United States Patent

Hudson et al.

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[54] NASAL CANNULA

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[51] **Int. Cl.** **A61m 15/08**

[58] **Field of Search** ..... 128/205, 140 N, 198, 199, 200, 128/205, 207, 142.3, 145.5, 348, 342, 350

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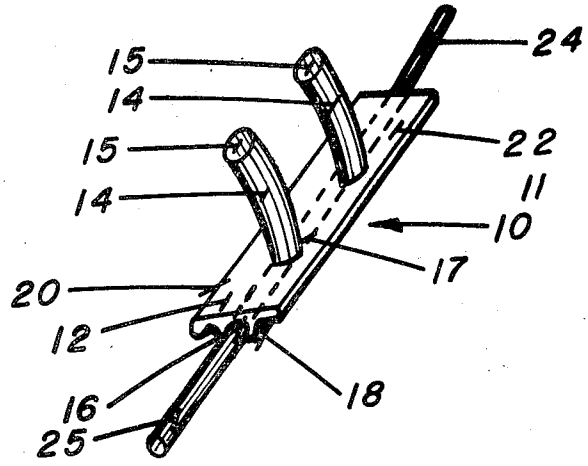
[57] **ABSTRACT**

A unified nasal cannula comprises a hollow tubular body having an upper flat or plane surface and a pair of spaced and curved elongated tubular extensions, having exterior orifices for directing a gas flow which extensions project upwardly at an angle from the surface.

