

Oct. 28, 1941.

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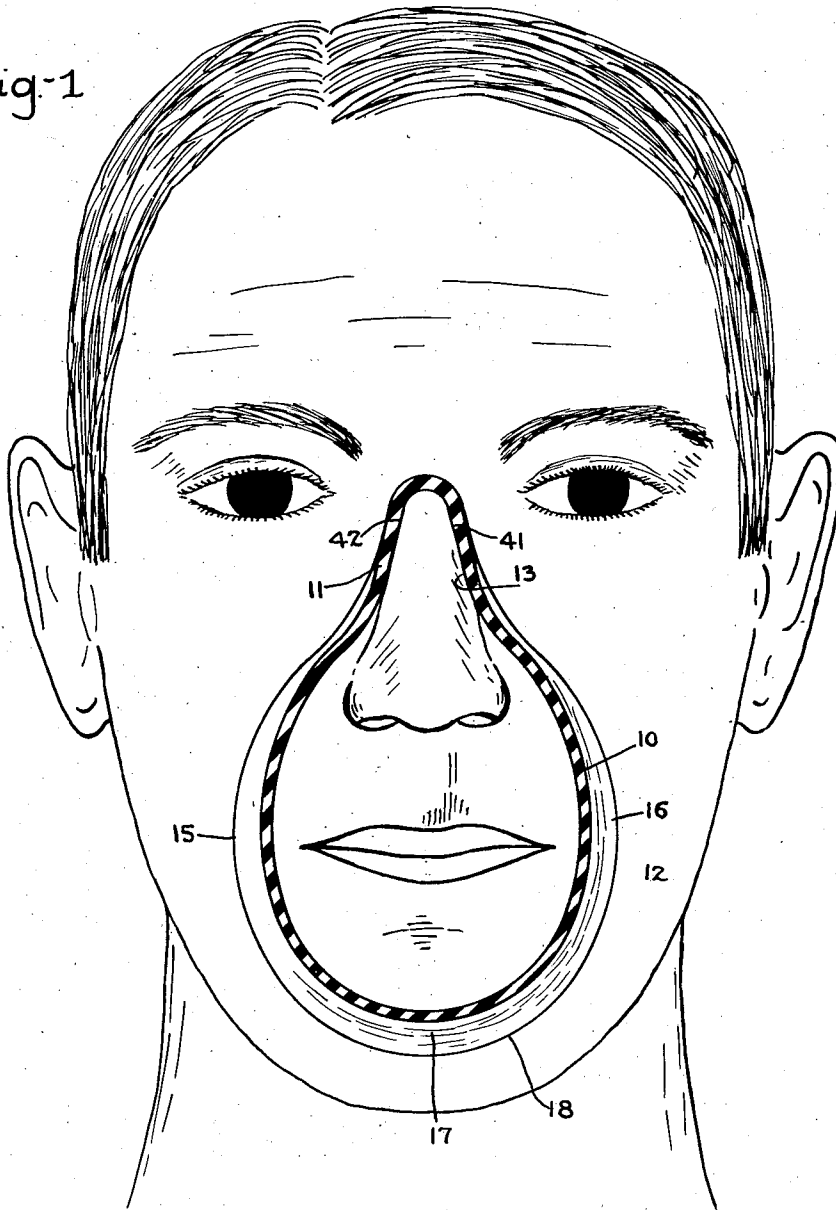
2,260,701

