 6. In those conditions, when the plug 21 is in the lower position (Position of FIG. 8) the tube 6 is obturated and the evaporator 9 is not fed. When the plug 21 is pulled upwards (FIG. 9) the wick 8 contacts the evaporator 9 again and the apparatus is put back into operation. Preferably, in this case retaining means are provided for the evaporator so as to prevent its being entrained by the displacement of the wick 8.

The apparatus shown in FIG. 10 is made entirely from plastic material. The reservoir 1 is of polyvinyl chloride; it is obtained by blow extrusion and the unit of the wick tube 6 and the equalization tube 15, of the same material, is obtained by injection moulding. This unit has a common cylindrical well 93 into which a plug 94 can engage, to which plug is attached a wick 8 of a felt of wool and cotton. The Unit 6, 15 is fixed in the opening of reservoir 1 by welding. The evaporator 9 is of a felt of wool and cotton of type identical to that used for the wick 8. The diffuser 95 is a see-through cap of polypropylene obtained by injection moulding, and it is crossed axially by a rod 96 fixed to plug 94, provided with a manipulation ring 97 and a stop 98. Putting this apparatus to use is effected by raising the plug 94 by means of ring 97, which has the effect of contacting wick 8 with evaporator 9, the plug 94 moving to 94a.

By way of illustration, the following tests are noted: The reservoir 1 of the preceding apparatus has a total capacity of 500 ml. and is filled to 40 percent of its capacity with a solution of water containing 3.3 percent of concentrated deodorant known under the mark AIR-WICK-0017. Filling is effected via the tube 6, then the wick 8 and plug 84 are put in position, while the evaporator has a surface of 20 cm.². The plug 24 is raised and the apparatus is placed in a living room where the temperature is maintained at 20/22° C. The relative humidity is initially 35 percent. Daily weighing allowed the determination of the regular evaporation of 7.2 ± 0.6 grams per day; the room is thus permanently protected against bad odors.

Whatever the position of the apparatus, no escape of the liquid from inside took place. The apparatus underwent any temperature difference without overflow.

In another construction, the reservoir having a total capacity of 780 ml. is filled to 40 percent of its volume with a 10 percent aqueous solution of formaldehyde. The evaporative surface is 32 cm.². The plug 94 is raised and the apparatus placed in a living room the temperature of which is maintained at 20–

–22° C. and in which the relative humidity is initially 35 percent; Daily weighings showed a regular evaporation of 4.5 ± 0.2 gms. per day; the atmosphere in the room is thus permanently protected from germs and bacteria, and pathogenic agents in general.

In the use of the apparatus according to the present invention, it is placed supported on its face 3 as shown in FIG. 1. The liquid 2 is absorbed by the wick 8 which feeds the evaporator 9 the surface of which ensures the evaporation of the liquid and its distribution into the atmosphere.

Starting with filling, as has already been noted, the quantity of liquid introduced into the reservoir 1 should be such that in all positions thereof the free surface A of the liquid 2 should be located below the orifice 7 and it can be seen that the tube 6 forbids any escape of liquid. Furthermore, in this case, simply turning the apparatus upside-down allows the stopping of the feed to the wick 8 and, as a result, generates the cessation, after a certain delay, of the evaporation. This permits the liquid 2 to be preserved during times of stoppage.

It is often the case with the organophosphorous insecticides, particularly DDVP, that a deposit of solid impurities forms at the base of reservoir 1. To avoid this deposit clogging the wick 8 and thus preventing the rise of liquid 1 toward the evaporator 9, it is provided, according to the invention, that the base is so constructed that it has a convex surface at the center as shown in FIG. 4. In this case, the impurities 2a collect together by gravity at the edge of the reservoir.

The invention thus provides notable progress in the field of diffuser apparatus. It permits at the same time easy and economic manufacture of these such apparatus, gives the user a large area of use, and avoids any danger, notably in the case of phosphorous insecticides.

It is clear that the invention is not limited to the constructions described and that one can make variations thereto. Thus, the wick tube 6 can comprise a radial swelling constituting an expansion vessel, when it is desired to prevent loss of liquid 2 due to excess pressure without recourse to an atmosphere communication tube 15 or a flexible pipe 17.

We claim:

1. Apparatus for diffusion of volatile liquids into the atmosphere by evaporation comprising a reservoir containing the liquid to be evaporated into which dips a feeder wick joined to an evaporator mounted on a wall of this reservoir, and a tube carried by the said wall inside the reservoir and directed with its interior orifice towards the base thereof, this tube surrounding the wick for at least part of its height, the said apparatus being characterized in that it comprises a destructible closure device interrupting the communication of the interior orifice of the wick tube with the atmosphere before use and means to destroy the said closure device at the moment of putting to use.

2. Apparatus according to claim 1 characterized in that the base of the reservoir as seen from the interior orifice of the wick tube, includes a basin separated from the rest of the base of the reservoir by an annular ridge.

3. Apparatus according to claim 1 and characterized in that the reservoir carries a tube communicating the gaseous volume inside to the atmosphere.

4. Apparatus according to claim 3 and characterized in that the atmosphere communication tube is located parallel to the wick tube and at a height such that its interior orifice is situated above the level of the liquid, whatever the orientation of the reservoir.

5. Apparatus according to claim 3 and characterized in that the atmospheric communication tube is formed by a flexible pipe connected to the wall of the reservoir bearing the evaporator, the free end of which pipe is attached to a float.

6. Apparatus according to claim 1, characterized in that the interior orifice of the wick tube is sealed initially by a diaphragm means being additionally provided to ensure perforation of this diaphragm when the apparatus is put to use.

7. Apparatus according to claim 6 and characterized in that the diaphragm perforation means includes a piercing pin

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located in the wick tube and of which the other end extends to the outside to allow of manual operation.

8. Apparatus according to claim 1 comprising a second tube communicating the liquid reservoir with the atmosphere in that this tube is initially sealed by a diaphragm, means being provided to allow the perforation of this diaphragm when the apparatus is put to use, and further characterized in that the interior orifice of the wick tube is sealed initially by a diaphragm, means being additionally provided to ensure perforation of this diaphragm when the apparatus is put to use.

9. Apparatus according to claim 8 characterized in that it comprises two piercing pins to perforate the diaphragms of the two tubes and in that these two piercing pins are fixed to the same actuation button to allow their operating simultaneously.

10. Apparatus for diffusion of volatile liquids into the atmosphere by evaporation comprising a reservoir containing the liquid to be evaporated into which dips a feeder wick joined to an evaporator mounted on a wall of this reservoir, and a tube carried by the said wall inside the reservoir and

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directed with its interior orifice towards the base thereof, this tube surrounding the wick for at least part of its height, the said apparatus being characterized in that it comprises a non-destructible closure device interrupting the communication of the interior orifice of the wick tube with the atmosphere before use and in that the closure device comprises a sealing plug located in the projection of the feeder wick and which crosses the evaporator, the unit formed by the plug and the wick being slidable between a closure position at which the plug obturates the wick tube and an open position in which the plug is pulled beyond the evaporator, this latter being then in contact with the feeder wick.

11. Apparatus according to claim 10 characterized in that the wall of the reservoir carrying the evaporator is covered by a movable lid having a diffusor wall, which lid is set on to the body of the reservoir and which carries cutting lines which end in a tear-off tab.

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