

Jan. 9, 1945.

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2,366,904

OXYGEN TENT

Filed May 16, 1942

3 Sheets-Sheet 1

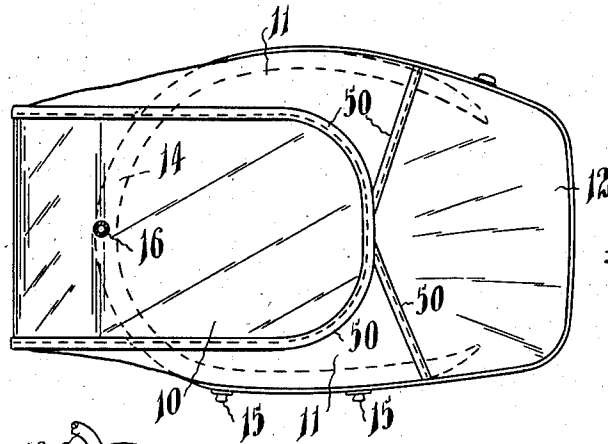


FIG. 1.

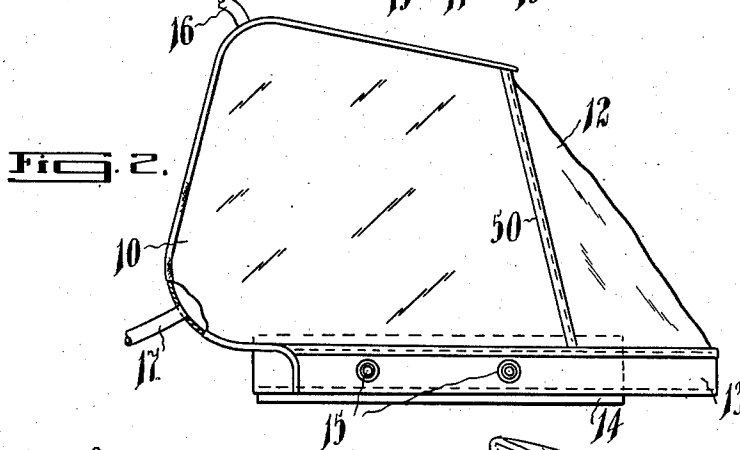


FIG. 2.

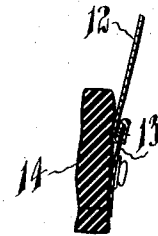


FIG. 4.

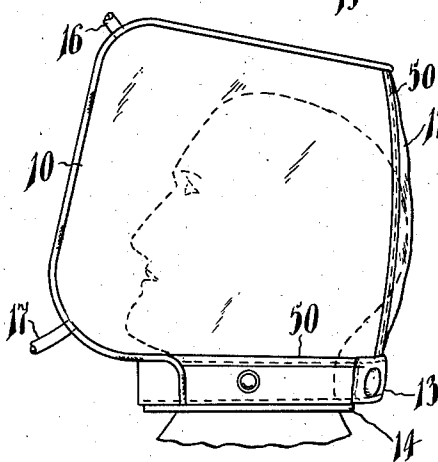


FIG. 3.

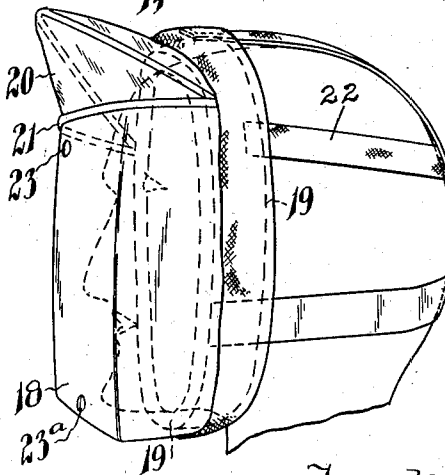


FIG. 5.