ORONASAL MASK

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3 Sheets-Sheet 1

Fig-1



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3 Sheets-Sheet 2

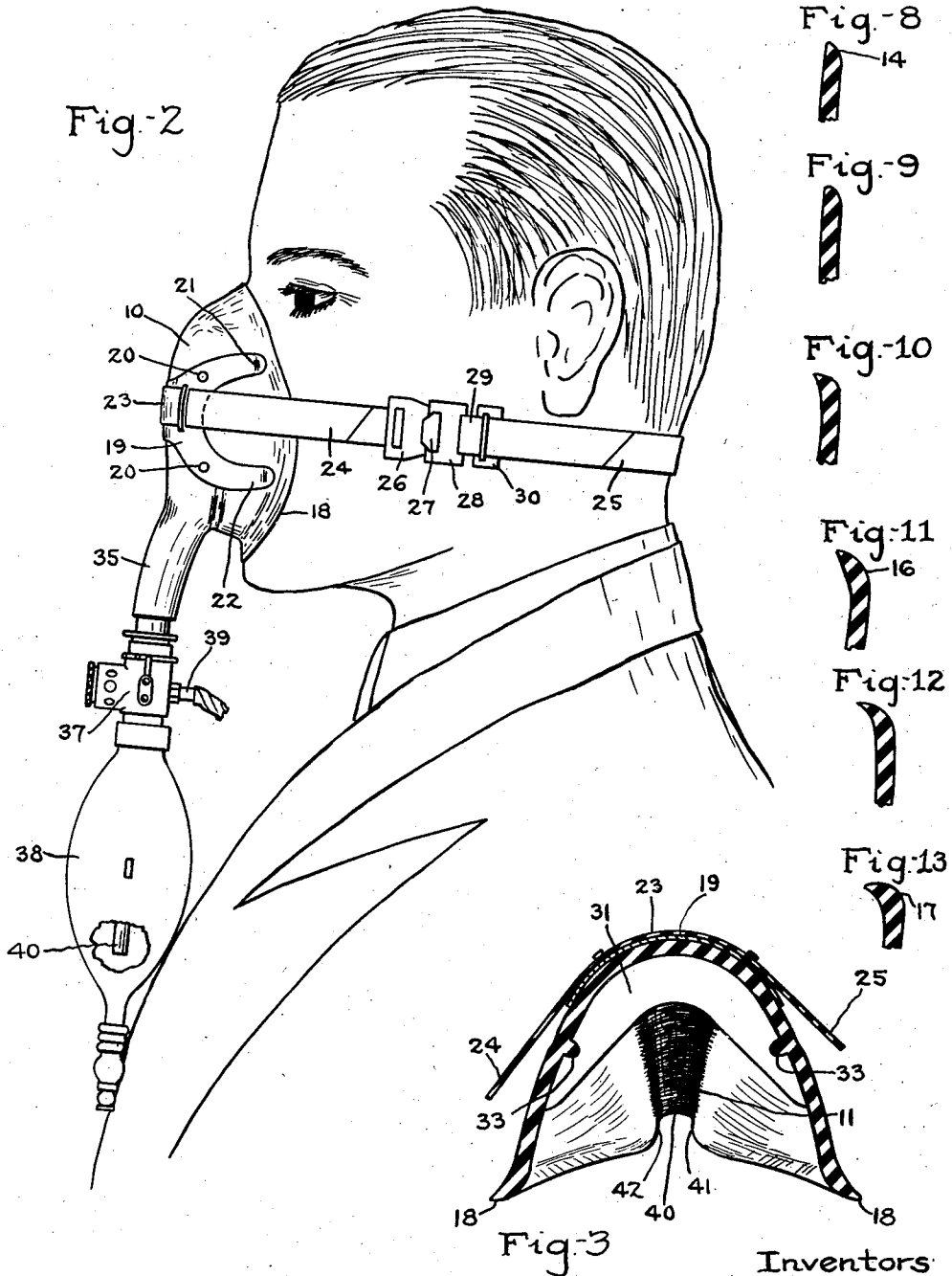


Fig-8



Fig-9



Fig-10



Fig-11



