



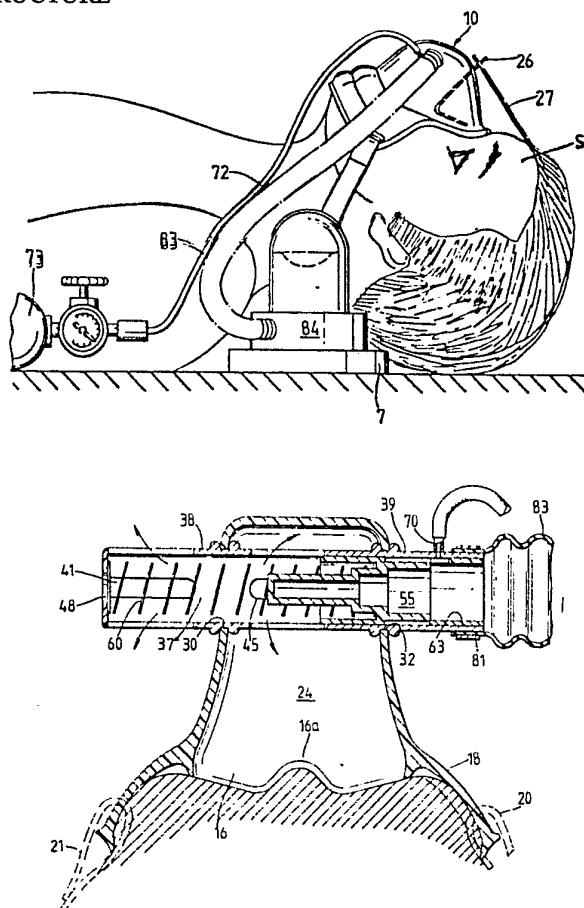
INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

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<p>(21) International Application Number: PCT/DK79/00027 (22) International Filing Date: 12 September 1979 (12.09.79) (31) Priority Application Number: 011,136 (32) Priority Date: 12 February 1979 (12.02.79) (33) Priority Country: US  (71) Applicant: HOVMAND, Erik [DK/DK]; Filstedvej 141, DK-9000 Aalborg (DK). (72) Inventor: GUNDERSON, Arthur, Michael; 24. N.E. Wilson Avenue, St. Cloud, MN 56301 (US). (74) Agent: NØRREJYSK PATENTBUREAU ApS; Aagade 19, P.O. Box 655, DK-9100 Aalborg (DK).</p>		<p>(81) Designated States: CH (European patent), DE (European patent), DK, FR (European patent), GB (European patent), SE (European patent).  <b>Published</b> <i>With international search report</i></p>

(54) Title: RESPIRATORY VALVE FACE MASK STRUCTURE

(57) Abstract

The respiratory valve face mask (10) herein relates to a structure for use in restoring respiration by providing for a subject of respiratory failure or cardiac arrest a supply of pressurized oxygen enriched air (73) and which permits in the alternative the free passage of ambient air to the subject under atmospheric pressure. The mask (10) comprising the invention herein has a plurality of chin grooves (15) to provide a general face fit for various sizes or lengths of faces with a perimeter (12) overlying the airpassages of a face together with appropriate strap members (20, 21) to secure the same about the head of a person and projecting from the inner surface of the mask (10) in a particularly designed air sealing rib (16) encircling the nose and mouth and carried in the mask (10) is a valve structure (35, 63) which permits the free passage of ambient air to the person atmospheric pressure and into which the input of oxygen (84) or oxygen enriched air (84, 73) under appropriate pressure acts upon a piston (52) to close the valve (41) to ambient air, and further, in connection therewith, is pressure relief (41) to the atmosphere in the event of an excessive build up of the pressure of oxygen or oxygen enriched air within the mask.



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## RESPIRATORY VALVE FACE MASK STRUCTURE

## BACKGROUND OF THE INVENTION -

1. Field of the Invention. This invention relates to a valve equipped respiratory mask for restoration of re-  
5 spiration in cases of respiratory failure or cardiac arrest.

2. Description of the Prior Art. Representative of the prior art known is the U.S. Patent 3,796,216 to K. H. Schwarz wherein a flap valve serves in the alternative  
10 to close exhalation and inhalation ports with respect to a gas supply but appears to have no provision for inhalation for ambient air under atmospheric pressure and the U.S. Patents Nos. 3,215,413 to J. A. Mota and  
15 3,106,204 to B. Paramelle respectively disclose the use of pairs of bellows and each have a plurality of valves for inhalation, exhalation and for pressure relief purposes.

The structure herein comprising a face mask coupled with a pressurized air and oxygen supply provides a simply  
20 constructed positive acting control valve which provides pure oxygen mixed with an ambient air for a pressurized oxygen enriched air supply and which seals off communication with the atmosphere with the passage of said oxygen enriched air under pressure into the air passages of  
25 the subject.

## SUMMARY OF THE INVENTION -

The invention herein comprises a respiratory valve equipped oxygen mask readily adapted to be positioned air tight onto the face of a subject for the injection of



oxygen enriched air to a subject suffering from respiratory failure or cardiac arrest such as in connection with the apparatus described in my pending application S. N. 895,733 filed April 5, 1978 entitled Cardiac Pulmonary Resuscitation Apparatus.