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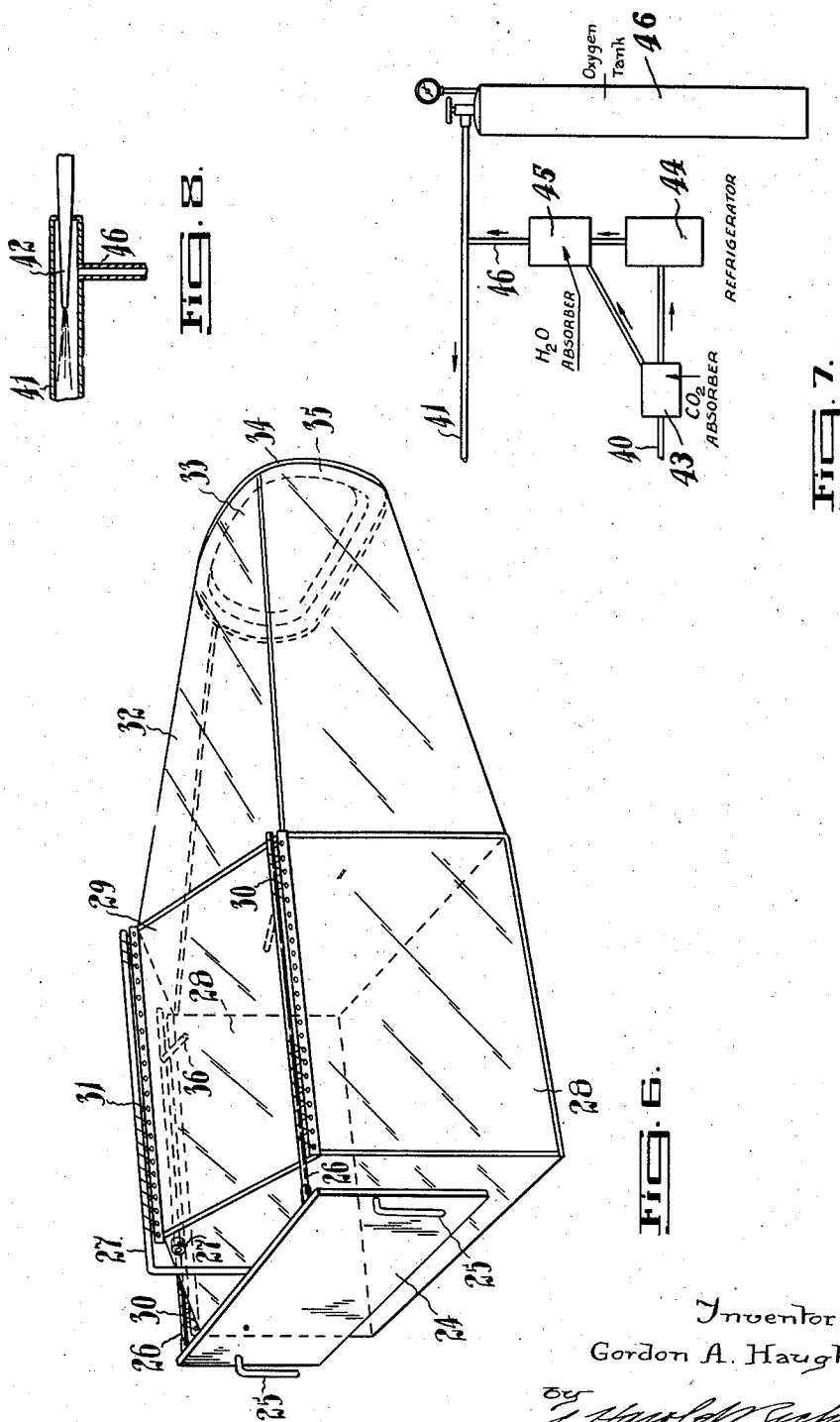
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