Fig-12



Fig-13

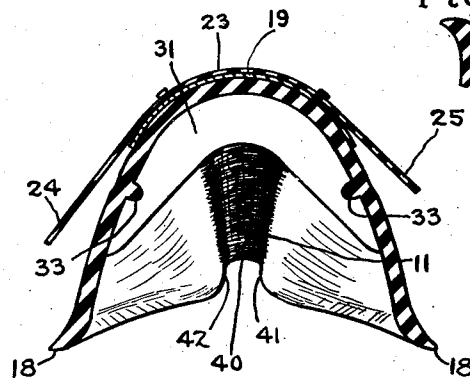


Fig-3

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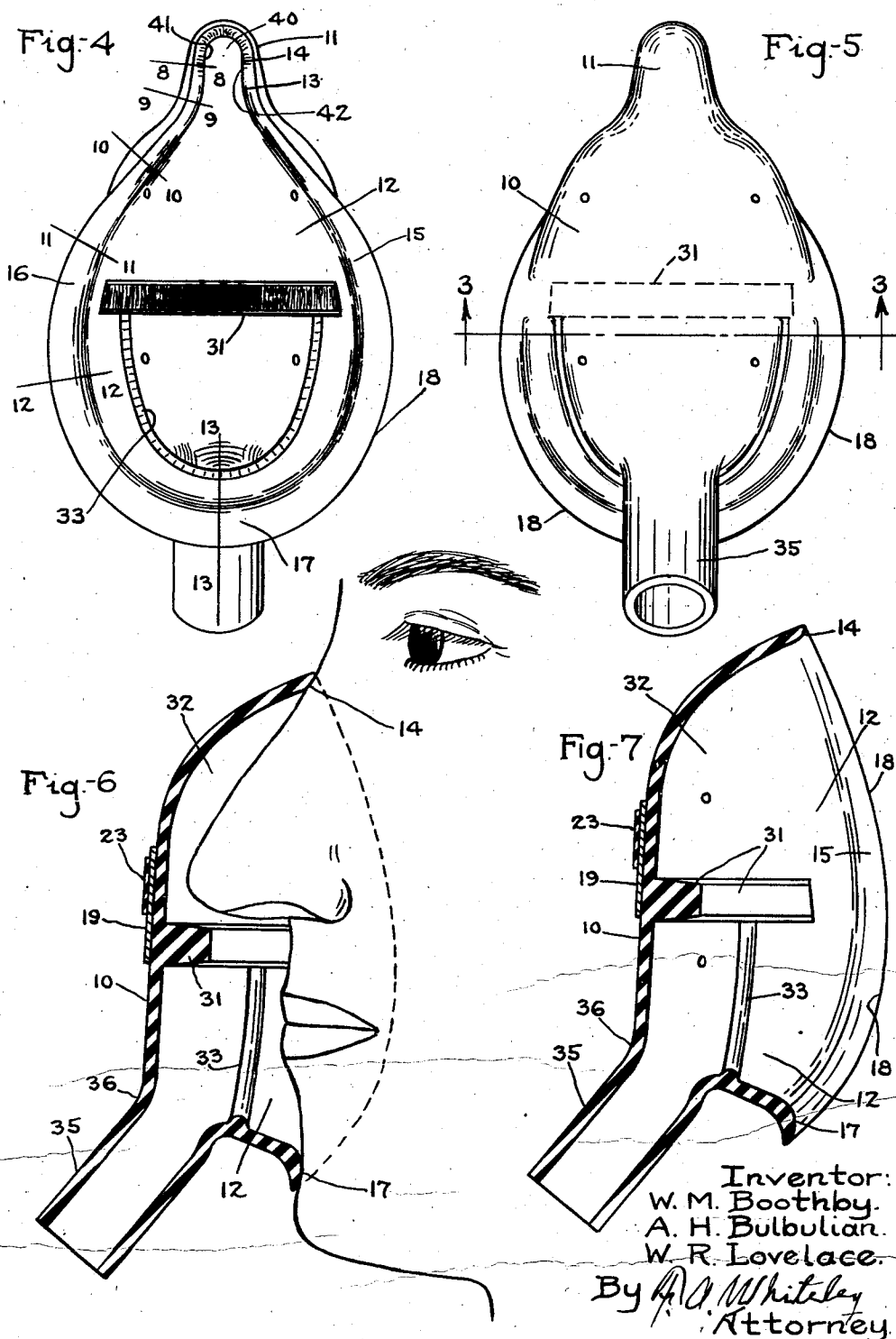
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UNITED STATES PATENT OFFICE

