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AUTOMATIC POSITIVE PRESSURE BREATHING MACHINE

Filed April 8, 1950

2 SHEETS—SHEET 1

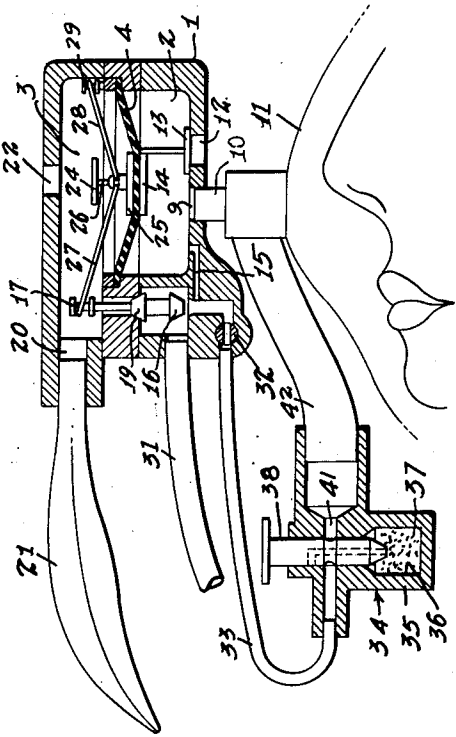
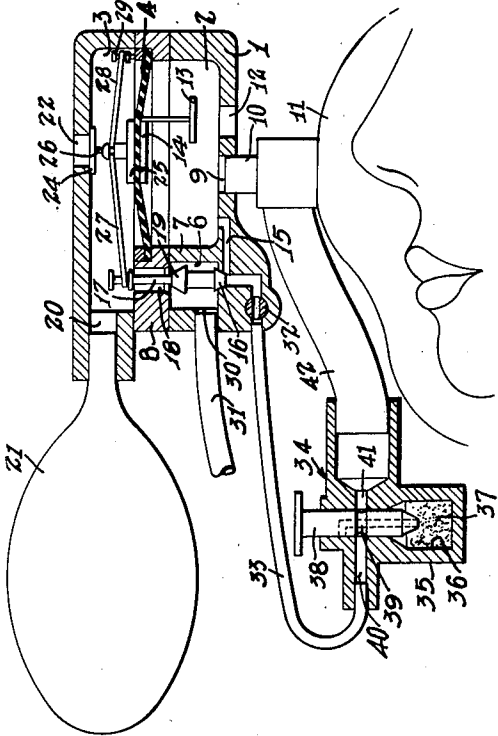


