Nov. 2, 1948. W. M. BOOTHBY ET AL 2,452,722

CLINICAL MASK FOR BREATHING AND REBREATHING MIXTURES OF GASES

Filed July 14, 1947 2 Sheets-Sheet 1

Fig. 1

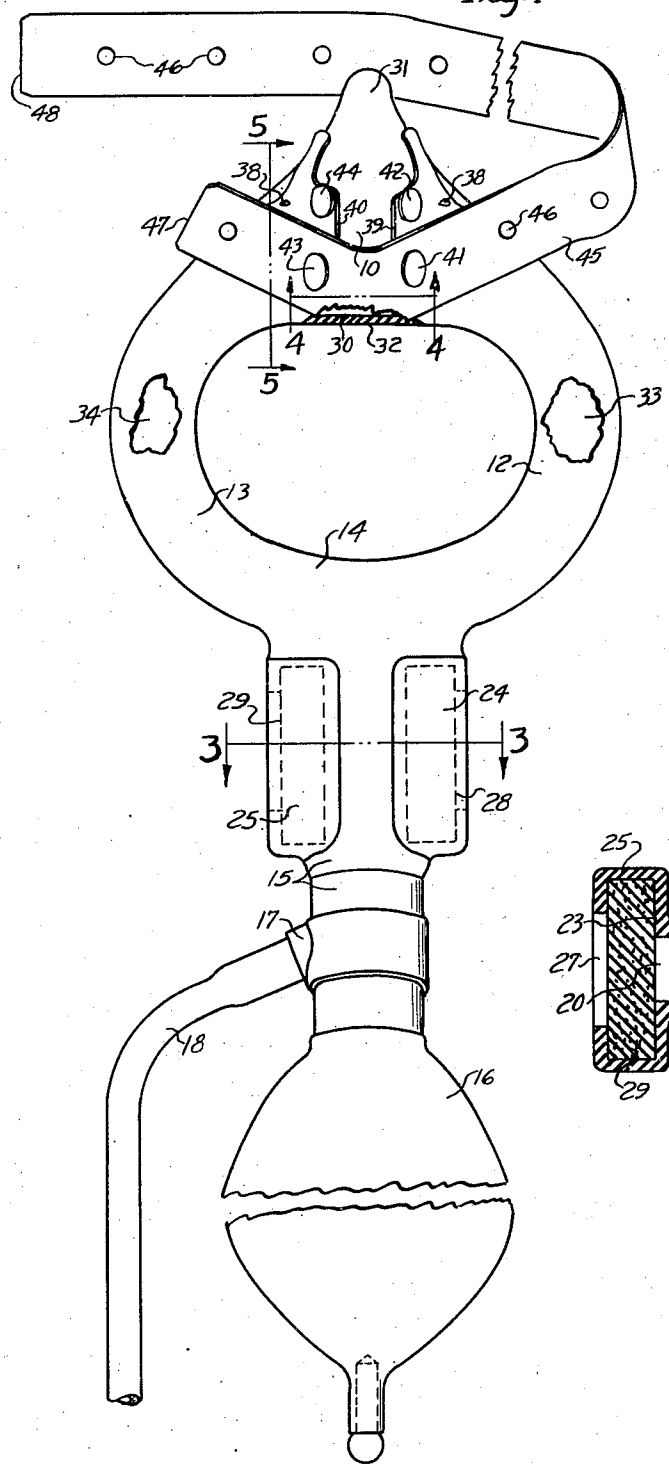


Fig. 2

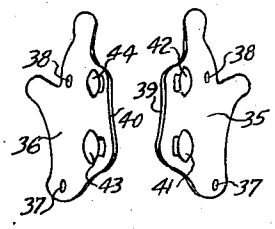


Fig. 4

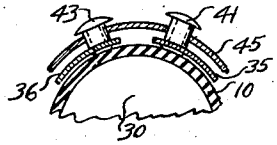
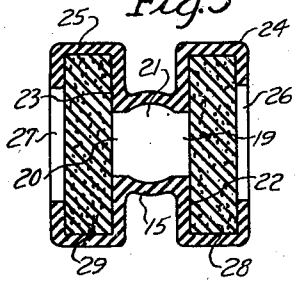