2,260,701

ORONASAL MASK

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2 Claims. (Cl. 128—202)

Our invention relates to oronasal masks for use in connection with and as a part of means for providing mixtures of gases delivered to the interior chamber of the mask, and which will permit normal breathing of such mixtures. The particular mixtures of gases contemplated may be for example, 100 per cent oxygen mixed with the first and most oxygen-enriched portions of gases of exhalation, or oxygen may be mixed with desired proportions of air, from none at all, where 100 per cent oxygen is being employed, to the minimum percentages of oxygen, to be breathed through our oronasal mask, which is adapted to be held positioned upon the face of a wearer in such manner as to be comfortable, non-irritating and to permit normal breathing.

Our oronasal mask will be employed in the combinations and for the purposes, as to permitting breathing of 100 per cent oxygen or any percentage of oxygen mixed with air, set forth in our copending application, Serial No. 287,086, filed at the same time as this application. So this application will be limited to covering the features of the oronasal mask per se, which obviously can be used in the inhalation apparatus combinations of the aforesaid application in the same manner, so far as securing oxygen mixtures in any desired percentages up to 100 per cent, as in the nasal mask therein specifically disclosed and claimed with its associated oxygen-regulating means.

This application is a continuation in part of our application, Serial No. 227,588, filed August 30, 1938, in which we disclose both a nasal mask and an oronasal mask, the nasal mask as above stated, being specifically covered in the aforesaid pending application. The oronasal mask herein presented is adapted to serve the same purposes as the nasal mask in those cases where mouth breathers are involved and it is necessary to provide means for supplying to the mouth the mixtures of gases to be breathed.

The conditions to be met are such as are involved in breathing in a rarified atmosphere, such for example as in transport and aviation at high altitudes, and in oxygen therapy. In the former situations ordinarily oxygen is mixed with air being breathed in varying proportions according to the altitude and the consequent attenuation of the atmosphere. In oxygen therapy there are numerous well recognized pathological conditions which are aided by the addition of oxygen to air being breathed and the consequent enrichment of the gases breathed by a proportion of oxygen greater than that in air. It is

also well known that pure oxygen, or 100 per cent added oxygen, may be breathed over extended periods of time and produce valuable remedial effects in numerous pathological conditions, so that a provision of inhalation apparatus which will be economical in the use of oxygen and which at the same time permits the administration of 100 per cent oxygen will open up a whole new field of oxygen therapy of great value for the alleviation of certain pathological conditions, such as migraine headaches, disturbances of the system after too much alcohol, surgical and traumatic shock, gas gangrene, and many other conditions inimical to comfort and health.

For use in all of these types of cases, where individuals are natural mouth breathers or where for any cause the patient's condition is such that he may find it necessary to breathe through the mouth, an oronasal mask is required, that is, a mask which is adapted to inclose both the nose and the mouth. It is, therefore, an object of our invention to provide such a mask which shall be capable of being worn in any normal erect, sitting or recumbent position of the wearer and which is held in position with a gentle pressure by means of an elastic band naturally positioned to come across the nape of the neck.

It is a further important object of our invention to provide such an oronasal mask adapted to be held upon the face of a wearer and inclosing both the nose and the mouth, to which is supplied any desired mixture of gases, as of oxygen and air, or where indicated 100 per cent oxygen mixed with exhalation gases, such that an individual can wear the oronasal mask and breathe while wearing it without conscious discomfort or irritation and with substantially the same degree of ease and naturalness as he could, without any appliance, from the open air.

