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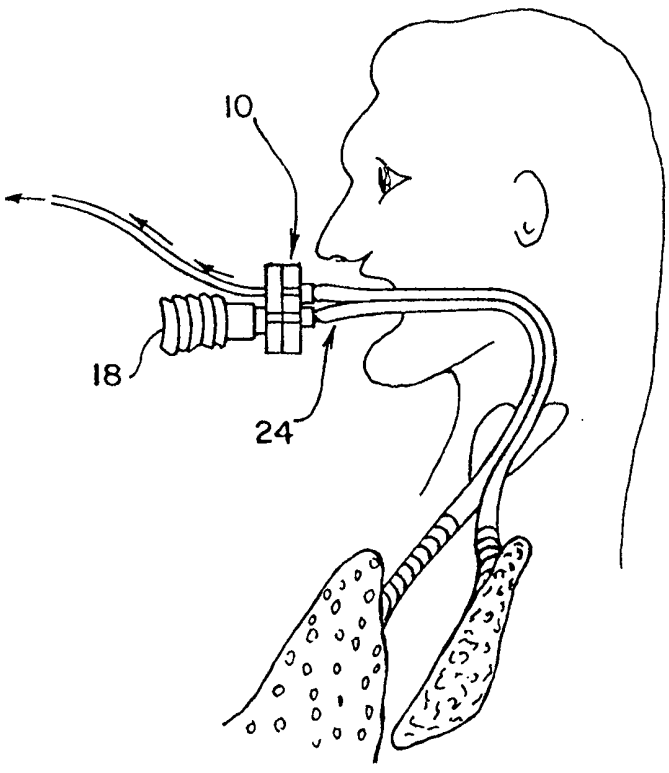
(54) Title: ADAPTOR FOR USE WITH A DOUBLE LUMEN ENDOBRONCHIAL TUBE

(57) Abstract

An adaptor (10) is disclosed for directing breathing gas from a source of such gases to the lumen of a double lumen endotracheal tube. The adaptator has three operative conditions. In one of these conditions, breathing gases flow to both tubes via a fitting (16) and one of a pair of fittings (22). In a second condition breathing gases flow to one lung via one of the fittings (22) and the other lung is connected to a deflation port (66) of the adaptor so that it can be collapsed. In a third condition breathing gases flow through the other fitting (22) and hence to the other lung, and the one lung is deflated through another deflation port. Markings (20, 26, 28) are provided on the external surface of the adaptor to enable the user to determine which of the three conditions it is in.



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ADAPTOR FOR USE WITH A DOUBLE LUMEN ENDOBRONCHIAL TUBE

FIELD OF THE INVENTION

THIS INVENTION relates to an adaptor for use with a double lumen endobronchial tube.

BACKGROUND TO THE INVENTION

Collapsing of a lung by an anaesthetist during an operation involving the thorax provides the surgeon with more space in the thorax to perform the surgical procedure. Collapsing of a lung is advantageous during certain forms of cardiac, pulmonary and pneumo surgery.

BRIEF DESCRIPTION OF THE INVENTION

According to the present invention there is provided an adaptor comprising first and second components which can be displaced relatively to one another between first, second and third relative positions, a fitting for connection to a source of breathing gases and a pair of fittings for connection to two lumens of an endobronchial tube, the interior of said fitting being in communication with the interiors of the pair of fittings when said components are in said first relative position and in communication with the interior of one or the other of said pair of fittings when in said second and third relative positions, there being a pair of ports through which

the lungs can deflate, one of said ports being in communication with the interior of one of said pair of fittings when the components are in said second relative position and a second of said ports being in communication with the interior of the other of said pair of fittings when the components are in the third relative position.

Preferably said components can be turned with respect to one about an axis to displace the components between said relative positions. Said first position is preferably a mean position, said components being turned in one direction with respect to one another from said mean position to said second position and in the other direction with respect to one another from said means position to said third position.

The adaptor can comprise detent means for locating the components in said first, second and third relative positions. Said detent means can comprise recesses in one of said components and a spring loaded detent carried by the other of said components. Said recesses can be conical in form and said detent can be a ball.

A means for limiting relative turning movement between the two components can be provided. Such limiting means can comprise a pin carried by one component and an elongate recess in the other component, a portion of the pin which projects from said one component being in the recess of the other component.

Said components can be disc like and displaceable with respect to one another in rotary fashion about a common axis.

In another form one component defines a socket and the other component is in the form of a disc which is within the socket and encircled by a peripheral wall of the socket. Said fittings in this form are all carried by said socket. Said disc has bores which extend across the disc and connect the interior of said fitting to the interiors of the pair of fittings.

In another embodiment said first component is in the form of a base plate which carries said fitting and said second component is in the form of a slide which can be displaced rectilinearly with respect to the base plate and which carries said pair of fittings, said ports being in said base plate, and there being a recess in said base plate into which the bore in said fitting and the bores in said pair of fittings open.

BRIEF DESCRIPTION OF THE DRAWINGS

For a better understanding of the present invention, and to show how the same may be carried into effect, reference will now be made, by way of example, to the accompanying drawings in which:-

Figure 1 is a top plan view of a double lumen endobronchial tube adaptor;

Figure 2 is a similar view showing the adaptor in a different position;

Figure 3 is a view similar to that of Figures 1 and 2 but showing the adaptor in a third position;

Figure 4 is a top plan view, to a larger scale, of one of the components of the adaptor of Figures 1 to 3;

Figure 5 is a similar top plan view of the other component of the adaptor;

Figure 6 is an elevation of that face of the component of Figure 4 which is visible during use;

Figure 7 is an elevation of that face of the component of Figure 4 which abuts the component of Figure 5;

Figure 8 is an elevation of the visible face of the component of Figure 5;

Figure 9 is an elevation of that face of the component of Figure 5 which abuts the component of Figure 4;

Figure 10 shows the adaptor in use to collapse a lung;

Figure 11 is a top plan view of one component of a further adaptor;

Figure 12 is a section on the line XII-XII of the adaptor component of Figure 11;

Figure 13 is a top plan view of another component of the adaptor of Figures 11 and 12;

Figure 14 is a side elevation of the component of Figure 13; and

Figures 15, 16 and 17 are respectively a side elevation, a top plan view and an end view of yet another form of adaptor.