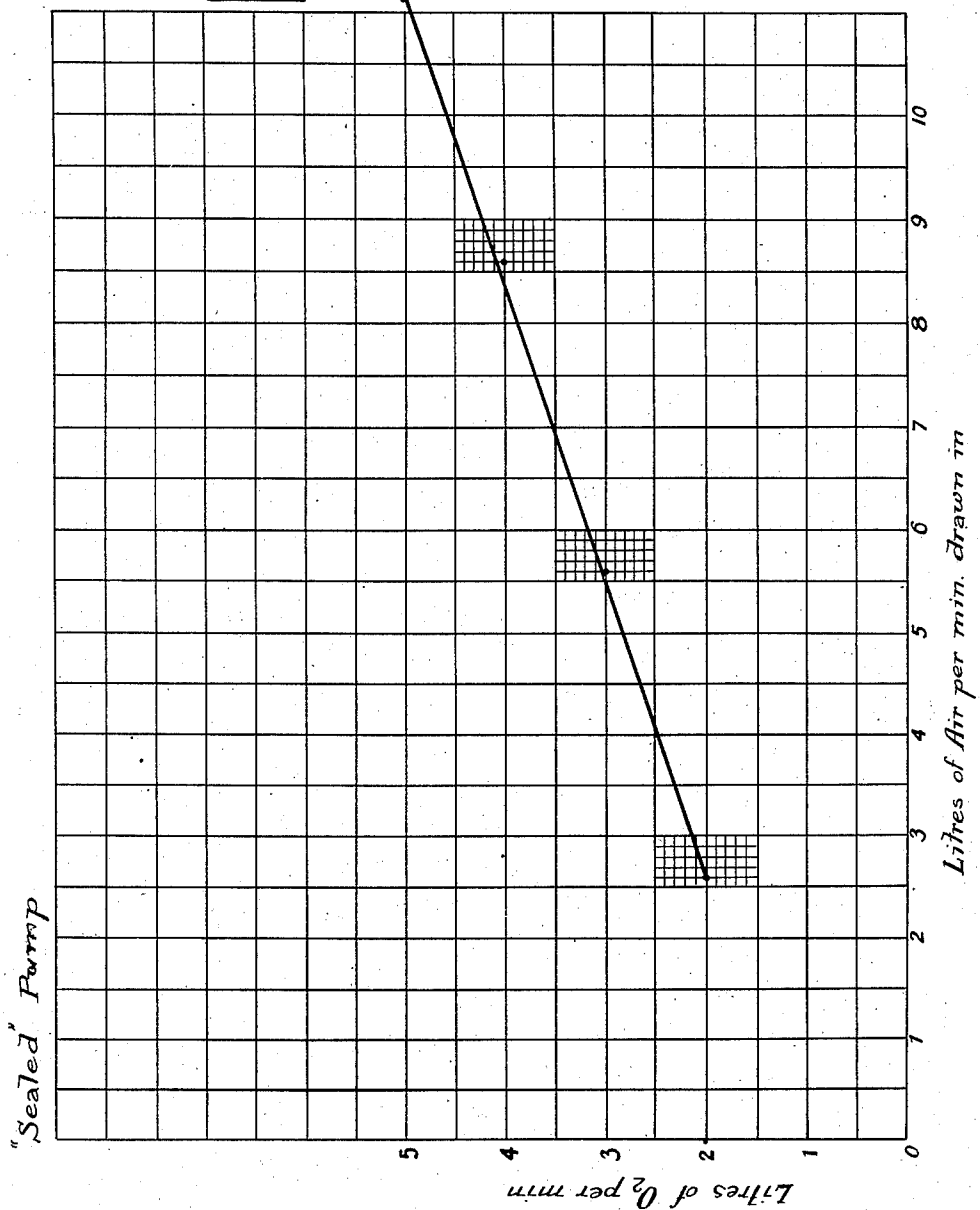
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FIG-8-



