

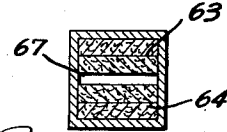
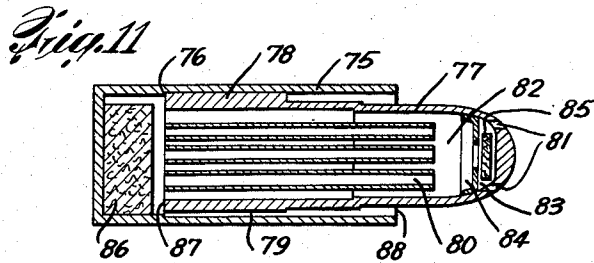
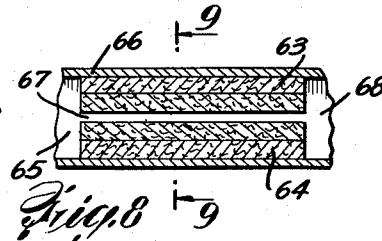
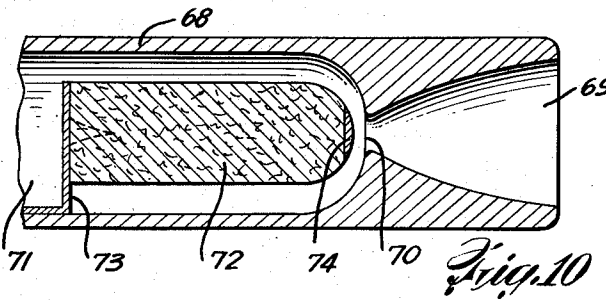
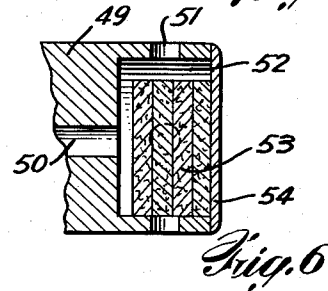
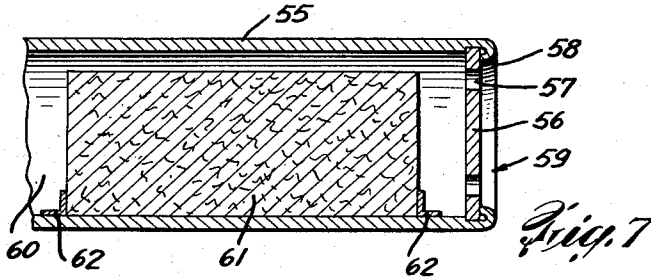
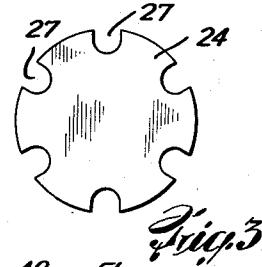
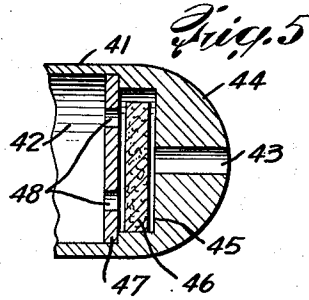
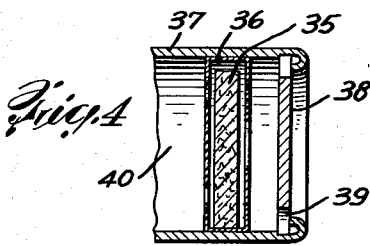
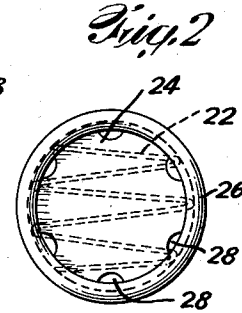
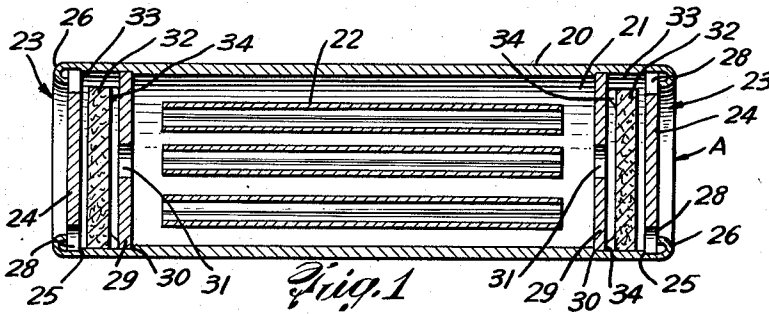
March 31, 1953

W. M. GROSVENOR, JR

2,633,131

MEDICAMENT INHALER

Filed March 3, 1949



INVENTOR.
WILLIAM M. GROSVENOR, JR.
BY
Hammond & Littell
ATTORNEYS

UNITED STATES PATENT OFFICE

2,633,131

MEDICAMENT INHALER

William M. Grosvenor, Jr., New York, N. Y., assignor to John H. White, Old Greenwich, Conn., and Mary White Rose, San Francisco, Calif.