13 Claims, 4 Drawing Figures



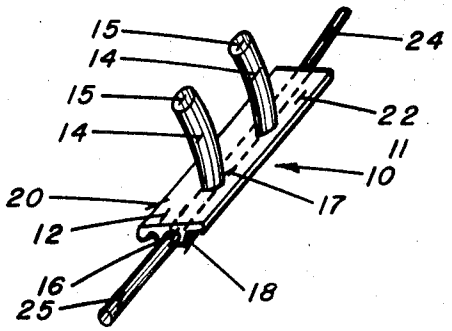


fig. 1

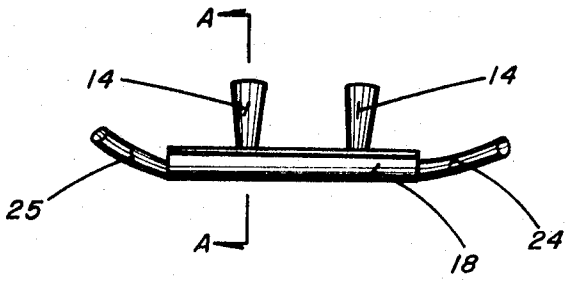


fig. 2

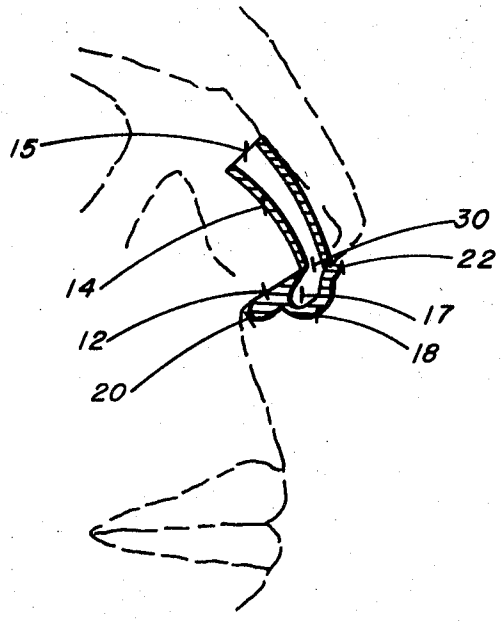


fig. 3

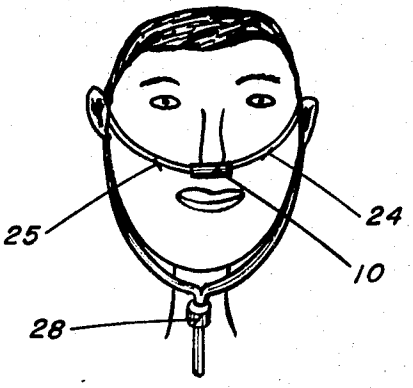


fig. 4

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NASAL CANNULA

BACKGROUND OF THE INVENTION

One of the most efficient methods of administering therapeutic oxygen to patients has been accomplished by the use of nasal cannulae. Early cannula models were somewhat cumbersome due not only to their relatively large sizes, but also in the manner by which they were affixed to the patient. For example, devices were attached to the user's forehead or utilized strap means which extended around the cheeks to the back of the patient's head. With the advent of plastic tubing, a number of improvements were realized, both as to the more efficient oxygen administration, as well as to the patient's comfort, for example, as disclosed in U.S. Pat. Nos. 2,735,432 and 2,868,199. These cannulae are designed so that gases flow directly into the patient's nasal passages and pharynx. This object was achieved by tilting a flattened portion of the cannula which lies against the patient's face or cheeks, with respect to the plane of the elongated nasal extensions and by curving these extensions in a manner so as to conform with the shape of the nasal passageways.

Notwithstanding such improvements, there remained some disadvantages notably in the area of patient discomfort. The above-noted cannulae, as well as others, in view of their design, generally have been placed on the user so as to be primarily positioned or seated in the nasolabial area, i.e., the area between the patient's upper lip and the nostrils. Even though such devices are made of soft, flexible plastic or rubber, in attempts to minimize skin irritation at the points of contact, some discomfort is known to persist. For example, when a patient is required to have prolonged oxygen administration thereby necessitating constant wearing of the cannula, both during awakening as well as sleeping hours, continued contact of the cannula, especially at the philtrum and around the unprotected upper lip and cheek areas causes inflammation and irritation. Not only does the wearer inadvertently move the cannula while sleeping as the head moves from side to side, but when eating and/or talking, further movement occurs. There is also associated discomfort and inconvenience, particularly in talking or eating where the device is firmly positioned against the upper lip area and across the cheeks. As in the case in any instances of prolonged contact of the patient's skin with an object, not only does irritation result, but inflammation and ulcerous conditions may occur after a period of time.

A further disadvantage associated with prior cannulae is in the method in which they are placed on the patient. Where a strap or elastic band is required to be secured around the back of the patient's head, the head must be lifted. In cases where the patient suffers from a serious back, head or neck injury, movement of the head is quite undesirable and could cause additional injury. It is to the reduction or elimination of the above-noted disadvantages that the preset invention is directed.

SUMMARY OF THE INVENTION

The nasal cannula described herein comprises a body portion having a hollow tunnel or tubular area extending therethrough and which body portion has an upper generally flat surface. A pair of spaced elongated tubular extensions extend from the flat surface. The extensions have an outer orifice for directing a gas flow to the nasal passageways of the patient and a lower interior orifice communicating with the tubular area of the body portion. The termination of the tubular area extending through the body provides an opening at each end, which openings may be connected to an oxygen supply tube. The tubular extensions are preferably curved so that they intersect the flat surface of the body portion at an angle. In use, the cannula when fitted to the patient is positioned so that the flat surface lies across the nostrils (anterior nares) and the approximate center thereof between the spaced tubular extensions rests upon the exterior nasal septum. In this manner, contact of the cannula with the upper lip area is essentially avoided with patient discomfort and skin irritation minimized. These, as well as other advantages will be described and become more evident from the following detailed description.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a perspective view of the nasal cannula of the invention;

FIG. 2 is a view in front elevation of the cannula of FIG. 1;

FIG. 3 is a sectional view through the cannula of FIG. 2 taken along line A—A showing its relative position when secured to the patient with its extensions inserted into the nasal cavity; and

FIG. 4 illustrates a preferred method by which the cannula is secured to the patient utilizing the oxygen supply tubes.