To have effective use of the injection of oxygen enriched air into a subject there must be the cooperative relationship of a valve equipped mask readily positioned to be air tight, to suitably fit various sized faces and have a valve structure which permits free passage of ambient air under atmospheric pressure and which embodies means for simultaneously sealing off the passage of ambient air during the application of oxygen enriched air to the subject.

More specifically stated, it is an object of this invention to provide a flexible face mask having a elongated chin angaging structure with cheek flaps and an internal rib to provide an air tight fit about the air passages of a subject and which will accommodate various sized faces and integral therewith is a pressure operated switch valve which closes off ambient air when pressurized oxygen or oxygen enriched air is injected into the air passages of the subject and coupled with said valve is a relief structure to relieve an excessive build up of the pressure of oxygen or oxygen enriched air.

The above and like objects and advantages of the invention will be set forth in the following description made in connection with the accompanying drawing in which like reference characters refer to similar parts through the several views thereof.

#### BRIEF DESCRIPTION OF THE DRAWINGS -

Fig. 1 is a broken view in side elevation



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showing the structure of the invention herein in an operating position.

5 Figs. 2 and 3 are respective views in front and side elevation of the invention herein with portions broken away;

Fig. 4 is a view in vertical section taken on line 4-4 of Fig. 3 as indicated;

Fig. 5 is a view similar to Fig. 4 showing the structure in an alternate position; and

10 Figs. 7 and 8 are respectively top and bottom plan views with some portions broken away.

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#### DESCRIPTION OF A PREFERRED EMBODIMENT -

Referring to the drawings with a particular reference to Figs. 4 and 5, the valve equipped face mask structure comprising the invention herein is indicated generally by the reference numeral 10. The application of said mask in an operating position as indicated in Fig. 1 is with reference to my pending application S. N. 895,733 filed April 5, 1978 entitled Cardiac Pulmonary Resuscitation Apparatus for the specific description of the supporting structure herein which shows the subject S in a supine position with its head resting on a head positioning member 7.

25 Said mask is designed to overlie the nose, mouth and chin facial portion of a subject, the word subject as used herein being defined as a person to whom the mask is applied as in Fig. 1.

As indicated in Figs. 1 and 5, said mask has a perimeter 12 which will conform generally to the physical contours about the nose, mouth and chin portions of a face struc-

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ture and has formed in the chin portion 14 thereof a plurality of spaced transverse grooves 15 to accommodate various lengths of faces and provide a sealing chin fit, see Fig. 2.

- 5 Said mask will be formed preferably of a suitable flexible form-retaining plastic material such as of polyvinyl chloride which plastic material has sufficient resilience to make a tight yielding fit about a face structure.

Formed on the inner surface of said mask 10 is a projecting yielding rib 16 constructed and contoured to engage and fit about the nose structure of a subject and extend just under the lower lip portion into the transverse depression thereunder and said rib is of sufficient height to form a seal when the mask is secured as will be described.

Extending or flaring outwardly of said chin portion 14 of said mask to overlie the adjacent cheek portions of the subject are flap portions 18 and 19. Said flap portions have secured thereto strap members 20 and 21 which will be secured as to an appropriate headboard such as the headboard 7 indicated in Fig. 1.

The central body portion of said mask as indicated by the reference numeral 23 projects upwardly from about said rib portion 16 and provides a chamber 24 thereunder about the nose and mouth portions or air passages of a subject.

Said rib portion 16 is arched at 16a to seat about the bridge of a nose.

Embedded in front wall 23a of said portion 23 as shown in Figs. 1-3 is an angled spring wire 26 which has a base portion comprising wires 26a and 26b lying along each side of a nose and being angled upwardly as at 26c arched over



the bridge of the nose to form an outwardly projecting loop 26d. A strap member 27 will suitably engage said loop and pass over the head of the subject to be secured at its other end to said headboard 7 and thus the holding  
5 action of said three straps secures said rib 16 in a sealing position onto the face of a subject to seal from the atmosphere the pressurized oxygen or oxygen enriched air passing through said chamber 24 as will be further described.

10 Said upward projecting portion 23 is apertured as at 30 and 32, said apertures being aligned transversely thereacross to receive therethrough and to have extend outwardly thereof a cylindrical valve housing 35 which is here indicated for purpose of illustration as being formed of  
15 a plastic material and secured in position by the pairs of spaced annular ribs 35a and 35b as shown.

Said valve housing has a chamber 37 therethrough and has end portions 38 and 39 extending outwardly of said mask portion 24 through said apertures 30 and 32, said extended  
20 end portion 38 having a plurality of longitudinal slots or ports 41 extending thereabout and the central portion 36 of said housing has a plurality of longitudinal slots or ports 45 thereabout for communication with the air passages of the underlying nose and mouth portions of a subject.

25 Forming an end plate for the end portion 38 is a disc 47 having a central aperture 48 therethrough. Disposed into said housing as here shown is a cylindrical valve seat 50 having a recessed body portion 51 having a projecting shaft or rod portion 52 passable through said aperture 48.  
30 The rear body portion of said valve seat is reduced in transverse dimension by here being fluted as at 53 to provide clearance with respect to adjacent wall surface of the said valve housing and the remaining forward body portion 51 of said valve seat has a sealing engagement with  
35 said adjacent wall surface of said valve housing. Formed



within said body portion 54 is an open ended chamber 55 facing in the direction of said valve housing end portion 39.

