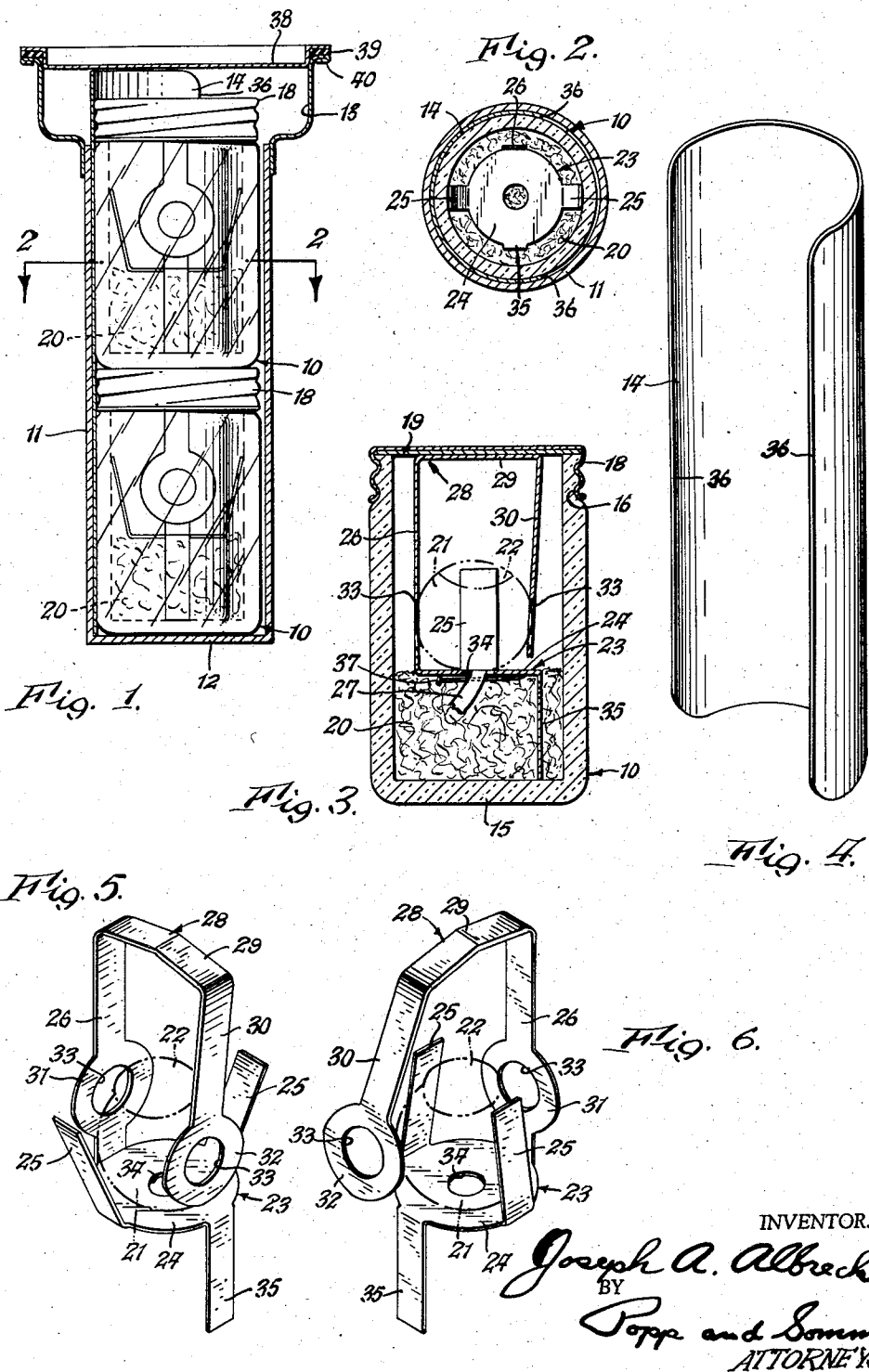


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J. A. ALBRECHT
EYE CARRIER

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INVENTOR.

Joseph A. Albrecht
BY
Popp and Sommer
ATTORNEYS.

