

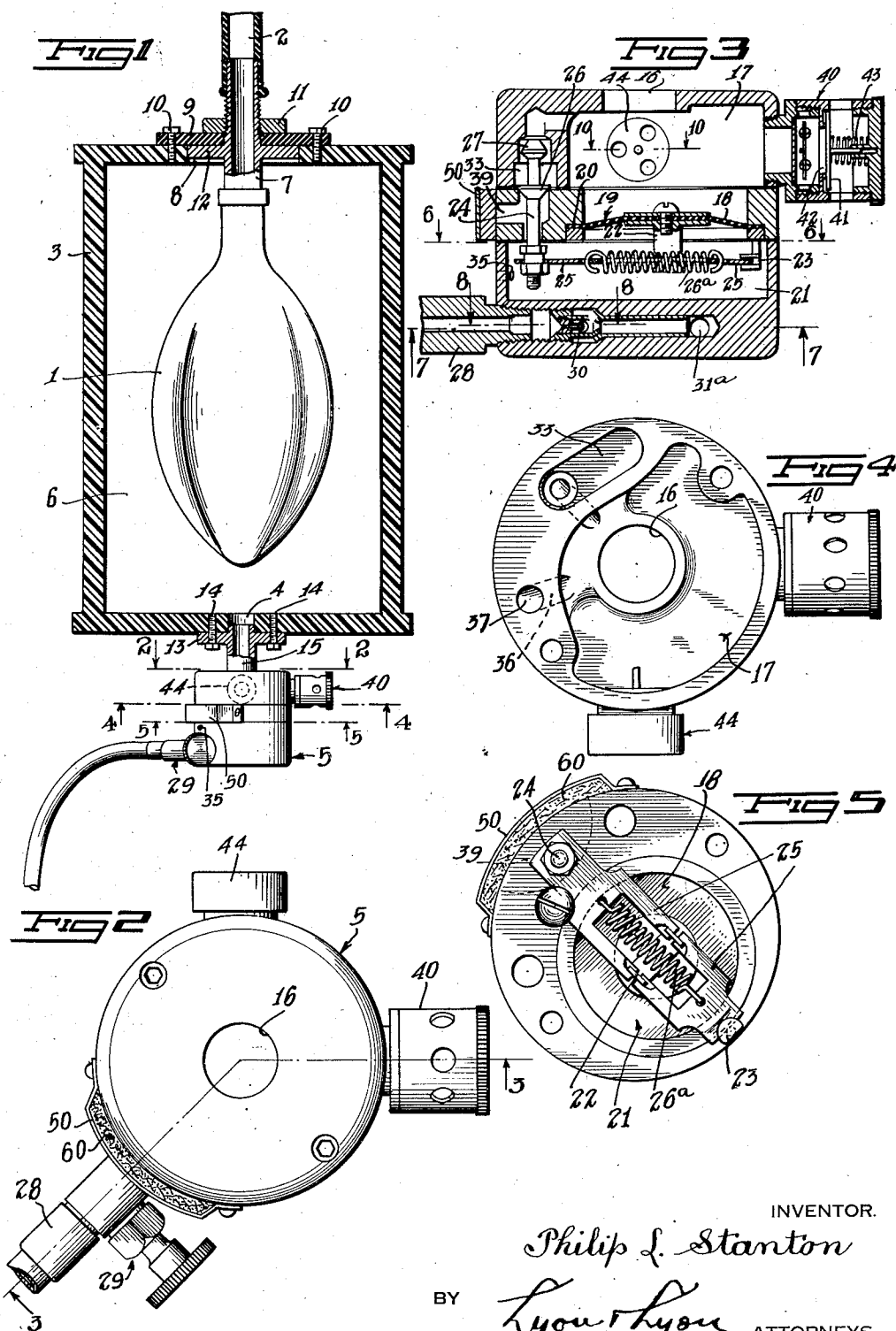
Jan. 8, 1952

P. L. STANTON  
APPARATUS FOR POSITIVE RESPIRATION  
DURING GAS ANESTHESIA

2,582,210

Filed July 5, 1949

2 SHEETS—SHEET 1



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2 SHEETS—SHEET 2

FIG 6

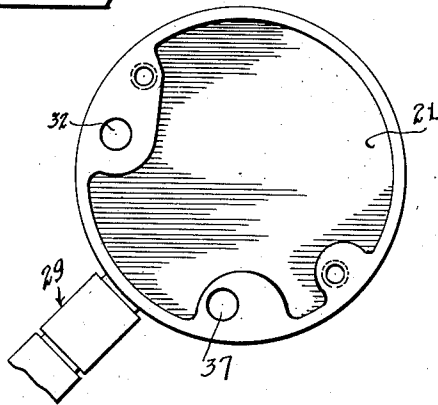


FIG 7

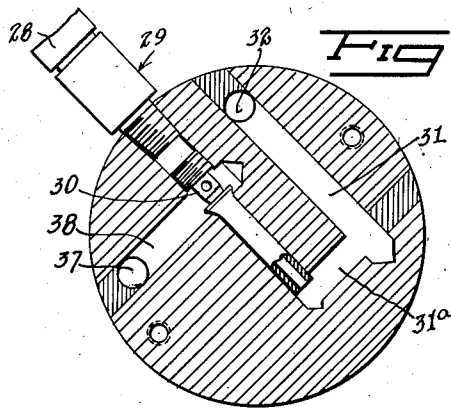


FIG 9

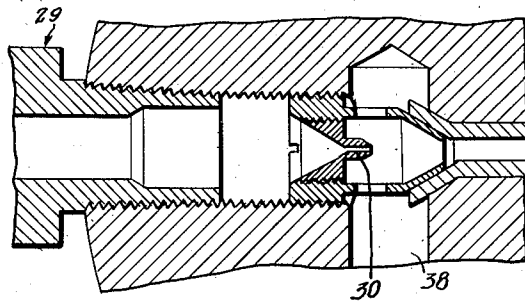
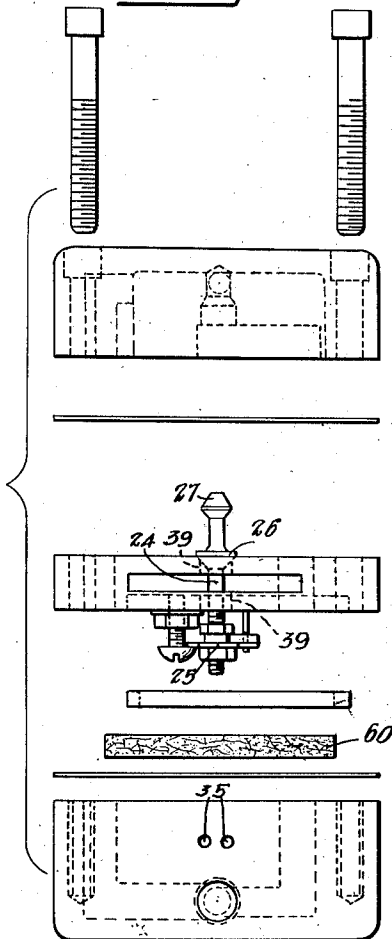


FIG 8

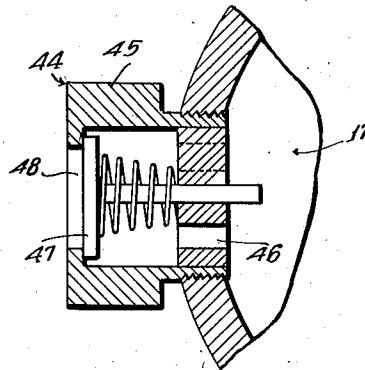


FIG 10

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## UNITED STATES PATENT OFFICE

2,582,210

APPARATUS FOR POSITIVE RESPIRATION  
DURING GAS ANESTHESIAPhilip L. Stanton, Flintridge, Calif., assignor to  
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8 Claims. (Cl. 128—184)

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My invention comprises a process and the apparatus for positive respiration during gas anesthesia. In gas anesthesia it is very important that you do not dilute the gas mixture by injecting outside air or oxygen beyond the quantity ordinarily desired to maintain the proper gas mixture.

It always has been a problem in emergency cases during anesthesia in thoracic surgery to maintain the proper gas mixtures in the apparatus and also to administer artificial respiration simultaneously. My invention makes it possible to maintain these gas mixtures within a patient's lungs and in the anesthesia machine and at the same time administer intra-pulmonary pressures automatically without diffusing these gas mixtures.