Disposed about said rod 52 and retained between the adjacent body of said valve seat and said end plate member 47 is a coil compression spring 60 which urges said valve seat 50 to be adjacent the end portion 39 of said valve housing to permit the free entry of ambient air through the ports or aperture 41 of said valve housing end portion 38.

Seated within the end portion 39 of said valve housing is an internal ring member 63 to form a stop for said valve seat 50. Carried by said end portion 39 is a projecting orificed nipple 70 with said orifice extending through said ring member 63 and providing passage into said valve housing as shown. Said nipple has secured thereto an oxygen line 72 which will run to an appropriate oxygen source 73 such as indicated in Fig. 1.

Secured to said end portion 39 by a press fit or clamp member 81 is an air hose 83 running to a pressurized air supply such as to the pump 84 indicated in Fig. 1 which is a conventional air pump with a one way air valve to pass ambient air through the hose 83.

#### OPERATION -

25 The structure herein is a substantial improvement over mouth to mouth resuscitation and provides an effective means of supplying oxygen enriched air as required as in the case of respiratory failure or cardiac arrest. The face mask herein used in conjunction with the apparatus set forth above described is intended to place oxygen or a high level of oxygen enriched air into the lungs of a subject. It is understood that pressurized air will be





supplied as required by pulmonary resuscitation.

Oxygen may be fed constantly through the hose 72 and with each stroke of the pump 84 supplying air through the line 83, the valve seat 50 moves to close the ports 41 and thus  
5 delivers oxygen enriched air into the air passages of the subject. The oxygen is flowing constantly such as at two liters per minute and will accumulate to approximately 150 cc's between pump strokes and the accumulation will occur within the end portion 39 of the valve housing 35  
10 and within the chamber 55. Said oxygen is mixed with the incoming air stroked into said valve housing through the the airline 83 to provide a mixture of oxygen enriched air and the same passes through the ports 45 into the air passages of the subject as indicated in Fig. 5 and thence in-  
15 to the lungs at the end of each air stroke, the valve seat 50 is moved directly to seat against the ring 63 and prevent suction of air from the air passage of the subject.

Said valve seat 50 has its body portion 51 of such a length that when moved against the compression of the  
20 spring 60 by incoming air from the airline 83 under appropriate pressure, said valve seat will move to the point of having its body portion 54 seal off the ports 41 as indicated in Fig. 5.

The rod 52 preferably will be brightly colored and will  
25 project through the aperture 48 with each surge of incoming air to visually indicate that the air pump is operating and that air is passing into the subject's air passages. The air is suitably pumped at a pressure level such as at 150 cm of water. The spring 60 is designed to permit  
30 the closure of the ports 41 by the valve seat 50 responsive to such a pressure level of incoming air.

In the event of an excessive build up of pressure of oxygen enriched air within the chamber 24 beyond the predetermined pressure limits for which purpose the spring 60



has been calibrated, the valve seat will be moved further against the spring 60 and the rod 52 will extend substantially further outwardly of the end plate 47 which will be visually noted and at which point the fluted slots 41 permitting the passage of oxygen or oxygen enriched air from the chamber 24 to the atmosphere to relieve the pressure within said chamber. The pressure within said chamber 24 is thus self regulating with respect to the valve seat 50 according to the predetermined calibration of the spring 60 and the oxygen enriched air consumption of the subject.

The mask as indicated here is made of a flexible yielding material which conforms very nice to different faces of subjects and the rib 16 under the pressure of the straps 20, 21 and 27 makes a very effective seal.

15 The spring wire member provides an outwardly projecting loop to secure one end of a strap member and further retains the form of the nose portion of the mask structure to conform very nicely to the nose of a subject.

20 The mask here described is a simple and safe structure and has proved to be very successful in practice. It will be understood that the mask will be used by one knowledgeable about CPR practice.

25 It will of course also be understood that various changes may be made in form, details, arrangement and proportions of the parts without departing from the scope of the invention herein which, generally stated, consists in an apparatus capable of carrying the objects above set forth, in the parts and combinations of parts disclosed and defined in the appended claims.

## WHAT IS CLAIMED IS -

1. A respiratory valve face mask structure for use in connection with an appropriate pressurized oxygen and air supply, consisting of

5 a flexible body portion formed to overlie the front portion of a face of a subject,

an internal flexible rib projecting from the underside of said body portion extending about the nose and mouth air passages of said subject and having sealing engagement with said face,

10 an upward projection of said body portion above said rib forming a chamber,

a valve housing disposed through said projecting portion and said chamber,

15 air ports centrally of said housing and within said chamber communicating with said air passages,

one end portion of said valve housing arranged and constructed to pass ambient air to said air passages,

20 the other end portion of said valve housing communicating with a pressurized oxygen supply and pressurized air supply,

a valve seat slidably disposed within said housing,

means normally urging said valve seat to a position to seal said air ports from said pressurized oxygen and air supply,

25 said means yielding to incoming pressurized air from said



air supply bearing against said valve seat for movement of said valve seat to seal off the entry of ambient air and pass said pressurized air to said air passages,

said means yielding further to an excessive pressure of  
5 air from said air supply within said chamber, and

said valve seat being arranged and constructed to have a portion thereof relieve said excessive pressure to the atmosphere.

2. The structure set forth in claim 1, wherein said one  
10 end portion of said valve housing has air ports passing ambient air into said chamber of said valve housing.

