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2,988,284

DEVICE FOR CONTROLLING THE EVAPORATION OF VOLATILE SUBSTANCES

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Fig. 1

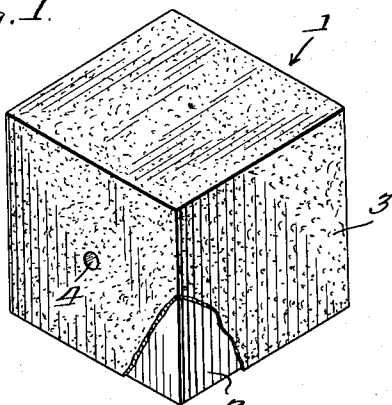


Fig. 4

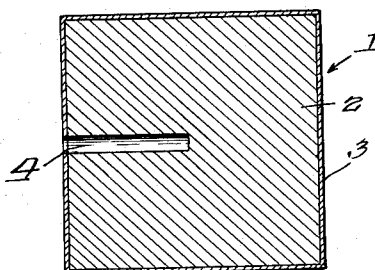


Fig. 2

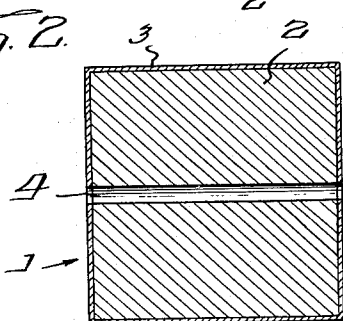


Fig. 5

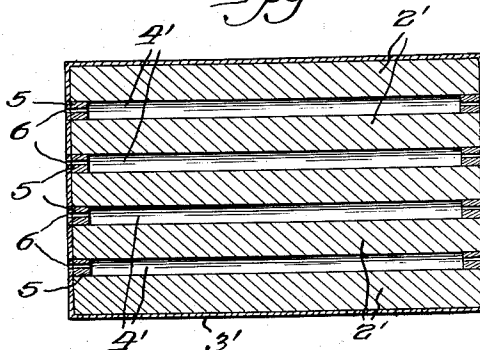


Fig. 3

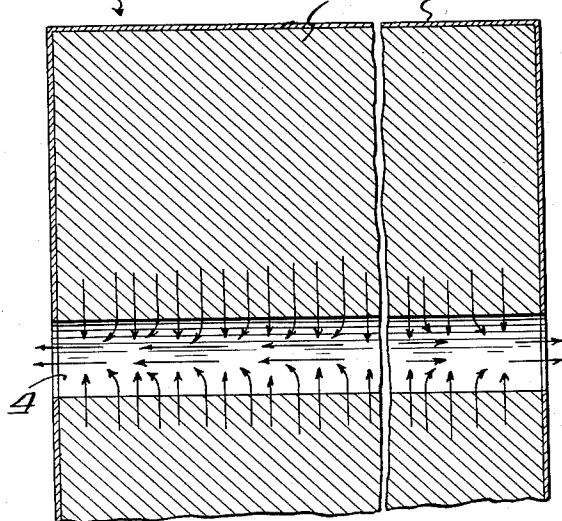
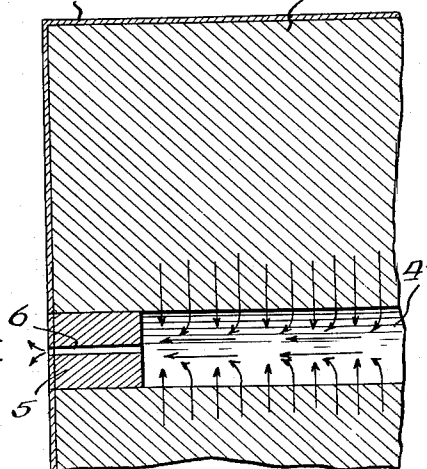


Fig. 6



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**DEVICE FOR CONTROLLING THE EVAPORATION
OF VOLATILE SUBSTANCES**

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The invention relates generally to the volatilization of materials and more particularly to means for controlling the volatilization of applicable substances.