It is a further object of our invention to construct an oronasal mask which, in one size, shall be adapted to fit the face of any normal male person, and in another size shall be adapted to fit the face of any normal female person, it being understood that these sizes are for adults and that smaller sizes may be required for children. In carrying out this object, we have made extensive experimentation, from which we have discovered that the differences in human faces, male and female, by which they are generally distinguished, are largely due to the tissues and soft parts over the bony structure, and that in general the bony structures of the faces of adult males, and of adult females in a differing de-

gree, bear a close resemblance, particularly in respect to shape and relative arrangement.

We have therefore, in carrying out this object, made the margins of our oronasal mask, which are adapted to engage the soft parts of the face about the nose and mouth and across the chin, conform to the bony structure beneath said margins. The result is that, in a single size oronasal mask for men and a similar single size oronasal mask for women, the aforesaid margins are adapted to so fit the face of the wearer in relation to the soft parts slightly pressed over the bony structure beneath as to be comfortable at all times and not to produce unsatisfactory strains which, when long continued, would cause discomfort.

Pure oxygen comes compressed in storage tanks, and for its delivery to breathers well known pressure reducing means operating in conjunction with flow valves for indicating the volume being delivered provide indicated volumes of oxygen for the breather, whether it be 100 per cent oxygen mixed with exhalation gases, or any desired percentage of oxygen mixed with such gases and with air. For these purposes we have discovered that if the oxygen is delivered to a reservoir-rebreathing bag to which may be added through the action of breathing the first and most oxygen-enriched parts of the exhaled gases and air in desired amounts, advantageous results will be obtained.

For accomplishing the waste of the later part of the exhaled gases, which contain the larger proportions of carbon dioxide, we have employed as a reservoir-rebreathing bag one in which its volumetric capacity as a reservoir is less than the volume of a normal exhalation, in conjunction with spring-held valve mechanism which will open after the reservoir-rebreathing bag is fully distended by the first parts of the exhalation, permitting waste to atmosphere of the last parts of such exhalation. It is of added advantage to have the reservoir-rebreathing bag held close to the patient's mouth. It is a further object of our invention, therefore, to provide in conjunction with an oronasal mask covering the nose and mouth of the wearer, a central inlet-outlet passageway or tube, to which is connected certain regulating valve mechanism and a supported reservoir-rebreathing bag together with introduction of the conduit leading to the oxygen supply directly into the reservoir-rebreathing bag, said conduit being extended preferably to a point at or near the bottom thereof.

The organization of elements by which these several objects are met and the desired advantages are obtained, and the detailed parts which cooperate to produce these advantages are hereinafter described in the specification and the novel features are particularly pointed out in the claims.

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

Fig. 1 is a front view of a normal face, male, showing the position of the oronasal mask thereon with parts in section to illustrate the manner in which the breathing chamber incloses the nose and mouth of the wearer.

Fig. 2 is a side elevation view on a reduced scale of the apparatus as the same is worn.

Fig. 3 is a sectional view on line 3-3 of Fig. 5 viewed in the direction of the arrows.

Fig. 4 is a front plan view of the oronasal mask.

Fig. 5 is an outside plan view with the fasten-

ing and finger plate removed and with some parts shown in dotted lines.

Fig. 6 is a central longitudinal sectional view showing a face in position within the oronasal mask.

Fig. 7 is a view similar to Fig. 6 with the face eliminated.

Figs. 8, 9, 10, 11, 12 and 13 are fragmentary transverse sectional views taken on lines 8, 9, 10, 11, 12 and 13, in Fig. 4. These figures show progressively the relation of the contacting beveled marginal faces of the mask to the body portion.