DETAILED DESCRIPTION OF THE DRAWINGS

Referring firstly to Figures 1 to 3, the adaptor illustrated is generally designated 10 and comprises first and second components 12 and 14. The component 12 includes a male fitting 16 which fits into a ventilation tube 18 (see Figure 10). The male fitting 16 has an indicator line 20 on the cylindrical outer periphery thereof.

The component 14 has a pair of male fittings 22 for insertion into the lumen of a double lumen endotracheal tube 24 (see Figure 10). The component 14 has first and second indicator lines 26 and 28 on the cylindrical outer periphery thereof.

The components 12 and 14, as best seen in Figures 6 to 9, are circular in elevation and are rotatable relatively to one another about a common central axis. The components 12 and 14 can be rotated relatively to one another between the extreme positions shown in Figures 1 and 2. In one of these positions (Figure 1) the lines 20, 26 are in register and in the other extreme position the lines 20, 28 are in register (Figure 2). In the mean or intermediate position (Figure 3) the line 20 is midway between the lines 26 and 28.

Turning now to Figures 4, 6 and 7, the fitting 16 has a bore 30 therethrough, the bore 30 passing through the component 12 and emerging through that surface 32 of the component 12 which is shown in Figure 7. The fitting 16 is

tapered as shown at 34 to facilitate fitting of the tube 18.

On the central axis of the component 12 there is a stepped bore 36, the bore 36 receiving a pivot member 38 which has a head 40 and a shank 42. The shank 42 has, at the end thereof opposite to the head 40, a tapped blind bore 44. An O-ring 46, seated in a groove 48 which encircles the bore 36, prevents leakage along the bore 36. The member 38 is a press or force fit in the bore 36.

A stop pin 50 is a force fit in a blind bore 52 drilled in the surface 32. The pin 50 is tapered at both ends. A further blind bore 54 opens through the surface 32 adjacent the bore 52. This bore receives a spring 56 and a ball 58 which acts as a detent. A circular groove 60 extends around the face 32 and receives an O-ring 62 for sealing between the components 12 and 14.

On each side of the bore 30 where it opens through the surface 32 there is a recess 64 (see particularly Figure 7). The recesses 64 communicate with the bore 30.

Two deflation ports 66 (only illustrated in Figures 6 and 7) are provided in the component 12 on opposite sides of the central pivot member 38. The ports 66 pass through the component 12.

Turning now to Figures 5, 8 and 9, the fittings 22 have bores 68 and 70

therethrough and are both tapered at 72. The bores 68 and 70 open through a surface 74. A further bore 76 having two steps therein passes through the component 14. A second pivot member 78 having a head 80 with a transverse slot 82 in it, and also having a threaded shank 84, is inserted into the bore 76. The head 80 seats in the larger diameter part of the bore 76. The shank 84 passes through the smallest diameter part of the bore 76 and into the intermediate diameter part which is adjacent the face 74.

Three conical recesses 86 are drilled in the surface 74, these lying on a circle which has as its axis the axis of the bore 76. Radially outwardly of the recesses 86 there is an arcuate circumferentially extending groove 88 which is also centred on the bore 76.

When the two components are fitted together, the surfaces 32 and 74 are adjacent one another. The O-ring 62 is compressed between the surfaces 32 and 74 thereby to prevent leakage radially outwardly between the two components 12 and 14. The pin 50 enters the groove 88, the ball 58 enters the centre one of the recesses 86 and the member 38 enters the intermediate diameter portion of the bore 76. The shank 84 is screwed into the tapped bore 44 thereby fastening the components 12 and 14 together. The lengths of the members 38 and 78 are such that the members can be screwed together to join the components and compress the seal 62, but not so tightly that relative rotary movement between them is impossible.

It will be understood that the components can be rotated relatively to one another through a distance determined by the length of the groove 88. More specifically, as the components are turned relatively to one another in one direction, the pin 50 encounters one end of the groove 88, and when the components are turned in the other direction, the pin 50 encounters the other end of the groove 88. These two extreme positions correspond to the positions shown in Figures 1 and 2. As the components are rotated with respect to one another, the ball 58 is cammed out of the recess 86 in which it is seated, rolls over the surface 74, and enters another of the recesses 86. Thus the components 12 and 14 are positively located with respect to one another in each of the three positions shown in Figures 1 to 3.

In use, the tube 18 is pressed onto the fitting 16 and the double lumen endobronchial tube 24 is pressed onto the fittings 22. As shown in Figure 10, the tube 24 is inserted through the mouth and trachea into the bronchi.

Normally the components 12 and 14 are positioned so that the ball 58 is in the centre one of the recesses 86, the line 20 then being intermediate the lines 26 and 28 as shown in Figure 3. Breathing gasses from the tube 18 pass through the bore 30 of the fitting 16, enter the recesses 64, and then flow into the bores 68 and 70 which, while the component 12 is in the mean position with respect to the component 14, are in communication with respective ones of the recesses 64. Breathing gasses thus flow through both bores 68 and 70 and through both lumen of the tube 24 to ventilate both lungs.

