

Feb. 21, 1956

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2,735,432

CANNULA

Filed May 5, 1954

2 Sheets-Sheet 1

Fig. 1.

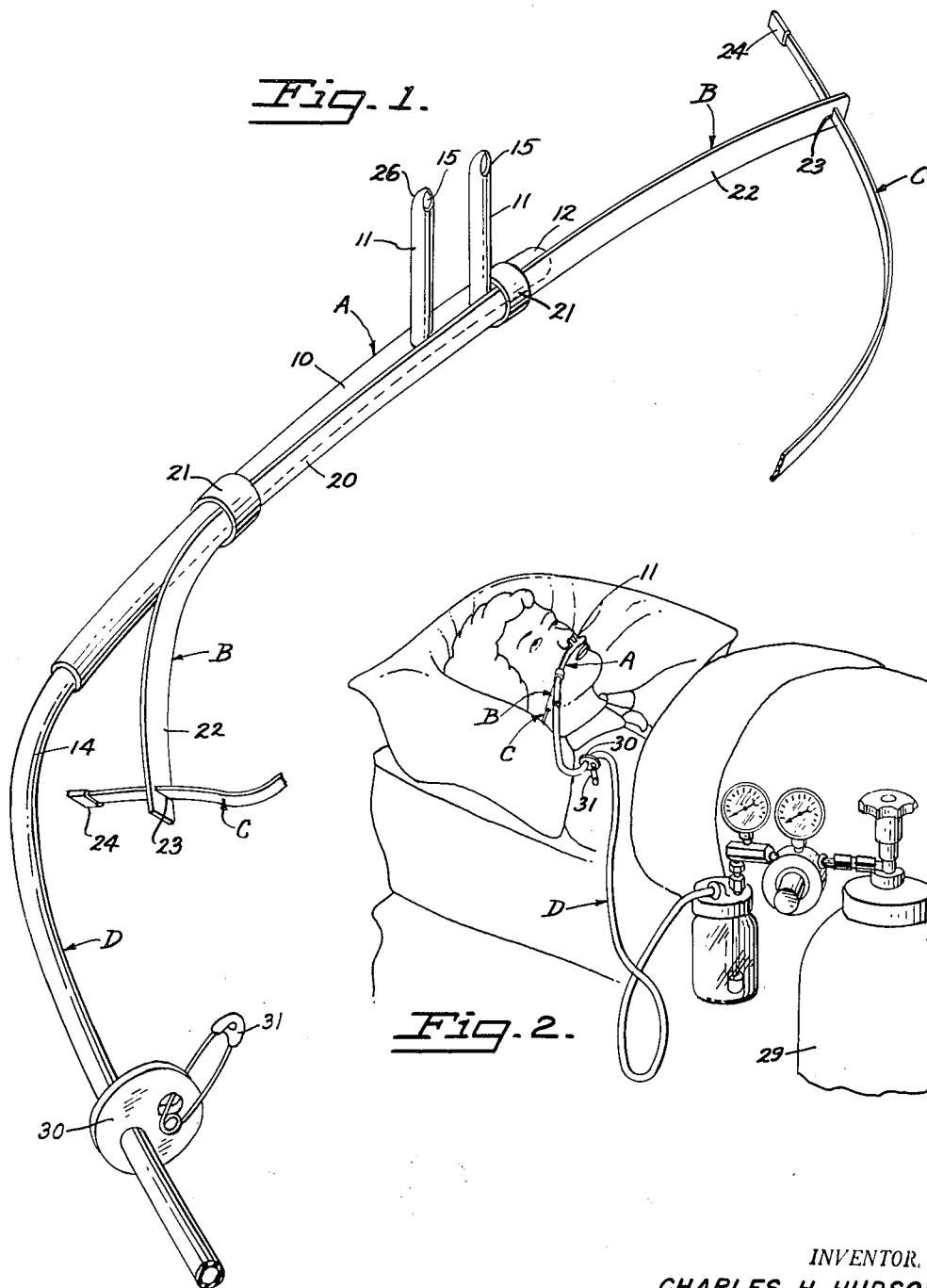
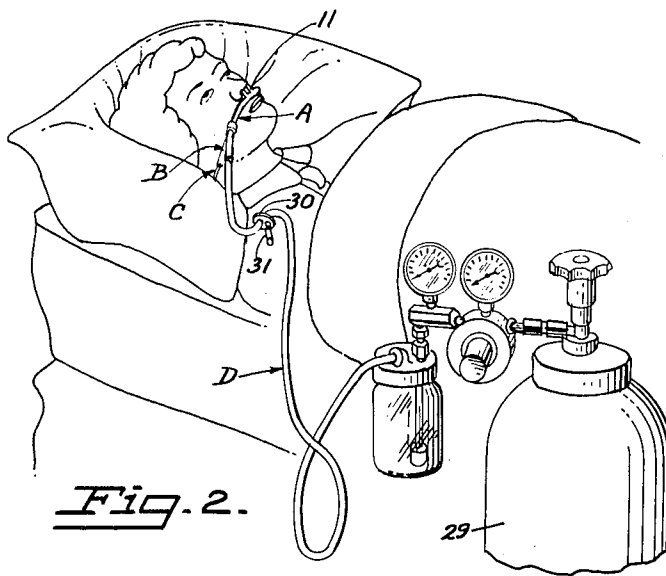


Fig. 2.