Fig. 5



Fig. 3



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Filed July 14, 1947 2 Sheets-Sheet 2

Fig. 6

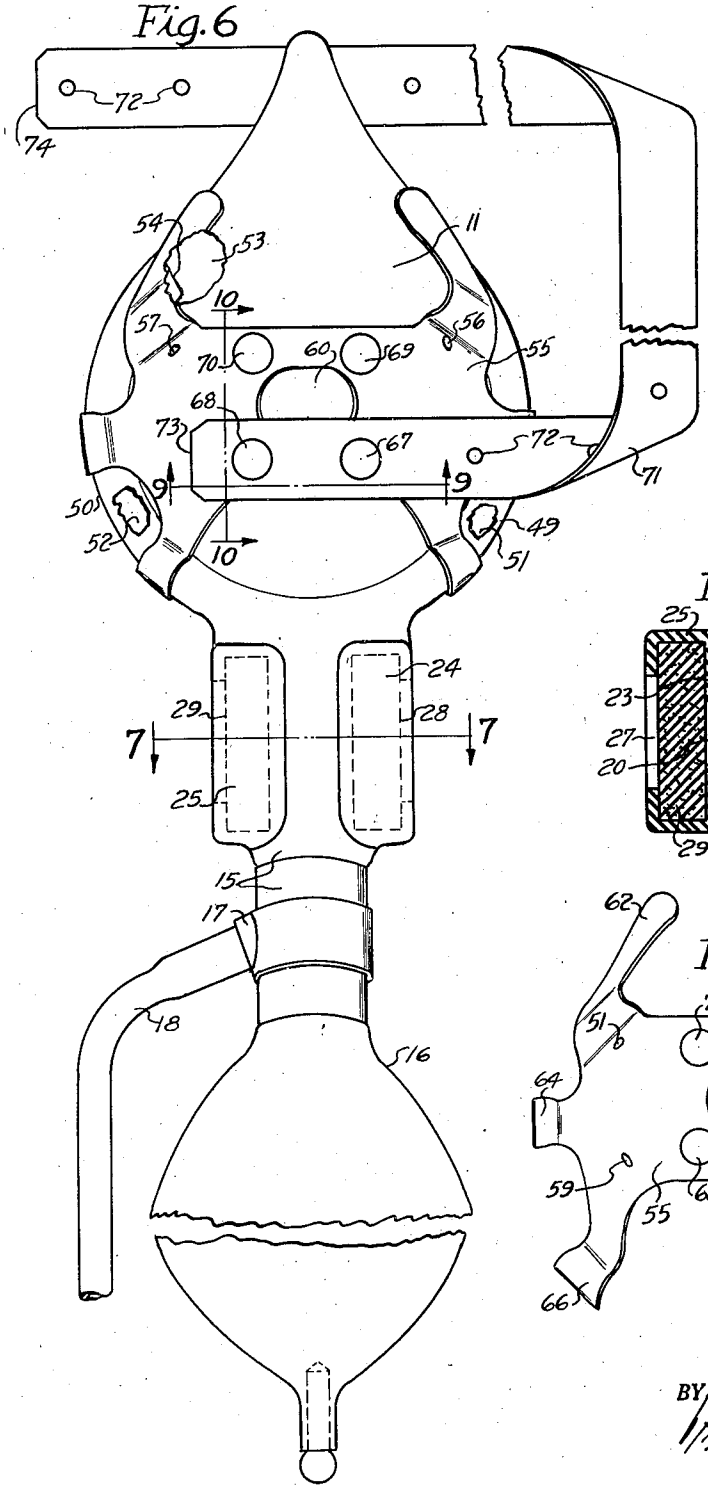


Fig. 9

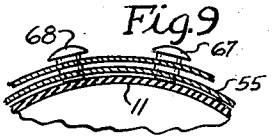


Fig. 10

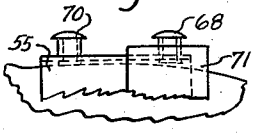


Fig. 7

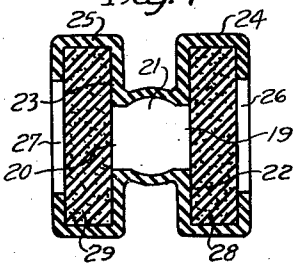
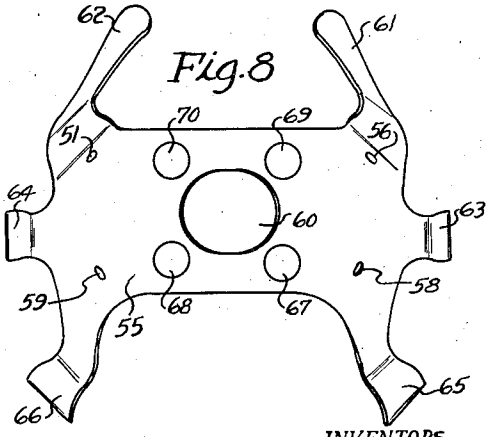


Fig. 8



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2,452,722

CLINICAL MASK FOR BREATHING AND REBREATHING MIXTURES OF GASES

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Application July 14, 1947, Serial No. 760,892

4 Claims. (Cl. 128—202)

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Our invention relates to clinical masks for breathing and rebreathing mixtures of gases and has for its object to provide a body portion forming, when worn, a breathing chamber with means for adjustably attaching the said body portion to position it over the breathing openings, so that the device may quickly be applied comfortably to wearers having different sizes and forms of head and face, said breathing chamber having connection with a depending tube to the end of which is applied a rebreathing bag. The said tube has turret members opening into the tube and to outside atmosphere and has chambers formed within the turret in which are positioned sponge rubber discs.

Our invention applies to masks of the nasal type in which the mask body forms a breathing chamber about the nasal openings only, and to masks of the oronasal type in which the mask body forms a breathing chamber about the nasal and mouth breathing openings; and the invention applies, in substance, to both nasal and oronasal mask structures.

In this type of mask, oxygen is delivered to the breathing stream in advance of the gas coming from a rebreathing bag, the purpose being that the wearer gets oxygen enriched gas first and then the rebreathed gas from the rebreathing bag. The former practice has been to apply some form of restrictive exhalation means directly to the breathing chamber, which has not been sufficiently responsive to the breathing action in filling the rebreathing bag.

We have discovered that if the exhalation restrictor, in the form of sponge rubber discs, is placed in parallel relation at each side of a depending tube leading to the rebreathing bag and below the connection of that tube with the breathing chamber, much greater efficiency in the transfer of gases to the lungs on inspiration and from the lungs on expiration is accomplished. Furthermore, this construction greatly simplifies means of securing in proper position the mask body forming the breathing chamber to the face of the wearer.

Growing out of this simplification we have discovered a means securing the mask body to form a breathing chamber over the nasal openings or over the mouth and nasal openings, which is exceedingly simple and yet adapts itself by automatic attachment to any size or shape of head and face. This is accomplished merely by the use of shaped plate members having fixed thereon protruding studs in conjunction with a flexible rubber strap, or a pair thereof, embodying a series

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of spaced openings any of which can be applied to the studs. The straps are free of any permanent attachment and the openings run to both ends of the straps, so the same may be secured by the wearer to effect exactly the appropriate length to hold the mask firmly and yet comfortably.

It is, therefore, an object of our invention to provide a mask structure having a body portion adapted to be positioned over breathing openings of a wearer to form a breathing chamber, and to provide exhalation valve means in the form of chambers, holding sponge rubber discs, which are entirely disconnected from the body portion of the mask.