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EYE CARRIER

Joseph A. Albrecht, Buffalo, N.Y., assignor to Buffalo Eye-Bank and Research Society Inc., Buffalo, N.Y., a corporation of New York

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6 Claims. (Cl. 206—1)

This invention relates to a carrier for human eyes and more particularly to such a carrier which can be used in air transport and other common carriers to convey rapidly an eye from an eye bank to the hospital where a corneal transplant is to be made.

This application is a continuation in part of my co-pending application for Refrigerated Carrier, Serial No. 429,331, filed May 12, 1954, now abandoned.

In recent years there have been developed procedures which permit the transplanting of the cornea of one eye into another eye. Thus, it is often possible for persons who are blind because of a defective, injured or diseased cornea to have a new cornea substituted and thus gain or regain their sight. It has been found that a sound, healthy cornea may still be satisfactorily used for transplanting even if the eye from which it comes is not removed until after the death of its owner.

Since the surgical techniques involved in the transplanting of a cornea are very delicate and precise, it is generally unfeasible to carry out transplanting operations except at places where special facilities and capable, experienced surgeons are available. Consequently, since the eyes from which the corneal transplants are to be obtained are usually procured after the death of those persons who have before death agreed to donate them, the eyes are likely to be available at places distantly removed from the hospital at which the operation will be performed.

Although, if a donated eye is kept under ideal conditions, successful transplanting of the cornea thereof may be achieved for a period of as long as about thirty hours after the death of the donor, it has been difficult heretofore to meet the requirements that the cornea be maintained undamaged and aseptic during transit; that the eye not become dried out or water-logged; and that it must be kept moist while excessive moisture is avoided and that the temperature of the cornea during the intervening period must be maintained at about 34° F. Prior to the present invention no satisfactory way of maintaining the required conditions for the prolonged time necessary in many cases was available. As a result, numerous donated eyes were damaged or spoiled in transit and in such cases the anticipated restoration of sight was delayed or made impossible.

It is therefore an object of the present invention to provide a carrier of the type described in which an eye may be maintained in a proper state of preservation for corneal transplants for a prolonged period of time.

Another object of the invention is to provide a carrier of the type described which is provided with means for preventing displacement and physical injury of the eyes carried therein.

A further object of the invention is to provide a carrier of the type described which is provided with individual containers for the eyes being carried.

Another object of the invention is to provide a carrier of the type described in which the eyes being carried

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are contained in a compartment separate from any refrigerant such as ice.

Another object is to provide such a carrier which can be rapidly loaded and rapidly emptied without danger of injury to the eyes, the time factor being most important.

Still another object of the invention is to provide a carrier of the type described which is convenient to use and which may be filled or emptied of refrigerant without disturbing the eye containers carried therein.

Another object is to provide a carrier for a multiplicity of eyes from which the individual eye carriers are removed as a group and the individual eye carriers then separated from each other.

Other objects and advantages of the present invention will be apparent from the following description taken in conjunction with the accompanying drawings in which:

Fig. 1 is a vertical sectional view through a carrier for two eyes embodying the principles of the present invention;

Fig. 2 is a transverse sectional view taken on the line 2—2 of Fig. 1;

Fig. 3 is an enlarged, vertical, sectional view through an eye-carrying jar showing in broken lines the position of an eye when properly positioned therein;

Fig. 4 is an enlarged, perspective view of the jar clip employed in the jar assembly shown in Fig. 3;

Fig. 5 is an enlarged, perspective view of the cage employed to support and properly position an eye in a carrying jar such as is shown in Fig. 3; and

Fig. 6 is a view similar to Fig. 5 and showing a modified form of the invention.

The human eyes are placed in separate cages, Fig. 5, the cages are then placed in eye-carrying jars, Fig. 3, the jars are then snapped into the clip, Fig. 4, which is then placed in the tube or carrier, Fig. 1. This carrier is a tube, flanged outwardly at the top and closed at the bottom. For convenience this carrier is herein referred to as a capsule. The clip, being longer than the tubular portion of the capsule, extends above the jars making it easy to remove the jars by grasping the extended portion of the clip with one's fingers.