3. The structure set forth in claim 1, wherein said one  
15 end portion of said valve housing has air ports thereabout and an aperture in its end wall passing ambient air into said chamber of said housing,

said valve seat has a projecting rod extending from the body portion thereof passable through said aperture of said end wall,

a compression spring is disposed about said rod bearing  
20 against the adjacent body portion of said valve seat and against said end wall,

said spring normally urges said valve seat against said other end portion of said valve housing,

means in said other end portion of said valve housing  
25 forms a stop member for said valve seat, and

said valve seat and said spring yield to the pressure of incoming pressurized air from said pressurized air supply and said rod extends through said aperture indicating the



presence of pressurized air passing into said valve housing.

4. The structure set forth in claim 3, wherein said valve seat has an end portion of reduced transverse dimension remote from said projecting rod,

5  
said valve seat and said compression spring yield under excessive pressure of said pressurized incoming air in said valve housing for further movement of said valve seat toward said one end portion of said valve housing for further projection of said rod through said aperture of said end wall and for said portion of reduced diameter of said valve seat to underlie said air ports of said end portion to relieve said excessive air pressure to the atmosphere, and

15 said rod is color coded for clear visual indication that said excessive pressure is being relieved.

5. The structure set forth in claim 1, wherein said valve seat is substantially cylindrical in form having an open ended chamber formed therein facing said other end portion of said valve housing,

20 said other end portion of said valve housing has an orifice therein,

means connect said orifice with an pressurized supply of oxygen passing into said end portion of said valve housing and said oxygen accumulates within said chamber of said valve seat.

6. The structure set forth in claim 1, wherein said other end portion of said valve housing has an orificed nipple,

means connecting said nipple with a pressurized supply of oxygen,



means connecting said other end portion of said valve housing with a pressurized supply of air,

said valve seat has an open ended chamber formed therein thereof facing said other end portion of said valve housing, and

said nipple passes said oxygen into said valve housing and the same accumulates therein and within said chamber of said valve seat whereby when said pressurized air is passed into said valve housing, said valve seat moves in the direction of said first end portion of said valve housing to seal the same and said incoming air mixes with said accumulated oxygen within said valve housing to pass oxygen enriched air into said air passages.

7. The structure set forth in claim 1, wherein said one end portion of said valve housing has an outer end wall having an aperture therethrough,

said valve seat has a rod projecting in the direction of said one end portion of said valve housing and adapted to pass through said aperture, whereby

the projection of said rod through said apertures indicates the passage of pressurized air into said valve housing.

8. The structure set forth in claim 1, wherein said body portion has a pair of flap portions overlying either side of said face portion,

a fastening means in connection with each of said flap portions, and

a fastening means extending from said upwardly projecting portion cooperate whereby said first and second mentioned