It is a further object of our invention to have a tubular member depending from the mask body and having gas connection with the breathing chamber, and to form in said tube a pair of turret-like chambers, having openings into the tube at one side and to atmosphere at the other side, and to arrange in each of said chambers a sponge rubber disc to act as a restrictive exhalation valve.

It is a further object of our invention to provide a rebreathing bag secured to the end of the depending tube and to position the sponge rubber exhalation valves between the rebreathing bag and the mask body.

It is a further object of our invention to have an oxygen supply tube enter the depending tube between the rebreathing bag at its end and the sponge rubber valve discs opening into its sides.

It is a further object of our invention to provide plate means permanently secured directly to the outside of the body portion of the mask structure, said plate means embodying one pair or a plurality of pairs of studs permanently secured to the plate means; and to use in connection with said studs an elongated flexible rubber strap with equally spaced holes along the length of said strap such that the strap, or straps if more than one is employed, can be fastened through the holes in the strap towards an end thereof and then be passed around the head or neck of the wearer and secured toward its other end to the body of the mask to form and hold a breathing chamber over the breathing openings so the mask will be held firmly and comfortably upon the wearer.

The full objects and advantages of our invention will appear in the detailed description given in the appended specification, and the novel features of our invention will be particularly pointed out in the claims.

In the drawings illustrating the application of our invention in one of its forms:

Fig. 1 is a plan view of our mask structure as applied to what is known as a nasal mask.

Fig. 2 illustrates in separate detail plan the plate means adapted to be attached directly to the body member.

Fig. 3 is a sectional view on lines 3—3 of Fig. 1.

Fig. 4 is a sectional view taken on line 4—4 of Fig. 1.

Fig. 5 is an exterior side view taken on line 5—5 of Fig. 1.

Fig. 6 is a full plan view of our invention as applied to what is known as an oronasal mask structure.

Fig. 7 is a sectional view taken on line 7—7 of Fig. 6.

Fig. 8 is a detail view of the plate means employed in the construction of Fig. 6.

Fig. 9 is a sectional view taken on line 9—9 of Fig. 6.

Fig. 10 is an outside fragmentary detail view taken from line 10—10 of Fig. 6.

As shown in Figs. 1 and 6, the mask comprises a body portion 10 and 11. Fig. 1 shows a nasal mask, Fig. 6 an oronasal mask.

In the form of Fig. 1 the body portion 10 is extended into tubular parts 12 and 13 joining at 14, from which depends tubular member 15. The parts 12 and 13 convey gases of exhalation and inhalation to and from the hollow tubular member 15.

This member has secured to its bottom a rebreathing bag 16 of standard construction. Entering the tubular member 15 at 17 is a tube 18 which is connected to a source of oxygen under pressure, not shown, and which delivers to tube 15 adjacent the upper end of rebreathing bag 16 a continuous stream of oxygen.

As best shown in Figs. 1 and 3, and equally the same in Figs. 6 and 7, the tube 15 is formed with a pair of openings 19 and 20 through its sides. These openings connect the passageway 21 through tube 15 with chambers 22 and 23 formed in turret-like members 24 and 25.

The chambers 22 and 23 open to atmosphere through enlarged openings 26 and 27. Fig. 3. Chambers 22 and 23 are cylindrical. Within chamber 22 and between openings 19 and 26 is positioned a sponge rubber disc 28, and within chamber 23 and positioned between openings 20 and 27 is a sponge rubber disc 29.

As all of the last named parts, beginning with part 14, are identically the same in Fig. 6 as in Fig. 1, the same reference numerals have been applied on Figs. 6 and 7, and the description for Fig. 1 applies to Fig. 6.

The breathing chamber 30 is formed when the mask is applied to the face of the wearer with the projecting part 31 over the nose. This chamber is formed by a septum 32, Fig. 1, which rests against the lip of the wearer below the nose, and the passageways 33 and 34 through the two tubes 12 and 13 open into the chamber 30 for conveying inhalation and exhalation gases to and from said chamber.

