

[54] **ENDO-TRACHEAL TUBE ADAPTORS
FOR USE IN ADMINISTERING GASES**

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1965, abandoned.

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[51] Int. Cl. A61m 16/00, F16l 27/10

[58] Field of Search 128/351; 285/93, 225

[56] **References Cited**

UNITED STATES PATENTS

873,300 12/1907 Cranston 285/93 X

3,236,236 2/1966 Hudson 128/351 X
3,388,705 6/1968 Grosshandler 128/351
3,499,667 3/1970 Pfeuffer 285/93

FOREIGN PATENTS OR APPLICATIONS

421,505 5/1947 Italy 285/225

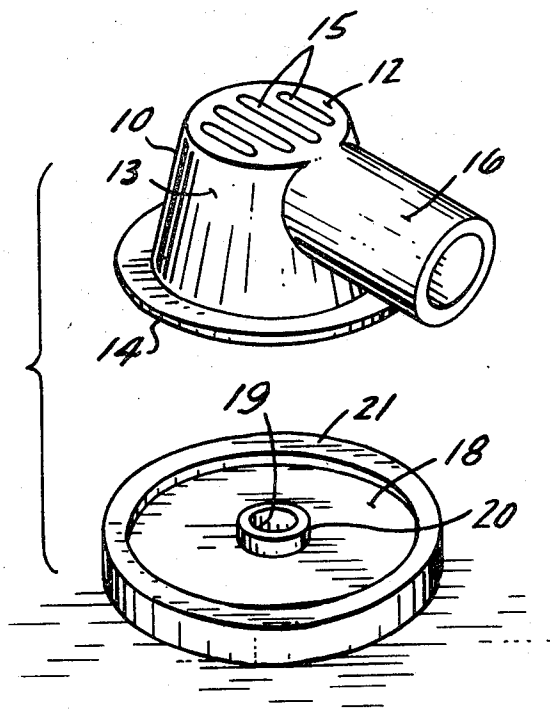
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[57] **ABSTRACT**

An endo-tracheal tube adaptor including an inexpensive, light weight, transparent open-bottom housing, there being a flexible elastic diaphragm removably stretched over said housing bottom having an expandable opening through which the ends of endo-tracheal tubes of various diameters can be projected to couple the same to a gas supply line connected to said adaptor, the transparency of said housing enabling an attendant to detect an accumulation of phlegm or other foreign matter therein, and the detachable nature of said diaphragm permitting said foreign matter to be readily removed from the housing.

10 Claims, 3 Drawing Figures



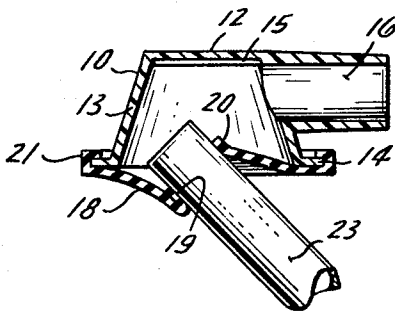
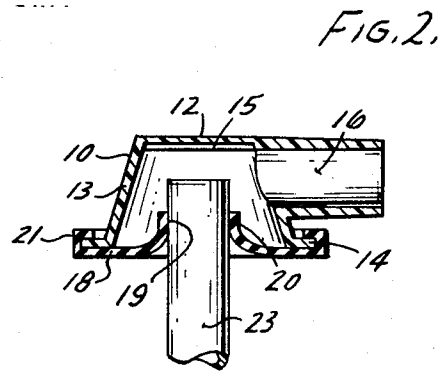
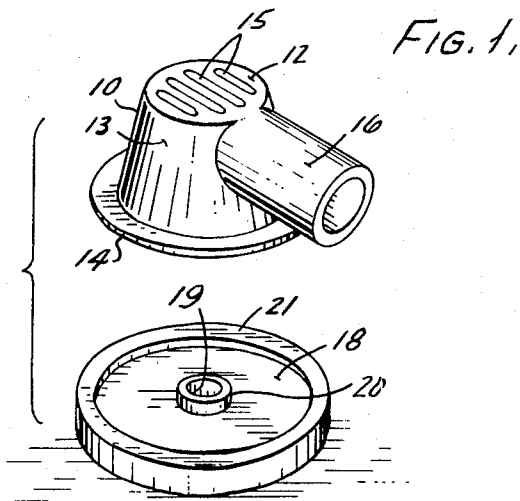


FIG. 3.