Each of the glass jars is indicated at 10, a pair of such glass jars being shown as contained within a capsule indicated generally at 11. This capsule 11 is cylindrical and preferably of seamless metal construction and has a closed lower end as indicated at 12. Adjacent its open upper end the capsule 11 is enlarged to form an enlarged mouth or a well 13 which permits the metal jar clip 14 that holds the eye-carrying jars 10 longitudinally aligned to be easily grasped by the fingers. As shown in Fig. 1, although the capsule 11 has a greater overall length than the clip 14, the latter is somewhat longer than the main tubular portion of the capsule into which it and the jars 10 held therein slidably fit.

In Fig. 3 there is shown, on a somewhat enlarged scale, one of the eye-carrying jars 10 that constitutes a part of the present invention. The jar, which may be conveniently made of glass, is cylindrical and is provided with a closed bottom 15 and is provided adjacent the open top thereof with external threads 16 for securing thereon a cap 18, preferably formed of stainless steel. A circular gasket or sealing member 19 is provided in the screw cap 18 to insure against leakage from or into the jar. As previously pointed out, it is necessary to maintain the cornea of the eye being transported in moist condition although excessive moisture is highly deleterious and must be avoided. Therefore, there is provided in the lower portion of each jar 10 a mass 20 of cotton or other porous, absorbent material saturated with a sterile, saline solution which keeps the air in the jar moist enough to prevent drying of the cornea and, there being no ex-

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cess saline added, the cornea cannot become water-logged regardless of the position of the carrier. The eye itself, which is identified by the character 21 and the cornea of which is indicated at 22 is held in fixed position within the bottle by a cage indicated generally at 23. The end of the optic nerve of the eye is indicated at 27. The cornea is therefore in approximately the center of the jar where it cannot move, be injured by coming in contact with the sides of the jar, the cage or the absorbent material regardless of the position of the whole assembly.

As best shown in Figs. 5 and 6, the cage 23, which is conveniently and preferably formed by stamping from corrosion-resistant metal such as stainless steel sheet, comprises a horizontal supporting plate 24 of substantially circular shape. Projecting upwardly from the plate 24 in diametrically opposed positions are a pair of finger members 25 adapted to assist in positioning and holding the cage 23 centered in the jar 10 or to hold the eye 21 centered on the plate 24. Midway between the finger members 25 on one edge of the plate 24 there is attached one leg 26 of a yoke 28. The yoke also comprises an arched cross member 29 and a depending leg 30, free at its lower end, diametrically oppositely disposed to the leg 26 so that the legs 26, 30 form a pair of leg members. At their lower ends the legs 26 and 30 of the yoke 28 are formed with enlarged disks or circular portions 31 and 32, respectively, which are provided with diametrically aligned holes 33. A centrally located hole 34 is also provided through the supporting plate 24. At one side of the plate there is formed a depending spacing tab or foot 35 for the cage 23.

In the embodiment illustrated, two jars or bottles 10, each of which may contain an eye, are inserted in the slightly greater than semi-cylindrical spring clip 14 the longitudinal edges 36 of the spring clip embracing and yieldingly grasping the opposite salient parts of each jar 10 to provide an open-sided holder from which the jars can be conveniently released. The two jars 10 so held in the clip 14 are lowered into the capsule 11. A lid or cap 38 is then put in place with the gasket 39 thereof engaging an end flange 40 of the capsule. The capsule can be mounted in a larger carrier (not shown), and which may contain ice, in any suitable manner.

The manner in which an eye 21 is supported and held in each jar 10 during shipment is clearly evident from Figs. 3 and 5 of the drawings. Before use, the jar 10, its cap 18, the gasket 19 and the cage 23 are carefully sterilized. Then into the jar or bottle there is placed the mass 20 of sterile, absorbent material such as cotton and the mass is saturated with a sterile, saline solution.

