Oct. 3, 1950 C. A. WATROUS 2,524,720

EYE-BATHING DEVICE

Filed July 24, 1946

Fig. 1.

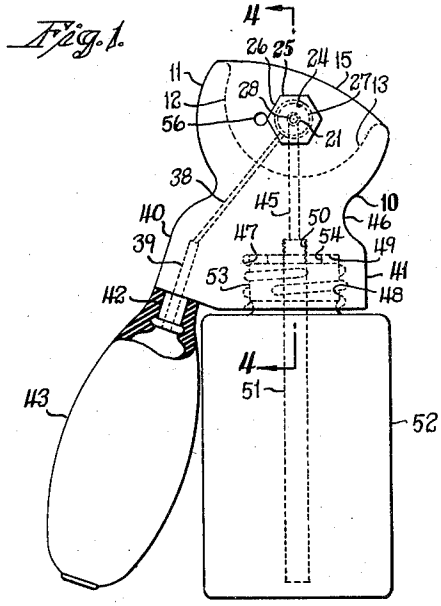


Fig. 2.

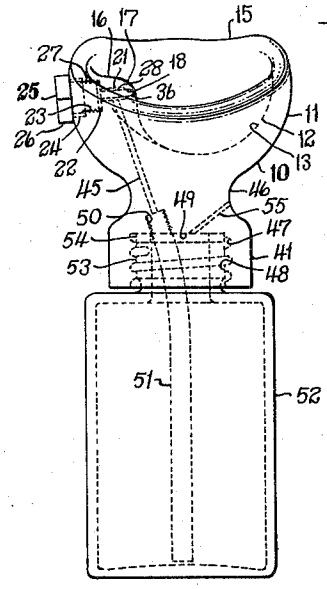


Fig. 3.

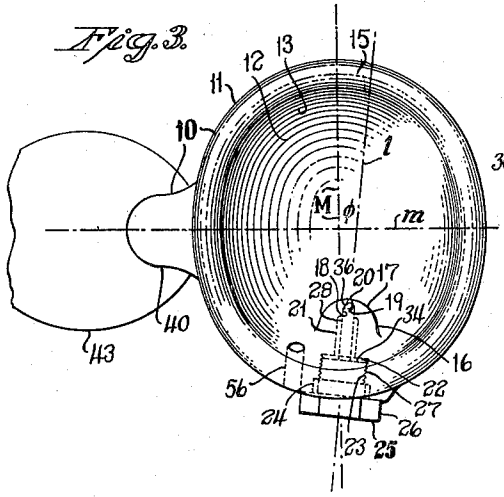


Fig. 4.

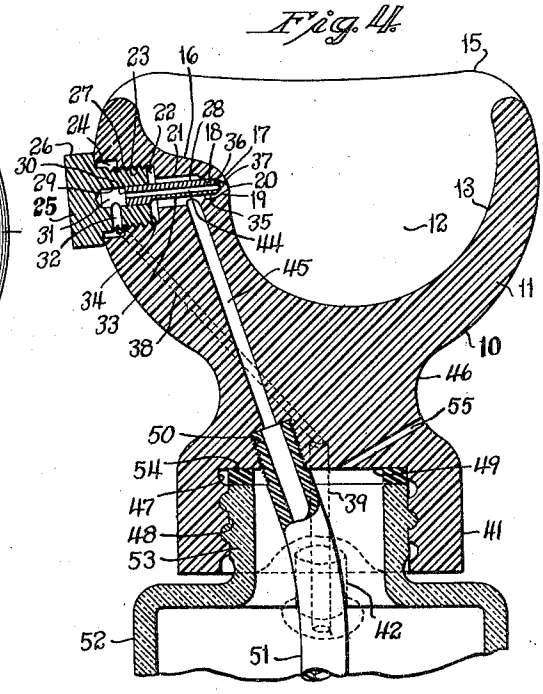
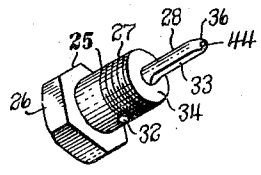


Fig. 5.