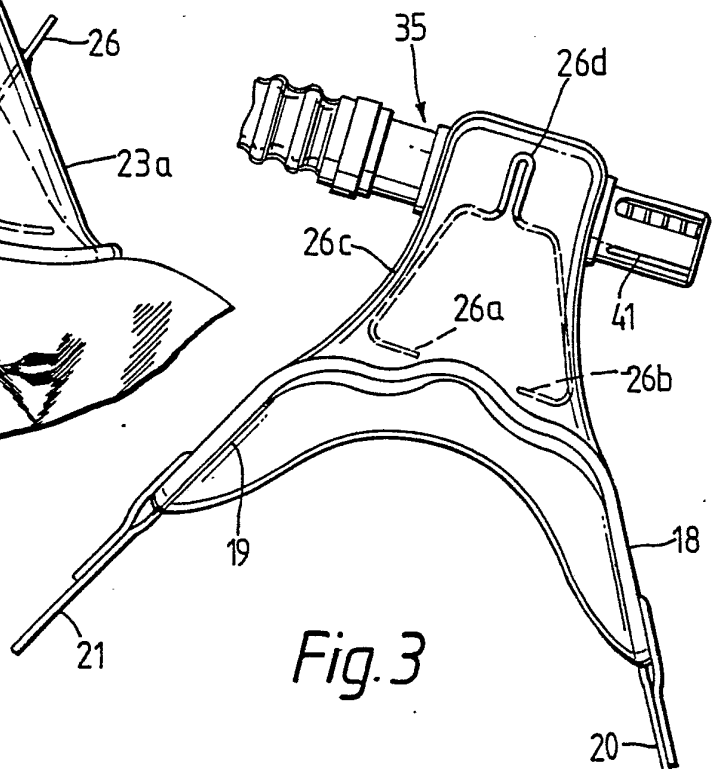
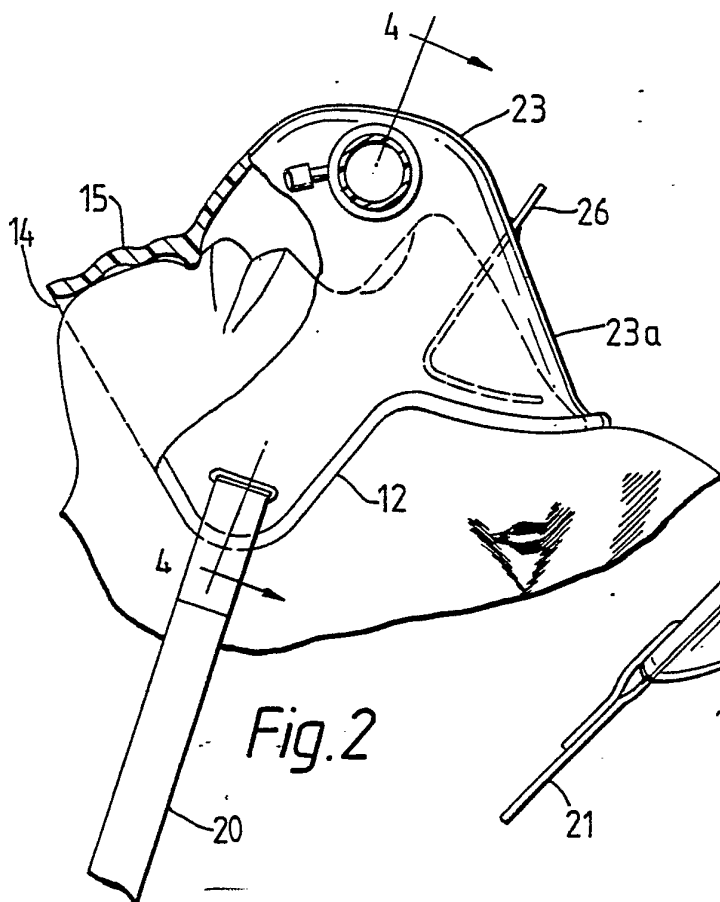
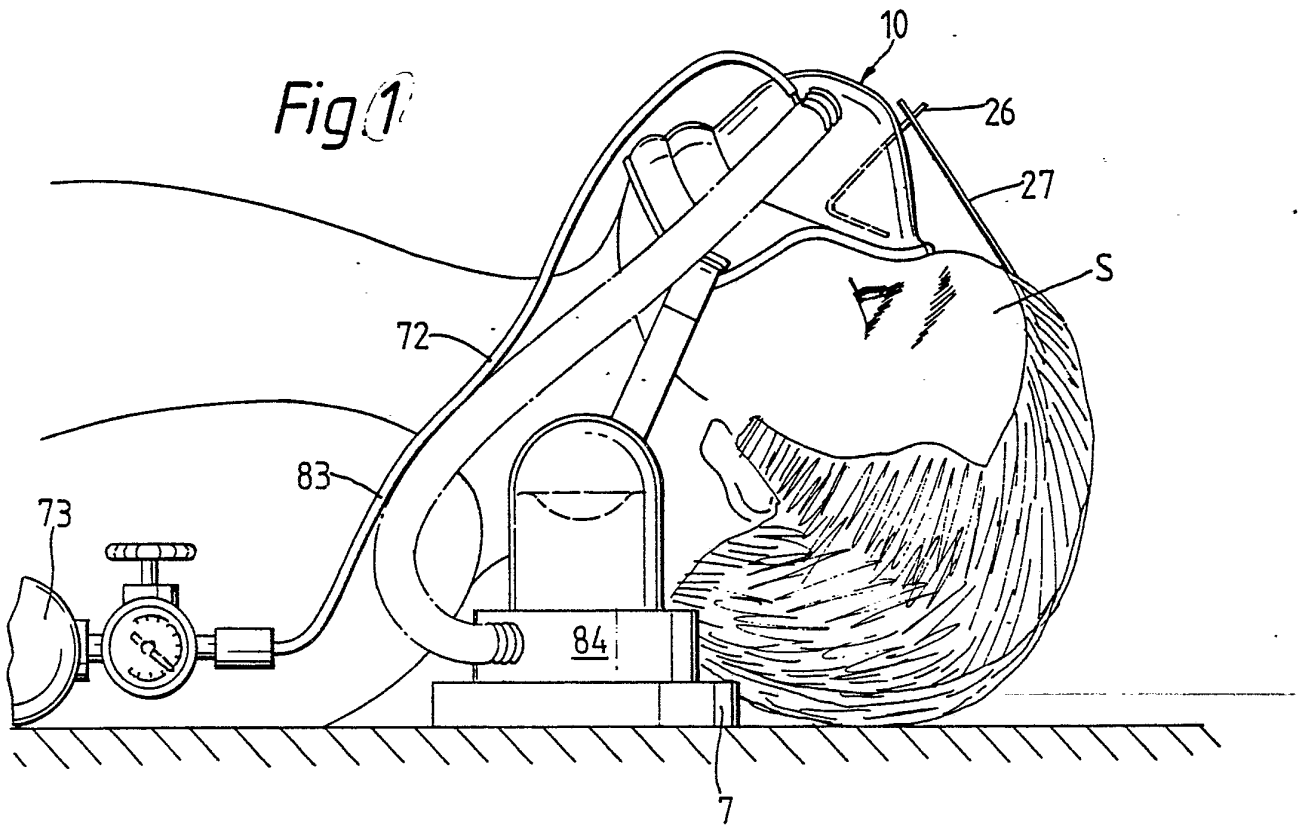


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fastening means to secure said mask about the head of  
said subject.

9. The structure set forth in claim 1, including  
resilient means embedded within said upwardly project-  
5 ing portion conforming the same to the form of a nose.