The gas driven out by the lungs passes through passageways 33 and 34 and through the tube 15 into the rebreathing bag 16 until that is sufficiently filled, when considerable pressure will build up to cause part of the exhalation gas to pass through the exposed parts 28 and 29 of valve sponge rubber discs 24 and 25 and to exhaust to atmosphere through openings 26 and 27.

Upon inhalation, oxygen from tube 18 and the contents of the rebreathing bag will be carried to the lungs, and in the event that there is deep breathing such as to produce any considerable negative pressure in the tube passageway 21, air may pass through the sponge rubber discs 24 and 25 along with the stream of oxygen.

The construction above outlined positions the valve restrictions at a point entirely removed from the body of the mask even when the tubes 12 and 13 are considered as part of the body of the mask. This has an important advantage in the provision of our means of attaching the mask to a wearer.

This attachment comprises plate means, preferably, in the form of Fig. 1, consisting of two plate members 35 and 36 of the form shown in detail in Fig. 2. These members are riveted at 37 and 38 of each member, as shown in Fig. 2, directly to the upper wall of the body portion 10.

Each of the members 35 and 36 carries a pair of studs positioned in alignment with the respective adjacent edges 39 and 40 of the plates 35 and 36. The studs are designated as 41 and 42 on plate portion 35 and 43 and 44 on plate portion 36. This produces pairs of studs in transverse alignment, one pair being studs 41 and 43, and the other pair being studs 42 and 44, as shown in Fig. 1.

A flexible elastic rubber strap 45 is provided with a multiplicity of holes 46. Although these holes are considerably smaller in diameter than the studs 41 and 43, the stretching characteristics of the material of strap 45 enables the studs to be thrust through any of the holes 46. Doing this is aided by rounding of the outer ends of the studs, as shown in Fig. 4.

It follows that the strap 45 may have the studs 41 and 43 thrust through any pair of holes 46 in strap 45. This is done initially toward the end 47 of the strap 45. The strap can then be carried back of the neck or over the head of the wearer and the studs 41 and 43 be pushed through other holes 46 toward the end 48 of the strap 45. Obviously a second strap similar to the strap 45 shown can be similarly applied to studs 43 and 45.

The construction of Figs. 6 to 10 inclusive, as heretofore stated, is identically the same as to tube 15 and parts connected therewith. The body portion 10 of this mask construction extends in a continuous sheet over the top of the mask from the outer limits of what may be referred to as tube portions 49 and 50. These embody passageways 51 and 52, as indicated by broken-away portion at the points so designated. These passageways discharge into the breathing chamber 53, as indicated at 54 of Fig. 6, through broken-away portion in body 11.

This construction covers what is generally known as an oronasal mask in which the nasal openings and the mouth openings come within the breathing chamber either by reason of a chin-contacting portion across the chin below the lower lip or a chin contacting portion which comes under the chin of the wearer.

The plate means of this form of our invention comprises a simple plate member 55 indicated both in Fig. 1 and in plan detail in Fig. 8. This plate member is secured by rivets 56 and 57 near its top and 58 and 59 near its bottom. For lightness and some flexibility, the plate is cut away as indicated at 60 of Figs. 1 and 8.

This form of plate comprises upwardly extending fingers 61 and 62 which extend along the nose-receiving part of the mask and tend to hold it

in nose-contacting relation. There are other fingers 63 and 64 at the center of the plate 55, and fingers 65 and 66 extending downwardly which give a measure of lateral support to the tubes 49 and 50 forming the passageway 51 and 52.

Lower studs 67 and 68 and upper studs 69 and 70 are fixedly secured to plate 55 and extend outwardly therefrom. These studs are positioned laterally in pairs along plate 55 above and below the opening 60.

A flexible elastic rubber strap 71 identical in its characteristics with strap 45 is provided with equally spaced circular openings 72. This strap is shown connected through said openings to studs 67 and 68 toward its end 73.