Inventor
Charles A. Watrous
By
Seymour, Esler & Nichols
Attorneys

Patented Oct. 3, 1950

2,524,720

UNITED STATES PATENT OFFICE

2,524,720

EYE-BATHING DEVICE

Charles A. Watrous, New Haven, Conn.

Application July 24, 1946, Serial No. 685,874

6 Claims. (Cl. 128—249)

1

The present invention relates in general to means for treating the eye and more particularly to an improved device for bathing the orbital-cavity or elements of the eye within the orbital-cavity.

Devices which have heretofore been used for applying a medicament to the eye or for washing the eye have, for the most part, consisted of douche cups adapted to be filled with a liquid which is applied directly to the eye by throwing back one's head; or devices having a syringe associated therewith for directing a jet of liquid against the ball of the eye.

An object of the present invention is to provide an improved device for applying an eye-treating medium to the eye.

A further object of the invention is to provide an eye-bathing device with improved means for applying an aerified fluid to the eye.

A still further object of the invention is to provide an improved eyecup adapted to be applied over the orbital cavity, and having atomizer means cooperatively associated therewith for bathing the eye with spray or foam.

A still further object of the invention is to provide a highly-efficient, simple and economical device of the class described embodying fluid-nebulizing means in conjunction with other elements, to permit treatment of the eyes and orbital cavity without causing strain on the muscles of the patient's neck and similar inconveniences which usually accompany the treatment of eyes with the ordinary type of eyecup.

With the above and other objects in view, as will appear to those skilled in the art from the present disclosure, this invention includes all features in the said disclosure which are novel over the prior art.

In the accompanying drawings, in which certain modes of carrying out the present invention are shown for illustrative purposes:

Fig. 1 is a side elevation of the improved eye-treating means of this invention;

Fig. 2 is a front elevation of the eye-treating means shown in Fig. 1;

Fig. 3 is a top plan view of the eye-treating means shown in Fig. 1;

Fig. 4 is a sectional elevation on line 4—4 of Fig. 1; and

Fig. 5 is a perspective view of the atomizer-valve of the eye-treating means.

In its broadest aspects, the invention comprehends eye-treating means characterized by an improved device for introducing a medicinal powder or aerified medicament such as, for example, a liquid mist or foam into the orbital cavity and is embodied in a structure which, for the purpose of illustration, comprises, a cup-element cooperatively associated with atomizing-means and hereinafter referred to as an "atomizer-eyecup."

2

Referring to the drawings, the cup-element, indicated generally at 10, may consist of glass, a molded plastic such, for example, as a phenolic material, a methyl-methacrylate resin, or other equivalent material, and comprises a substantially-semi-ellipsoidal cup 11 provided with a central-cavity 12 open at its upper end, the inside wall 13 of the cavity 12 being substantially-semi-ellipsoidal in shape, as seen in Fig. 3, and blending at its upper edge into the outer walls of the cup 11 by a radius to form a smooth rounded rim 15 adapted, when applied to the eye, to fit comfortably around the orbital cavity. The walls of the cup 11 are of substantially uniform thickness throughout except at one end of the major axis M of the ellipsodial-shaped cup. Here the thickness of the wall is increased by an inwardly-projecting protuberance indicated generally at 16, the profile of which is substantially-knee-shaped, as shown in Figs. 2 and 4, and smoothly blended into the inner wall 13 of the cup. The cap or cap-portion 17 of the knee 16 is located in the lower half of the cavity 12, while a line l, perpendicular to the tangent of the cap 17, is disposed in angular relationship to the major axis M of the ellipsoid. Referring to Fig. 3, in the present embodiment, the angle ϕ between the major axis M of the ellipsoidal cup and the line l is substantially 6° and may be more or less than 6°, as long as the particular angle chosen maintains the salient features of the invention., Referring to Figs. 3 and 4, a longitudinal aperture 18 extends through the wall of the cup at the knee-portion 16 thereof, the longitudinal axis of the aperture 18 being substantially coincident with the line l and having a slight upward tilt, as shown in Fig. 4, for the purpose hereinafter described. The forward end of the aperture 18 is reduced in cross section by a conically-tapered bore 19 which intersects the cap 17 in a relatively-small orifice 20. The rear end of the longitudinal aperture 18 is enlarged in diameter to provide a chamber 21 hereinafter referred to as the "medicament-chamber" which has a counterbore 22 at its rear end provided with internal threads 23. The rear or outer extremity of the internally-threaded counterbore 22 is provided with a smooth-walled counterbore 24, hereinafter referred to as the "air-chamber." Adapted to be secured in the threaded counter-