The invention has among its objects the production of a retaining structure for volatile substances, particularly where it is desired to permit a relatively small amount of evaporation to the atmosphere over a long period of time, as for example, in connection with sachets, perfumes, scenting of air, etc.

Another object of the invention is the production of articles having the above advantages which are very simple in construction, easily manufactured at low cost and very effective for the purposes intended.

A further object of the invention is the production of an article for controlling the volatilization of materials, in which the materials may be effectively controlled over very long periods, much greater than presently possible, the action being subject to variations as may be desired.

Many other objects and advantages of the construction herein shown and described will be obvious to those skilled in the art from the disclosure herein given.

In the drawings, wherein like reference characters indicate like or corresponding parts:

FIG. 1 is an isometric view of a container for volatile substances constructed in the accordance with the present invention with one corner of the surface material broken away;

FIG. 2 is a transverse cross section of a container such as that illustrated in FIG. 1;

FIG. 3 is an enlarged sectional view similar to FIG. 2 of a portion of a block of material constructed in accordance with the present invention and illustrating the apparent action involved;

FIG. 4 is a transverse sectional view similar to FIG. 2 illustrating a modified form of the invention;

FIG. 5 is a transverse section similar to FIGS. 2 and 4 of a further modification of the invention; and

FIG. 6 is an enlarged figure of a portion of the structure illustrated in FIG. 5.

Volatilization involves evaporation, the process of volatile molecules mingling with the atmosphere, and in the event the evaporation takes place in a closed vessel recondensation is also involved. The accepted theory with respect to evaporation in a closed vessel considers that molecules will leave the mother liquid and after a certain number of collisions with other free molecules and the sides of the vessel will fall back again into the liquid, thus involving both evaporation and recondensation. Ultimately, in a closed vessel, the number of molecules lost to the liquid by evaporation is deemed exactly equal to that regained by condensation and the liquid thus becomes in equilibrium with its own vapor. If the whole liquid becomes vaporized before this stage is attained, a staple condition exists in which the vessel is occupied solely by free molecules of the substance, describing paths which are disturbed only by encounters with other free molecules or the sides of the vessel.

The present invention utilizes the properties of evaporation and recondensation to achieve effective control of the volatilization, particularly where it is desired to reduce volatilization to a degree that will provide suitable results over a long period of time.

In the case of articles such as blocks impregnated with an odor or scent, it is possible to so control the

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rate of evaporation, that the original characteristics of the odor may be prolonged from one hundred to two hundred times the customary unrestricted rate and for even longer periods when required. Thus it is possible to provide blocks containing a suitable scent or odor which deliver the scent to the atmosphere at a relatively precisely predetermined rate, whereby such action may be achieved from two to four years or longer, depending on the size of the block and the specific construction thereof. Obviously these results are of particular importance and value in the manufacture of sachets and for use in air conditioners and the like, as well as in the manufacture of articles where volatilization is for one reason or another desired to extend over a long period of time or in applications requiring relatively accurately controlled volatilization.

The present invention contemplates the provision of a structure which is suitably impregnated with the volatile material to be employed, which structure is so designed that the action of the molecules is utilized to control evaporation to the atmosphere. This is accomplished in the embodiment of the invention illustrated by providing a small chamber, passageway or tunnel in the container for the volatile substance, which passageway communicates with the exterior atmosphere and forms or is provided with a restricted opening for the passage of molecules from the interior of the device to the exterior thereof. The size of the internal passageway as well as the opening therefrom to the exterior is so proportioned that a collision of volatile molecules takes place therein in such a manner that there is a delay or retardation of the evaporation as well as a positive deterrent on other volatile molecules which are still in the impregnated material of the device and which otherwise would be about to release themselves into the atmosphere.