If the component 12 is turned relatively to the component 14 to the position shown in Figure 1 or the position shown in Figure 2, only one lung is ventilated. More specifically, one of the bores 68 or 70 moves out of register with the respective recess 64 with which it was in register and into register with one of the deflation ports 66. The other bore 70 or 68 remains in communication with the bore 30 through the other of the recesses 64. Thus one lung is disconnected from the bore 30 and does not receive breathing gasses and collapses. A source of suction can be applied to the respective port 66 if so required. Whilst this might be for deflation purposes, it is more likely to be for removing liquid from the lung.

Turning now to Figures 11 to 14, these illustrate a further form of adaptor. The adaptor of Figures 11 to 14 has many components in common with the adaptor 10 of Figures 1 to 9 and, where applicable, like reference numerals with the addition of the suffix ".1" have been used.

The component 12.1 shown in Figures 11 and 12 is in the form of a housing with a fitting 16.1 protruding therefrom on one side and two fittings 22.1 protruding therefrom on the other side. The bore 30.1 opens through the inner face of the housing constituting the component 12.1 as do the bores 68.1 and 70.1 of the fittings 22.1. Recesses 86.1 in the bottom wall of the component 12.1 are spaced apart in an arc.

An undercut 90 is provided where the cylindrical wall of the component

12.1 meets the base wall of the component 12.1.

The component 14.1 (see Figures 13 and 14) is in the form of a disc which fits into the component 12.1. An O-ring for sealing between the two components 12.1 and 14.1 fits into a groove 92 of the component 14.1. The component 14.1 has two bores therein, the bores being designated 94 and 96. At one end each bore 94, 96 opens through the circular periphery of the component 14.1 and at the other end the bores 94, 96 open into a recess 98 formed in the periphery of the component 14.1.

Deflation ports 66.1 are provided, these each having an inlet in a top disc-like surface 100 of the component 14.1 and an exit in the cylindrical peripheral face of the component 14.1. Thus each deflation port runs at an angle to horizontal when the surface 100 is horizontal. This facilitates insertion of an optic fibre used to determine that the lumen in the trachea are correctly positioned.

A blind bore 54.1 formed in the underside of the component 14.1 receives a spring 56.1 and a short rod 58.1 with a hemispherical head. The recess 88.1 receives a stop pin (not shown) equivalent to the pin 50 and which is in the blind bore 52.1.

The component 14.1 includes a pair of protrusions 102 (Figures 13 and 14) which facilitate rotation of the component 14.1 with respect to the component

12.1.

A single marker dot 104 is provided on the surface designated 106 of the component 12.1. An arcuate line 108 is provided on the surface 100 of the component 14.1.

Two further marker dots 110, 112 are provided immediately above the outlet ends of the bores 94 and 96 and pairs of marker dots 114, 116 are provided on the surface 106 above the bores 68.1, 70.1.

When the components 12.1, 14.1 are positioned with each dot 110, 112 positioned between the dots of the pairs of dots 114, 116, the bores 68.1 and 70.1 are in communication with the bore 30.1 through the bores 94, 96 and the recess 98. Hence both lungs are ventilated. The rod 58.1 is in the centre one of the recesses 86.1. The dot 104 is at the centre of the line 108.

When the component 14.1 is rotated with respect to the component 12.1, the rod 58.1 is cammed out of the centre recess 86.1 and, depending on the direction of rotation, seats in one of the other recesses 86.1. The dot 104 is now aligned with one end of the line 108 and only one of the dots 110, 112 is between the dots of one of the pairs of dots 114, 116.

On the assumption that the component 14.1 is then turned clockwise

as viewed in Figure 13, the bore 94 moves out of register with the bore 68.1 and into register with the bore 70.1. The "upper" port 66.1 (as viewed in Figure 13) moves into register with the bore 68.1. The recess 98 moves with respect to the bore 30.1 but the permitted travel of the component 14.1 and the length of the recess are such that it is not possible to disconnect the recess 98 from the bore 30.1. Thus breathing gasses are supplied through the bore 30.1, the recess 98, the bore 94 and the bore 70.1 to one lung. The other lung collapses and if desired suction can be applied to the port 66.1 which is now in communication with the bore 68.1. If the component 14.1 is rotated in the other direction i.e. anticlockwise, it is the bore 68.1 which remains connected to the recess 98 by way of the bore 96 and it is the bore 68.1 which comes into register with the other port 66.1.

In each of these positions only one of the marker dots 100, 112 is between the dots of one of the pairs of dots 114, 116. This indicates which bore 68.1, 70.1 is being supplied with breathing gases.

Turning now to Figures 15 to 17, the adaptor illustrated is generally designated 10.2. Where applicable, its components are designated with the same reference numerals as used in Figures 1 to 9 with the addition of the suffix .2.

In this form the component 14.2 is in the form of a slide which is carried by the component 12.2. The component 12.2 comprises a base plate 118 and a pair of end structures 120 with rectangular openings 122 therein for receiving

the ends of the slide. The bore in the fitting 16.2 enters a recess 124 in the top surface of the base plate 118. The bores in the fittings 22.2 both open into the recess 124 when the slide is in its centre position.

The deflation ports 66.2 are in the base plate 118, and each is encircled by a sealing ring 126.

To limit movement of the slide, two protrusions 128 are provided on the top surface thereof. The protrusions 128 abut the end structures 120 as the slide is moved to its end positions.

When the slide is in the centre position, the fittings 22.2 are connected to the fitting 16.2 via the recess 124. When the slide is moved to either of the end positions, one fitting 22.2 remains connected to the fitting 16.2 via the recess 124, and the other fitting 22.2 is connected to one of the ports 66.2.