FIG. 1

FIG. 2

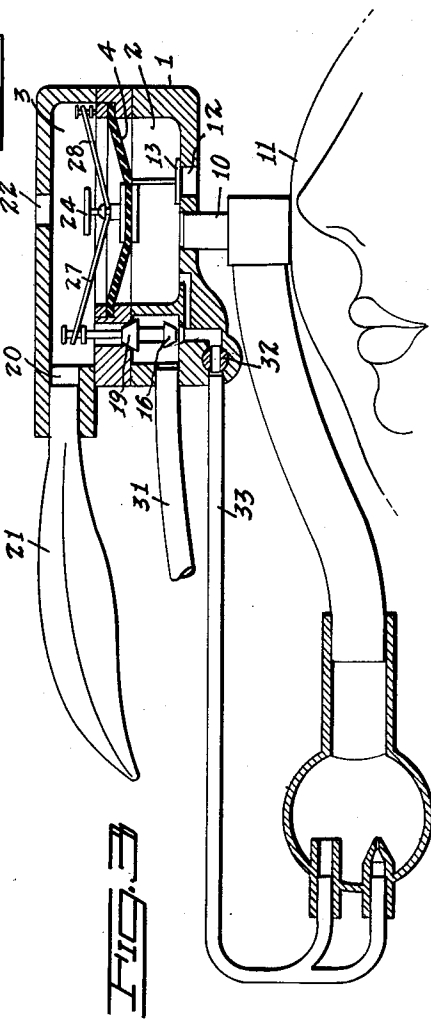


FIG. 3

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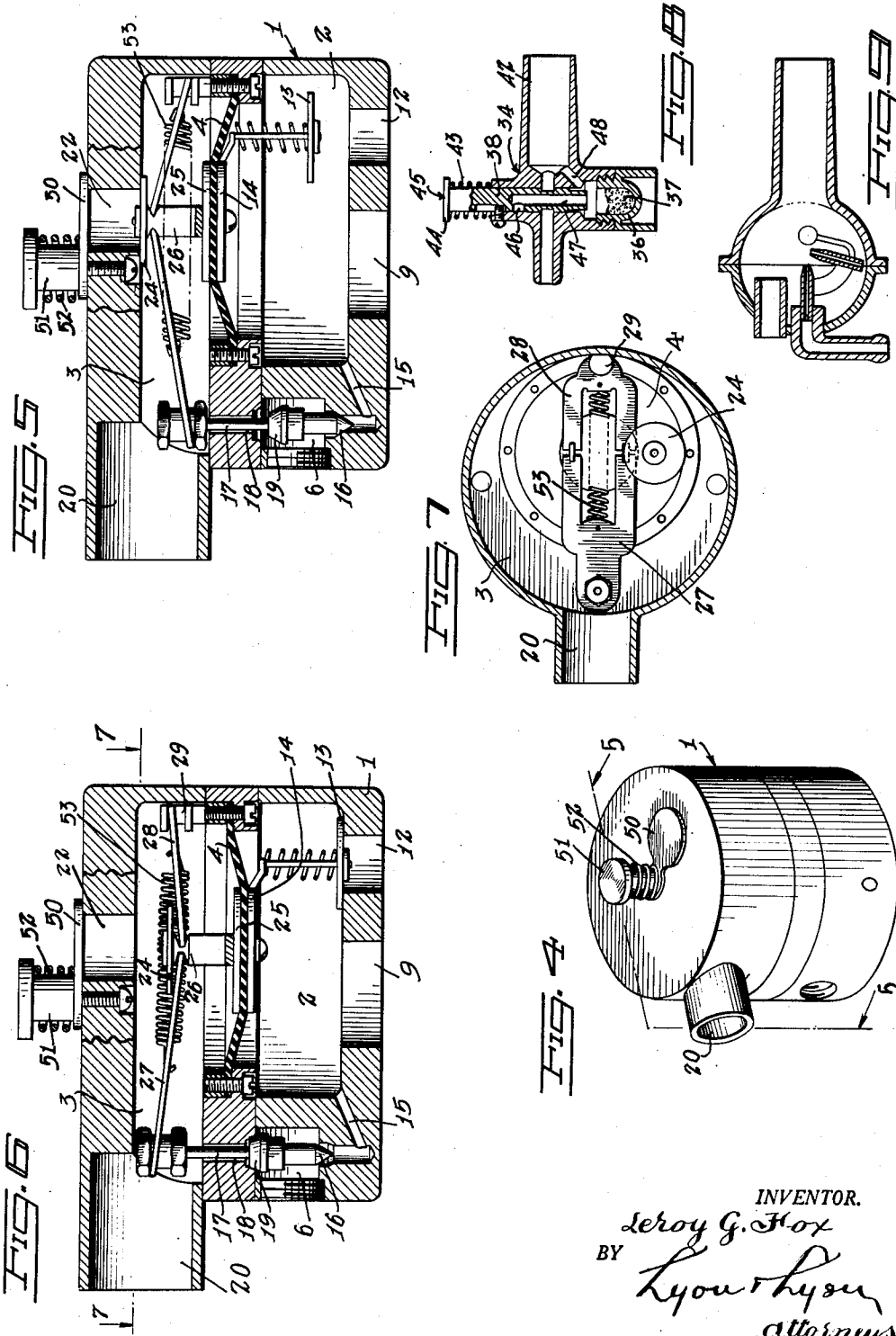
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2 SHEETS—SHEET 2



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AUTOMATIC POSITIVE PRESSURE
BREATHING MACHINELe Roy G. Fox, Glendale, Calif., assignor to E & J
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6 Claims. (Cl. 128-29)

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My invention relates to an automatic positive pressure breathing machine, and more specifically to a device to be used as a therapeutic machine, as a resuscitator or an oxygenator, and which can be used to supply oxygen to aviators at high altitudes.