In the case of perfumes and scents, the final odor is obtained from many individual components which often have different evaporation rates and which under normal conditions may evaporate in undesirable manners, as for example, the most volatile being given off first, followed by the next most volatile, etc., whereas in the ideal situation it would be desirable that the desired mixture be given off substantially uniformly throughout the discharge of the supply thereof. Tests indicate that by the use of the present invention for perfumes or scents the apparent molecular action is such that a continuous mixing process is apparently induced among evaporating aromatic molecules of the combination so that a continuous flow of the desired complete odor the compound or mixture is designed to convey is substantially uniformly maintained, whereby the fragrance is gently introduced in an assembled complete and continuous state into the atmosphere without any substantial separation of its component parts in the process of evaporation.

The present invention also enables further advance in connection with the development of fragrances and scents in that occasionally certain combinations of elements cannot be utilized as mixtures due to incompatibility for one reason or another between the specific elements. However, with the present invention it is possible to obtain fragrances involving such combinations of elements by utilizing one series of containers or blocks for one element and another series of blocks assembled and intermixed therewith for the next element, etc., whereby such elements are never actually intermixed but only the vapors of each intermixed as they are discharged from their respective containers.

Referring to the drawings and more particularly to FIGS. 1, 2 and 3, the reference numeral 1 indicates generally a container structure for volatile substances constructed in the form of a block 2 of suitable material having a porous character whereby it is capable of being

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impregnated with volatile material or substance. The block 2 may be of any suitable material, as for example wood, cellulose, fiber, pulp, filament, silicate, gum, plastic or the like, capable of being impregnated by suitable means with a volatile substance, as for example, by submerging it in a solution of the volatile substance either before or after the block is formed.

For the purposes of explanation, the invention will be described in detail in connection with blocks of a size suitable for use in sachets of the like, in which case a very effective size of block has been found to be in the form of approximately a five thirty-seconds of an inch cube. However, depending upon the nature of the use, the blocks normally will run from approximately one-sixteenth of an inch square to three-quarters of an inch square, and for air conditioning and the like may involve larger blocks as hereinafter described. Following the formation of the impregnated block, the contents is then substantially hermetically sealed by an air tight coating of suitable material such as shellac, lacquer, varnish, gum, wax, casein, resins, plastic or other suitable bland, reasonably hard coating, or combination thereof. It will be appreciated that in such case the impregnating material is contained in a substantially air tight retainer generally corresponding to a closed glass bottle, etc. The coating 3 may be applied in any suitable manner, as for example, dipping, spraying or the like.

When the coating has suitably hardened or set to permit further processing, the coated block is then formed with a passageway or tunnel 4 therein, which may be suitably accomplished by boring or drilling, or under suitable conditions by a punching operation or may even be constructed by a molding or forming operation. Normally the size of the passageways or tunnels 4 will range from one two-hundredths of an inch to three sixteenths of an inch in diameter. In the case of a five thirty-second inch cube with approximately one sixty-fourth inch diameter bore therethrough, a sachet of approximately one-half ounce in weight would contain from forty to eighty blocks depending on construction and design of the sachet.

If the basic material, as for example raw wood, is utilized for the blocks and thus initially contains deleterious matter, such material must be suitably conditioned to remove such matter, which in the case of wood may be readily accomplished by boiling from four to ten hours or longer in ten or more changes of water, by the use of live steam, or by extraction in an extractor using hot ether. After conditioning, the blocks should be completely dried by suitable heat such as in an oven, until all traces of moisture are removed. In the case of wood, well seasoned hard maple, or any mature well seasoned firm wood whose structure remains intact and will satisfactorily hold the desired impregnating materials is suitable. Normally the small sized wood and cellulose blocks can be impregnated without any increase in atmospheric pressure, but in the use of large sized wood blocks of considerable density, a pressure of three or more atmospheres may be required under controlled temperatures to suitably drive the impregnating material in the block.

