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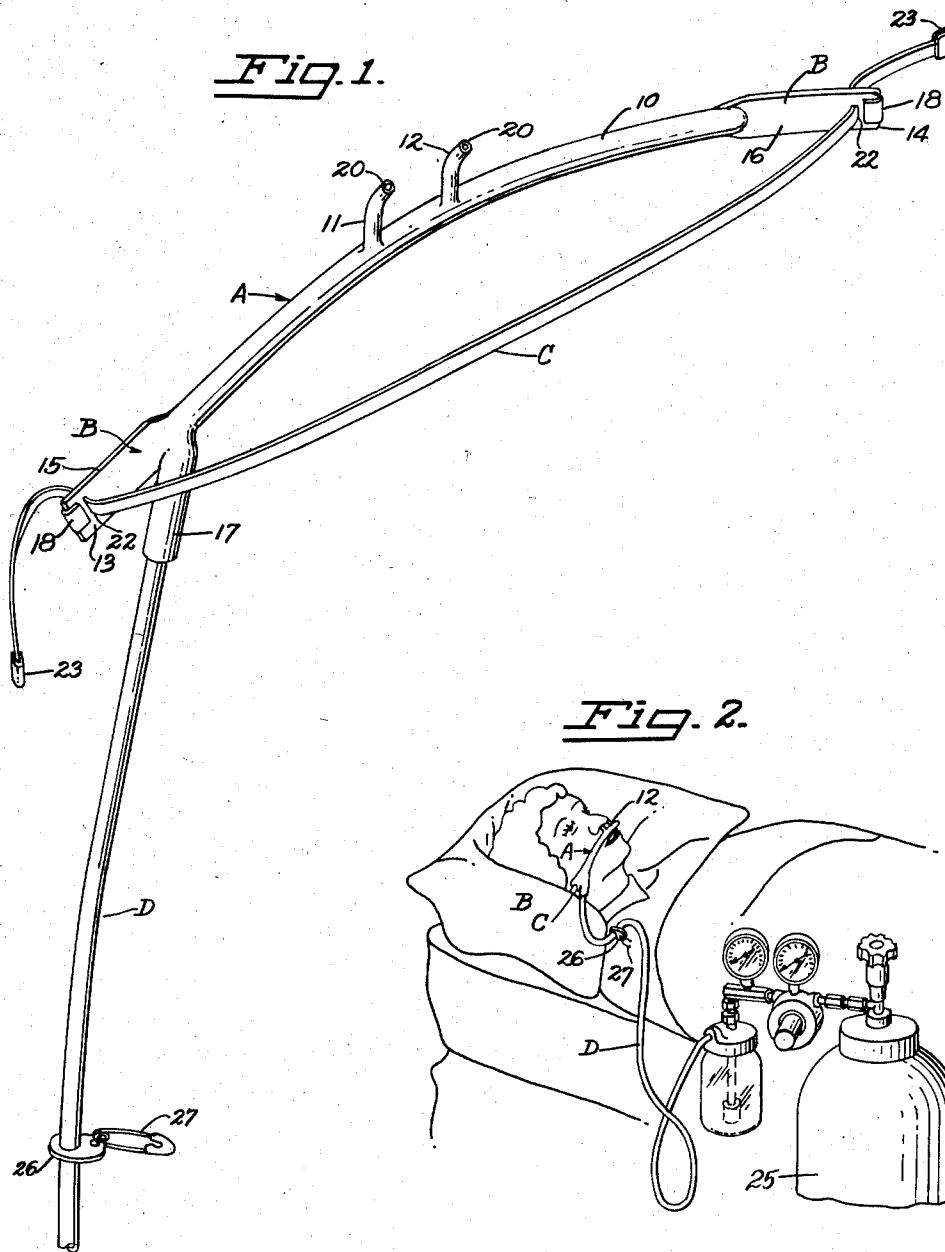
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2,868,199