bore 22 is an atomizer-valve indicated generally at 25 in Fig. 5, comprising a head-portion 26, the perimeter of which may be cylindrical or hexagonal as desired; and an externally-threaded shank-portion 27 which is adapted to be threadedly engaged with the threads 23 of the counterbore 22. Extending from the shank-portion 27 of the atomizer-valve and coextensive with the longitudinal axis thereof, is the nozzle 28 of the valve which, as shown in Fig. 4, comprises a tubular member substantially equal in diameter to the diameter of the aperture 18 and mounted at its rear end with a sliding friction fit in a longitudinal aperture 29 of the shank 27 of the valve for the purpose hereinafter described. The rear end 30 of the nozzle 28 is normally spaced forwardly of the closed end of the aperture 29 to form a chamber 31 into which air is adapted to be delivered from an aperture 32 which intersects the wall of the aperture 29 and extends radially and at substantially right angles thereto through the wall of the shank 27 of the valve, for the purpose hereinafter described. Although the valve-nozzle 28 is shown as a separate element, it will be understood that the latter may be formed as an integral part of the shank-portion 27 of the atomizer-valve. A longitudinal flat 33 is provided along the nozzle from a point thereon slightly forwardly of the face 34 of the shank 27 to the forward end of the nozzle, so that when the valve 25 is assembled in the apertured protuberance 16 of the cup, a relief-recess 35 will be provided between the substantially-cylindrical wall of the aperture 18 and the flat 33 of the valve-nozzle. The forward extremity of the valve-nozzle is provided with a substantially-conical point 36, the taper of which, as indicated in Fig. 4, corresponds substantially to the conical bore 19 of the aperture 18 in the protuberance 16 of the cup. Although one flat 33 provides a satisfactory relief-recess, it is to be understood that more than one flat or its equivalent may be used.

Thus, when the valve 25 is threadedly mounted in the counterbore 22 in the protuberance 16, its head 26 is adapted to seal the outer end of the air-chamber 24, at which time the conically-tapered end 36 of the nozzle is spaced an extremely-slight normally-predetermined distance from the adjacent conically-tapered bore 19 of the aperture 18 so as to form a relatively-narrow substantially-conical inwardly-diverging passage 37 therebetween. Since it may be desirable to vary the fineness of the atomized fluid issuing from the orifice 20, the nozzle 28 is mounted with a longitudinal sliding friction fit in the shank-portion of the atomizer-valve, as described above, as a consequence of which the conically-tapered end of the nozzle may be adjusted at varying distances from the conically-tapered bore 19 of the aperture 18. In the event the nozzle 28 is formed as an integral part of the valve, then it is within the purview of the invention to provide a resilient washer (not shown) between the head 26 of the valve and the adjacent wall of the cup, to permit adjustments to be made in the size of the passage 37, at the same time maintaining the outer end of the air-chamber 24 closed.