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UNITED STATES PATENT OFFICE

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OXYGEN TENT

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Application May 16, 1942, Serial No. 443,196

1 Claim. (Cl. 128-143)

This invention relates to a therapeutic apparatus especially applicable for the treatment of pulmonary diseases and is particularly directed to providing a device in which the constitution of the air admitted to and contained therein can be controlled precisely within predetermined limits, which is light and comfortable for the patient undergoing treatment, which is readily portable, and which can be manufactured inexpensively of readily available materials.

In the treatment of various diseases, particularly pulmonary diseases, devices are in relatively widespread use for maintaining a patient in an atmosphere of air enriched with oxygen, or other elements or compounds. Various types of apparatus for administering this form of therapy are well-known and may be in the form of face masks or nasal inhalers, nose catheters, tents or chambers. The type of apparatus used ordinarily depends upon the equipment which is available, upon the personal preference of the patient, and upon the constitution of the air prescribed for the patient.

One of the principal objects of the present invention is to provide an apparatus for maintaining a patient in an atmosphere, the constitution of which can be predetermined and controlled within very narrow limits.

A further object of the invention is to provide an apparatus which can be brought into air sealing engagement with the head or body of the patient and is of such construction and design that the patient is subjected to a minimum, if any, discomfort.

A further object of the invention is to provide an apparatus which is readily portable, and which is easily manufactured of inexpensive and readily available materials.

A still further object is to provide a method for preparing the air and delivering the pre-treated air to the apparatus, by means of which method the usual mechanical devices for creating forced circulation are eliminated.

An understanding of the objects of the present invention and the manner in which they are attained may be had from the following description and the accompanying drawings, in which:

Figure 1 is a plan view of a helmet embodying the present invention;

Figure 2 is a side elevation of the helmet shown in Figure 1;

Figure 3 is a side elevation of the helmet shown in Figures 1 and 2, being worn by a patient;

Figure 4 is a sectional detail view showing a preferred arrangement of joining the various parts of the helmet;

Figure 5 is a side elevation of a face mask embodying the present invention;

Figure 6 is a tent incorporating the features of the present invention;

Figure 7 is a diagrammatic view of the apparatus used to treat the air;

Figure 8 is a detail view of the injector device by means of which air is drawn from and forced to the therapeutic apparatus; and

Figure 9 is a chart illustrating the volume of air drawn into the circulating system by the arrangement illustrated in Figures 7 and 8.

Like reference numerals refer to like parts throughout the specification and drawings.

The modification of my invention illustrated in Figures 1 through 5 is suitable for use by patients who are not confined to their beds.

In the device illustrated in Figures 1, 2, 3, and 4, the helmet is formed with a face piece 10, side pieces 11, a back piece 12, and a neck band 13.

The face piece 10 is formed of relatively rigid, non-porous, transparent sheeting, such as cellulose or acetate sheets, and extends approximately horizontally, preferably, the full width of the head from the back of the head to well in front of the face, thence downwardly to below the chin, thence inwardly and downwardly to the point at which it is secured to the neck band 13.

The side pieces 11 and back piece 12 are formed of soft, pliant, non-porous material, such as that sold under the trade-mark "Vinylite," and extend loosely from the face piece 10 to the neck band 13, being secured to the face piece and neck band by stitching or cementing as indicated by the numeral 50.

The neck band 13 is formed of relatively strong, relatively pliant material, such as cloth or canvas, and is of a length sufficient to permit the helmet to be brought over the head of the patient. It is provided with fastening devices 15, such as dome fasteners, by means of which the neck band can be adjusted to the neck of the patient.

The device is brought into air-sealing engagement with the neck of the patient by means of a soft rubber band 14, such as sponge rubber, which is secured to the inner surface of the neck band 13, such as by stitching or cementing.

Air is admitted to and withdrawn from the helmet through ducts 16 and 17 respectively, which are connected to the circulating system described in detail hereinafter.