CANNULA

Filed May 20, 1955

2 Sheets-Sheet 1



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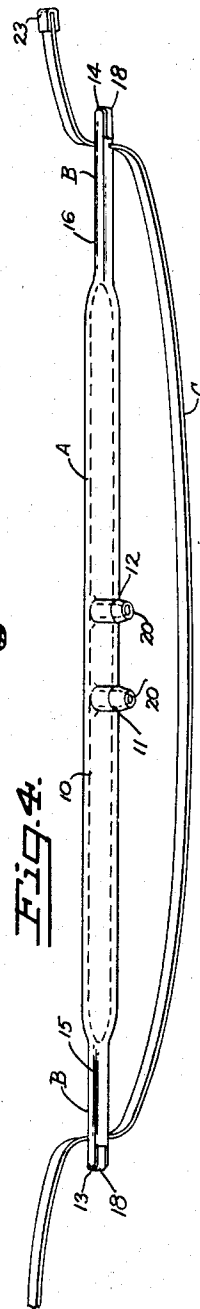
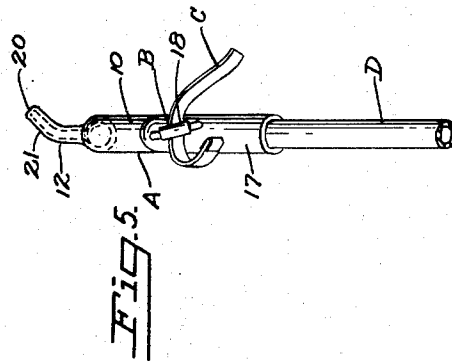
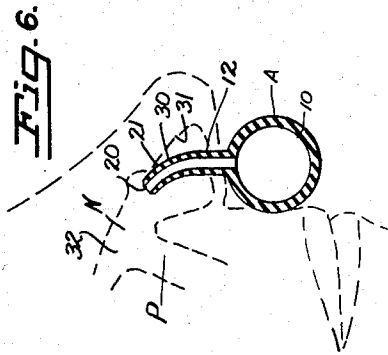
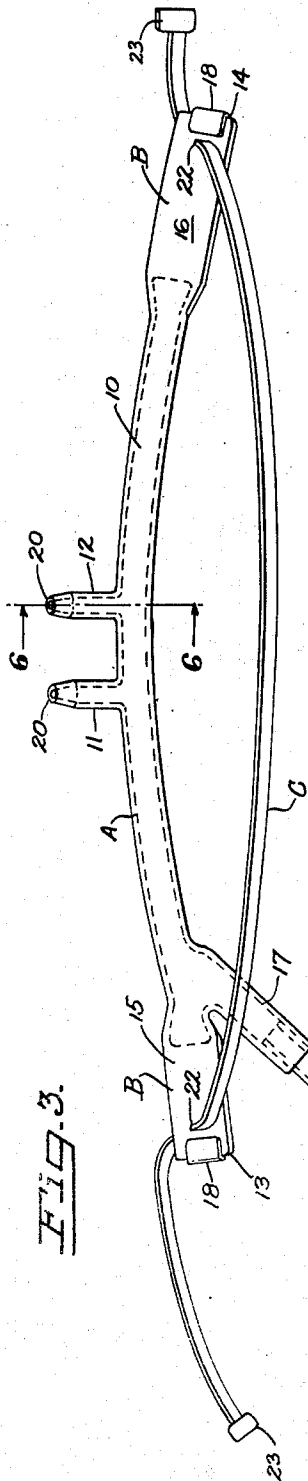
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2 Sheets-Sheet 2



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CANNULA

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3 Claims. (Cl. 128-206)

This invention relates to improvements in nasal cannulae, and more particularly to improvements in nasal cannulae that will permit a comfortable administration of oxygen along the natural airway of the nasal passage. This application is a continuation-in-part of application Serial Number 427,811, filed May 5, 1954, which matured as Patent No. 2,735,432 issued February 21, 1956.

Heretofore, conventional nasal cannulae have been constructed as relatively heavy fork-shaped devices of metal, such as brass or copper or of rigid plastic. The cannula generally has to be strapped in place, after insertion in the patient's nostrils, by a strap or elastic band passed about the back of the head above the ears. However, serious problems of discomfort to the patient and improper guiding of the oxygen into the nasal passages have resulted from the use of such devices.