The ratio between the size of the block and tunnel would appear to be in almost direct proportion to the length of time required for complete evaporation. Consequently it would appear to be desirable that the blocks and tunnels remain as small as possible to accomplish satisfactory results where a long period of time is desired for dissipation. For example, taking an odor of a determined intensity that will last two years with a given size of blocks and tunnels can be made to last about four years by using double the quantity of the same sized blocks but using only half the size of tunnel utilized for the two year period. Thus various combinations of block material and size of blocks and tunnels can be used to achieve the desired results.

The blocks may be kept loose in a container, or may be secured in a container by any suitable means, as for

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example, setting in indentations or grooves and the like, or by means of suitable strands passing through tunnels to hold the blocks in place.

It will be apparent from the above description that it becomes possible to utilize normally incompatible substances in arriving at a desired odor which heretofore could not be suitably accomplished, the incompatible substances being contained in separate blocks wherein the vapors of each substance may be mingled and combined without bringing the incompatible substances into physical or chemical contact with one another or other ingredients. Thus a whole field for the creation of new odors, heretofore impractical, can be obtained. Likewise the creation of new odors may be obtained in a manner analogous to the three color system employed in lithography, wherein three color plates are superimposed to create a complete range of colors.

Various examples could be given of incompatibility rendering certain combinations impractical. For example, each of the artificial nitro-musks, ambrette, ketone and xylol has a highly desirable scent, nuance or side note, but their uses are restricted in many combinations because these substances in some compositions tend to create a chain reaction with other ingredients in the compound, which in course of time deteriorates or destroys the originally desired scent. By confining artificial musk substances or affiliates dissolved in suitable material such as benzyl, benzoate, diethyl, phthalate or other solvents in separate impregnated blocks in an assembled combination, the fine scent of artificial musks or affiliates can mingle with notes of the remainder of the combination to create a highly desired scent without bringing the artificial musks or affiliates into physical or chemical contact with the other ingredients of the combination.

Similarly, various sizes of blocks of various materials and various sizes of tunnels can be used in the same sachet to obtain a timed and balanced result. For example, fugitive odors such as flower absolutes can be impregnated into separate blocks to lengthen their period of evaporation so that their notes will last as long as the heavier notes involved throughout the entire life of the combination.

As illustrated in FIG. 4, in some cases it may be desirable to drill the tunnel 4 only partially through the block rather than completely through as illustrated in FIG. 2. This might be true, for example, in the case of a delicate flower absolute, duly fixed with a bland fixative if required, which could be contained in blocks of suitable proportionate size with small tunnels measuring one one-hundredth of an inch or smaller in diameter and extending only one-third to one-half the distance through each block.

The invention is also applicable to correction of air in air conditioner systems and the like, where it is usually intended to lend a slight nuance to the air after it has passed through a clarifying or washing process. Blocks for this purpose may be considerably larger than those heretofore described, normally measuring up to approximately three-quarters of an inch in diameter and up to four inches in length, in which case the block would be very similar to that illustrated in FIG. 2, with the exception that it is of greater length in the direction of the axis of the tunnel 4. In most cases the blocks will be impregnated with a special neutral behavior fine type scent of agreeable and delicate pattern having gentle notes carried in extreme dilution to effectively correct and neutralize reconditioned air so that the scent will remain discreet and almost imperceptible. Consequently blocks for this purpose may be constructed of suitable size, as for example, as above set forth, with the tunnels extending down the center and of approximately three-sixteenths of an inch in diameter. In this case the block, following impregnation, may be provided with suitable plugs of wood, plastic or other suitable material at each end of the tunnel, thereby effectively restricting

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the open end of the latter. The block then may be coated and each plug formed with a small bore having a diameter of one-sixteenth of an inch to about one-sixty-fourth of an inch or smaller, depending on the quantity of circulating air the blocks are called upon to serve.

