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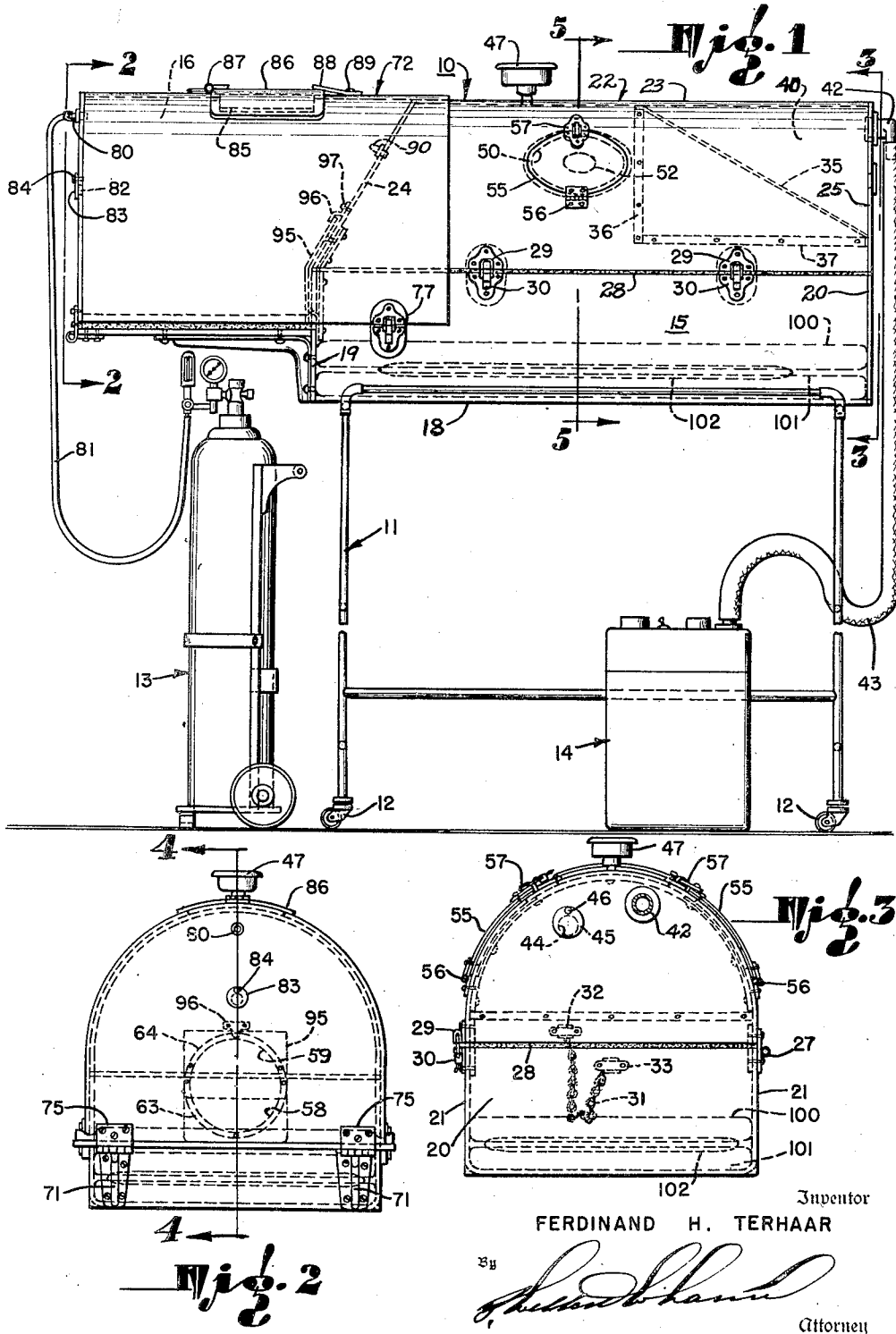
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RESPIRATOR

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2 Sheets-Sheet 1



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RESPIRATOR

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12 Claims. (Cl. 128—1)

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This invention relates generally to therapeutic appliances and relates more particularly to improved devices of this character which are particularly useful for the treatment of infants.