CLAIMS:

1. An adaptor comprising first and second components which can be displaced relatively to one another between first, second and third relative positions, a fitting for connection to a source of breathing gases and a pair of fittings for connection to two lumens of an endobronchial tube, the interior of said fitting being in communication with the interiors of the pair of fittings when said components are in said first relative position and in communication with the interior of one or the other of said pair of fittings when in said second and third relative positions, there being a pair of ports through which the lungs can deflate, one of said ports being in communication with the interior of one of said pair of fittings when the components are in said second relative position and a second of said ports being in communication with the interior of the other of said pair of fittings when the components are in the third relative position.

2. An adaptor as claimed in claim 1, wherein said components can be turned with respect to one about an axis to displace the components between said relative positions.

3. An adaptor as claimed in claim 2, wherein said first position is a mean position, said components being turned in one direction with respect to one another from said mean position to said second position and in the other direction with respect to one another from said means position to said third position.

4. An adaptor as claimed in claim 1 and including detent means for locating the components in said first, second and third relative positions.

5. An adaptor as claimed in claim 4, wherein said detent means comprises recesses in one of said components and a spring loaded detent carried by the other of said components.

6. An adaptor as claimed in claim 5, wherein said recesses are conical in form and said detent is a ball.

7. An adaptor as claimed in claim 2 and including means for limiting relative turning movement between the two components.

8. An adaptor as claimed in claim 7, wherein said limiting means comprises a pin carried by one component and an elongate recess in the other component, a portion of the pin which projects from said one component being in the recess of the other component.

9. An adaptor as claimed in claim 2, wherein said components are disc-like and displaceable with respect to one another in rotary fashion about a common axis.

10. An adaptor as claimed in claim 1, wherein one component defines a

cylindrical socket and the other component is in the form of a disc which is within the socket and encircled by a peripheral wall of the socket.

11. An adaptor as claimed in claim 10, wherein said fittings are all carried by said socket.

12. An adaptor as claimed in claim 11, wherein said disc has bores which extend across the disc and connect the interior of said fitting to the interiors of the pair of fittings.

13. An adaptor as claimed in claim 10 and including detent means for locating the components in said first, second and third relative positions.

14. An adaptor as claimed in claim 13, wherein said detent means comprises recesses in one of said components and a spring loaded detent carried by the other of said components.

15. An adaptor as claimed in claim 1, wherein said first component is in the form of a base plate which carries said fitting and said second component is in the form of a slide which can be displaced rectilinearly with respect to the base plate and which carries said pair of fittings, said ports being in said base plate, and there being a recess in said base plate into which the bore in said fitting and the bores in said pair of fittings open.