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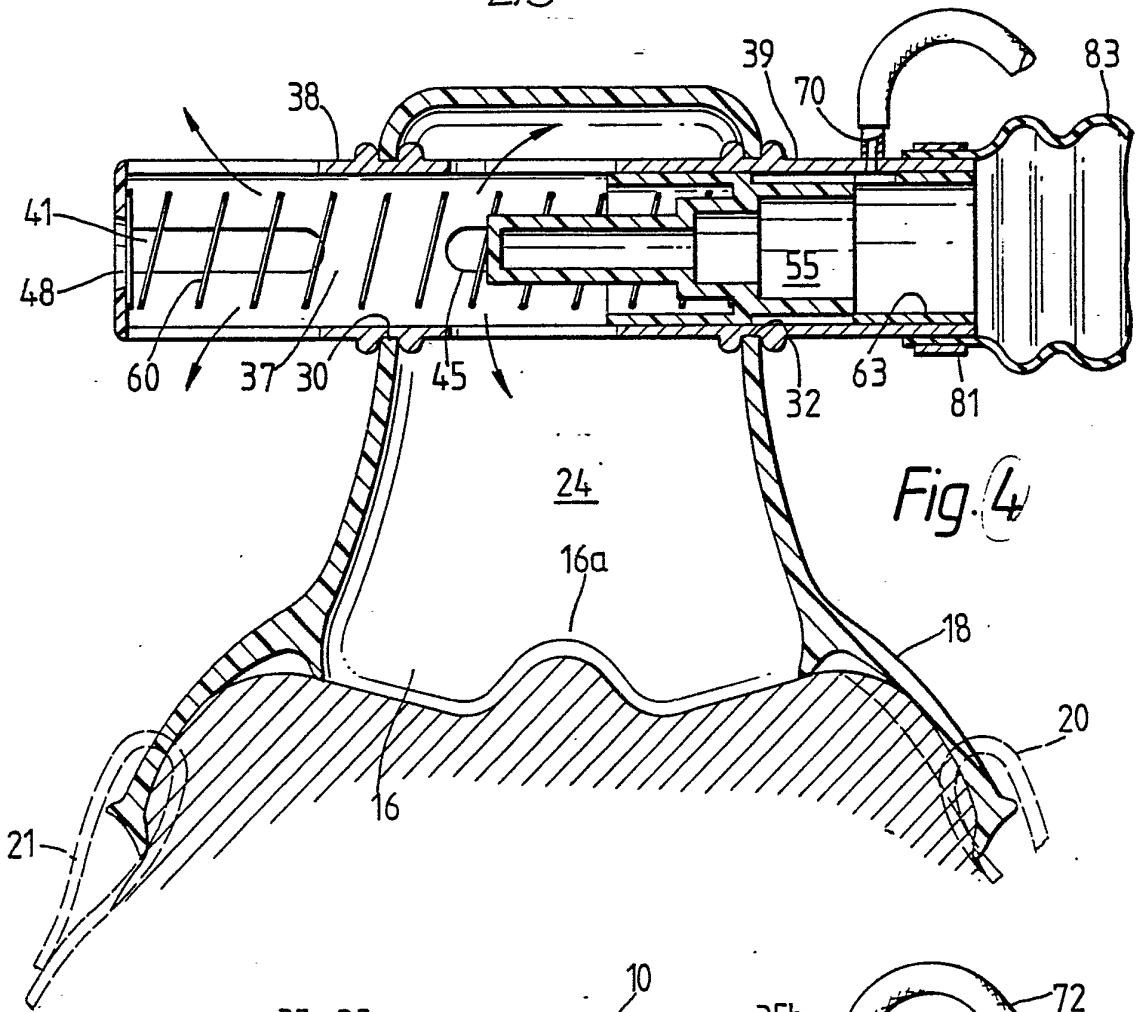