FIGS. 5 and 6 illustrate bores formed in this manner, the block 2' having, in this case, a plurality of bores 4' which are provided at each end with a suitable plug 5' over which the exterior coating 3' extends. Each of the plugs is provided with a small bore 6 extending there-through operatively connecting the interior of the tunnel 4, with the exterior of the block.

Where the invention is employed in air conditioning systems and the like wherein the larger or elongated type of block is employed, the blocks will usually be suitably supported so that the air flow is transverse with respect to the axis of the tunnels, and thus not flowing through the tunnels.

FIG. 6 also illustrates a construction which may be desirable in certain instances wherein the block 2' has a transverse dimension which is more or less a multiple of the general configuration illustrated in FIGS. 1, 2 and 3 and a plurality of tunnels which are suitably spaced in the block. The block 2' illustrated in FIG. 5 vertically is substantially the equivalent of approximately four blocks assembled with similar long sides abutting one another and each block provided with its respective tunnel.

As illustrated in FIG. 6, the molecular action of a construction such as illustrated in FIG. 5 is believed to be similar to that illustrated in FIG. 3.

The effectiveness of the tunnel structure and the manner herein described may be readily demonstrated by taking two blocks which are identical as to size, shape, impregnation and coating, providing one block with a tunnel in accordance with the present invention and merely removing a portion of the coating equivalent in area to the cross sectional area of the tunnel at its mouth. The omission of the tunnel would result in a more or less uninterrupted evaporation of the volatile substance to the atmosphere and such substance would exhaust its odor in a relatively short period of one to three months as compared with two or more years where the present invention is employed. Also in the process, the evaporation would be fractional and spotty, i.e. the compound in the course of evaporating would resolve itself into its various components, with the result that the lighter and more volatile portions would exhaust themselves first, leaving the heavier components to evaporate toward the end of the life of the substance. Such action often brings out an odor of raw materials that may become unpleasant and highly undesirable.

It might also be mentioned that in previous devices, as for example old styled sachets, outside undesirable odors may be absorbed, impregnating surfaces tending to draw seepage from the outside atmosphere. As such unwanted outside odor mingles with the impregnated material to create a hybrid product, the result is an odor that can become rancid, tiresome, dead or extremely obnoxious. With the present invention the small size of the tunnel openings in the blocks in relation to molecular force driving scent out of the blocks would appear to substantially completely prevent any outside unwanted odors from coming in. This is of particular importance because sachets are often required to overcome other odors in a place of storage.

It will be appreciated from the above disclosure that the present invention has among its functions the control, not only of the rate and duration of evaporation, but also control of the behavior of evaporation. Perfumes yield their finest fragrance in diffused and subtle form, and with the device herein described this is achieved by restraint which enables the finest top notes to manifest themselves throughout the entire period of evaporation of the compound without becoming subdued or overwhelmed by heavier components which may be re-

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quired in the perfume compound to compose a better balanced odor and a finished scent.

While I have illustrated the blocks as being of rectangular cross section, it is believed apparent that various configurations may be employed, as for example, spheres, cylinders, octagons, bars of various shapes, etc. While I have described the invention in connection with fragrant scents or odors such as perfumes and the like, it is believed apparent that the invention may have applicability in other unrelated fields involving the use of volatile substances wherein it is desired that the latter be volatilized over a prolonged period at a controlled rate in accordance with the invention.

Having thus described my invention, it will be obvious to those skilled in the art that various immaterial modifications may be made in the same without departing from the spirit of my invention, hence I do not wish to be understood as limiting myself to the exact form, construction, arrangement and combination of parts herein shown and described, or uses mentioned.