The face mask illustrated in Figure 5 is also a convenient embodiment of my invention and is also suitable for use by a patient who is not confined to a bed. The face mask includes a face piece 18 which extends the full length of the face, from the forehead to the chin, and approximately the full width of the head. The face piece 18 is formed of transparent, relatively rigid sheeting, such as cellulose or acetate sheets, and is shaped to extend outwardly from the face a distance sufficient to be comfortable to the wearer.

A piece of soft, pliant, non-porous material 20,

such as that sold under the trade name "Vinylite," is joined to the top of the face piece along the seam indicated by the numeral 21, and extends loosely to the periphery of the mask where it is joined to the soft rubber band 19.

The face piece and the soft, pliant piece 20 are brought into air-sealing engagement with the head by means of a soft rubber band 19 which is secured, by stitching or cementing, to the inner side of the periphery of the face piece. The band 19 extends completely around the periphery of the face mask.

The mask is secured to the head by the head straps 22 which may be slightly resilient in order to ensure a tight but comfortable fit.

Air is admitted to and withdrawn from the face mask through the ducts 23 and 23a respectively, which are connected to the circulating system.

The modification of my invention illustrated in Figure 6 is particularly suitable for patients who are confined to their beds. The principle upon which this modification is based is the same as that of the preceding modifications in that the device is brought into air-sealing engagement with the patient's body as distinguished from those devices wherein the sides and ends of the device are merely tucked under the bed-clothes. This modification is in the form of an oxygen tent in which the upper part of the body of the patient is enclosed.

The portion of the tent enclosing the patient's head comprises a rigid supporting structure having a panel 24 which extends across the width of the tent and which is securable to the end of a bed by means of the outwardly and downwardly extending hook-like rods 25. A rod 26 extends horizontally forwardly from each end of the panel 24 and a rod 27 extends vertically upwardly, thence forwardly from approximately the middle thereof. The rods 26 and 27 comprise the framework which supports this portion of the oxygen tent, as described in detail hereinafter.

The oxygen tent comprises a supported portion having substantially vertical side walls 28, and an inverted V-shaped roof 29. The upper edges of the side walls 28 are secured to the rods 26 by lacing, as indicated by the numeral 30. The apex of the inverted V-shaped roof 29 is secured to the rod 27 by lacing as indicated by the numeral 31. The main body of the oxygen tent is preferably formed of relatively pliant transparent, non-porous material such as that sold under the trade name "Pliofilm."

The remainder of the tent, indicated by the numeral 32, extends, preferably, below the chest of the patient and is formed of non-porous, soft pliant material, such as that sold under the trade name of "Vinylite." The portion 32 of the tent terminates in the opening 33, the only opening in the tent. The end of the portion 32 is secured to a band 34 which is of sufficient diameter to permit drawing the tent over the body of the patient. A strip of soft rubber 35 is joined to the inner surface of the band 34. When in place, the soft rubber strip 35 is brought into air-sealing engagement with the body of the patient by adjustment of the length of the band 34 and the rubber strip 35 can be adjusted to fit snugly around the body of the patient.

Air is admitted to and withdrawn from the oxygen tent through the ducts 36 and 37 respectively. The ducts 36 and 37 are connected to the circulating system.

A relatively simple circulating system is illus-

trated in Figures 7 and 8. In this system, the use of the usual mechanical circulating devices are eliminated. The air is preferably circulated in closed circuit, to avoid wasteful losses of oxygen, being withdrawn from the therapeutic device through the conduit 40 and passed through a carbon dioxide absorber 43 in which the carbon dioxide content of the air is absorbed. The air leaving the carbon dioxide absorber may be passed to a refrigerator 44 and cooled to a predetermined temperature, and thence passed through a moisture absorber 45 or, alternatively, it may be passed directly from the carbon dioxide absorber to the moisture absorber. The air from the moisture absorber passes into conduit 46 which is connected to conduit 41.