Application March 3, 1949, Serial No. 79,480

3 Claims. (Cl. 128—200)

1

This invention relates to containers having a fibrous means for closing access thereto in the presence of water and is particularly adapted for use in conjunction with a medicament inhaler wherein it may be desirable to prevent removal of the medicament from the inhaler for use other than that intended, such removal being accomplishable previously by placing the inhaler in water or other similar liquid.

In one aspect of the invention, a container is provided for holding a supply of the particular medicament to be used, the container having a passage for emission of the vapor of the medicament, the passage including an aperture in the wall of the container. A portion of the passage is arranged to receive a water or liquid absorbent fibrous body in such a manner that normally vapor and air can pass through the passage; but which is operative upon wetting of the fibrous body to seal said portion of the passageway so that liquid cannot flow therethrough and thus reach the medicament.

It is of course quite evident that the invention can be employed for purposes other than inhalers or vaporizers, such purposes including those wherein it is desirable to prevent water or liquid from reaching the contents, yet where air or vapors are free to pass. These and other objects, advantages, and features of the invention will become apparent from the following description and drawings.

Figure 1 is an enlarged sectional view of one form of the invention.

Figure 2 is an end view of the form shown in Figure 1.

Figure 3 is an end view of the outer apertured disc used in the form of the invention shown in Figures 1 and 2.

Figure 4 is a fragmentary sectional view of one end of a modified arrangement of the fibrous member.

Figure 5 is a fragmentary enlarged view of one end of a modified arrangement of the fibrous sealing member.

Figure 6 is a fragmentary sectional view of one end of still another modification of the invention.

Figure 7 is a fragmentary enlarged view of one end of still another form of the invention wherein the fibrous body swells radially to close the passage.

Figure 8 is a fragmentary sectional view of another form of the invention.

Figure 9 is a section taken along the line 9—9 of Figure 8.

2

Figure 10 is a fragmentary sectional view of a still further form of the invention.

Figure 11 is a sectional view of another modification of the invention.

Tubular member 20 may be made of steel which can be hardened after it is formed and before assembly of the medicament therein. Tube 20, of course, can be made of any suitable material such as plastic, hardened steel being used where non-destructive properties are necessary.

The medicament or other substance can be held in the tubular member in various manners. As one example, passageway 21 of the tubular member may have the medicament placed therein by means of a piece of impregnated absorbent paper 22, said paper being folded in an accordion-like arrangement so as to provide air passages along the length thereof. The passageway 21 has apertures 23 at each end of tubular member 20. Outer apertured discs 24 may be held in place on shoulders 25 at each end 23 of the tubular member 20 by crimping the ends of the walls of the tube at 26. Discs 24 have slots 27 therein which provide apertures 28 in conjunction with crimped portions 26 (Figs. 1, 2, 3). The discs preferably are made of hardened steel so that they cannot be punched, drilled or otherwise deformed for the purpose of obtaining easy access to the interior of the inhaler or the sealing elements. Inner discs 29 are held on shoulders 30 of tubular member 20 in any desired manner, discs 29 having apertures 31 therethrough for the passage of air and/or vapors.

Water absorbent swellable fibrous bodies 32 are provided in the chambers or cavities 33 formed between the two discs 24 and 29. In a preferred form, said water absorbent swellable discs 32 have a plurality of spaced projections 34 around one face so as to hold the fibrous bodies 32 in spaced relation relative to the inner restraining discs 29. The projections can be formed, for example, by pressing inwardly on the fibrous body disc edges at spaced points around the periphery thereof.

The fibrous body preferably should be made of fibers capable, upon wetting with water or the like, of swelling a major amount when in an unconfined condition. Such a swelling should be reasonably rapid so that when the fibrous body comes into contact with water, or liquid, it will swell with sufficient rapidity to close the passage from the exterior of the inhaler to the interior or point where the medicament is located.

In a further and preferred aspect, a fiber can be used such as one of cellulose fiber normally

employed in the manufacture of paper or paper board. Preferably, the fibers should not be subsequently treated so as to reduce the swelling characteristics by processes such as vulcanizing or impregnation. It may be, however, possible to select a fiber with the desired characteristics which may have had some subsequent treatment after it has been made into paper or paper board, as long as the swell rate is not seriously affected thereby.

As one example, the fibrous body or elements 32 preferably are made of a kraft process fiber although it is to be understood that other similar fibers can be used. As an example of one type of suitable fibrous body, the fiber thereof in its manufacture can be medium well cooked and beaten, and the fiber board made therefrom in a conventional wet paper machine.