One cause of these difficulties was the sharp edges of the outlet orifice in the extreme end of each cannula extension. Consequently, when the cannula was inserted upwardly into the nostrils, the sharp edges tended to irritate the soft mucous tissue forming the roof of the nasal cavity. In addition, the positioning of the orifices in prior-art cannular extensions and the rigidity of these extensions cause the oxygen to be directed well up into the posterior portions of each nostril so that it had to find its way back into the nasal passages leading into the pharynx. This improper guiding of the oxygen flow not only added to the patient's discomfort; it also resulted in some loss of oxygen.

Another problem was created by the clumsy apparatus which prior-art devices used in positioning the cannula on the patient's head. Generally such apparatus was nothing more than a strap placed about the patient's head above the ears, the upward pull of which was relied on to hold the cannula extensions up in the nostrils. However, this arrangement was not capable of firmly positioning the cannula in the nasal passages, and it permitted the cannula extensions to be easily dislodged or knocked out of alignment in the nostrils, contributing further to the irritation of the nostrils and the patient's discomfort. Equally annoying to the patient was the restriction of head movement caused by the strap's extending across the cheeks to a position behind the ears.

Another problem with prior-art cannulae was that the nasal tips tended to roll out from the nose in some instances, thereby defeating the purpose completely. The present invention is directed to a solution to these and many other problems, as will appear, and one object of the present invention is to provide a flexible nasal cannula and head strap arrangement that will permit a firm positioning of the cannula and a positive guiding of the oxygen supply along the natural contours of the nasal passage directly into the pharynx.

Another object of the present invention is to provide an improved construction for each cannula extension which will simultaneously direct the flow of oxygen toward the nasal outlet in the nostril while providing a

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smooth contacting surface adjacent the soft mucous tissues of the nasal passage.

Another object of the present invention is to provide a nasal cannula extension with a soft smooth upper contacting surface and an oxygen supply orifice opening without sharp edges so that the cannula may be inserted into the nasal passages without irritation, yet will insure proper guiding of the oxygen supply to the pharynx.

Another object is to provide a flexible nasal cannula construction that may be firmly positioned on the upper lip to insure proper guiding of the oxygen supply into the nostrils and which permits a convenient, non-confining supporting strap to be looped about the patient's head below the ears.

Another object is to provide a nasal cannula and head-strap arrangement which may be firmly and comfortably positioned on the patient's head and which will not be easily dislodged by normal head or body movements of the patient.

Another object is to provide a nasal cannula which is held on the face in such a manner that the nasal tips are prevented from rolling out from the nostrils.

Another object is to provide a simple, integral nasal cannula that is comfortable, convenient, and foolproof.

Other objects and advantages of the present invention will appear from the following description presented in accordance with 35 U. S. C. 112, and from the drawings in which:

Fig. 1 is a view in perspective of a nasal cannula and head-strap construction embodying the principles of the present invention;

Fig. 2 is a view in perspective showing the manner in which the device of Fig. 1 might be used when administering oxygen to a patient;

Fig. 3 is a view in front elevation of the cannula of Fig. 1;

Fig. 4 is a top plan view thereof;

Fig. 5 is an end elevational view thereof;

Fig. 6 is an enlarged view in section taken along the line 6-6 in Fig. 3 with the cannula in place on a patient.

Broadly, the present invention is drawn to an improved, flexible nasal cannula and head-strap construction including a nasal cannula A having a pair of flattened ends B adapted for retaining a strap C, and connected to an oxygen supply tube D. The cannula A is provided with soft cannula extensions or tips for insertion in the nasal passages, with orifices providing a proper guiding of the oxygen supply along the natural airways of the nasal passages. These features, coupled with a carefully aligned yet flexible construction of the head-strap elements B and C, permit a firm, comfortable positioning of the cannula and a positive guiding of the oxygen supply that is not possible with prior art devices.

