This invention relates to a device for applying a medicament to the eye, and particularly, a medicament contained within an aerosol.

The principal object of the invention is to provide a simple and inexpensive device that will apply the aerosol-contained medicament to the eye in an effective and safe manner.

The various features of the device by which this principal object is achieved will be evident from the following description, in conjunction with the accompanying drawings, in which:

FIGURE 1 is a view, in perspective, of the complete device and showing the manner of its use;
FIGURE 2 is a vertical section along the axis of the device, with an aerosol cartridge in position;
FIGURE 3 is a plan view of the outer end of the device, with the aerosol discharge stem shown in section and with a portion of the device broken away to show its interior construction;
FIGURE 4 is a vertical cross-sectional view of the device taken along the line 4—4 of FIGURE 2; and
FIGURE 5 is a vertical cross-sectional view of the device taken along the line 5—5 of FIGURE 3, with the aerosol discharge stem removed.

Referring to FIGURE 1 of the drawings, the eye-applying aerosol device generally designated 10 consists of an eyecup 11, a tube-like block 12, and an aerosol cartridge 13 containing the medicament under a suitable pressure. The discharge stem 14 of the aerosol cartridge fits into an aperture 15 in the outer end 16 of the tube-like block 12.

When the upper end of the aerosol cartridge 13 and the under surface of the outer end 16 of the tube-like block 12 are grasped between the thumb and forefinger of the hand, as shown in FIGURE 1, and compressed, the medicament within the aerosol cartridge is discharged as a mist through its stem 14 into the tube-like block 12, and from there the mist is guided by the eyecup 11 to the eye 17 of the person whose face is shown in outline in FIGURE 1.

The aerosol cartridge 13 contains a metering valve (not shown) effective to discharge a small, definite amount of the medicament within the cartridge each time the cartridge is moved toward the outer end 16 of the tube-like block 12 as a result of the manual compression action referred to. After this amount of medicament is discharged, there is no further discharge of medicament while the cartridge is maintained depressed against the outer end 16 of the tube-like block 12. The cartridge 13 must be released so that it moves upwardly to its normal, unpressed position, and then moved again to its depressed position, in order to discharge additional medicament. Such additional medicament will be a second small, definite amount of the medicament.

The end result is that the medicament is discharged from the aerosol cartridge in a single small burst of mist for each compressive action of the hand.

Metering valves for aerosols are well-known, and as they are not part of this invention, are not shown or described in detail.

This invention is primarily concerned with what is positioned between the aerosol discharge stem 14 and the eye 17. This consists of the eyecup 11 (of conventional shape) and of the tube-like block 12.

Referring now to FIGURES 2, 3, 4 and 5, in addition to FIGURE 1, the tube-like block 12 has a chamber portion 21 with a substantially cylindrical exterior surface. Block 12 also has an outer end portion 16, this portion having its exterior surface 22 facing the aerosol container 13 cut away from the plane defined by the outer surface of chamber portion 21 so that the aerosol container may move along its axis toward the block 12 the full distance necessary to effect a discharge of medicament from the aerosol, without such movement being impeded by having some part of the aerosol container engage the block 12. Preferably, this is accomplished by having the aerosol-facing exterior surface 22 a substantially flat surface perpendicular to the axis of the aerosol discharge stem 14, and by positioning this surface along the axis of the aerosol discharge stem 14 a distance from the tip 23 of such stem that is sufficient to enable the outer end 16 of the block 12 to support the aerosol container, preferably in the inverted position shown. In the construction illustrated, this surface 22 is tangent to a circle whose radius is approximately one half the radius of the cylindrical exterior surface of the chamber portion 21.

Preferably, the outer end portion 16 of block 12 has a flattened surface 24 in the area most remote from the aerosol cartridge, where this portion 16 is engaged by the thumb of the person who uses the device in the manner shown in FIGURE 1.

Between surfaces 22 and 24, the outer end portion 16 of block 12 is of a solid material that is substantially impervious to gas and liquid, yet is readily formed with the apertures now to be described and is not in contact to the medicament and other constituents in the aerosol cartridge. Preferably this is of a plastic material that is readily molded or cast to the shape and form desired.

Aperture 15 is a cylindrical aperture extending perpendicularly inwardly from the aerosol-facing surface 22 for receiving the discharge stem 14 of the aerosol cartridge 13. Before this aperture 15 reaches the axis of the cylindrical chamber portion 21, its diameter is reduced to form an annular shoulder 25 against which the tip 23 of the aerosol discharge stem 14 abuts. The aperture 15 continues inward, at a reduced diameter as shown at 25, to at least the axis of the cylindrical chamber portion 21, and preferably slightly beyond.

The side wall of the reduced diameter portion 26 of aperture 15 has a small lateral opening 27 about on the line of the axis of the cylindrical chamber portion 21 and extending toward the chamber portion 21. This lateral opening 27 connects with the end wall of an intermediate chamber 28, most of which is formed inside the outer end 16 of block 12 and which is preferably symmetrical in cross-section about the axis of the cylindrical chamber portion 21. In the construction illustrated, the cross-section of the intermediate chamber is rectangular with rounded ends, and with the long flat sides of the rectangle parallel to the aerosol-facing exterior surface 22 of outer end 16, as clearly shown in FIGURE 5.