The body and fibers preferably can be chosen to have at least a predetermined real volume in relation to the active or actual space occupied by the fibrous body and to have a predetermined swell rate when unconfined. The term "active space" can be defined as the actual space occupied by the fibrous body or plurality of members after they have once been wet. "Swell rate" can be defined as a percentage increase in thickness of the normally dry fibrous body per specified unit of time. The choice of fibrous body preferably should be made so that when swelling of the fibers composing the fibrous body occurs under unrestrained conditions, the swelling will more than cause the body to fill the active space occupied thereby.

In one aspect, the fibrous body when relatively dry can have intercommunicating pores therethrough which will be subsequently shut when the fibrous body becomes exposed to water and the body is confined by the walls of a cavity restraining structure or arrangement. When the fibrous body is in its chamber and is normally dry, it is dimensioned relative to the chamber or restraining cavity in such a manner that air and vapors can pass therethrough or so that it is pervious to the vapor. Upon being contacted with water, the fibrous body swells sufficiently and is restrained in such a manner that it will cut off or seal the passageway to water or liquid and thus prevent water from reaching the medicament.

In a preferred form, but not necessarily, the fibers of the fibrous body are substantially randomly oriented in substantially parallel layers. The fibers in such a case should be so arranged in the device so that the main swelling occurs substantially perpendicular to the parallel layers. Also in one form, the edges of the fibrous body may have portions pressed inwardly so as to provide projections on the end faces of the fibrous body for the purpose of providing a passageway between the face of the body and a restrained disc of the inhaler, when the fibrous body is in normally dry condition.

As one example of the characteristics of a suitable wet fibrous body, one can be used which has a density of 0.80 to 1.40 with an initial swell rate for the first minute of more than about 5% when exposed to water with the body unrestrained. In one suitable fiber, the initial swell rate is 20% for the first minute and it will swell 70% in 5 minutes. The swell rate is not necessarily a straight line relationship but must be rapid or quick during the first minute.

The particular swell rate of the fibrous body used also is related to the real volume of the

fibers. If the real volume of the fibers is at least 50% of the active space thereof, the fibrous bodies or elements will function properly, even under fluid pressure, to close off the passageway from the exterior of the inhaler to the interior thereof.

In normal use of the inhaler, one end A of the tubular member 20 can be held adjacent the nostril and air drawn through the inhaler. The air drawn through the inhaler will pick up volatilizable ingredients from the folded impregnated paper 22. An example of one medicant for the shrinking of the nasal mucosa is racemic amphetamine or 1-phenyl-2-aminopropane, and for which this invention is adapted to be used.

It is to be understood that the invention is applicable to inhalers or other devices having other medicaments or substances therein. If tubular member 20 is placed in water in an attempt to remove the medicament from the interior thereof, the swellable fibrous body members 32 will immediately swell and effectively seal the passageway against liquid inflow or outflow relative to the interior of the tubular member 20.

As another example of an arrangement for closing off access to the interior of the tubular container, a water absorbent swellable fibrous body 35 (Fig. 4) can be located in an annular restraining member 36 held in tubular member 37. Steel disc 38 may be crimped in the end of tubular member 37 in a manner similar to that described for Figures 1 to 3, inclusive, discs 38 having slots 39 similar to slots 27 of Figures 1 to 3, inclusive. Upon water contacting the swellable fibrous body 35, said body will seal off access to passageway 40 of the tubular member 37. A similar arrangement can be located at the other end of tube 37.

A still further modification is shown in Figure 5 wherein a tubular member 41 has a passageway 42 and an aperture 43 in the rounded end 44 thereof. Cavity or restraining chamber 45 is arranged to hold water absorbent fibrous body 46, said fibrous body being held in place therein by disc 47. Said disc has apertures 48 therein for the passage of air and vapor.

Another form is seen in Figure 6 wherein tube 49 has a passageway 50 leading to apertures 51. Passageway 50 can connect with the medicament cavity or holding chamber of this arrangement. Restraining cavity or chamber 52 can have one or a plurality of fibrous bodies 53 therein, said bodies being held in said restraining cavity by means of a cap member 54, said cap member 54 being welded, brazed, or otherwise fastened to the tubular body 49.

In another form of the invention, the fibrous body can be located in the passageway so as to close off the same by a radial swelling of the fibrous body. Tube 55 (Fig. 7) can have a disc 56 with apertures 57 therein, said disc 56 being held by crimping of tube 55 at 58 into the end of the tube 55 and across the aperture 59 leading to passageway 60 of said tubular member 55. Fibrous body 61 is held in place longitudinally in passageway 60 by means of restraining members 62, 62. When the fibrous body comes into contact with a liquid or water, said fibrous body 61 will swell radially so as to completely fill the passageway 60 and thus seal off access to the interior of the tube.