Pure oxygen, from an oxygen cylinder, is fed under pressure into conduit 41 from an injector 42, as illustrated in Figure 8. The oxygen in the oxygen tank is under a relatively high pressure and, consequently, the oxygen is injected into conduit 41 under the same relatively high pressure. The injector 42 is located in conduit 41 in such a position that the oxygen ejected therefrom serves to create a syphon effect in the line behind it and thereby draw the air from conduit 46 into the conduit 41 wherein it comes in contact and is mixed with the oxygen ejected from nozzle 42, and the circulation of the used air from and the treated air to the therapeutic device is established.

The several forms of the therapeutic apparatus described and illustrated herein have been found to possess desirable advantages which are not present in the various devices of the prior art with which I am familiar. In each form of apparatus, the patient can be maintained in a prescribed atmosphere which is controllable within very narrow limits. This is made possible by bringing the apparatus into air-sealing engagement with the head or body of the patient, and uncontrolled leakage of air into or out of the device is prevented. The use of soft, sponge rubber to draw the device into air-sealing engagement with the head or body of the patient serves several purposes. Under normal circumstances, the leakage of air into or out of the device is prevented. However, should the circulating system, for any reason, cease to function, sufficient air can be drawn through the pores of the sponge rubber to satisfy the breathing requirements of the patient.

The use of material having the characteristics of that sold under the trade name "Vinylite," a vinyl resin, is very desirable. The material is, of course, very soft and pliant. It is translucent in that it permits a certain amount of light to pass through it. It is non-porous and it is not uncomfortable to the wearer in that moisture does not appear to collect on the surface and, therefore, it is not clammy to the touch. In addition to these characteristics, the surplus of the material in each modification of the invention serves to equalize the pressure during inhalation and expiration and thereby permit natural breathing without any discomfort.

As pointed out hereinbefore, there is no loss of treated air from the device except, of course, that consumed by the patient. By circulating the air in closed circuit as described and illustrated herein, it serves to minimize the amount of oxygen or other element or compound added to the air in preparing the air for admission to the therapeutic device. It has been found that it is only necessary to add to the air only that amount of the element or compound consumed by the

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patient, there being no other loss. In addition, of course, a further substantial saving in the cost of manufacturing and operating the device may be effected by using the oxygen admitted to the system to establish the circulation of the treated air, thereby dispensing with the need of providing any mechanical circulating devices.

In the event, of course, that the apparatus for absorbing the carbon dioxide and moisture from the used air is not available, or if for any other reason the used air is not to be recirculated, an exhaust valve can be substituted for the outlet duct and the only piece of equipment necessary is the oxygen container and the air duct to the atmosphere.

The efficiency of the described circulating system is shown by the chart which constitutes Figure 9 of the drawings. On reference to this chart, it will be noted that the injection of oxygen at the rate of 2 litres per minute into conduit 41 draws into that conduit 2.6 litres of air from conduit 46, making a total of 4.6 litres per minute of treated air passed to the therapeutic apparatus; 3 litres of oxygen draws with it 5.6 litres of air, making a total of 8.6 litres per minute of treated air; 4 litres per minute oxygen draws with it 8.6 litres of air making a total of 12.6 litres of treated air. I have found that this syphon system of cir-

ulation is very satisfactory and the constitution of the treated air passed into the therapeutic device can be controlled within very narrow limits.

It will be understood, of course, that modifications may be made to the specific embodiment of the invention described and illustrated herein without departing from the scope of the invention as defined in the appended claims.

What I claim as new and desire to protect by Letters Patent of the United States is:

A therapeutic device of the class described comprising a relatively rigid face piece formed of transparent, non-porous material and extending the full length and width of the face of the wearer and terminating at its upper end in a loose, bag-like piece of soft, pliant material, a band of soft, sponge rubber-like material joined to and extending around the inner surface of the periphery of said face piece and said bag-like piece, and means for holding said soft, sponge rubber-like band in air-sealing engagement with the sides and top of the head and under the chin of the wearer, an air duct in the lower part of said face piece and a second air duct in the upper part thereof, each of said air ducts communicating with the interior of said face piece.

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