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Fig. 3.

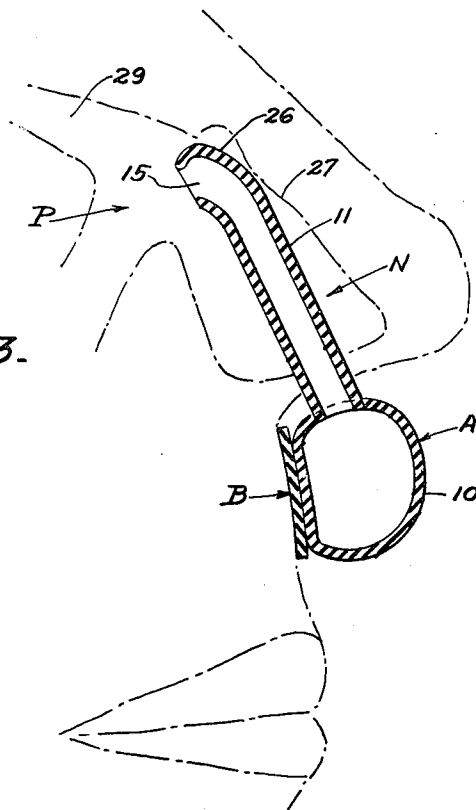


Fig. 4.

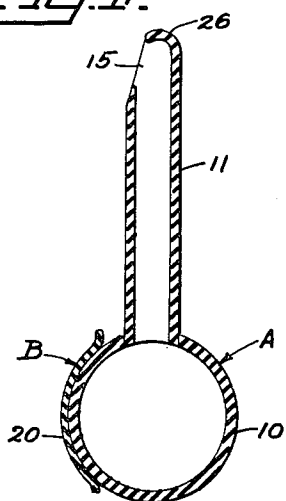
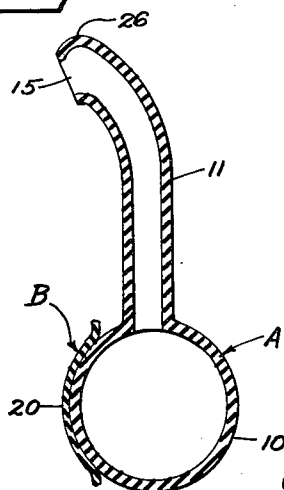


Fig. 5.



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3 Claims. (Cl. 128—348)

This invention relates to improvements in nasal cannula, and more particularly to improvements in nasal cannula that will permit a comfortable administration of oxygen along the natural airway of the nasal passage.

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 has generally been 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 has been the positioning of the outlet orifice in the extreme end of each cannula extension. Consequently, when the cannula is inserted upwardly into the nostrils, the sharp edges surrounding each orifice tend to irritate the soft tissue forming the roof of the nasal cavity. In addition, the positioning of the orifices axially of each cannula extension causes the oxygen to be directed well up into the posterior portions of each nostril so that it must find its way back to the nasal passages leading into the pharynx. This improper guiding of the oxygen flow only adds to the patient's discomfort and may even result in some loss of oxygen as well.

Another problem is created by the clumsy apparatus used in positioning the cannula on the patient's head. Generally such apparatus is nothing more than a strap proceeding about the patient's head above the ears which, by pulling upwardly, tends to hold the cannula extensions up in the nostrils. However, such an arrangement is not capable of firmly positioning the cannula in the nasal passages, and permits 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 is the restriction of head movement caused by the necessary path of the strap across the cheeks to a position behind the ears.

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

Another object of the present invention is to provide a cannula extension with a soft smooth upper contacting surface and an oxygen supply orifice opening on its lower surface 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-con-

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fining 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.

Other objects and advantages of the present invention will appear from the following description and from the drawings in which:

Fig. 1 is a view in perspective of a nasal cannula and head-strap construction according to 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 vertical section through a cannula extension of the device of Fig. 1, showing its operative shape and position relative to a diagrammatic representation of the nasal passages of a human patient;

Fig. 4 is a view in vertical section similar to Fig. 3, but showing the shape and position of the cannula extension prior to insertion in the nasal cavity; and

Fig. 5 is a like view illustrating a modified form of cannula extension having a curved end contour.