The end of intermediate chamber 28 remote from the end wall having the lateral opening 27 therein, connects with one end of the main chamber 30 formed inside the cylindrical chamber portion 21 of the tube-like block 12. This main chamber 30 is considerably larger in volume than the intermediate chamber. Thus, in the construction illustrated the cross-section of the main chamber 30 is rectangular with rounded ends, with the chamber about four or five times longer, axially, than the intermediate chamber 28, about twice as large across the narrow transverse dimension of the chamber 30 (i.e., parallel to the axis of the aerosol discharge stem 14) as the same dimension of the intermediate chamber 28, and about 1.3
times as large across the wide transverse dimension of the chamber 30 as the same dimension of the intermediate chamber 28.

The end of main chamber 30 remote from the intermediate chamber 28 connects with the small end or apex 31 of the eyecup 11. Preferably the end of the chamber portion 21 of tube-like block 12 adjacent the eyecup is formed with a detachable collar portion 32 having an axially-extending annular lip 33 that overlays and fits snugly upon an interior annular lip 34 formed on the body of the chamber portion 21. In the construction illustrated, the small end 31 of the eyecup fits around a neck 35 and against a shoulder 36 formed at the eyecup end of the collar 32. If desired, the eyecup 11 and the collar 32 may be formed as a single integral unit.

There is thus provided two chambers in series (i.e., intermediate chamber 28 and main chamber 30) through which the medicament in mist form, as discharged from the aerosol discharge stem 14 into the lower portion 26 of aperture 15, and from there into the small lateral opening 27, must pass on its way to the eyecup 11 and the eye 17.

In addition, the intermediate chamber 28 is provided with two side vents 37 and 38 communicating directly with the atmosphere. In the construction illustrated, these are two apertures extending from the aerosol-facing exterior surface 22 through the outer end 16 of the block 12 down to the nearest side wall of the intermediate chamber 28. These apertures or side vents 37 and 38 are positioned on opposite sides of a vertical plane passing through the axis of the cylindrical portion 31 of the tube-like block 12, and are considerably larger in diameter than the diameter of the lateral opening 27 through which the aerosol mist is introduced into the chambers 28 and 30. In the construction illustrated, this ratio is about 3 to 1.

The result is that as the medicament in mist form passes, as a burst of mist at relatively high velocity and a relatively low temperature, from the aerosol discharge stem into the intermediate chamber 28, a substantial quantity of air is sucked through the side vents 37 and 38 into the intermediate chamber 28 and mixes with the mist in chambers 28 and 30, reducing its velocity and raising its temperature. Consequently, when the mist reaches the eye 17, it is not at a velocity or a temperature which will injure the eye.

To achieve this transition from a burst of high-velocity, low-temperature medicated mist from the aerosol cartridge that would be injurious to the eye if applied directly to the eye, to a much slower velocity mist having a higher temperature that does not injure the eye, this invention provides a device that is easy to use and simple in construction, and so can be made readily and inexpensively, such as by molding or casting a suitable plastic resin or other synthetic material.

It is evident that the operation of this device is the same whether the device is used with the aerosol cartridge 13 positioned above the device, as shown in FIGURES 1 and 2, or is used in a position 180 degrees therefrom, in which the aerosol cartridge 13 would be positioned below the device.

What is claimed is:

A device for administering to the eye a burst of medicament-containing mist discharge from an aerosol container having an aerosol discharge stem, said device comprising:

(a) an eyecup; and
(b) a tube-like block connected to the eyecup and adapted to be interposed between the aerosol discharge stem and the eyecup; said block comprising:

(i) a substantially solid end portion having a shouldered aperture therein for receiving the discharge stem of the aerosol container, the axis of the aerosol stem-receiving aperture being substantially perpendicular to and intersecting the axis of the tube-like block with the end of such stem adapted to abut against the shoulder of such aperture, said shoulder being located in a position prior to the intersection of said axes, said aperture extending a short distance past said shoulder;

(ii) a substantially cylindrical, largely hollow portion forming a main chamber, with one end of said chamber communicating with the opening in the apex of the eyecup;

(iii) an intermediate portion integral with said solid end portion and forming an intermediate chamber communicating at one end with the end of the main chamber remote from the eyecup and communicating at its opposite end with the extension of the aerosol stem-receiving aperture, said intermediate chamber being substantially smaller than the main chamber, but in axial alignment therewith, the exterior aerosol-facing portion of the tubelike block in the region of the aerosol container being flat-faced, which face extends over part of the side wall of said intermediate chamber and with the thickness of the wall of said intermediate chamber being substantially less to said flat exterior surface of the block than the thickness of the wall of said intermediate chamber elsewhere around the periphery of the block; and

(iv) said intermediate portion having at least one aperture in the wall thereof extending from the side of the intermediate chamber to said flat exterior surface of the block to provide a side vent of minimum length and hence of maximum air capacity possible for its diameter, whereupon, when the aerosol container is compressed relative to the block and the burst of medicament-containing mist is discharged at a relatively high velocity and at a relatively low temperature through the aerosol discharge stem into the intermediate chamber of the tube-like block, a substantial quantity of air is drawn into the intermediate chamber through the side vent thereof and is mixed with the aerosol mist in the intermediate chamber and in the main chamber to increase the temperature of the mist and decrease its velocity so that, when the mixture reaches the eye through the eyecup, the resulting temperature and velocity of the mixture is not injurious to the eye.

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