In its assembled position in the cup-wall, the outer end of the radial aperture 32 of the valve lies substantially opposite the air-chamber 24 into which air is adapted to be lead by means of a passage 38, the upper end of which intersects the wall of the air-chamber 24; and which extends downwardly through the wall of the eyecup to a point at the rear thereof substantially opposite the corresponding end of the minor axis *m* of the cup ellipse. At this point, the lower end of the passage 38 intersects a passage 39 which coincides with the longitudinal axis of a shoulder 40 (see Fig. 1) protruding rearwardly and downwardly from the base-portion 41 of the cup 11. Formed integrally with or otherwise secured to the lower end of the shoulder 40 is a nipple 42 to which an air-bulb 43 is adapted to be secured. It will be clear that by squeezing the bulb 43, air may be forced up through the passages 39 and 38 into the air-chamber 24 and from thence through the radial passage 32 of the valve into the axial passage 44 of the valve-nozzle 28, the outer end of which is disposed substantially opposite the orifice 20 in the cap 17 of the cup. Although an air-bulb 43 provides suitable means for forcing air through the aforesaid passages of the cup, it is to be understood that air may be supplied by any other equivalent air-compressing device, which may be attached, for example, by an air-hose to the nipple 42. Intersecting the wall of the fluid-chamber 21 in the protuberance 16 of the cup is a passage 45 which extends downwardly through the wall of the cup into the base-portion 41 thereof. The base-portion 41 of the cup 11 is an integral part thereof, being blended to the underside of the cup 11 by a neck-portion 46 of reduced diameter, to facilitate holding the cup. The periphery of the base 41 is substantially cylindrical and has in its bottom an upwardly-extending substantially-cylindrical aperture 47, the walls of which are provided with relatively-coarse threads 48. Intersecting the upper closed end 49 of the aperture 47 is an internally-threaded aperture 50, the longitudinal axis of which is in alignment with the longitudical axis of the passage 45, the lower end of the latter terminating in the upper end of the aperture 50. The diameter of the latter is greater than the diameter of the passage 45 and is adapted to receive the upper externally-threaded end of a tube 51 which is threadedly secured therein. The lower end of the tube 51 extends downwardly and terminates immediately adjacent the bottom of a suitable container 52 for holding the fluid or other medicament to be used in treating the eye. The container may comprise a glass bottle or equivalent means which is provided at its upper end with a neck 53 having external threads adapted to threadedly engage the internal threads 48 of the aperture 47 in the base 41 of the cup. A washer 54 is shown between the end wall 49 of the base 41 and the neck 53 of the bottle to provide a tight joint therebetween. As shown in Fig. 4, the bottle is adapted to be vented by means of a passage 55, the upper end of which is opened to the atmosphere adjacent the neck-portion 46 of the cup, the lower end of the passage 55 intersecting the end wall 49 of the base 41 opposite the upper open end of the bottle 52. The specific location of the passage 55 is not critical, however, and is preferably located where it will be least likely to be inadvertently closed when using the cup.

From the foregoing description, it will be clear that when the bulb 43 is squeezed, air will be forced up into the axial aperture 44 of the nozzle 28 and out the forward end thereof, as described above, thereby creating an aspirating effect within the chamber 21 sufficient to cause a fluid medicament within the bottle 52 to move upwardly through the tube 51 and passage 45 into the chamber 21 and from thence through the relief-recess 35 into the extremely-narrow substantially-conical passage 37 between the conical end 36

of the valve-nozzle and the conically-tapered bore 19 of the aperture 18. As a consequence, the liquid will issue from the orifice 20 in a substantially-atomized condition, that is to say, in the form of finely-divided particles. As pointed out above, the atomizer-valve 25 and orifice 20 from which the spray issues, are located substantially at one end of the major axis M of the cup-ellipse, as a consequence of which the spray issuing from the orifice 20 is directed across the cup so as not to impinge directly upon the eyeball and the other highly-sensitive membranes of the orbital cavity. It is to be understood, however, that the same advantages would result by locating the orifice 20 of the atomizer-valve at one end of the minor axis *m* of the cup-ellipse, or at any point intermediate the extremities of the ellipse axes so long as the spray or other atomized medium issuing from the orifice, is directed across the cup in a plane substantially parallel to the plane of the major and minor axes of the cup-ellipse. As a consequence, the minute particles of the spray travel transversely across the open end of the cup before impinging against the opposite wall thereof, and hence the heavier particles of spray will drop to the bottom of the eyecup before reaching the opposite wall or wall of impingement, thus separating out the heavy from the fine particles and providing a substantially-nebulized mist within the upper part of the cup. Moreover, the extremely-fine highly-aerified or nebulized particles which do impinge against the wall of the cup substantially opposite the orifice 20, do so at an angle to the wall of impingement because of the angular disposition of the valve-nozzle 28, as described above, and hence are induced both by the slope of the surface of the wall of impingement and the concomitant air issuing from the orifice 20 to rotate or swirl around the inside wall 13 of the cup. Although the angular disposition of the valve-nozzle with respect to the major axis M of the cup is a preferred construction for inducing the swirling action of the atomized medium, it is to be understood that substantially the same effect may be accomplished by arranging the valve-nozzle 28 substantially parallel to the major axis but offset laterally therefrom; and that any other arrangement of the valve-nozzle 28 may be used as long as the spray or medium issuing from the orifice 20 is induced, when striking the wall of impingement of the cup, to rotate or swirl around the inside wall thereof. The slight upward tilt of the valve-nozzle also serves to enhance the turbulent swirling motion of the nebulized mist.