As shown, our mask comprises a body portion 10 which has an extension 11 adapted to pass around the bridge of the nose and inclose and grip it. The chamber 12 within the member 10 is thus formed with a nose receiving projection portion 13, clearly shown in Figs. 1 and 14. The chamber 12 is open in the front and is provided with a wide, beveled or beveled margin which, as indicated at 14, Figs. 4, 6, and 7, is narrowest toward the top of the nose and which gradually widens through said portions 15 and 16 to a maximum bottom portion 17. The edge 18 of this margin has a conformation shown in Figs. 1, 4 and 5 in plan, and in Figs. 2, 6 and 7 in elevation and also partially shown in Fig. 3. The progressive variation of the angle of these beveled faces to the body 10 of the mask is shown in Figs. 9 to 13 inclusive. It is this conformation and this progressive variation of relation which has been conformed with the bony structure beneath the soft parts of the face. When, therefore, the mask by its contacting portions 14, 15, 16 and 17 is brought into engagement with the soft parts of the face, it will adapt itself to these soft parts with a very little pressure from the securing means hereinafter to be described and will produce no unpleasant pressure strains against the bony structure so that the mask can be worn for long periods of time without discomfort or compression aches or disturbances.

The body of the mask 10 has secured thereto a composite plate structure 19 of which one side is clearly shown in Fig. 2. This plate structure may be secured to the body 10 of the mask by means of rivets 20 or other suitable securing means. The plate is provided on each side of the mask with spring fingers 21 and 22 which are adapted, when the mask is worn, to cause the contacting surfaces 14, 15, 16 and 17 to be pressed gently inwardly to insure perfect seating against the side portions of the face and over the front of the cheek bone. The member 19 also provides means for securing to the mask an elastic band 23 which, as clearly shown in Fig. 2, has a short end 24 and a long end 25 adapted to be passed around the head of the wearer so as to fit into the hollow at the nape of the neck. The securing member 26 on the short end of the tape is provided with a hook 27 with which an eye-piece 28 is adapted to connect. The eye-piece 28 is on a loop 29 of band end 25 which loop is held by means of a clip 30. The clip 30 permits adjustment of the length of member 25 to adapt itself to different wearers. In this manner the mask is held directly pressed against the face of the wearer with a gentle pressure whereby the engaging faces 14, 15, 16 and 17 conforming with the shape of the bony structure beneath the soft parts are held substantially permanently in engagement with the said soft parts

in a manner which is comfortable and satisfactory when the device is worn.

A strong reinforcing rib 31 is formed on the inside of the mask body 10 below an upper chamber 32, Figs. 6 and 7, which receives the wearer's nose when the mask is worn. A U-shaped rib 33 extends from the rib 31 on the inside of the mask, as clearly shown in Figs. 4 and 7. This rib structure has two functions; first, it provides support for the elastic band 23 when the same is fastened about the head of the wearer so that the pressure exerted by the band will have no tendency to collapse to any degree the mask proper. The second function of the rib structure is to aid in the support of members attached to the outlet tube 35. This inlet-outlet tube, as shown in Figs. 6 and 7, extends at a broad angle indicated at 36 away from the normal plane of the mask on the face. Attached to the mask is a connecting and regulator member 37 to which is connected a reservoir-rebreathing bag 38 supplied with oxygen in a described manner from a supply tube 39. The curve of the inlet-outlet tube 35 in reference to the body of the mask 10 is such that when the members 37 and 38 are attached to the inlet-outlet tube, as the same is worn in the erect position, the tube will be slightly bent, as indicated in Fig. 2, putting pressure on the contacting surfaces 17 of the mask against the chin of the wearer which acts as a fulcrum with respect to the securing band 23 whereby the surfaces 17 are effectively seated upon the fronts and sides of the chin.

An important feature of our invention is the provision of the extension 11 on the mask which, as best shown in Figs. 3 and 4, provides a nose-receiving chamber 40 whose side walls 41 and 42 are adapted to engage over the bony structure of the sides of the nose and grip the same with a sealing action while the lip portions about this chamber are seated against the cheeks adjacent the bony structure of the nose, thus effecting a natural and complete seal at the hollows of the bony structure below and in front of the eyes.