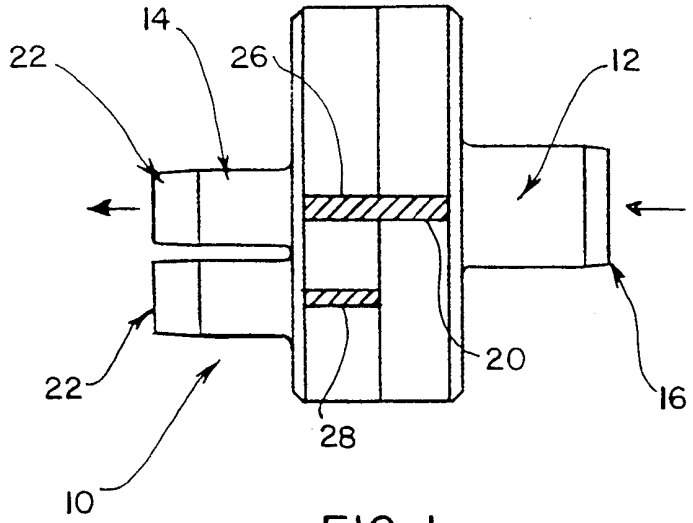

FIG. 1

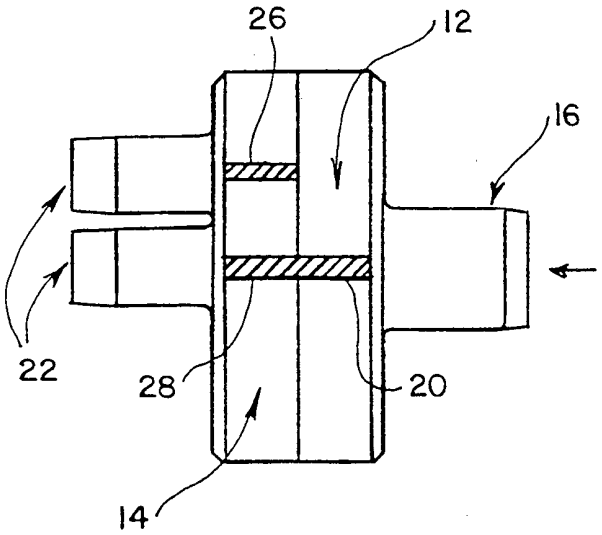

FIG. 2

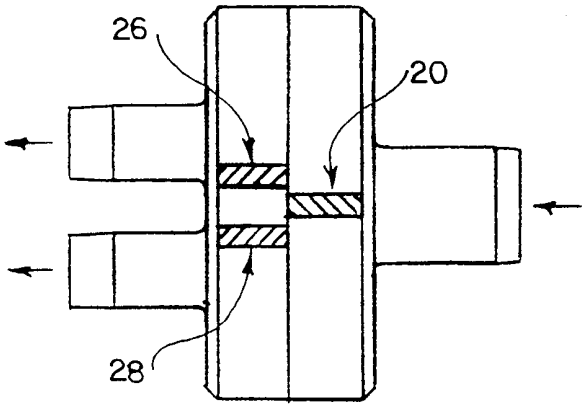

FIG.3

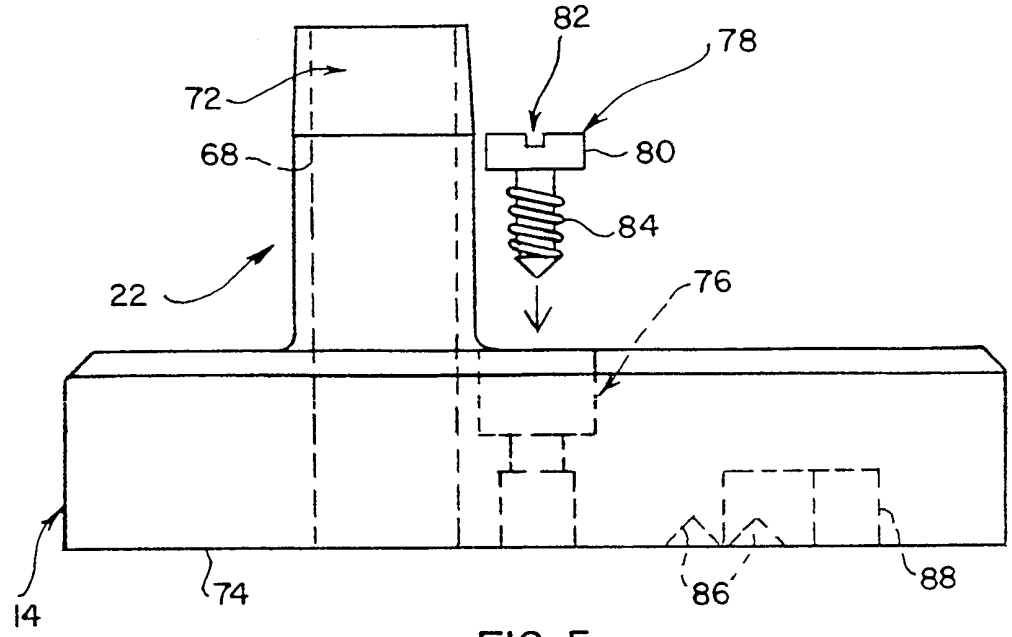
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FIG. 5

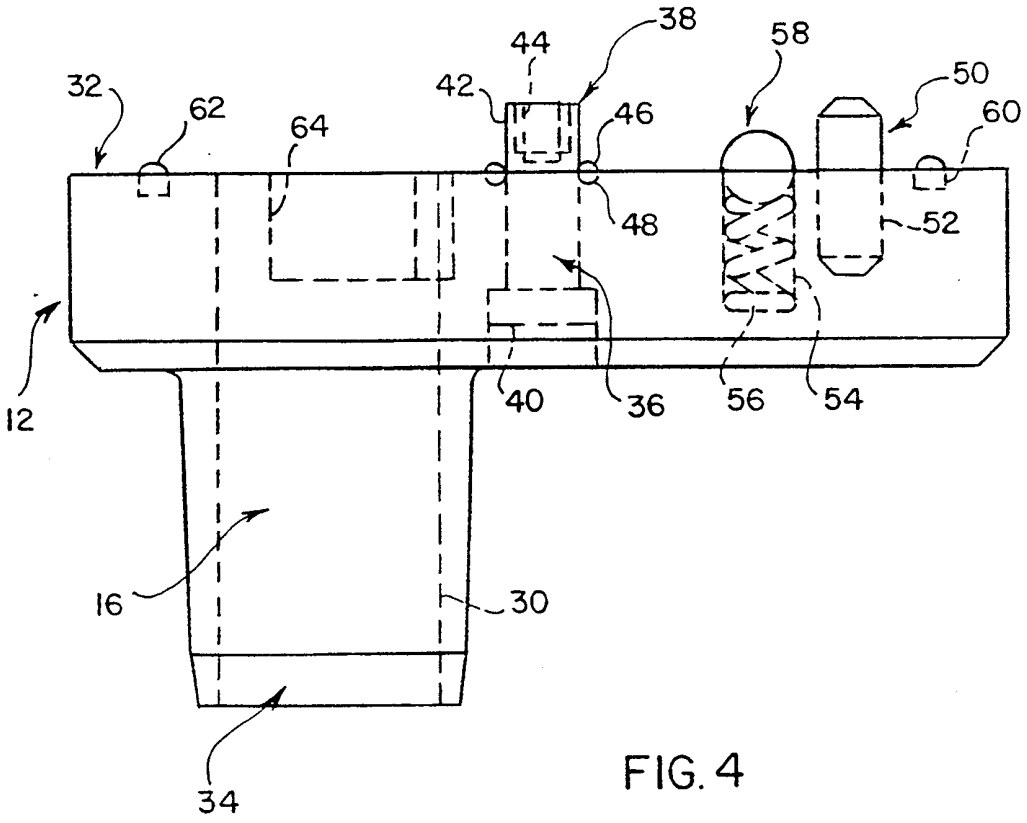
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FIG. 4