Referring to the drawings in detail, the cannula A includes a soft flexible synthetic tube 10 having a pair of smaller diameter curved cannula extensions 11 and 12, preferably joining the tube 10 substantially perpendicular to the axis of the tube. The tube 10 has its ends 13 and 14 closed by flattened portions 15 and 16 constituting the strap-retaining portions B and an inlet tube 17 joining the tube 10 at an angle near one end portion 13 and suitably secured to an oxygen supply tube D. In its preferred construction, the cannula A is molded of polyvinyl chloride, though for some uses it could be made from polyethylene or a soft latex or synthetic material so that it is soft and deformable, while still being capable of retaining its shape under conditions of normal use. In such event the plastic tube 10, flattened ends 13 and 14, inlet tube 17, and nasal extensions 11 and 12 comprise an integral homogeneous article. An orifice 20 is provided at or adjacent the outer end of each cannula extension 11, 12.

Any suitable method may be used to fabricate the cannula A. One method would be to use a forming rod positioned centrally of a suitably-shaped mold with a pair of removable pins inserted in one of its ends to form the cannula extensions 11, 12. Upon removal of the cannula from the mold, the removable pins can be pulled out of the orifice 20. The forming rods could then be removed from one end of the lead tube 10, and then both ends can be flattened and welded, fused, or cemented together. A metal clip 18 may be secured at each end to reinforce the plastic and to prevent tampering.

A feature of the invention is the use of flexible curved cannula tips or extensions 11 and 12. The gentle curve of their shank portion 21 conforms to the natural contour of the nasal passages, thereby achieving the proper direction of oxygen into the natural airway. The curve begins at about midway between its ends and continues over an angle of about 10° to 20°. This construction also tends to hold the extensions 11 and 12 away from the natural surface of the nasal cavity N, while the soft flexible material permits ready, comfortable insertion.

Another important feature of the invention is the fact that the flattened ends 15 and 16 are tilted out relative to the nasal tips 11, 12. In other words the plane of flattened ends 15 and 16 lies at a small angle to the plane of the intersection of the nasal extension tubes 11, 12 with the main tube 10. The importance of this is that, when the cannular is installed on the patient, the ends 15 and 16 exert an inward rotational force on the tube 10 that aids in keeping the nasal tips 11 and 12 from rolling out of the nostrils, often as happened with prior-art cannulae.

The flexible retaining strap C is suitably secured in the flattened end portions 15 and 16. Preferably the strap C is woven of stretchable elastic cord, so that when its ends are threaded through tiny punched holes 22 in the flattened ends 15, 16, a "grabbing" effect will be provided. In other words, the material of the retaining strap should be more susceptible to stretch than the material of the ends 15, 16, so that the strap C will tend to extend rather than to pull through the holes 22. This feature permits the length of the retaining strap C, included between the holes 22, to be easily adjusted by firmly pulling either end of the strap so that some of it passes through one of the holes, but prevents accidental slipping of the retaining strap that would alter a desired length adjustment. The ends of the strap C may be additionally provided with knots or metal clips 23 to prevent them from being accidentally pulled through the holes 22 during adjustment.

It is clear that the cannula A may be connected to a suitable source of oxygen 25 by the supply tube D, as generally indicated in Fig. 2. Preferably the supply tube D is fabricated of a sturdy, tough, plastic material—such as vinyl resin, polyethylene, or any other suitable polymer or condensation resin and is thicker and more rigid than the cannula. In the illustrated embodiment, the supply tube D has a slightly larger outside diameter than the inside diameter of the cannula lead tube 10, so that a convenient leak-tight connection may be easily accomplished between the two. An apertured disc 26 and pin 27 may also be secured to the supply tube D for a purpose to appear.

The operation and use of the device will now be described. When it is desired to administer oxygen to a patient, the tube 10 is positioned just below the nose (see Fig. 2), and the soft and flexible nasal tips 11 and 12 are then inserted into the nose. For small children, the length of the tips 11 and 12 may be shortened by clipping them off with sharp scissors. The tube 10 will then have its inner side flush with the upper lip of the patient. The retaining strap C is now slipped over the head and ears and is positioned below the ears about the back of the neck. The ends 23 of the strap are

then pulled gently through the holes 22 in the mounting strap until the proper adjustment is obtained—a snug and comfortable fit. The cannula is now firmly and comfortably positioned for the administration of oxygen.