A modification of the form seen in Figure 7 is found in Figures 8 and 9 wherein the fibrous elements 63, 64 are located in passageway 65 of tube 66. An aperture or passage 67 is formed

5

between fibrous elements 63, 64. Upon contact with water, fibrous elements 63, 64 will swell inwardly in such a manner so as to close off passage 67 and thus seal the passage.

In still a further form of the invention, body 68 (Fig. 10) of the inhaler may have an aperture 69 in the end thereof connected through port 70 with passageway 71. The longitudinally expandable water absorbent fibrous element 72 is held at one end by bracket 73. Upon contact with water, fibrous element 72 will swell longitudinally so as to cause the end or valve seat 74 to contact opening 70 and close off access to passageway 71. It is evident that various valve seats and arrangements can be used employing the principle indicated in Figure 10.

As a further example of an arrangement of the invention, exterior tube or casing 75 (Fig. 11) can be made of metal, although a plastic may be used if desired or permissible. Outer casing 75 can have a shoulder 76 for limiting inward movement of the tube 77. Tube 77 may have projections 78 spaced around the periphery providing passages 79 between the main part of tube 77 and the inner wall of casing 75. The tube 77 may have impregnated folded paper 80 therein carrying the medicament. In this form of the invention, tube 77 preferably should be joined to casing 75 in some manner so that they cannot be taken apart after assembly. Apertures 81 in the end of tube 77 connect with passage 82 containing the medicament through a chamber or cavity 83, said cavity or chamber being formed by a ring or retaining member 84 fastened in tube 77 in such a manner that the ring cannot be moved inwardly.

Water absorbent fibrous body 85 is placed in cavity 83 so that upon becoming wet, the body will seal off aperture 81 and thus access to the medicament in passage 82.

At the interior portion of the inner and outer tube, a second water absorbent fibrous body 86 is located so as to cooperate with the inner end 87 of tube 77.

Air drawn through aperture 81 normally will pass into the inhaler through annular passageway 88, around the inner end of tube 77 and through the medicament containing paper 80.

If desired, the tubular body of the inhaler can be made of a metal such as steel, which can be hardened so as to make it quite difficult to gain access to the contents by destruction of the container. The end closures preferably are arranged so that it will not be possible to force holes through the fibrous body and thereby permit water to pass into the interior of the inhaler.

In the forms shown in Figures 1-6, inclusive, the fibrous body is of smaller diameter than the cavity in which it resides but the fibrous body may take various shapes and sizes. Also the ends and exterior of the tubular members may take any desired shape as needed for their in-

6

tended purpose. It is to be understood that various modifications can be made in the details of construction without departing from the spirit of the invention except as defined in the appended claims.

What is claimed is:

1. A medicament inhaler comprising a container having a passageway for emission of the vapor of said medicament, said passageway including an aperture in a wall of said container, a chamber connected to said passageway, a water absorbent fibrous body in said chamber, said chamber being normally pervious to the vapor, and a cover member for said chamber having a plurality of peripheral slots, said fibrous body in said chamber being operative when wet by water to seal the passageway against liquid flow, said slots being constructed and arranged in said cover relative to said fibrous body herein and said passageway so that the body cannot be mechanically rendered pervious from the exterior to water when the body is wet.

2. A medicament inhaler comprising a tubular body having a medicament holding cavity therein with a chamber at each end of said cavity communicating with the exterior of the tubular body, water absorbent fibrous bodies in each of said chambers, said chambers normally passing vapor and air and said fibrous bodies being swellable when wet to seal said chambers against liquid flow, a slotted periphery disc at the exterior of each chamber, and inner discs having a central aperture at the interior side of each of said chambers, said fibrous body being between said discs.

3. A medicament inhaler comprising a tubular body having a medicament holding cavity therein with a chamber at each end of said cavity communicating with the exterior of the tubular body, water absorbent fibrous bodies in each of said chambers, said chambers normally passing vapor and air and said fibrous bodies being swellable when wet to seal said chambers against liquid flow, a slotted periphery disc at the exterior of each chamber, inner discs having a central aperture at the interior side of each of said chambers, said fibrous body being between said discs, and said discs being held in place by a crimped end of said tube.

WILLIAM M. GROSVENOR, JR.

REFERENCES CITED

The following references are of record in the file of this patent:

UNITED STATES PATENTS

Number	Name	Date
567,558	Wiseman -----	Sept. 8, 1896
957,548	Doane -----	May 10, 1910
1,091,362	Levalley -----	Mar. 24, 1914
1,398,764	Blum -----	Nov. 29, 1921
2,331,431	Simoneau -----	Oct. 12, 1943