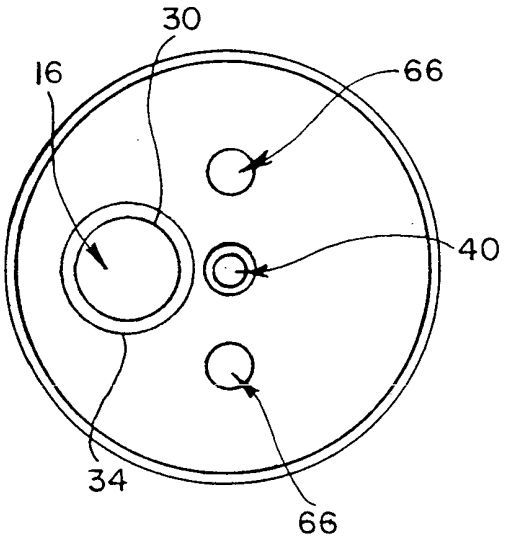

FIG. 6

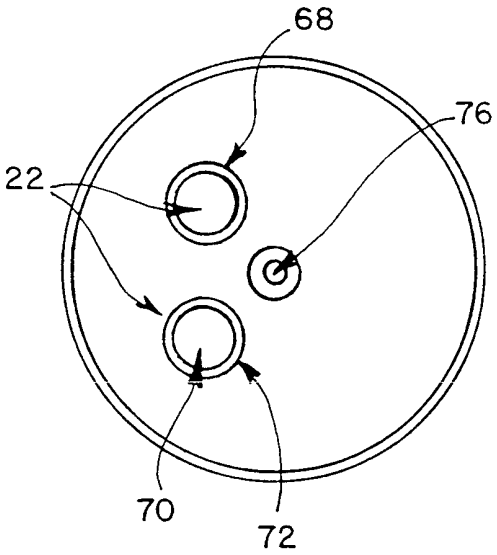

FIG. 8

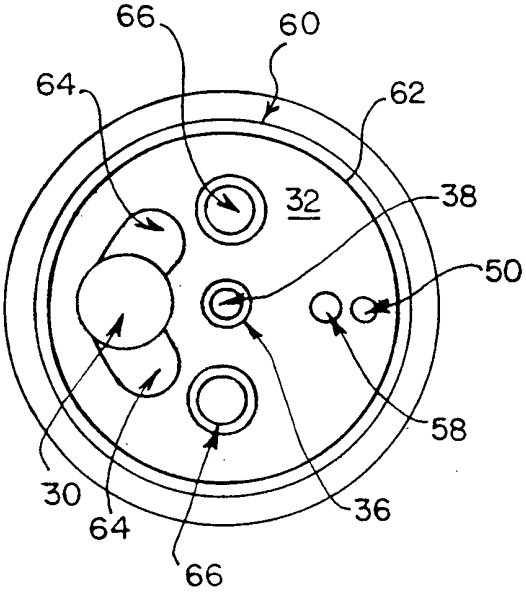

FIG. 7

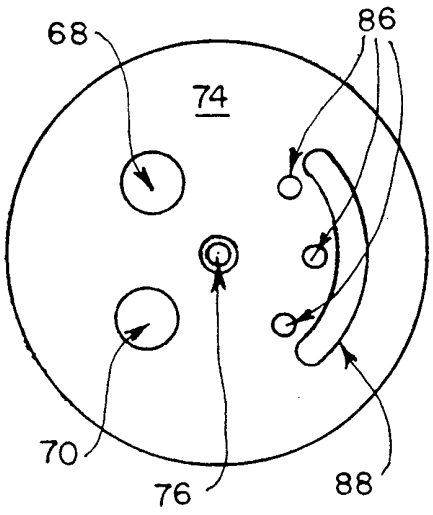

FIG. 9

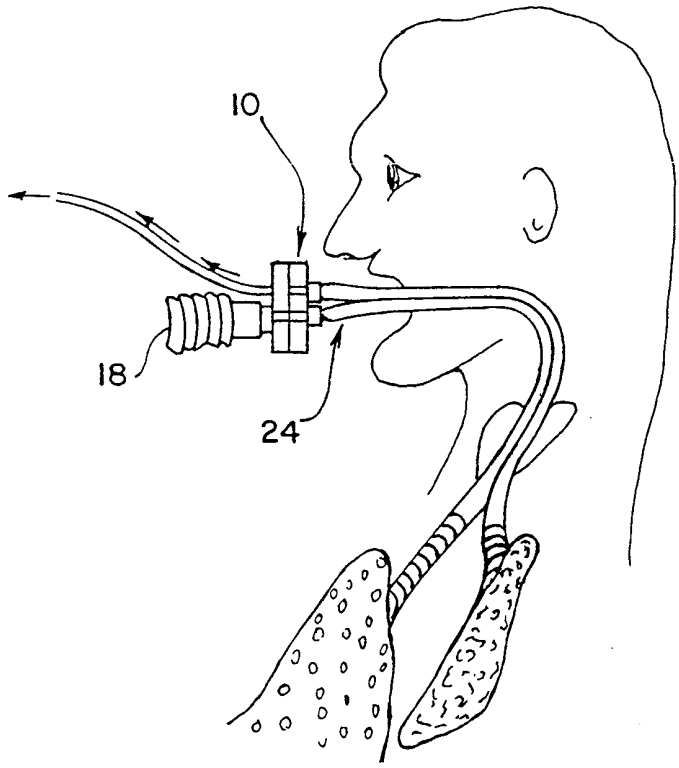

FIG. 10

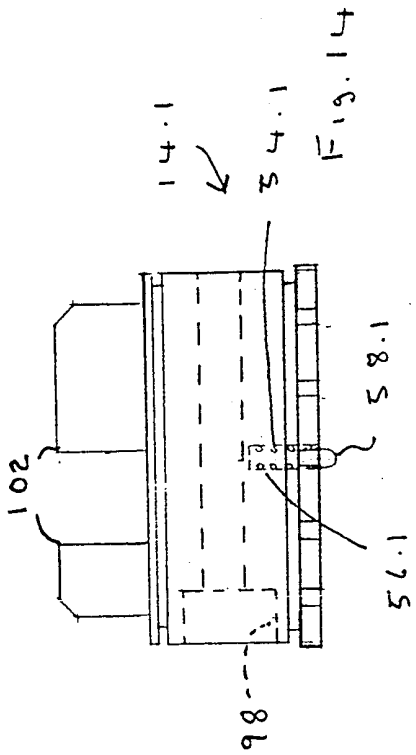

Fig. 14

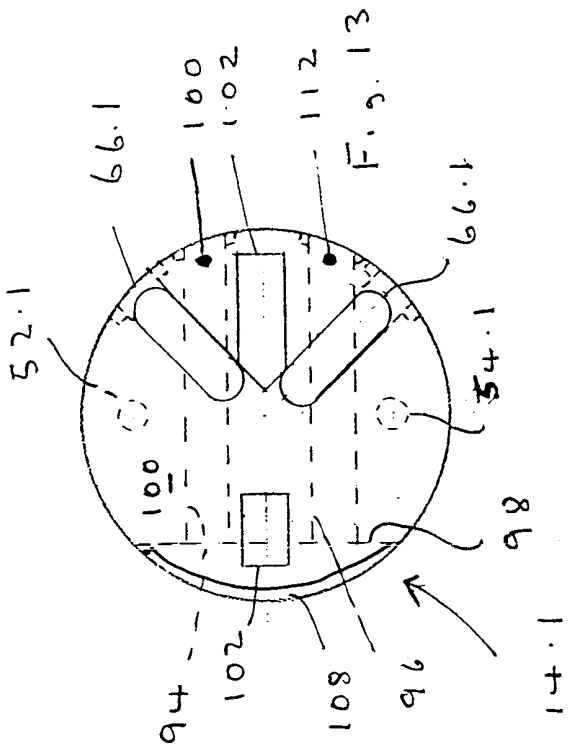

Fig. 13

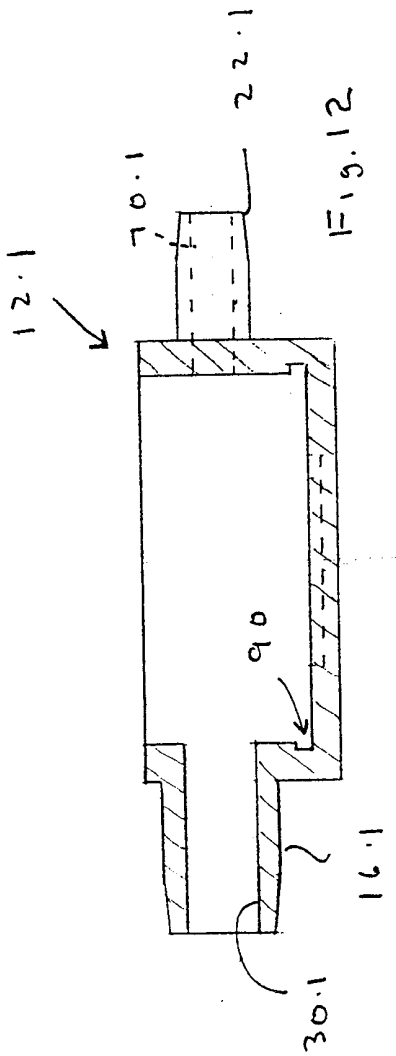

Fig. 12

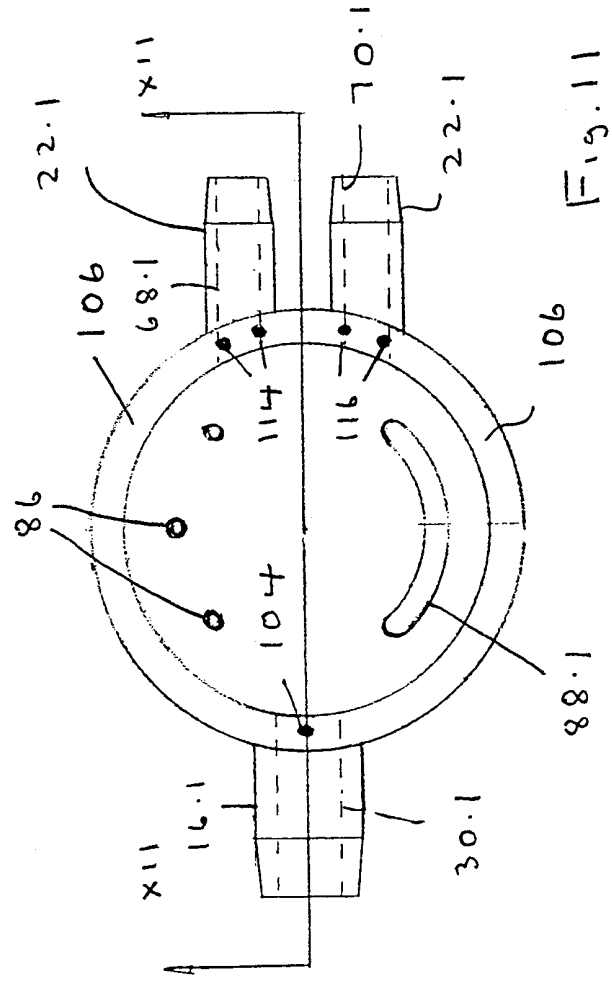

Fig. 11

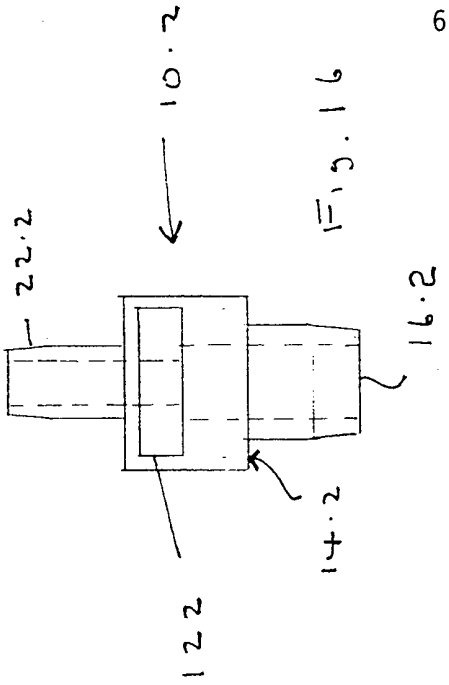

Fig. 16

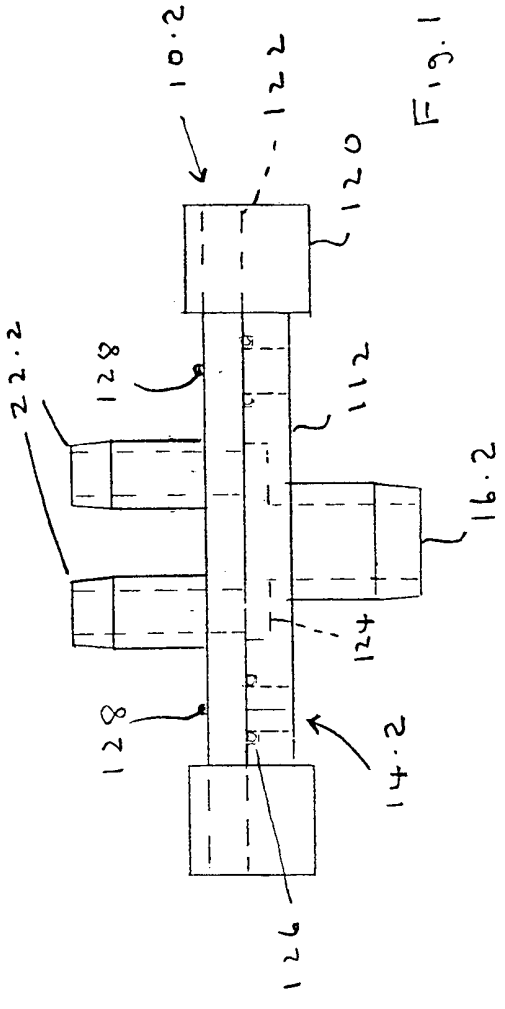

Fig. 15

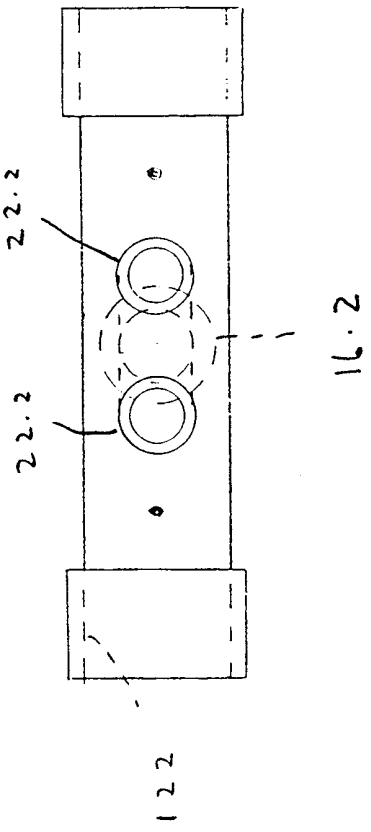

Fig. 17

INTERNATIONAL SEARCH REPORT

Int. tional Application No
PCT/IB 98/01794

A. CLASSIFICATION OF SUBJECT MATTER
IPC 6 A61M16/04 A61M16/20

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 6 A61M