DETAILED DESCRIPTION OF THE INVENTION

Referring to FIGS. 1 and 2, the construction of the nasal cannula **10** includes a body portion **11**, having a hollow tunnel **17** through the entire length of the body portion **11**. Exterior openings **16** of the tunnel **17** are located at each end of the body portion **11**. The size or diameter of the tunnel **17** is not particularly critical so long as it is essentially uniform throughout and sufficient to allow for unrestricted passage of gas therethrough. However, the diameter of the tunnel opening **16** should be great enough to allow for insertion of oxygen supply tubes **24** and **25**. These supply tubes are preferably of catheter size, for example, having an external diameter of about 0.125 inches. The upper surface **12** of the body portion **11** is flattened so as to provide a smooth surface for contacting the patient's nostrils and exterior nasal septum, although it may be slightly outwardly curved. The surface **12** not only provides for patient comfort, but, in addition and of more importance, prevents the cannula from turning or rotating thereby maintaining its proper position during use. Thus, with the flat surface engaging the anterior nares, the cannula does not tend to roll which would otherwise cause the tubular extensions to be displaced from within the nostrils. The rear edge **20** of the upper surface **12** is preferably rounded to provide a smooth surface should it contact the nasolabial area between a patient's upper lip and nostrils. This feature is also shown in FIG. 3. The underside of lower surface **18** of the cannula body **11** as shown is shaped as the exterior diameter of the tunnel **17**, but may have alternate form. However, in the interest of being lightweight and flexible, by molding the cannula **10** to have a general shape as shown, material requirements are minimized and simplified molding techniques may be utilized.

Integral with the cannula body **11** and protruding or extending from the upper flat surface **12** are a pair of spaced tubular extensions **14**. These extensions **14** are desirably curved, as shown, so that when placed within the nasal cavities (Note FIG. 3) they conform to the shape of the passageway as well as providing a smooth surface which may contact the delicate nasal membranes. It will be noted in FIG. 3 that the lower internal orifice **30** of each of the tubular extensions **14** open to the hollow tunnel **17** of the cannula body **11**. Then, as oxygen is introduced into the cannula **10** through the oxygen supply tubes **24** and **25**, there is an unrestricted passageway for entry of the oxygen through the orifices **30** of each of the tubular extensions **14** which oxygen then passes upward through the tubular extensions **14** and out of the upper external orifices **15**. Thus, the oxygen is directly introduced into the patient's nasal cavity and pharynx.

As best seen in FIGS. 1 and 3, the tubular extensions **14** intersect with the upper flat surface **12** of the cannula body **11** at an angle which is preferably obtuse with the plane of the surface **12**. The tubular extensions **14** are also preferably located at or near the forward edge of **22** of the surface **12**, which location combined with the angle of intersection of the tubular extensions **14** with that surface provide maximum comfort to the patient and easy placement of the cannula extensions **14**

into the nasal passageways. Although the extensions **14** may be curved to any desired extent, it has also been found that for most patients having normal nasal passageway contours where the plane of the external gas directing orifices **15** is essentially normal to the plane of the flat surface **12**, proper gas flow direction and maximum patient comfort will be achieved. However, the greater or lesser curvatures of these tubular extensions **14** may be utilized depending on individual patient requirements. Yet, due to the flexibility of these extensions **14** small angle deviation is possible by inserting the cannula extensions into the patient's nostrils with concomitant movement of the extensions so as to conform to the patient's nasal cavity.

Another preferred feature is in utilizing flared extensions **14**. The flaring is preferably uniform between the lower internal orifice **30** and upper exterior orifice **15**, resulting in a reduced velocity gas flow from the external orifice **15** as compared to the velocity at which the gas enters the lower orifice **30**. Thus, although the same volume of gas will be delivered to the patient, the reduced gas velocity entering the nasal cavity avoids high-velocity impingement on the delicate nasal cavity membrane which could cause oxygen burn, irritation and discomfort. The amount of flaring between the external orifice **15** and the internal orifice **30** may be varied to any desired extent with diameter ratios between about 2:1 and about 4:1 respectively being preferred.

The size of the cannula is not particularly critical with the provision that the length and width of the upper flat surface **12** to be such that it will rest comfortably when placed on the patient. Thus, for example, a length of the surface **12** being between about 1½ and about 2 inches will ensure that it will span the width of the nostrils. Further, the width of the flat surface **12**, i.e., the distance between the edges **22** and **20** should be sufficient to provide a comfortable contact area with the nostrils and nasal septum, while at the same time, holding the cannula firmly in place when on the patient. However, it should also be understood that this distance should not be excessive which would otherwise cause edge **20** to engage the upper lip area excessively, resulting in discomfort or irritation. In addition, the tubular extensions **14** should be separated or spaced so that they are comfortable and can be easily inserted into the nasal passages. It will be appreciated that such dimensional requirements will vary between individual patients depending on age, size, facial features, etc. Thus, cannula model sizes may be varied accordingly.