Another object of my invention is to provide a device into which either powdered or liquid medicines can be inserted in the flow of oxygen given to a patient to force the medicines into his lungs.

Another object of my invention is to provide a machine which will force drugs carried by oxygen into partially inflated lungs.

Another object of my invention is to provide a device which will automatically adjust to the size of the patient's lungs.

Another object of my invention is to provide a device which will give a warning signal if the patient's throat or lungs are congested.

Other objects and advantages of my invention will be apparent from the following description of the preferred embodiments thereof.

In the drawings:

Figure 1 is a sectional view of my machine with an attachment placed thereon for supplying powdered drugs, showing my device in an exhaling position;

Figure 2 is a similar sectional view showing the device in the inhaling position;

Figure 3 is a similar sectional view to Figure 2 showing the device connected to a nebulizer for supplying liquid medicines;

Figure 4 is a perspective view;

Figure 5 is a sectional view of a modification of my invention showing the device in the exhaling position taken on the line 5-5 of Figure 4.

Figure 6 is a sectional view similar to Figure 5 in the inhaling position;

Figure 7 is a sectional view taken on the line 7-7 of Figure 6;

Figure 8 is a sectional view of the powered drug dispenser; and

Figure 9 is a cross section of a nebulizer.

An automatic positive pressure breathing machine constructed in accordance with my invention has an outer case 1 forming two chambers, 2 and 3, separated by a diaphragm 4. A third chamber 6 in the case 1, is separated from the chambers 2 and 3 by the partitions 7 and 8. The chamber 2 has port 9 into which is inserted a tube 10 to connect a breathing mask 11. The chamber 2 has port 12 to the atmosphere, which is opened or closed by a flat valve 13 attached to the plate 14 on the diaphragm 4.

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Connecting the chambers 6 and 2 is a passage 15 opened or closed by a valve 16 carried upon a push rod 17. Through the partition 8 is a port 18 which connects the chambers 6 and 3. The push rod 17 extends through the port 18 and carries a valve 19 thereon to seal the port 18.

A port 20 from the chamber 3 provides a means for attaching a rubber balloon 21 so that oxygen can be driven from the chamber 3 into the balloon. Port 22 provides an opening to the atmosphere from the chamber 3 and is closed by a valve 24 attached to a plate 25 on the diaphragm 4. The connecting rod 26 between the valve 24 and the plate 25 has two arms 27 and 28 loosely connected thereto, which extend outwardly to the push rod 17 and a post 29. The arms 27 and 28 are made of resilient spring material so that when the diaphragm moves from one position to the other as shown in Figures 1 and 2 they act as a snap toggle. When the diaphragm 4 is moved from one position to the other the arm 27 will raise or lower the push rod 17, opening or closing, as the case may be, the valves 16 and 19. The diaphragm 4 also opens and closes the valves 13 and 24.

A port 30 from the chamber 6 provides an opening into which a tube 31 from an oxygen regulator is inserted to supply oxygen to the chamber 6.

In the use of my device as a simple resuscitator oxygenator or for high altitude oxygen breathing the mask 11 is placed over the patient's face so that there is no leakage of air around its perimeter. The oxygen enters the chamber 6 through the port 30 and passes through the chamber 6, the port 18, into the chamber 3 and the rubber balloon 21. In this position the diaphragm is in the position shown in Figure 1, the port 22 is closed by the valve 24 and the port 12 is open. Also the valve 16 is closed and the oxygen passes directly into the rubber balloon 21.

When the pressure in the chamber 3 is higher than the pressure in the chamber 2 and therefore in the patient's lungs, the diaphragm 4 will snap over into the position shown in Figure 2, closing the valves 13 and 19 and opening the valves 16 and 22. In this position the oxygen flows from the chamber 6 through the passage 15 into the chamber 2 and through the tube 10 into the mask 11 and into the patient's lungs. The amount of pressure and the speed of the passage of this oxygen are regulated by the ordinary valve member on the oxygen bottle.