The operator then takes the sterilized cage 23 and spreads its pair of finger members 25 and bends the depending leg member 30 toward the companion leg member 26. This depending leg member 30 is then sprung outwardly so that the eye 21 can be placed on the plate 24 of the sterilized cage 23 with the cornea 22 upward and the end 27 of the optic nerve protruding through the hole 34 of the plate. A sterilized common pin 37 is then passed through the optic nerve on the underside of the plate 24. The depending leg member 30 which has previously been sprung outwardly is then gently released so that the eye 21 is gently grasped between the enlarged portions 31, 32 of these legs and held centered by the holes 33 therein. The cage 23 is then placed, with the foot 35 leading, into a glass jar 10 so that the optic nerve 27 contacts the saline saturated absorbent material 20, thereby to prevent any drying out of the interior of the eye through osmosis. In sliding the cage 23 into the jar 10 the spread apart finger members 25 compressively engage the inside of the jar 10 and yieldingly hold the cage in centered relation to the jar. The cap 18 is then placed on the threads 16 and tightened. The cap is thereby brought into compressive relation with the arched cross member 29 so as to depress this arched cross member and yieldingly hold the

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cage 23 and eye 21 against axial displacement in the jar 10.

Two filled jars 10 can then be placed in the slightly greater than semi-cylindrical clip 14 and the clip 14 slid into the capsule 11. With the lower end of the clip 14 engaging the bottom wall 12 of the capsule 11, its upper end protrudes into the enlarged mouth 13 of the capsule so that the surgeon can readily seize the upper end of the clip 14 and slide it, and the two jars 10 contained therein, out from the open upper end of the capsule 11.

The lid 38 can then be placed on the capsule and the covered capsule placed in an ice filled container (not shown) for shipment. The ice reduces the temperature of the air in each jar so as to increase the relative humidity therein and thereby reduce any drying out tendency. If condensation takes place, the condensate is absorbed by the porous body 20.

Alternatively in placing the eye 21 in the cage 23 and the cage 23 in the capsule 11, the finger members 25 can be sprung toward each other or inwardly to yieldingly engage the sides of the eye 21 and the depending leg member 30 can be bent away from each other or outwardly so that the sides of the jar 10 are compressively engaged by the pair of leg members 26, 30.

From the foregoing description it is evident that the carrier of the present invention is of great value and utility and very convenient and efficient in use. It will be noted that the jars 10, being held by the clip 14, are removable together from the capsule. Thus either or both jars may be examined or removed for use without the necessity of removing the capsule from the ice filled carrier (not shown). Further note should be taken of the manner in which the cornea of an eye being transported is protected. The eye 21 is held on the plate 24 in the cage 23 by the pin 37 through the optic nerve 27 and also at opposite sides around its periphery, but the cornea 22 is not touched by any part of the cage. The supporting plate is held in fixed position within the jar 10 by engagement of the foot 35 with the bottom 15 of the jar 10 and engagement of the slightly arched yoke cross member 29 with the screw cap 18 when the jar is closed. By sealing the jars a moist atmosphere will be maintained therein particularly as there is a saline solution in the bottom and as the air therein is cooled by the surrounding ice. However, since the saline solution in the jars is held in the porous absorbent material 20, no flow of liquid will wash over the cornea 22 if the carrier is tipped or shaken. Moreover, the sealing of the jars prevents entry of liquids or air into them which would destroy the sterile conditions therein.

As mentioned above, the jars 10 are removably held in the clip 14. The latter is held in position within the capsule 11 when the cap 38 is in place so that the jars are prevented from shaking about in the capsule without the use of packings which might interfere with proper cooling of the jars and their contents.

It will be obvious that in constructing a carrier for eyes in accordance with the present invention numerous modifications of the construction shown and described may be made without departing from the spirit of the invention. Thus, for example, the overall shape of the various parts thereof may be varied. As a further example, the size of the capsule may be varied, if desired, so it will hold only one or more than two jars. It will be understood, therefore, that the present invention is not to be considered as limited by the disclosed details of construction but is to be interpreted as broadly as permitted by the appended claims.

I claim:

1. In combination with a tubular jar having a bottom enclosing member and an open upper end, and a sealing cap member removably closing said open end, a carrier for a human eye, comprising a cage made of a single piece of sheet metal and slidable into and out of said

jar for supporting said eye within and against movement relative to said jar, said cage including a horizontal plate arranged centrally in said jar to support the eye and having a central opening to receive the optic nerve, an integral vertical foot extending from one edge of said horizontal plate with its outer end engaging one of said members, a pair of integral spring fingers extending from diametrically opposite marginal edges of said horizontal plate toward the other of said members and spaced to yieldingly grasp the sides of the eye, an integral vertical leg extending from one edge of said horizontal plate toward said other of said members and bearing against the inside of said jar, an integral arched cross part connected to the outer end of said leg and yieldingly bearing against the inside of said other of said members, and a second integral vertical leg connected to the outer end of said cross part and bearing yieldably against the inside of said jar.