It is an object of the invention to provide a device of this character which may be used as a bed, incubator or respirator, or both incubator and respirator simultaneously.

It is another object of the invention to provide a device of this character wherein no outside air enters the body compartment when the device is used as a respirator.

Still another object of the invention is to provide a device of this character having means for warming the interior thereof and for maintaining a substantially uniform temperature therein.

A further object of the invention is to provide a device of this character having means whereby access for the hands may be had to the interior so that the attendant, nurses or doctor may wash the occupant, give a hypo, or do other necessary tasks without interfering with the respiratory action or breaking the seal.

A still further object of the invention is to provide a device of this character which is substantially free of vibration.

Another object of the invention is to provide a device of this character which may be used as an oxygen tent.

Further objects and advantages of the invention will appear from the following part of the specification.

Referring to the drawings, which are for illustrative purposes only,

Fig. 1 is a side elevation of a therapeutic appliance embodying the present invention, said appliance being mounted on a stand and having a connection with an oxygen tank and a connection with an air pump;

Fig. 2 is an end view of the device taken from line 2—2 of Fig. 1;

Fig. 3 is a view of the opposite end of the device as seen from line 3—3 of Fig. 1;

Fig. 4 is a longitudinal section through the device taken on line 4—4 of Fig. 2;

Fig. 5 is a sectional view taken on line 5—5 of Fig. 1;

Fig. 6 is an end view of the device showing the cover of the body compartment in the open position; and

Fig. 7 is a partial section taken on line 7—7 of Fig. 4.

Referring more particularly to the drawings, the therapeutic device is indicated generally by the reference numeral 10 and rests on a stand,

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indicated generally at 11, which is shown as comprising a framework of tubular members. The stand is provided with castors 12 so that the device may be moved about readily, it being understood, of course, that any other suitable supporting means may be provided. There is an oxygen tank, indicated generally at 13, and an air pump, indicated generally at 14. The oxygen tank is of conventional make, and likewise the air pump is of any well known type.

The appliance 10 includes a body chamber 15 and a head chamber 16, the former being defined by a bottom portion, indicated generally at 17, and comprising a bottom wall 18, end walls 19 and 20 respectively, and side walls 21. The upper portion of the chamber 15 is defined by a cover member, indicated generally at 22, having a rounded top wall 23, inclined end wall 24 and a normal end wall 25. The cover 22 is generally semi-circular in cross section, and has a lower edge 26 which is hinged at 27 to one of the side walls 21 of the lower member 17, adjacent the upper edge thereof. A seal 28 is provided between the adjacent edges of the lower portion 17 and the upper portion or cover 22, when the latter is closed, to prevent the passage of air between the edges of the respective parts. Means for latching the parts in the closed position are provided and comprise upper and lower latch parts 29 and 30 on the cover and bottom portion respectively, said latch means being on the opposite side of the device from the hinges 27, said latching means being of any suitable well known character.

If desired, means may be provided for limiting the opening movement of the cover, as shown particularly in Fig. 6, said means being shown as a chain 31 having one end, 32, secured to the cover and having the opposite end, 33, secured to the bottom portion.

Means for creating variations in the pressure within the chamber 15 is provided and, as shown, comprises a diaphragm 35 secured within the cover adjacent one end thereof. The means for securing the diaphragm is shown as comprising plastic strips 36, 37 and 38, although they may be of any other suitable material. The plastic strip 36 follows the contour of the interior of the cover wall 23 and sealingly secures one end of the diaphragm to said wall 23. The horizontal edges of the diaphragm 35 are secured by the members 37 and the end of the diaphragm, opposite the end secured by the member 36, is sealingly secured by the member or strip 38 to the wall 25. Thus is provided a pressure chamber 40 within

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the cover 22, there being an opening 41 in the wall 25 whereby the pressure chamber 40 may be connected to the air pump 14 by means of a fixture 42 (Fig. 1) and a hose 43.

If desired, an adjustable vent 44 may be provided for connecting the chamber 40 with atmosphere, said vent being controlled by a disc-like valve member 45, which is pivoted at 46. With this vent arrangement, the effective sides of the opening 44 may be controlled for regulating the pressure within the chamber 40. This is in addition to the regulating means provided on the air pump 14.