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ENDO-TRACHEAL TUBE ADAPTORS FOR USE IN ADMINISTERING GASES

CROSS REFERENCE TO RELATED APPLICATIONS

This application is a Continuation-in-Part of our application Ser. No. 499,272, filed Oct. 21, 1965, now abandoned.

BACKGROUND OF THE INVENTION

1. Field of the Invention

The present invention relates to the medical equipment field, and more particularly to a novel and improved endo-tracheal tube connecting device for use in the administering of anesthetic gases or oxygen to patients.

2. Description of the Prior Art

So-called endo-tracheal tube adaptors are intended to provide a safe, practical means for connecting the flexible hose, or so-called endo-tracheal tube, which is inserted down the patient's throat to an anesthetic gas or oxygen supply pipe. Conventional endo-tracheal tube adaptors are rigid, elbow-type devices formed of stainless steel, and in addition to being expensive, a large number of adaptors of various sizes must be kept available in order to accommodate endo-tracheal tubes of differing sizes, depending upon the size requirement of the particular patient. More importantly, the connection provided by said rigid adaptors is such that the flexible endo-tracheal tube is liable to be bent or kinked if the patient moves his head, thus cutting off the vital supply of gas. Moreover, such metal adaptors are non-transparent, of course, and with such devices it is impossible for the doctor to determine when an accumulation of phlegm or other foreign matter is present in the adaptor. Such accumulated foreign matter can quickly clog the adaptor or tube and result in an extremely dangerous or even fatal situation.

In order to provide a signal-sized adaptor designed to accommodate endo-tracheal tubes of various diameters, as well as to eliminate the danger of the tube being bent or kinked in the adaptor and thereby cutting off the gas supply to the patient, improved endo-tracheal tube adaptors have recently been developed wherein the adaptor includes a flexible, stretchable diaphragm through which the end of the rubber tube is inserted. By this means it is possible to accommodate tubes of various diameters, and, in addition, there is provided a flexible coupling which minimizes the possibility of the tube inadvertently kinking or bending to a degree preventing the passage of gas therethrough. Such improved adaptors are an important advancement in the art. Unfortunately, however, even with said newer adaptors it is impossible for the doctor or attendant to see when phlegm or other matter accumulates in the adaptor, nor is it possible to quickly open the adaptor and clean out such foreign matter before it can clog the line.

Examples of prior, conventional tube-connecting or adapting devices are disclosed in U.S. Pat. Nos. 2,693,182; 3,139,088; 2,669,988; 2,857,911; 2,493,577; 2,273,837; 2,912,982; 470,531; 2,587,784; 3,236,236; and 1,597,635. An improved endo-tracheal tube adaptor of the newer type utilizing a flexible diaphragm is disclosed in U.S. Pat. No. 3,388,705.

SUMMARY OF THE INVENTION

The present invention provides a new and improved tube coupling device or adaptor of the general type used to connect an anesthetic gas or oxygen supply line to a so-called endo-tracheal tube which is inserted through the mouth and down a patient's throat. More specifically, the invention comprises a transparent housing having an open bottom and having a hollow arm formed on and projecting laterally outwardly from the housing side to which the end of a gas supply conduit can be secured. A flexible elastic diaphragm is detachably stretched over the open bottom of said adaptor housing, and formed in the center of said diaphragm is an aperture through which the end of an endo-tracheal tube can be inserted to couple the same to said gas supply conduit, said diaphragm aperture being expandable to accommodate and sealingly engage

endo-tracheal tubes of various sizes. Unlike prior endo-tracheal tube adaptors, the transparency of the housing in the present invention permits a doctor or attendant to immediately detect a dangerous accumulation of phlegm or the like in the adaptor, and in such event the diaphragm can be quickly and easily detached and the phlegm or other foreign matter removed before it can impede the vital supply of gas.