Assuming the eyecup is held over the orbital cavity, as the operator continues to squeeze the bulb 43, the eyecup 11 becomes quickly filled with the fine swirling body of nebulized fluid or mist which provides an ideal bathing medium for treating the highly-sensitive membranes, eye-socket and eyeball of the eye. Since the upper rim 15 of the cup 11 is shaped to fit closely around the orbital cavity, it is desirable to provide venting-means in the cup 11 to preclude building up undesirable pressure within the cup during its use. To this end, the cup is provided with a vent 56 in the wall thereof which, in the construction shown, is adjacent the head 26 of the atomizer-valve 25, as shown in Figs. 1 and 3, the location of the vent 56 being such as to prevent accidental occlusion of the vent when using the cup. It is to be understood, however, that one or more vents may be used and that the location of the vent 56 may be other than that shown so long as it is not in the wall of impingement of

the cup, that is to say, directly opposite the orifice 20 from which the spray issues. Moreover, it should be pointed out that in providing the escape-port adjacent the atomizer-orifice 20, the release of pressure within the cup will, of necessity, augment the swirling motion of the nebulized fluid within the cup.

The atomizer eyecup thus provides improved means for bathing the eye with a medium which is not directed at the highly-sensitive organs of vision and which is preferably in an extremely-finely-divided highly-aerified state. This mist-like eye-treating medium wholly eliminates the discomfitures and shock which usually accompany the use of the ordinary liquid-douche eyecup. Furthermore, the eye-treating medium, be it a water mist or a suitable atomized medicament, has imparted thereto a turbulent swirling motion which is extremely beneficial and effective for bathing all areas of the eye and, although the device is especially adapted for bathing the orbital-cavity in a swirling fluid mist, it is within the purview of this invention to use other eye-treating mediums such, for example, as a sulfa-compound dusting powder for treating an infected orbital cavity and the like. Finally, the device is designed so that it may be conveniently operated by one hand, if necessary, and so as to be operable without bending back the head, thus facilitating the removal of foreign bodies from the eye and precluding the discomfitures and waste attending the use of conventional eyecups.

The invention may be carried out in other specific ways than those herein set forth without departing from the spirit and essential characteristics of the invention, and the present embodiments are, therefore, to be considered in all respects as illustrative and not restrictive, and all changes coming within the meaning and equivalency range of the appended claims are intended to be embraced therein.

I claim:

1. An eye-treating device comprising a cup-element for enclosing the orbital cavity; and atomizer-means cooperatively associated with said cup-element and characterized by a valve-nozzle adjustably mounted in one wall of said cup-element and arranged to spray an atomized fluid of variable fineness into said cup-element and to direct said atomized fluid across said cup-element against the opposite wall thereof and at an angle, tangential to said opposite wall thereof so as to provide a swirling body of mist in said cup-element for bathing said orbital cavity.

2. An eye-treating device comprising a cup-element for enclosing the orbital cavity, said cup-element having atomizer-means comprising an air-chamber and a medicament-chamber formed in a wall thereof and a valve-member interconnecting said air-chamber and said medicament-chamber; air-supplying means secured to said cup-element for supplying air to said air-chamber; a medicament-container attached to said cup-element for supplying a medicament to said medicament-chamber; and passages in the wall of said cup-element joining said air-chamber and said medicament-chamber to said air-supply means and said medicament-container respectively, said valve-member being arranged to mix the air and medicament of said interconnected chamber so as to deliver an aerified medicament into said cup-element for bathing said orbital cavity.