As set forth in the statement of invention, the reservoir of the reservoir-rebreathing bag 38 will have a volumetric capacity less than the volume of a normal exhalation which, taken in connection with valve structure on connecting and regulating part 37, causes the last parts of exhalations most heavily charged with carbon dioxide, to go to atmosphere. And to make sure that no part of the oxygen is wasted the oxygen delivering tube 39 is extended within the reservoir-rebreathing bag 38 to a point near its bottom, as indicated at 40, Fig. 2.

The advantages of our invention have been quite fully pointed out in the foregoing description of its details and cooperating parts. The fundamental and essential advantage is that a mask is provided covering the face and mouth of the wearer which has contacting portions so shaped and developed with reference to the bony structure of the face beneath the soft parts of the face, that the mask, when worn, will not only seal itself against the soft parts of the face to shut out inlet or egress of air to and from the mask chambers, but will be worn with such a degree of comfort that free breathing with substantially no more restriction or effort than in the open air is provided. And further, this is accomplished in respect to a mask which has attached thereto valve mechanism, a collapsible

reservoir-rebreathing bag and an oxygen-delivering tube, all of considerable weight, and this attachment is borne from the mask without any annoyance to our consciousness of its weight on the part of the wearer.

The above advantages are useful and valuable where oxygen is to be added to the breathing mixture with normally well persons in rarified atmosphere at high elevations in those cases in which the individuals are natural mouth breathers. These advantages, however, have particular force and value in connection with patients suffering from any type of disease such as pneumonia, wherein it is essential to have the patients breathe 100 per cent oxygen or oxygen added to air (or if the particular conditions require it, additions of other gases).

Heretofore the provision of an increased oxygen supply which, in so called oxygen therapy, is generally recognized as a valuable aid in combatting disease and aiding recovery of patients seriously depressed by pathological conditions, has been by putting the patients into what is known as an oxygen tent. This is a structure which surrounds the upper part of the body of the patient as he lies upon a bed, within which it is attempted to supply the patient with air suitably enriched with added oxygen and wherein it is attempted to eliminate undesirable accumulations of carbon dioxide. One serious difficulty with oxygen therapy involving the oxygen tent is that the structure itself is costly, its operation wasteful of oxygen and expensive, and for these reasons, it is available usually only in the larger hospitals and in the larger cities and is not available to the vast number of sufferers in smaller towns and country districts.

We have discovered that our oronasal mask, in conjunction with suitable means for supplying oxygen to a reservoir-rebreathing bag of suitable volumetric capacity supported thereby, can effectively be used as a substitute for an oxygen tent, and can be available for physicians in smaller communities and in the country where very large numbers of patients have to be cared for in their own homes. Furthermore, our oronasal mask and its associated parts is admirably adapted for use with natural mouth breathers in administering 100 per cent oxygen for alleviation of numerous pathological conditions as set forth in the statement of invention hereto.

We claim:

1. An oronasal mask comprising a body of semi-rigid material forming an open-sided chamber adapted to receive the nose and mouth of a wearer, the marginal parts of said chamber embodying outwardly extended side portions shaped and positioned for contacting the cheeks and a bottom portion shaped and positioned for contacting the chin when worn, a stiffening member extending transversely inwardly into the chamber below the nose-receiving portion and above the mouth portion of the chamber, a tube extending at an angle outwardly and downwardly from the bottom of the body and opening into the lower part of said chamber, and a rebreathing bag and oxygen supply tube entering said bag which are connected with and supported by said first-named tube and the mask body close to said body.

2. An oronasal mask comprising a body of semi-rigid material forming an open-sided chamber adapted to receive the nose and mouth

of a wearer, the marginal parts of said chamber embodying outwardly extended side portions shaped and positioned for contacting the face and chin when worn, a tube extending at an angle outwardly and downwardly from the center of the bottom of the body above the chin-contacting portion of the body and opening into the lower part of said chamber, and a rebreathing bag and oxygen supply tube entering said

bag at its top which are connected with and supported by said first-named tube and the mask body close to said body, said rebreathing bag having a volumetric capacity less than the 5 volume of a normal exhalation.

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