A further object of the invention is to provide a novel endo-tracheal tube adaptor which can be quickly and easily opened to permit phlegm or other matter to be cleaned therefrom, as described, and wherein the adaptor housing is of a frusto-conical shape especially designed to speed and facilitate the removal of such foreign matter.

A further object of the invention is to provide an endo-tracheal tube adaptor characterized by an improved design which minimizes the possibility of the tube being bent or kinked while in use.

A further object of the present invention is to provide a new and improved endo-tracheal tube adaptor having special rib means formed integrally thereon to prevent the tube end from abutting against the housing top surface and closing off the gas supply.

A further object of the invention is to provide a new and improved endo-tracheal tube adaptor which is formed of relatively inexpensive plastic and rubber materials, thus permitting its manufacture for a fraction of the cost of conventional stainless steel tube adaptors, and which inexpensive adaptor can be economically discarded after one use, in contrast to the prior devices which are tediously cleaned and sanitized for reuse.

A further object is to provide an improved adaptor which is substantially lighter in weight than conventional endo-tracheal tube adaptors, thereby promoting the comfort and ease of use of said device.

A further important object of the present invention is to provide a novel disposable tube adaptor which will accommodate endo-tracheal tubes of various diameters, in contrast to conventional stainless steel adaptors which must be specially made for each different size tube.

A further object of the present invention is to provide an improved tube adaptor which permits the faster, more efficient coupling of the endo-tracheal tube to the gas supply line, which time-saving can be of critical importance in emergency operations.

Still further objects of the present invention are to provide a novel and improved endo-tracheal tube adaptor which is completely reliable and dependable in use, which is durable, and which novel adaptor is otherwise particularly well suited for its intended purposes.

With the above and other objects in view, which other objects and advantages of the present invention will become apparent hereinafter, the present invention comprises the improved endo-tracheal tube adaptor described in the following specification and also any and all modifications or variations thereof as may come within the spirit of said invention.

BRIEF DESCRIPTION OF THE DRAWING

In the accompanying drawing, illustrating one preferred embodiment of the invention, and wherein the same reference numerals designate the same parts in all of the views:

FIG. 1 is an exploded perspective view of the improved endo-tracheal tube adaptor;

FIG. 2 is a vertical sectional view through the adaptor, and showing the end of an endo-tracheal tube in its normal operative position therein; and

FIG. 3 is a similar vertical sectional view through the adaptor showing the endo-tracheal tube and diaphragm deflected from their normal position.

DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring now more particularly to the drawing, the novel endo-tracheal tube adaptor comprising the present invention

includes a frusto-conical housing member 10 which is formed of a rigid, transparent material, such as acrylic plastic or other comparable inexpensive plastic material. Said housing includes a flat top 12, a sloping annular wall 13, and an annular flange or rim 14 which projects radially outwardly a short distance from the base end of said housing, the bottom of said plastic housing member being open. Formed on the undersurface of the housing top 12 are a plurality of spaced, parallel protrusions or ribs 15, the function of which will be hereinafter seen, and formed integrally on and projecting outwardly from the annular housing wall 13 is a hollow cylindrical arm 16 communicating with the housing interior, said arm having an open outer end adapted to be connected to the conduit from a gas supply tank or cylinder. Unlike some prior adaptor units, the housing 10 in the present invention, including the laterally projecting arm 16, can be molded in a single piece, which substantially promotes economy in the manufacturing operation.

Removably mounted in covering relationship on the bottom of the housing 10 is a circular diaphragm 18 formed of an elastic and resilient material, such as thin surgical gum rubber or the like. Said diaphragm has a circular opening or aperture 19 centered therein, and surrounding said aperture and projecting upwardly a short distance above the surface of said diaphragm is an integral collar 20, said diaphragm being completely devoid of metal reinforcing rings or the like such as are required on some other diaphragm-type adaptors and which adds to the manufacturing cost. In the illustrated form of the invention said diaphragm is provided with a peripheral flange 21 which extends upwardly at a right angle and then radially inwardly parallel to the plane of said member, as shown.