Should it be desired, a pressure gauge or indicator 47 may be provided for indicating the pressure within the chamber 15, said gauge having a connection 48 with said chamber 15.

Means may be also provided whereby access for the hands may be had to the interior of the chamber 15, said means being shown as comprising openings 50 on opposite sides of the wall 23 of the cover 22. These openings are relatively large and each is provided with a diaphragm 51 which may be of rubber or other suitable material. Each diaphragm has a central opening 52 of sufficient size to permit a hand to be passed therethrough and each of said diaphragms is marginally secured to the inner side of the wall 23 by a metallic ring 53 which is secured to the wall 23 by means of rivets 54, or the like.

Under normal conditions, when it is not desired to have the hands within the chamber 15, the openings 50 are closed by doors 55, each door being hinged at 56 and provided with a releasable latch 57.

The wall 19 is provided with a semi-circular opening 58 and the wall 24 is provided with a corresponding opening 59, the openings 58 and 59 forming a generally circular neck opening for the patient's neck when the cover 22 is in the closed position.

Sealing means, indicated generally at 60, is provided for the neck opening, and comprises a lower neck band 61 and an upper neck band 62. Said neck bands are of flexible material, such as rubber or the like, and the inner ends thereof are secured to the walls 19 and 24 respectively by metallic strips 63 and 64 which are secured by rivets 65 to the respective walls 19 and 24.

When the device is closed, clamps 66 are provided to clamp the free side edges 67 of the parts 61 and 62 together so as to provide an effective seal about the patient's neck.

The chamber 16 is defined by a bottom wall 70 which extends outwardly of the end wall 19 and is connected thereto by brackets 71. A cover 72 of semi-cylindrical construction, has a top wall 73 which is semi-circular in cross section and an end wall 74 which is hinged at 75 to the outer end of the bottom wall 70. The cover is adapted to swing on the hinge 75 with the open end portion 76 disposed over the adjacent end of the body section, as best shown in Fig. 1, the fit of the cover 72 over the body section being tight enough to substantially prevent the passage of air therebetween into the chamber 16.

Latching means may be provided for latching the cover 72 in the closed position and said means comprises latches 77 adjacent the lower sides of the wall 73 when in the closed position.

In order to provide a seal between the cover and the bottom wall 70, a pad 78 is provided and the marginal portions of said pad extend between the adjacent free ends of the cover 72 of the upper

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side of the bottom wall 70, said pad also serving as a head rest for the patient.

The wall 74 is provided with a fixture 80 for attachment of a hose 81 from the oxygen tank 13 so that oxygen may be delivered into said chamber 16. A vent 82 may also be provided in the wall 74 and said vent is controlled by a disc-like valve member 83 which is pivoted at 84. Thus, the effective sides of the opening 82 may be controlled. The purpose of the vent or opening 82 is to provide for the elimination of carbon dioxide from the chamber 16 when the patient is being given oxygen.

The wall 73 may also be provided with an opening 85 which is provided with a cover or door 86 hinged adjacent one end, as at 87, and releasably latched adjacent its opposite end by means of a latch member indicated generally at 88. The latch member 88 is shown as comprising a resilient metal strip pivotally attached to the wall 73 by means of a rivet 89.

The wall 24 of the chamber 15 may also be provided with a fixture 90, whereby an oxygen hose, such as 81, may be attached thereto for supplying oxygen to said chamber. The fixture 90 is provided for supplying oxygen to the chamber 15 when small infants are being treated within the chamber 15. Oxygen, of course, enters through the fixture 90 and ventilation is obtained by adjustably opening a sliding door 95 which will be described more fully hereinafter.

When thus used as an incubator, the parts of the neck seal 60 may be pushed inwardly relative to the chamber 15 and the neck opening in the walls 19 and 24 may be closed off by means of the angular laterally sliding plate or door 95 which fits over the opening, as best shown in Figs. 1 and 2, said plate 95 being secured by a bracket 96 attached to the wall 24 by means of rivets 97.