It will be noted that during insertion of the cannula extensions 11, 12 into the nasal cavity N (Fig. 3), a soft, curved contacting surface 30 is presented to the sensitive layer of mucous tissue 31 lining the upper wall of the cavity. In addition, once the cannula is in position, there are no sharp-edged openings in the end of the cannula extensions 11, 12 to irritate the nasal passage due to the continued movements of breathing. Also, the soft, flexible material of the cannula permits it to easily conform to the contours of the nasal cavity and the outer skin surface below the nose.

Of equal importance is the fact that the oxygen supply is guided throughout administration along the normal airways of the nasal cavity directly into the pharynx P. This result is achieved by the ideal length of the tips 11 and 12 and by the unique positioning of the orifices 20 with respect to the flattened portions 15, 16 and cannula extensions 11, 12 so that the orifices 20 open directly above the passage P. As a result, there is no tendency for oxygen to pass up into the upper reaches of the nasal cavity N where it would cause pressure, escape into other cranial cavities, or otherwise irritate the patient.

Also, when the flattened portions 15, 16 are fastened against the side of the face by the elastic D, they rotate the tube 10 a small amount so as to urge the nasal tips 11, 12 into the nose and at a slight angle away from the upper wall of the nose, at one and the same time increasing the patient's comfort and assuring the continuous administration of oxygen. This safety feature can hardly be overemphasized.

An additional advantage of the present invention is the snug, comfortable attachment of the cannula device to the patient's head, which results primarily from the extreme light weight and flexibility made possible by the materials used in constructing the device. Thus the cannula A and straps B and C easily conform to many different sizes and shapes of heads and nasal cavities, while the soft rubber or plastic materials used permit an over-all weight of less than one-half ounce. Coupled with the self-retaining features of the head strap, fitting snugly below the ears, the weight and bulkiness of the device is kept at a minimum. As a result, a patient using the cannula and head-strap arrangement of the present invention is allowed an unusual freedom of head and body movements, such as cannot be matched in the prior art.

To add to the freedom of body movement just described, a disc 26 and safety pin 27 may be secured to the supply tube D to permit the tube to be attached to the patient's bed clothing, as best illustrated in Fig. 2. This relieves the weight of the tubing, precludes pulling on the face, keeps the extra tubing away from the patient, and allows the patient the freedom of motion necessary to roll on either side, or even to sit up, without disturbing the comfortable guided passage of oxygen into his nasal passages.

To those skilled in the art to which this invention relates, many changes in construction and widely differing embodiments and applications of the invention will suggest themselves without departing from the spirit and scope of the invention. The disclosures and the description herein are purely illustrative and are not intended to be in any sense limiting.

I claim:

1. An improved nasal cannula adapted to both protect the soft nasal tissue and to positively direct fluid flow within the nasal passages comprising: a soft, flexible plastic tube having its ends closed and flattened, with an inlet tube extending out at an angle adjacent one end; said plastic tube having an integral pair of tubular, flexible, but shape-retaining extensions protruding there-

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from with each tubular extension having an orifice adjacent its outer end, said plastic tube and tubular extensions forming a flexible nasal cannula providing a smooth contacting surface adjacent the soft tissues of the nasal passage during insertion of each tubular extension into a patient's nostril, said flattened ends being tilted with respect to the plane where said tubular extensions intersect said plastic tube.

2. The cannula of claim 1 in which an elastic retaining strap is secured to said flattened ends, so that the cannula can be secured to the patient's upper lip, with the retaining strap passing around the patient's head below his ears, said elastic strap tending to rotate said plastic tube for preventing said extensions from rolling out from said nostrils.

3. A nasal cannula adapted to positively direct gases along the normal airways of the nasal passages comprising: a nasal cannula tube with flattened closed ends adapted to overlie the upper lip of a patient including

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a main tube having an inlet adjacent one end and a pair of tubelike cannula extensions projecting up from said main tube and having gas-directing orifices adjacent the ends thereof; said cannula extensions being curved to conform to the natural contours of the nasal passages, strap means to secure said cannula main tube to the patient, and a gas supply tube leading into the inlet of said main tube, whereby said main tube may be secured adjacent a patient's upper lip so that gas may flow through said cannula extensions and be directed by said orifices directly into the patient's pharynx.

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