What I claim as new and desire to secure by Letters Patent is:

1. A device for controlling volatilization of a volatile aromatic substance over a relative long period of time, comprising a block of material having a porous relatively non-volatile structure containing a supply of a volatile aromatic substance therein, the volume of said block ranging from approximately $\frac{1}{4000}$ cubic inch to approximately $2\frac{3}{4}$ cubic inches and the dimensions of said block ranging from approximately $\frac{1}{16}$ " x $\frac{1}{16}$ " x $\frac{1}{16}$ " to $\frac{3}{4}$ " x $\frac{3}{4}$ " x 4", said block having a substantially impervious coating thereon of high impermeability to the volatile aromatic substance, said block having a mixing passageway for the volatile aromatic substance therein extending to at least one face of the block, said mixing passageway having an effective diameter ranging from $\frac{1}{200}$ " to $\frac{3}{16}$ ", said substantially impervious coating having an opening therein operatively connecting said mixing passageway with the exterior through which molecules of the volatile aromatic substance may flow, said opening ranging in effective diameter from $\frac{1}{200}$ " to $\frac{1}{16}$ " operative to produce a molecular action within the mixing passageway that tends to approach an equilibrium in evaporation and recondensation, resulting in a comparatively small relatively uniform discharge of molecules from said opening for the mixing passageways over a relatively long period of time, and said substantially impervious coating of the block directing the volatile aromatic substance towards said mixing passageway.

2. A device as defined in claim 1, wherein said device comprises a plurality of said blocks, the latter being impregnated with the volatile aromatic substance including constituents of a desired scent, said substantially impervious coating comprising a material which is relatively inert with respect to such constituents and forms a substantially air-tight coating on each of said blocks.

3. A device as defined in claim 2 wherein different constituents are contained in respective blocks, the size of said blocks and the size of said passages being selected to provide desired molecular discharges in the respective blocks operative to achieve a desired combined effect over a relatively long period of time.

4. A device as defined in claim 1, wherein said opening in the substantially impervious coating is smaller in area than the cross-sectional area of said mixing passageway.

5. A device as defined in claim 1, wherein said mixing passageway has a plug therein at the adjacent face of the block on which said mixing passageway opens, said plug having a bore therein operatively connecting the mixing passageway with the exterior, the cross-sectional area of said bore being less than that of the mixing passageway.

6. A device as defined in claim 1, wherein said mixing passageway extends through the block and said substantially impervious coating has an opening therein for each end of the mixing passageway.

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7. A device as defined in claim 1, wherein said block has a plurality of mixing passageways therein, extending in spaced parallel relation with respect to one another.

8. A device as defined in claim 7, wherein said mixing passageways are provided with plugs at each end thereof, each plug having a relatively small bore therein and operatively connecting its respective mixing passageway with the exterior.

9. A device as defined in claim 1, wherein said block is of wood and said substantially impervious coating including one or more materials selected from a group consisting of shellac, lacquer, varnish, gum, wax, casein, resins, plastic, and other suitable bland, reasonably hard coating.

10. A device as defined in claim 2, wherein the size of the openings in certain blocks are larger than that of openings in other of such blocks.

11. A device as defined in claim 2, wherein certain of the blocks are larger than others and the larger blocks are provided with larger openings than those of the smaller blocks.

12. A device as defined in claim 1, wherein said substantially impervious coating is a suitable bland, reasonably hard coating.

13. A device as defined in claim 1, wherein said substantially impervious coating includes a suitable bland, reasonably hard coating in combination with an additional

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substantially impervious coating including one or more materials selected from a group consisting of shellac, lacquer, varnish, gum, wax, casein, resins, and plastic.

14. A device as defined in claim 1, wherein said block of material having a porous relatively non-volatile structure is of a material selected from a group consisting of wood, cellulose, fiber, pulp, filament, silicate, gum, and plastic capable of being impregnated with a volatile material.

15. A device as defined in claim 1, wherein said block of material is of a material selected from a group consisting of wood, cellulose, fiber, pulp, filament, silicate, gum, and plastic capable of being impregnated with a volatile material and said substantially impervious coating including one or more materials selected from a group consisting of shellac, lacquer, varnish, gum, wax, casein, resins, plastic, and other suitable bland, reasonably hard coating.

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