When the pressure in the patient's lungs arrives at the desired maximum, for example, three

or four ounces per square inch, the diaphragm 4 will snap to the position shown in Figure 1. After the oxygen in the rubber balloon 21 has escaped through the valve 24 and through the port 22 to the atmosphere the pressure in the patient's lungs and therefore in the chamber 2 is at its maximum pressure and the diaphragm 4 will snap to the position shown in Figure 1, closing the valves 16 and 24 and opening the valves 19 and 13, again filling the rubber balloon 21 with oxygen and allowing the patient's natural response to exhale out through the mask 11, tube 10 into the chamber 2 and out through the port 12.

It should be noted that none of the valves or working mechanism except the valve 13 is subject to any possible clogging as the patient's exhalation never strikes any of the mechanical portions of the breathing machine.

When it is desired to use my invention to administer drugs, the hand valve 32 is opened to permit oxygen to pass from the valve 16 into a tube 33, leading to a special nebulizer 34. The nebulizer 34 has a body 35 into which a small cup 36 is threaded. In this cup 36 is placed the powdered drug 37. A plunger 38 is slidably positioned in the body 35 and has a port running around its perimeter at 39 to permit the oxygen entering at 40 from the tube 33 to pass on out through the port 41 through the tube 42 into an opening on the mask 11.

It should be noted that I have shown in Figures 1 and 2 the tube 42 connected with the mask 11. When my device is used for a simple oxygenator, resuscitator or high altitude breathing machine, there is no opening in the tube 10 for the tube 42.

When the patient is breathing oxygen and it is desired to give him powdered medicine, the plunger 38, which is held in the position shown in Figure 8 by a spring 43 between the top of the body 35 and the flange 44 upon the plunger 38, is forced downwardly by pressure upon its top surface 45 until the bore 46 aligns with the port 40 so that the oxygen passes through the port 46 down the passage 47 into the cup 36 where it picks up the powdered drug 37 and forces the same out through the passage 48 into the tube 42 and thus into the mask 11.

An advantage of my invention lies in the fact that no provision is necessary to compensate for size of a patient's lungs as a patient with normal lungs will have oxygen forced therein by my device when the balloon 21 is filled and he will exhale until the balloon 21 is empty. However, a patient with small lungs will never exhale sufficiently to completely empty the balloon 21 and the drop in pressure in the chamber 2 will be faster causing the diaphragm 4 to reverse and start oxygen into his lungs before the balloon 21 is empty. This leaves a residue of oxygen in the balloon 21, which counter-balances the small capacity in the lungs and reverses the diaphragm 4 before an excess of oxygen is forced into the lungs. However, for certain medical precautions I have added an auxiliary control shown in Figures 5 and 6. Mounted on the exterior of the case 1 is a valve plate 50 rotatably held on the post 51, which can completely close the outlet 22. As the plate 50 is rotatably positioned upon the post 51 and is held in position to close the port 22 by a spring 52, it can be rotated to open or close the port 22 to any degree from clear open to clear closed to regulate the speed with which

the oxygen passes from the rubber balloon 21 to the atmosphere.

In Figure 3 I disclose a nebulizer for liquid medicines which can be used in place of the nebulizer 34. The one disclosed in the drawings is a standard nebulizer for use in the other types of machines and although I have shown it in the drawings, it is well known in the art and needs no description here.

In the modifications shown in Figures 5 and 6, the only changes in the operation of the diaphragm 4 is to place a spring 53 to act as a positive snapover on the toggle.

One of the advantages of my invention is that whenever the patient's throat is congested so that oxygen cannot be forced therein the diaphragm and toggle will snap back and forth rapidly at all times, thus giving a warning buzz to the user that a congestion exists which prevents the oxygen from entering the patient's lungs. Upon such warning the mask 11 can be removed and an aspirator used to clear the throat before the mask is reapplied.

While I have described the preferred embodiments of my invention, I do not wish to be limited to any of the details herein set forth except as described in the following claims.

I claim:

1. In a breathing machine, a case forming three chambers, one of said chambers connected to a supply of oxygen under pressure, said chamber having ports connecting with the other two chambers, said ports being alternately opened or closed by valves connected by a push rod whereby one valve is open when the other is closed, the other two chambers being divided by a diaphragm, both of said chambers having outlet ports equipped with valves to close said ports, said valves being connected to be operated by said diaphragm so that one of said valves is open when the other is closed, means connecting said diaphragm and said push rod to move said push rod and open the valve from the first chamber to the chamber whose outlet port is closed, ports to connect one of said diaphragm-separated chambers with a breathing mask and the other chamber with an expansible balloon.