3. An eye-treating device comprising a cup-element for enclosing the orbital cavity, said

cup-element having atomizer-means comprising an air-chamber and a medicament-chamber formed in a wall thereof and a valve-member interconnecting said air-chamber and said medicament-chamber; air-supplying means secured to said cup-element for supplying air to said air-chamber; a medicament-container attached to said cup-element for supplying a medicament to said medicament-chamber; passages in the wall of said cup-element joining said air-chamber and said medicament-chamber to said air-supply means and said medicament-container respectively, said valve-member being arranged to mix the air and medicament of said interconnected chambers so as to deliver an aerified medicament into said cup-element for bathing said orbital cavity; and means to adjust said valve-member to vary the fineness of the aerified medicament being delivered into said cup-element.

4. An eye-treating device comprising a cup-element for enclosing the orbital cavity, said cup-element having atomizer-means comprising an air-chamber and a medicament-chamber formed in a wall thereof and a valve-member having a shank-portion threadedly engaged in the said air-chamber and a nozzle arranged to project into said medicament-chamber and to interconnect the latter with said air-chamber; an air-bulb secured to said cup-element for supplying air to said air-chamber; a medicament-container attached to said cup-element for supplying a medicament to said medicament-chamber; and passages in the wall of said cup-element joining said air-chamber and said medicament-chamber to said air-bulb and said medicament-container respectively, said valve-member being arranged to mix the air and medicament of said interconnected chambers so as to deliver an aerified medicament to said cup-element for bathing said orbital cavity.

5. An eye-treating device comprising a cup-element for enclosing the orbital cavity, said cup-element having atomizer-means comprising an air-chamber and a medicament-chamber formed in a wall thereof and a valve-member having a shank-portion threadedly engaged in the said air-chamber and a nozzle arranged to project into said medicament-chamber and to interconnect the latter with said air-chamber; an air-bulb secured to said cup-element for supplying air to said air-chamber; a medicament-container attached to said cup-element for supplying a medicament to said medicament-chamber; passages in the wall of said cup-element joining said air-chamber and said medicament-chamber to said air-bulb and said medicament-container respectively, said valve-member being arranged to mix the air and medicament of said interconnected chambers so as to deliver an aerified medicament to said cup-element for bathing said orbital cavity, the said nozzle of said valve-member having an adjustable connection with the said shank-portion thereof thereby to vary the fineness of the aerified medicament being delivered into said cup-element.

6. An eye-treating device comprising a cup-element for enclosing the orbital cavity, said cup-element having atomizer-means comprising an air-chamber and a medicament-chamber formed in a wall thereof and a valve-member having a shank-portion threadedly engaged in the said air-chamber and a nozzle arranged to project into said medicament-chamber and to interconnect the latter with said air-chamber; an air-bulb secured to said cup-element for supplying air to said air-chamber; a medicament-container attached to said cup-element for supplying a medicament to said medicament-chamber; passages in the wall of said cup-element joining said air-chamber and said medicament-chamber to said air-bulb and said medicament-container respectively, said valve-member being arranged to mix the air and medicament of said interconnected chambers so as to deliver an aerified medicament to said cup-element for bathing said orbital cavity, the said nozzle of said valve-member being disposed at an acute angle to the major axis of said cup-element so as to direct an aerified medicament across said cup-element against and at an obtuse angle to the wall of said cup-element opposite said nozzle so as to provide a swirling body of aerified medicament in said cup-element for bathing said orbital cavity, said nozzle having an adjustable connection with the said shank-portion of said valve-member thereby to vary the fineness of the aerified medicament.

CHARLES A. WATROUS.

REFERENCES CITED

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

UNITED STATES PATENTS

Number	Name	Date
1,121,667	Ross	Dec. 22, 1914
1,362,632	Dayton	Dec. 21, 1920

FOREIGN PATENTS

Number	Country	Date
10,377	Great Britain	1888
295,162	Germany	Nov. 11, 1916
190,022	Great Britain	Dec. 14, 1922
764,728	France	May 26, 1934
113.476	Australia	July 24, 1941