After initial attachment to the studs 67 and 68, strap 71 will be preferably carried around the back of the neck, and will be secured to studs 67 and 68 by pushing them through two additional openings 72 toward the end 74 of strap 71. The particular openings 72 will be selected to firmly yet comfortably hold the mask. A second strap identical with strap 71 will be similarly attached to studs 69 and 70, and preferably will be carried over the top of the head.

This arrangement makes it possible to secure these straps to the mask structure in a perfectly adjusted position for any form or size of head and neck of the wearer.

The advantages of our invention have been quite fully pointed out heretofore in description thereof. These advantages are cumulative and result from the combined effect of positioning the exhalation valves entirely apart from the body of the mask anad thereby enabling simple and efficient securing means to be applied to the body of the mask.

Not only do the above advantages flow from the combined result attained, but the positioning of the flow valves on the main breathing tube and away from the body of the mask and without direct connection with the breathing chamber produces better movement of the exhalation gases to and from the rebreathing bag and balances discharge of exhalation gases through the restricting sponge rubber valves.

The simple means for securing the mask to the face of the wearer also is not only very advantageous, but is practical, inexpensive and results in the mask being comfortably positioned on the face of the wearer whatever his characteristics of head and neck size and shape may be.

We claim:

1. A mask structure embodying a body portion adapted to be positioned over breathing openings of a wearer and when so positioned forming a breathing chamber, a depending tube having gas passageway connection with said breathing chamber, a rebreathing bag depending from and having gas connection with the tube, a pair of openings formed in the tube at opposite sides thereof positioned between the connection of the tube with the breathing chamber and the rebreathing bag, turret members forming chambers connected with the respective openings and having openings to atmosphere therefrom, and a sponge rubber disc in each of said turret member chambers.

2. A mask structure embodying a body portion adapted to be positioned over breathing openings of a wearer and when so positioned forming a breathing chamber, a depending tube having gas passageway connection with said breathing chamber, a rebreathing bag depending from and having gas connection with the tube, an oxygen delivery tube connected with said depending tube close to the rebreathing bag, a pair of openings formed in the depending tube at opposite sides thereof positioned between the connection of the depending tube with the breathing chamber and the point of entry of the oxygen tube into the depending tube, turret members forming chambers connected with the respective openings and having openings to atmosphere therefrom, and a sponge rubber disc in each of said turret member chambers.

3. In a mask structure having a body portion adapted to be positioned over breathing openings of a wearer and when so positioned forming a breathing chamber and having a depending tube with gas passageway connection with said breathing chamber and with a rebreathing bag, said tube having valve means entirely disconnected from said body portion to permit escape of exhalation gases, means for securing the body portion about the breathing openings of the wearer to form a breathing chamber, comprising plate means permanently secured to said body portion, said plate means embodying a set of studs protruding outwardly therefrom, and a flexible elastic strap formed with a multiplicity of equally spaced openings, said strap being adapted to be connected to the studs toward one end and after the strap has been passed around the head of the wearer to be connected to the studs toward the other end to hold the mask body in position over the breathing openings of the wearer with firmness and comfort to the wearer.

4. In a mask structure having a body portion adapted to be positioned over breathing openings of a wearer and when so positioned forming a breathing chamber and having a depending tube with gas passageway connection with said breathing chamber and with rebreathing bag, said tube having valve means disconnected from said body portion to permit escape of exhalation gases, means for securing the body portion about the breathing openings of the wearer to form a breathing chamber comprising plate means permanently secured to said body portion, said plate means embodying two sets of studs protruding outwardly therefrom and a pair of flexible elastic straps each formed with a multiplicity of equally spaced openings, one of said straps being adapted to be connected to one pair of the studs toward one end of the strap and after the strap has been passed around the head of the wearer to be connected to the same pair of studs toward the other end of the strap and the other of said straps being adapted to be connected to the other pair of studs toward one end of the strap and after the second strap has been passed around the head of the wearer to be connected to the second pair of studs toward the other end of the strap, said pair of straps holding the mask body in position over the breathing openings of the wearer with firmness and comfort to the wearer.

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No references cited.