Fig. 4

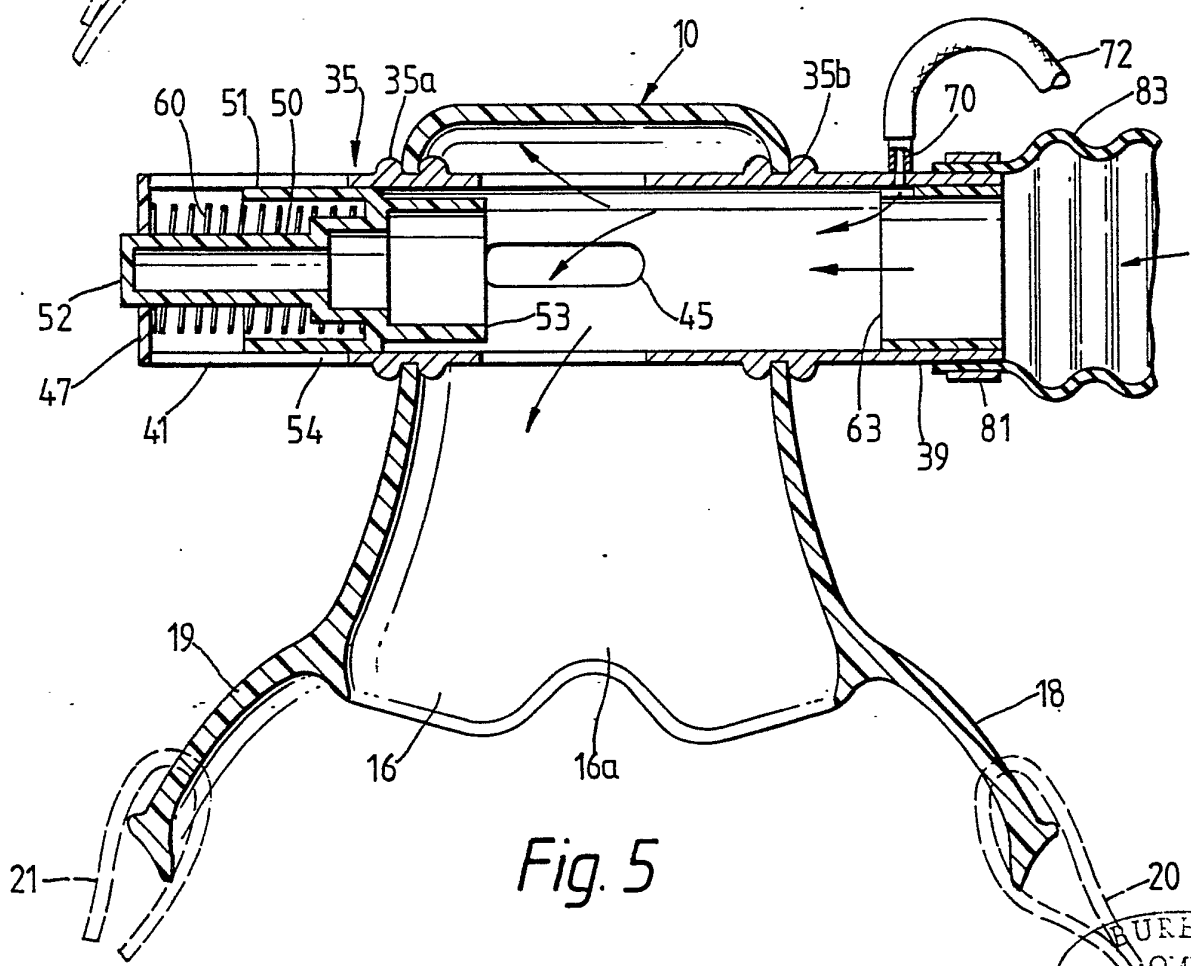


Fig. 5

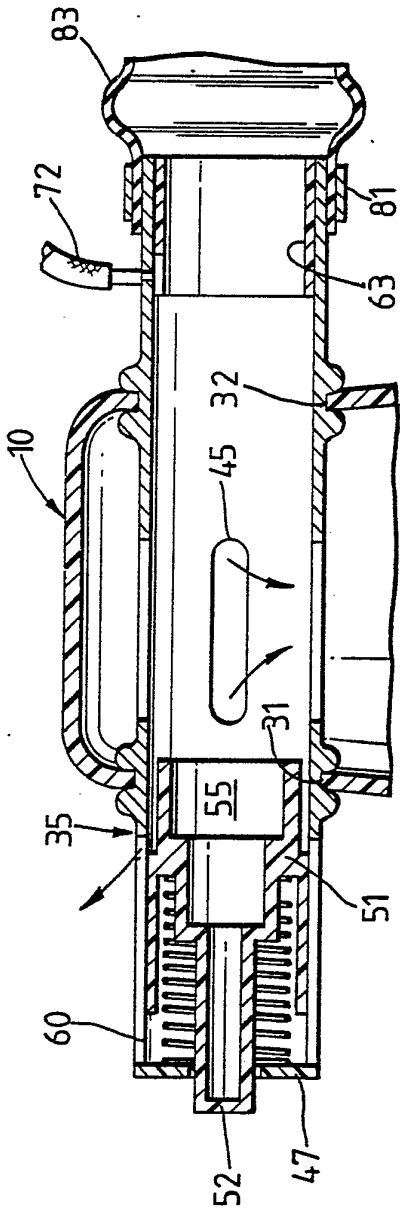


Fig. 6

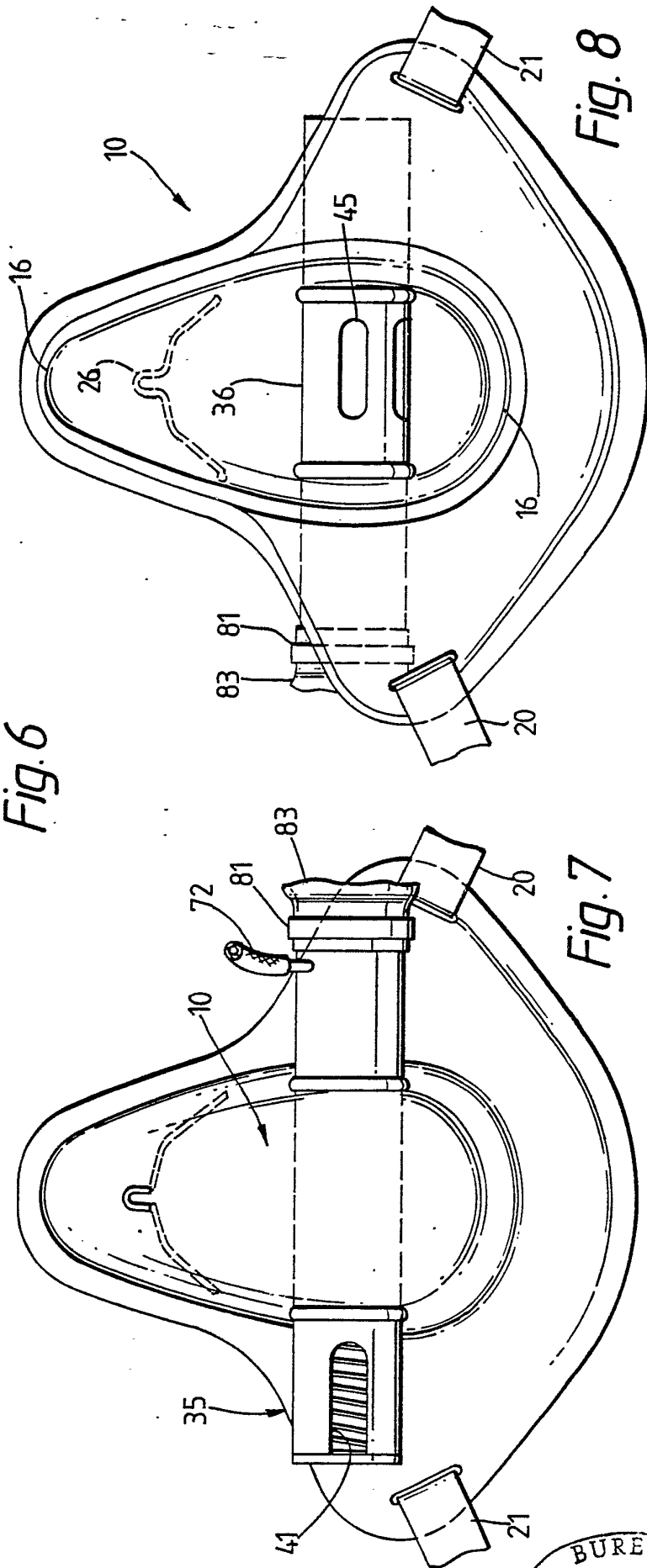


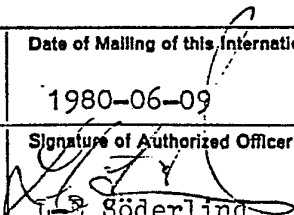
Fig. 8

Fig. 7

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# INTERNATIONAL SEARCH REPORT

International Application No. PCT/DK79/00027

<b>I. CLASSIFICATION OF SUBJECT MATTER</b> (If several classification symbols apply, indicate all) *				
According to International Patent Classification (IPC) or to both National Classification and IPC <sup>3</sup>				
A 61 M 16/00				
<b>II. FIELDS SEARCHED</b>				
Minimum Documentation Searched *				
Classification System	Classification Symbols			
IPC <sup>3</sup>	A 61 M 16/00, 17/02; A 62 B 18/08, 10			
National Cl	30k:13/01, 04; 61a:29/13			
US Cl	128:141, 142, 142.2			
Documentation Searched other than Minimum Documentation to the extent that such Documents are included in the Fields Searched *				
SE, NO, DK, FI classes as above				
<b>III. DOCUMENTS CONSIDERED TO BE RELEVANT</b> <sup>14</sup>				
Category *	Citation of Document, <sup>16</sup> with indication, where appropriate, of the relevant passages <sup>17</sup>	Relevant to Claim No. <sup>18</sup>		
A	SE, B, 7504833-0 published 1980, March 3, Pneupac Ltd.	3		
A	DK, C, 808 39 published 1956, April 9, Rubin H M	3		
X	DE, A, 2 402 192 published 1975, July 24, Dürr H. Fig 1, 2	1,2,5,6,8,9		
	DE, 2 402 192 is regarded in combination with one of the others.			
<p>* Special categories of cited documents: <sup>15</sup></p> <table style="width: 100%; border: none;"> <tr> <td style="width: 50%; border: none;"> <p>"A" document defining the general state of the art</p> <p>"E" earlier document but published on or after the international filing date</p> <p>"L" document cited for special reason other than those referred to in the other categories</p> <p>"O" document referring to an oral disclosure, use, exhibition or other means</p> </td> <td style="width: 50%; border: none;"> <p>"P" document published prior to the international