FIG. **4** illustrates a preferred manner in which the cannula is worn by a patient. The cannula **10** rests across the patient's nostril area (anterior nares) and the flexible oxygen supply tubes **24** and **25** are brought across the patient's face, over and behind the ears, down the jaw areas and brought together under the chin. A hollow sliding member **28** of sufficient size to encompass both tubes **24** and **25**, may then be adjusted so that the cannula **10** will remain firmly in place without the tubes being unduly taunt. The cannula **10** may be easily removed by sliding the member **28** downwardly so that the supply tubes **24** and **25** become loosened. In this manner the cannula can be easily placed on a patient and removed without moving the patient's head. The oxygen supply tubes **24** and **25** may be fitted into a larger oxygen supply tube which in turn is connected to an oxygen source as will be understood by those skilled in the art.

The above-described invention provides an oxygen administration device which not only can be easily fitted to and removed from a patient, but which is of minimum discomfort and irritation to the patient. Thus, since the cannula essentially contacts only the exterior nostril area, its presence is realized to the minimum possible extent. Further, the patient may eat, talk, and move his head while the cannula remains firmly, yet comfortably, in place. The fat upper surface which rests comfortably against the patient's anterior nares prevents cannula rotation thereby maintaining its proper position with the gas directing tubular extensions located within the nostrils rather than slipping out even though the supply tubes are rolled or turned somewhat. The cannula also offers the advantage of being simple in design, and in expensive to fabricate. The composition of the cannula is preferably of the thermoplastic composition such as polyvinyl chloride or polyvinyl acetate which materials are understood to be quite pliable or flexible. Alternatively, the cannula may be fabricated from a rubber composition or other flexible synthetic materials. The cannula obviates the requirement of straps or bands thereby also simplifying manufacturing techniques and reducing costs. The unitary device may be produced by a simple molding operation with the oxygen supply tubes then attached prior to or at the time of use.

We claim:

1. A nasal cannula comprising:

an elongated body adapted to have minimal contact with a patient's upper lip, said body having a tunnel extending through the length thereof terminating in an oxygen supply opening at each end, the body having a length sufficient to span the width of an average patient's nostrils and an upper essentially flat surface portion being relatively thin in cross section for resting against a patient's anterior nares and a pair of spaced hollow tubular extensions integral with and projecting upwardly from said flat surface which extensions terminate at a gas directing orifice and which hollow portion of said extensions communicate with said tunnel.

2. The cannula of claim **1** wherein the tubular extensions are curved.

3. The cannula of claim **2** wherein the tubular extensions join said flat surface at an obtuse angle.

4. The cannula of claim **1** wherein the hollow portion of each of said extensions communicates with said tunnel at a first orifice and terminates at its opposite end in a gas directing orifice said gas directing orifice being larger than said first orifice.

5. The cannula of claim **4** wherein said hollow portion of said extensions is flared uniformly between said first and said gas directing orifice.

6. The cannula of claim **1** having a flexible oxygen supply tube extending from each tunnel opening.

7. The cannula of claim **1** composed of a flexible material.

8. The cannula of claim **8** wherein the flexible material comprises a thermoplastic resin.

9. The cannula of claim **8** wherein the resin composition is selected from the group consisting of polyvinyl chloride and polyvinyl acetate.

10. The cannula of claim **1** wherein the length of said body is between about 1½ and about 2 inches.

11. A nasal cannula for delivering oxygen containing gas comprising:

a. a generally flattened upper body portion having a flat upper surface for resting against a patient's anterior nares said upper surface having a length sufficient to span the width of an average patient's nostrils, said body portion being thin in cross section so as to have minimal contact with a patient's upper lip,

b. a hollow tunnel portion of substantially the same length as said upper body portion and attached to the underside of said upper body portion and terminating in an oxygen supply opening at each end, and

c. a pair of spaced hollow tubular extensions projecting upwardly from and integral with said flat surface, each end of said extensions communicating with said tunnel at a first orifice and terminating at its opposite end in a gas directing orifice.

12. The cannula of claim **11** wherein the length of said upper body portion is between about 1½ and about 2 inches.

13. The cannula of claim **11** having a flexible oxygen supply tube extending from said tunnel ends.

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