In the assembly of the novel endo-tracheal tube adaptor comprising the present invention the resilient rubber diaphragm 18 is stretched over the open bottom of the plastic housing 10 with the peripheral flange 21 thereon positioned over the annular housing rim 14, the resiliency and elasticity of said rubber diaphragm causing said diaphragm flanged portion to fit snugly over said housing rim in leakproof engagement therewith.

In the use of the adaptor the gas supply conduit (not shown) leading from the supply cylinder or other source is mounted on the outer end of the housing arm 16, in a conventional manner, and the end of the rubber endo-tracheal tube 23 (FIG. 2) is manually urged through the somewhat smaller aperture 19 and integral collar 20 centered in the adaptor diaphragm 18, said resilient diaphragm stretching and said aperture expanding to permit said tube to be forcibly pushed therethrough, and said tube normally assuming a generally perpendicular position relative to the plane of said diaphragm, as shown in FIG. 2. Thus communication is provided between the gas supply line and said endo-tracheal tube 23 through the housing 10. When the tube 23 has been inserted into the patient's trachea the anesthesia or other gas may be administered.

Because of the elastic, resilient nature of the diaphragm 18 utilized in the present invention the peripheral flange 21 thereon is designed to sealingly engage the housing rim 14, as described, and the collar 20 through which the endo-tracheal tube 23 is inserted is adapted to sealingly engage around said tube, thus ensuring a leakproof assembly. The insertion of said tube through the diaphragm opening 19 can be accomplished more quickly than the coupling method employed in conventional elbow-type tube adaptors, which time-saving is important in many situations. In addition, and unlike conventional endo-tracheal tube adaptors of the elbow-type, with the present flexible coupling even if the patient moves or turns his head the diaphragm 18 will flex so that the tube will not be kinked or bent sufficiently to cut off or reduce the vital gas supply, as shown in FIG. 3.

Because the adaptor housing 10 characterizing the present invention is preferably formed of a clear acrylic plastic, or other clear material, the anesthetist can see how far the end

of the endo-tracheal tube is inserted within said housing, thus ensuring a suitable connection. Moreover, and of the utmost importance, due to the clear, transparent nature of said housing the anesthetist can continuously view the same and immediately detect a dangerous accumulation of phlegm or other foreign matter therein. In the event of such an accumulation the attendant can quickly and easily snap the stretchable diaphragm off of the housing bottom, remove said foreign matter, and replace the diaphragm, which can be accomplished in a matter of a few seconds and without endangering the patient. Thus the dangerous and sometimes fatal possibility of the tube becoming clogged or rendered inoperative by accumulated phlegm or the like is eliminated. In addition to the quick removability of the diaphragm 18, the novel frusto-conical shape of the housing 10 in the present invention also enhances the purging of phlegm or the like therefrom, the smooth, inclined wall of said housing causing continuous sliding movement of said accumulating foreign substances and preventing the same from adhering tightly thereto, thereby facilitating and speeding the cleaning out of said housing.

The spaced, parallel ribs 15 formed on the underside of the housing top 12 in the present invention are designed to prevent the endo-tracheal tube 23 from being pushed upwardly to a position flat against the top 12 of the housing, where the gas flow into said tube might be impaired. Further, and unlike some prior adaptors wherein the housing is curved and wherein if the tube is inserted too far it can bend or kink as it follows said curvature, in the present unit the housing top is flat and is arranged parallel to the normal plane of the bottom diaphragm 18, thus ensuring that the tube will merely abut against said flat, ribbed top surface and will not be curved or deflected even if it is inserted too far into the housing.

As hereinabove mentioned, due to the inexpensive construction of the present adaptor it can be economically discarded after one use, thereby providing a disposable endo-tracheal tube adaptor which eliminates the necessity for tediously cleaning and sanitizing the same for reuse, as is required with the relatively expensive conventional stainless steel adaptors. Moreover, in contrast to said prior, stainless steel adaptors, the stretchable nature of the diaphragm opening 19 permits the use of the present device with endo-tracheal tubes of various sizes. The result is that with the present invention it is not necessary to provide individual adaptors for each different tube diameter.