filing date but on or after the priority date claimed</p> <p>"T" later document published on or after the international filing date or priority date and not in conflict with the application, but cited to understand the principle or theory underlying the invention</p> <p>"X" document of particular relevance</p> </td> </tr> </table>			<p>"A" document defining the general state of the art</p> <p>"E" earlier document but published on or after the international filing date</p> <p>"L" document cited for special reason other than those referred to in the other categories</p> <p>"O" document referring to an oral disclosure, use, exhibition or other means</p>	<p>"P" document published prior to the international filing date but on or after the priority date claimed</p> <p>"T" later document published on or after the international filing date or priority date and not in conflict with the application, but cited to understand the principle or theory underlying the invention</p> <p>"X" document of particular relevance</p>
<p>"A" document defining the general state of the art</p> <p>"E" earlier document but published on or after the international filing date</p> <p>"L" document cited for special reason other than those referred to in the other categories</p> <p>"O" document referring to an oral disclosure, use, exhibition or other means</p>	<p>"P" document published prior to the international filing date but on or after the priority date claimed</p> <p>"T" later document published on or after the international filing date or priority date and not in conflict with the application, but cited to understand the principle or theory underlying the invention</p> <p>"X" document of particular relevance</p>			
<b>IV. CERTIFICATION</b>				
Date of the Actual Completion of the International Search <sup>19</sup>	Date of Mailing of this International Search Report <sup>20</sup>			
1980-06-03	1980-06-09			
International Searching Authority <sup>1</sup>	Signature of Authorized Officer <sup>20</sup>			
Swedish Patent Office	 L. Söderlind			