2. In a breathing machine, a case, partitions in said case to define a chamber, a diaphragm between one of said partitions and the exterior wall of said case to define two diaphragm-separated chambers, said first named chamber having a connection to a source of oxygen under pressure, said chamber having ports connecting with the other two chambers, said ports being alternately opened or closed by valves connected by a push rod whereby one valve is open when the other is closed, both of said diaphragm-separated chambers having outlet ports equipped with valves to close said ports, said valves being connected to be operated by said diaphragm so that one of said valves is open when the other is closed, means connecting said diaphragm and said push rod to move said push rod and open the valve from the first chamber to the chamber whose outlet port is closed, ports to connect one of said diaphragm-separated chambers with a breathing mask and the other chamber with an expansible balloon.

3. In a breathing machine, a case divided into two chambers by partitions, one of said chambers having a connection to a supply of oxygen and the other chamber divided by a pressure responsive diaphragm, outlet ports in the last mentioned chamber on both sides of said diaphragm,

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valves for said ports connected by push rods to opposite sides of said diaphragm, valves connected by a push rod to deliver oxygen from said first mentioned chamber to both sides of said diaphragm when the outlet valve on the responsive side of said diaphragm is closed, said valves being connected to be operated by said diaphragm, and ports on each side of said diaphragm adapted to connect a breathing mask and an expansible member.

4. In a breathing machine, a case divided into two chambers by partitions, one of said chambers having a connection to a supply of oxygen and the other chamber divided by a pressure responsive diaphragm, outlet ports in the last mentioned chamber on both sides of said diaphragm, valves for said ports connected by push rods to opposite sides of said diaphragm, valves connected by a push rod to deliver oxygen from said first mentioned chamber to both sides of said diaphragm when the outlet valve on the responsive side of said diaphragm is closed, said valves being connected to be operated by said diaphragm, and ports on each side of said diaphragm adapted to connect a breathing mask and an expansible member, a breathing mask connected to one of said ports and an expansible member attached to the other.

5. In a breathing machine, a case divided into two chambers by partitions, one of said chambers having a connection to a supply of oxygen and the other chamber divided by a pressure responsive diaphragm, outlet ports in the last mentioned chamber on both sides of said diaphragm, valves for said ports connected by push rods to opposite sides of said diaphragm, valves connected by a push rod to deliver oxygen from said first mentioned chamber to both sides of said diaphragm when the outlet valve on the responsive side of said diaphragm is closed, said valves being connected to be operated by said diaphragm

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phragm, ports on each side of said diaphragm adapted to connect a breathing mask and an expansible member, a breathing mask connected to one of said ports and an expansible member attached to the other, a port to connect a nebulizer to the port connecting said first chamber and said second chamber on the side of said diaphragm to which said breathing mask is connected, and a nebulizer connected between said port and said mask.

6. In a breathing machine, a case divided into two chambers by partitions, one of said chambers having a connection to a supply of oxygen and the other chamber divided by a pressure responsive diaphragm, outlet ports in the last mentioned chamber on both sides of said diaphragm, valves for said ports connected by push rods to opposite sides of said diaphragm, valves connected by a push rod to deliver oxygen from said first mentioned chamber to both sides of said diaphragm when the outlet valve on the responsive side of said diaphragm is closed, said valves being connected to be operated by said diaphragm, ports on each side of said diaphragm adapted to connect a breathing mask and an expansible member, a breathing mask connected to one of said ports and an expansible member attached to the other, a port to connect a nebulizer to the port connecting said first chamber and said second chamber on the side of said diaphragm to which said breathing mask is connected, and a nebulizer connected between said port and said mask, said nebulizer comprising a body having an inlet and an outlet, a plunger valve, a cup adapted to contain a drug, said plunger valve normally directly connecting said inlet and said outlet, but movable to port oxygen from said inlet into said cup and then to said outlet, and hence to said breathing mask.

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No references cited.