In the actual use of the present invention many anesthetists first check the patient to determine the correct size endo-tracheal tube required, and they then insert the tube end through the adaptor diaphragm while said diaphragm is still on the housing. The anesthetist then disconnects the diaphragm and tube from the housing, and inserts the tube into the patient with the diaphragm attached. It is then a simple and quick procedure, when the patient is ready to have the anesthetic administered, to re-attach the diaphragm to the housing and to secure the gas line thereto. The resulting time saving can be of critical importance in emergency operations.

From the foregoing detailed description it will be seen that the present invention provides a novel and improved endo-tracheal tube adaptor having a number of advantages over the devices heretofore used. Principally, of course, the transparent housing and quickly detachable diaphragm characterizing the present invention minimizes the possibility of phlegm or other foreign matter accumulating in the adaptor and blocking the flow of gas therethrough. Moreover, with the present unit there is no danger of the tube becoming bent or crimped and cutting off the supply of anesthesia gas to a patient during an operation. In addition, the present invention is adaptable for endo-tracheal tubes of various sizes, it permits the tube to be instantly coupled to the gas supply conduit, it is leakproof and dependable in operation, it is light in weight, and it is inexpensive enough to permit it to be thrown away after one use.

It is to be understood that the present invention is not to be limited or confined to a device identical in all respects to that

illustrated and hereinabove described. It is contemplated, for example, that numerous variations could be made in the design of the several components, and other suitable materials could be utilized in lieu of those described. In short, it is to be understood that the illustrated structure is intended merely as one preferred embodiment of the invention, and it is intended to cover herein not only the particular form of the invention described and illustrated but also any and all modifications or variations thereof as may come within the spirit of said invention.

We claim

1. An endo-tracheal tube adaptor comprising,
 - a housing formed of a sufficiently transparent material to provide for visual inspection of the interior thereof, said housing having a top wall, a side wall and an open bottom,
 - an annular flange projecting radially outwardly from said side wall at said bottom,
 - means on the housing for connecting the housing to a gas supply conduit,
 - and a diaphragm removably mounted on the bottom of said housing and being formed of a flexible elastic material, said diaphragm having an axially extending peripheral flange adapted to be stretched over and sealingly engaged on said housing annular flange,
 - a central opening in said diaphragm through which the end of an endo-tracheal tube can be inserted to couple said tube to the gas conduit, said diaphragm opening being adapted to be stretched to accommodate and sealingly engage tubes of various sizes.
2. The endo-tracheal tube adaptor according to claim 1 including an entegral collar said opening, said collar being adapted to sealingly engage an endo-tracheal tube.
3. The endo-tracheal tube adaptor according to claim 1 including a plurality of ribs formed on the inner surface of said

top wall to prevent closing of the endo-tracheal tube on engagement with said top wall.

4. The endo-tracheal tube adaptor according to claim 1 wherein said side wall is frusto-conical.

5. The endo-tracheal tube adaptor according to claim 1 wherein said housing is formed of a rigid plastic material.

6. An endo-tracheal tube adaptor comprising,

- a transparent housing having a top wall, a side wall and an open bottom,

means on said housing for connecting said housing to a gas supply conduit,

a flexible elastic diaphragm removably mounted on said bottom end of the side wall to form a chamber in said housing,

said diaphragm including means for sealingly engaging the outer periphery of the bottom end of said side wall, and an opening for receiving an endo-tracheal tube,

and a collar about said opening for sealingly engaging said tube.

7. The adaptor according to claim 6 wherein said housing has a frusto-conical configuration and a flange around the outer periphery of the bottom end of said side wall to provide a seal on engagement with said sealing means on said diaphragm.

8. The adaptor according to claim 6 wherein said housing is formed from a rigid plastic and said side wall has a frusto-conical configuration.

9. The adaptor according to claim 6 including a number of ribs on the inner surface of said housing to prevent closing of the endo-tracheal tube on engagement with the top wall.

10. The endo-tracheal tube adaptor according to claim 9 wherein said top wall and said diaphragm are parallel.

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