When the device is used as an incubator, the infant may be placed entirely within the chamber 15, in which case the plate 95 may be used to close the neck opening. Alternatively, the head of the infant may be disposed within the chamber 16 and the body disposed within the chamber 15. In this situation, the plate 95 is, of course, removed.

Pads for the comfort of the patient may be placed in the chamber 15 and, as shown, comprise pads 100 and 101 in the bottom of the portion 17. Further, if desired, means for heating or warming the patient may be provided and, as shown, comprises an electric heating pad 102 which is disposed between the pads 100 and 101 and is provided with electrical connection 103 which passes through a suitable opening in the seal 28 between the lower portion 17 and the cover 22.

The device may be used as a bed, in which case the cover 72 and the cover 22 are open, the infant lying on the pads 100 and 101.

When the device is used as a respirator, the body of the patient is disposed within the chamber 15 and the head within the chamber 16. The neck seal 60 is attached, as hereinabove described, and the pump 14 connected with the chamber 40. Pulsations of the pump alternately increase and decrease the pressure in the chamber 40, which causes the diaphragm 35 to move back and forth, as indicated by the dotted lines 35a and 35b. This movement of the diaphragm causes an increase and decrease in the pressure in the chamber 15 for effecting exhalation and inhalation of the patient.

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If it is desired to also supply oxygen to the patient, the cover 72 is secured in position and oxygen is supplied to said chamber 16 from the oxygen tank 13.

Should it be desired to bathe the patient, give a hypodermic, or the like, the attendant's hands may be inserted into the chamber 15 through the openings 52 of the diaphragms 51. When the hands are thus inserted in the openings 52, the marginal edges of said openings engage the attendant's arms so as to provide a seal against the passage of air into or out of the chamber 15. Inasmuch as it is contemplated that the walls of the chambers 15 and 16 be transparent, the device may be made of a clear plastic so as to permit viewing of the patient at this time as well as at other times during the treatment. Of course, other materials may be used for the walls of the device.

It is to be noted that in this device, vibration is eliminated by having the mechanical mechanisms entirely separated from the respirator, the only means which controls respiration being air acting against the diaphragm 35. Hence, there is no vibratory disturbance which will disturb the relaxing of the patient.

Also, it is to be noted that the cover 72 may be closed to provide an oxygen chamber or said cover may be open to expose the head to ordinary atmosphere.

I claim as my invention:

1. In apparatus of the class described: a body chamber defined by a bottom section having a bottom wall, side walls, and end walls, one of the latter having a semi-circular opening therein extending downwardly from the upper edge thereof and an upper section generally semi-circular in cross section and having end walls, one of the latter having a generally semi-circular opening cooperating with the first mentioned semi-circular opening to form a generally circular neck opening; a neck seal for said opening comprising a pair of flexible parts, one part being attached to the end wall of the upper section and the other part being attached to the end wall of the lower section; hinge means connecting one of the longitudinal edges of the upper section with one of the side walls of the lower section; means for releasably securing the two sections in closed position; a flexible diaphragm in the upper section having its longitudinal edges secured to the inner sides of said upper section and adjacent one end for defining a pressure chamber separated from the body chamber by said diaphragm; means whereby the pressure chamber may be connected with an air pump; a valve controlled atmospheric connection for the pressure chamber; a pressure gauge for the body chamber; a hand opening adjacent each side of the upper section; a flexible member for each opening having a central opening therein for reception of a hand or the like; releasable means for sealingly closing each of said hand openings; a head chamber extending outwardly from the end walls of the body chamber sections which have the neck opening, said chamber being defined by a flat bottom and a cover which is semi-circular in cross section and provided with an outer end wall hinged to the bottom, the cover being of sufficient length to snugly fit over the adjacent end portions of the walls forming the body chamber; releasable means for securing the top in closed position; sealing means between the bottom and the lower edges of the cover, said sealing means also extending over the bottom so as to form a cushion;

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means for connecting the head chamber with a source of oxygen or the like; a valve controlled atmospheric vent for the head chamber; an access opening in the top of the cover; a door for closing said opening; means for releasably latching the door in the closed position; a fitting in one of the end walls adjacent the head opening, for providing an oxygen connection to the body chamber; cushion means within the body chamber, said cushion means comprising a plurality of pads; heating means for the body chamber disposed between the pads; and a removable closure for the neck opening.