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 5 207 641 A (ALLTON ROBERT A) 4 May 1993 see abstract see column 6, paragraph 3; figures	1-5,7
A	US 4 489 721 A (ANDERSEN HENRIK W ET AL) 25 December 1984 see claim 1; figures	1
A	US 5 511 545 A (JINOTTI WALTER J) 30 April 1996 see abstract; figures	10-12
A	US 4 036 210 A (CAMPBELL ROY L ET AL) 19 July 1977 see abstract; figures	15

-/--

[X] Further documents are listed in the continuation of box C.

[X] Patent family members are listed in annex.

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Date of the actual completion of the international search	Date of mailing of the international search report
17 March 1999	25/03/1999

Name and mailing address of the ISA	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Tx. 31 651 epo nl, Fax: (+31-70) 340-3016	Villeneuve, J-M

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INTERNATIONAL SEARCH REPORT

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C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication,where appropriate, of the relevant passages	Relevant to claim No.
A	US 5 354 267 A (IRLBECK JR DENNIS H ET AL) 11 October 1994	
A	US 5 392 772 A (ZILBERSHTEIN MICHAEL) 28 February 1995	

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INTERNATIONAL SEARCH REPORT

Information on patent family members

Inte. onal Application No
PCT/IB 98/01794

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 5207641 A	04-05-1993	NONE	
US 4489721 A	25-12-1984	NONE	
US 5511545 A	30-04-1996	NONE	
US 4036210 A	19-07-1977	NONE	
US 5354267 A	11-10-1994	NONE	
US 5392772 A	28-02-1995	NONE	