Broadly, the present invention is drawn to an improved, flexible nasal cannula and head-strap construction including a nasal cannula A, a mounting strap B, retaining strap C, and oxygen supply tube D. The cannula A is provided with soft cannula extensions for insertion in the nasal passages, with side orifices to permit 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 synthetic lead tube 10 having a pair of smaller diameter cannula extensions 11, preferably extending substantially perpendicular to the axis of the tube. The lead tube has one closed end 12 and an open end 13 suitably secured to an oxygen supply tube 14. In its preferred construction the cannula A is molded of 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. A side opening or orifice 15 is provided adjacent the end of each cannula extension 11, preferably at a slight angle to their axes, as shown in Figs. 3 and 4.

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. Upon removal from the mold, the side orifice 15 would be cut in each cannula extension 11 and the removable pins pulled out of the resulting opening. The forming rod could then be removed from the open end 13 of the lead tube 10.

After forming, the flexible mounting strap B is securely bonded to the lead tube 10 so that its exposed face 20 is facing in the same general direction as the orifices 15. Any suitable means of bonding the mounting strap B to the cannula A may be employed, such as vulcanization or an adhesive. In the illustrated form, the strap is first secured to the cannula by an adhesive and rubber rings 21 slipped over their respective ends to hold them together while the adhesive sets and also to provide an additional binding effect. Preferably the strap B is molded or is cut from strap stock material similar to that of the cannula A, but is compounded to be softer and more flexible for a reason to appear below.

Suitably secured in the ends 22 of the strap B is a flexible retaining strap C. Preferably the strap B is woven of stretchable elastic cord so that when its ends are threaded through tiny punched holes 23 in the ends 22 of the mounting strap B, a "grabbing" effect will be provided. In other words, the material of the retaining strap should have a greater degree of stretch than the mounting strap B, so that it will tend to extend rather than pull through holes 23. This feature permits the length of the retaining strap C included between the holes 23 to be easily adjusted by firmly pulling either end of the strap 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 24 to prevent them from being accidentally pulled through the holes 23 during adjustment.

It is clear that the cannula A may be connected to a suitable source of oxygen 29 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 or any other suitable polymer or condensation resin. 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 30 and pin 31 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 strap B is positioned just below the nose with its exposed face 20 toward the patient's mouth, so that the cannula orifices 15 face inwardly. The cannula extensions 11 are then inserted into the nose until the face 20 is flush with the upper lip of the patient. The retaining strap C is now positioned about the base of the neck, and, using two hands, the ends 24 of the strap are pulled through the holes 23 in the mounting strap until the proper adjustment is obtained. 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 into the nasal cavity N (Fig. 3), a soft, blunt contacting surface 26 is presented to the sensitive layer of tissue 27 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 extension 11 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 unique positioning of the orifices 15 with respect to the lead tube B and cannula extensions 11 so that it opens directly above the passage P. As a result, there is no tendency for oxygen to pass up into the upper reaches 29 of the nasal cavity N where it would cause pressure, escape into other cranial cavities, or otherwise irritate the patient.

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 and 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 30 and safety pin 31 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 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 further adapt the cannula A to a patient's nose cavity, the cannula extensions 11 may be molded in a curved contour, as shown in Fig. 5. Preferably, the curvature conforms to the natural contour of the nasal passages, thereby achieving a more comfortable direction of the oxygen into the natural airway. This construction also tends to hold the cannula extensions 11 away from the upper surface of the nasal cavity N, while the soft, flexible material permits ready, comfortable insertion of the cannula, as before.

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, substantially flat mounting strap, and a soft, flexible lead tube having an open end and a closed end bonded to said mounting strap; said lead tube having a pair of tubular extensions protruding from said tube with each tubular extension having an orifice spaced inwardly from a relatively smooth closed end; said lead 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, and providing, also, a positive fluid path directing fluids outwardly from said orifices at a desired position within the nasal passage after insertion.

2. The device of claim 1 in which said cannula extensions are curved to conform said extensions to a normal contour of the nasal passages.

3. An improved nasal cannula for the nasal administration of therapeutic gases comprising: a gas supply tube; a nasal cannula including a soft, flexible lead tube having an open end secured in leak-tight relation to said supply tube, a closed end, and a pair of cannula extensions protruding at right angles to the axis of said lead tube therebetween; each of said cannula extensions having an open end adjacent the lead tube, a closed end spaced from the lead tube providing a smooth, relatively soft contacting surface during nasal insertion, and a gas-directing side orifice providing directional flow to gases escaping from said orifice; a soft, flexible, substantially flat mounting strap bonded to said lead tube to provide an exposed surface facing in the same direction as said orifices and having apertured end portions; and an elastic retaining strap adjustably secured in the apertured end portions of said mounting strap to provide an easily adjustable, non-restricting head mounting means for said cannula.

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