2. In a respiratory device: walls defining a lower chamber section and an upper chamber section; means for hinging the sections together; a diaphragm marginally secured within one of the chamber sections to define a pressure chamber separated from the rest of said chamber by said diaphragm; and means whereby said pressure chamber may be connected to an air pump for cyclic raising and lowering of the pressure in said pressure chamber to thereby effect corresponding changes in pressure within the rest of said chamber.

3. The invention defined by claim 2, wherein the pressure chamber is provided with an atmospheric vent and there is a valve member for controlling the effective area of said vent.

4. In a device of the class described: a body chamber having an upper portion generally semi-circular in cross section; a bottom wall extending longitudinally of said chamber adjacent one end thereof; a cover hinged to said bottom wall, said cover being generally semi-circular in cross section and adapted to have one end disposed snugly over the adjacent ends of the walls defining the first mentioned chamber; and a cushion on the bottom member, said cushion extending outwardly of the adjacent sides of the cover to form a seal between said bottom member and cover.

5. In a respiratory device: means defining a body chamber adapted to be closed to atmosphere, said means including a diaphragm; and means, including said diaphragm, defining a second chamber wherein the pressure may be regularly varied to effect movement of the diaphragm for effecting corresponding variations of the pressure in the body chamber.

6. In a device of the class described: walls defining a body chamber having a cover portion, and a pressure chamber including a movable wall exposed on one side to the atmosphere in said body chamber and on the other side to the pressure in said pressure chamber; means for effecting cyclic pressure changes in said pressure chamber which in turn effects cyclic respiratory pressure changes in the body chamber; a head chamber adjacent to said body chamber; a sealable neck opening between body chamber and head chamber; and means for introducing oxygen into the head chamber.

7. In a respiratory device: means defining a substantially closed body chamber and a pressure chamber; and a movable wall between said chambers, said pressure chamber being adapted to be subjected to a regularly varying pressure between two limits to which said movable wall is responsive, movements of said wall in response to the pressure variations in said pressure chamber effecting corresponding variations in the pressure of the body chamber in accordance with the respiratory requirements of a person in the body chamber.

8. In a respiratory device: means defining a

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body chamber and a pressure chamber, said pressure chamber being adapted to be cyclically subjected to varying pressure; and a movable wall exposed on one side to the pressure in said pressure chamber and responsive to variations in said pressure, said movable wall having its other side exposed to the atmosphere of the body chamber and adapted to effect cyclic respiratory pressure changes in the atmosphere of said body chamber in accordance with the movements of said wall.

9. In a respiratory device: means defining a body chamber and a pressure chamber, the latter having a restricted connection with atmosphere and being adapted to be subjected to regular cycles of pressure change; and a movable wall exposed on one side to the pressure in said pressure chamber and responsive to variations therein, said movable wall having its other side exposed to the atmosphere of the body chamber and adapted to effect, upon movement thereof, variations in the pressure of said atmosphere in accordance with the respiratory cycle of a person within the body chamber.

10. In a respiratory device: means defining a body chamber and a pressure chamber, the latter having a restricted connection with atmosphere and being adapted to be subjected to regular cycles of pressure change; an adjustable valve member for said opening; and a movable wall exposed on one side to the pressure in said pressure chamber and responsive to variations therein, said movable wall having its other side exposed to the atmosphere of the body chamber and adapted to effect, upon movement thereof, variations in the pressure of said atmosphere in accordance with the respiratory cycle of a person within the body chamber.

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11. In a respiratory device: means defining a body chamber adapted to be closed to atmosphere and including a movable wall exposed on one side to the air in said chamber; and means for subjecting the opposite side of said wall to fluid pressure varying regularly in accordance with the breathing cycle of a person within the body chamber, said movable wall moving in response to the pressure variations effected by the second mentioned means and in turn causing corresponding cyclic variations in the pressure of said body chamber.

12. In a respiratory device: means defining a body chamber and including a movable wall exposed on one side to the atmosphere in said body chamber; and means for effecting regularly varying cyclic movements of said wall to thereby effect cyclically varying respiratory pressure in said body chamber.

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