2. In combination with a tubular jar having a bottom enclosing member and an open upper end, and a sealing cap removably closing said upper end, a carrier for a human eye, comprising a cage made of a single piece of sheet metal and slidable into and out of said jar for supporting said eye within and against movement relative to said jar, said cage including a horizontal plate arranged centrally to support the eye and having a central opening to receive the optic nerve, an integral foot extending from one edge of said horizontal plate with its outer end engaging one of said members, a pair of integral spring finger members extending from diametrically opposite marginal edges of said horizontal plate toward the other of said members, an integral vertical leg member extending from one edge of said horizontal plate toward said other of said members, an integral arched cross part connected to the outer end of said leg member and extending toward said plate and yieldingly bearing against the inside of said other of said members and a second leg member integrally connected to the outer end of said cross part and forming with said first leg member a pair of leg members, the members of one pair of members being spaced to yieldingly grasp the sides of the eye and the members of the other pair of members being spaced to bear yieldingly against the inside of said jar and thereby yieldingly center said cage.

3. In combination with a tubular jar having a bottom enclosing member and an open upper end, and a sealing cap removably closing said upper end, a carrier for a human eye, comprising a cage made of a single piece of sheet metal and slidable into and out of said jar for supporting said eye within and against movement relative to said jar, said cage including a horizontal plate arranged centrally to support the eye and having a central opening to receive the optic nerve, an integral foot extending from one edge of said horizontal plate with its outer end engaging one of said members, a pair of integral spring fingers extending from diametrically opposite marginal edges of said horizontal plate toward the other of said members and bearing yieldingly against the inside of said jar to yieldingly center said cage, an integral vertical leg extending from one edge of said horizontal plate toward the other of said members, an integral arched cross part connected to the outer end of said leg and yieldingly bearing against the inside of the

other of said members, and a second leg connected to the outer end of said cross part and extending toward said plate, said legs being spaced to yieldingly grasp the sides of the eye.

4. The combination set forth in claim 3 wherein said legs are provided with enlargements having diametrically aligning apertures in line with the eye, the eye on said plate having opposite portions extending into said apertures.

5. In combination with a tubular jar having a bottom enclosing member and an open upper end, and a sealing cap removably closing said upper end, a carrier for a human eye, comprising a cage slidable into and out of said jar for supporting said eye within and against movement relative to said jar, said cage including a horizontal plate arranged centrally to support the eye and having a central opening to receive the optic nerve, a foot extending from said horizontal plate with its outer end engaging one of said members, a pair of spring finger members extending from diametrically opposite marginal edges of said horizontal plate toward the other of said members, a vertical leg member extending from one edge of said horizontal plate toward said other of said members, an arched cross part connected to the outer end of said leg and extending toward said plate and yieldingly bearing against the inside of said other of said members and a second leg member connected to the outer end of said cross part and forming with said first leg member a pair of leg members, the members of one pair of members being spaced to yieldingly grasp the sides of the eye and the members of the other pair of members being spaced to bear yieldingly against the inside of said jar and thereby yieldingly center said cage.

6. In combination with a tubular jar having a bottom enclosing member and an open upper end, and a sealing cap removably closing said upper end, a carrier for a human eye comprising a cage slidable into and out of said jar for supporting said eye within and against movement relative to said jar, said cage including a horizontal plate arranged centrally to support the eye and having a central opening to receive the optic nerve, a foot extending from said horizontal plate with its outer end engaging one of said members, a pair of diametrically spaced spring finger members connected to said plate and extending toward the other of said members, a pair of diametrically spaced spring leg members connected to said plate and extending toward said other of said members, the members of one pair being spaced to yieldingly grasp the sides of the eye and the members of the other pair being spaced to bear yieldingly against the inside of the jar and thereby yieldingly center the cage.

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