In general, my invention comprises placing an elastic chamber or bag or bellows in the gas circuit between the machine and the patient and surrounding that bag with a rigid airtight container that has an opening to a toggle diaphragm mechanism that is actuated by the pressure in the chamber. When the bag is deflated to its desired minimum the toggle mechanism opens to withdraw the air from the surrounding chamber. When the bag is inflated to its desired maximum the toggle acts to force air in the surrounding chamber. It acts in just the opposite from the way it acts on the lungs, that is, when the bag is inflated the lungs are on their aspirated phase and when the bag is collapsed the lungs are fully inflated and the toggle is open to permit the pressure in the chamber to escape.

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 apparatus for positive respiration during gas anesthesia.

Figure 2 is a top plan view of the toggle mechanism taken on the line 2—2 of Figure 1.

Figure 3 is a sectional view taken on the line 3—3 of Figure 2.

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

Figure 5 is a sectional view taken on the line 5—5 of Figure 1.

Figure 6 is a sectional view taken on the line 6—6 of Figure 3.

Figure 7 is a sectional view taken on the line 7—7 of Figure 3.

Figure 8 is a sectional view taken on the line 8—8 of Figure 3.

Figure 9 is an exploded view of the toggle mechanism.

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Figure 10 is a sectional view taken on the line 10—10 of Figure 3.

The process of my invention uses an ordinary anesthetic machine which is common in the art.

This machine is connected by a T-joint in the tubing connecting the anesthetic machine with the mask on the patient.

The T-joint connects a bellows 1 by means of the pipe 2 to form a gas-tight system comprising the anesthetic machine, mask and bellows. Surrounding the bellows 1 is an airtight container 3 which has an opening 4 into a toggle mechanism such as generally illustrated at 5.

The action of the toggle mechanism is such that when the pressure in the chamber 6 formed by the container 3 is at a maximum value, for example, 13 mm. of mercury, the bellows 1 will be in a collapsed position, thus forcing the gas mixture therein into the patient's lungs under a positive pressure. At that point the toggle mechanism 5 is so constructed as to trip over to allow the air to be evacuated from the chamber 6, whereupon the bellows 1 receives the pressure from the patient's lungs and is extended until the pressure in the chamber 6 reaches the minimum pressure desired in the patient's lungs, for example, a minus pressure of 9 mm. of mercury, whereupon the toggle 5 snaps over into the reverse position and ports air or oxygen into the chamber 6 until the maximum pressure is again achieved.

It thus will be seen that my invention provides a process for forcing anesthetic gas without contamination with the atmosphere into the patient's lungs under pressure and to be aspirated by the action of the minus pressure in the chamber 6. This type of respiration is known as positive pressure.

The preferred form of apparatus for carrying out the process of my invention comprises the bellows 1 connected to a flanged pipe 7 inserted in an opening 8 in the container 3. A washer plate 9 fits over the flanged pipe 7 and is bolted at 10 to the container 3. A nut 11 threaded on the flanged pipe 7 squeezes the plate 9 between the flange 12 on the flanged pipe 7 and the nut 11. The flanged pipe 7 is connected to the pipe 2 running to the T-joint in the anesthetic line.

The opening 4 has an adapter 13 placed therein and held in an airtight position by means of the bolts 14. The adapter 13 has a tapered member 15 which is inserted into the opening 16 in the toggle mechanism 5. The toggle mechanism 5 comprises a case forming a chamber 17. When the pressure in the chamber 17 and therefore in the chamber 6 to which it is directly connected

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by the adapter 13 is at the minimum pressure, for example, minus 9 mm. of mercury, the toggle diaphragm 18 is in the position shown in Figure 3. The toggle diaphragm 18 comprises an airtight diaphragm member 19 held sealed at its edges as shown at 20 to close the chamber 17 from the chamber 21 on the other side of the diaphragm 18.

Bolted to the diaphragm 18 are pivot posts 22. A hanger 23 and the valve stem 24 act as supports for the ends of the toggle arms 25 which are carried by the posts 22. To secure a snap-over action of the toggle arms 25 a toggle spring 26 is connected to the two toggle arms 25. When the diaphragm 18 is in its upper position as shown in Figure 3, the toggle arms 25 force downwardly the valve stem 24, causing the valve 27 to open.

Compressed air or oxygen under pressure enters the toggle mechanism 5 through an adapter 28, past a valve generally indicated at 29, through a Venturi tube 30, through passages 31 and 31a, the cross port 32 into the chamber 33. When the diaphragm 18 opens the valve 27 the compressed air passes from the chamber 33 past the valve 27 into the chamber 17 and, hence, into the container 3. When the pressure in the chamber 17 and container 3 is at the desired maximum of 13 mm. the diaphragm 18 will move to its lowermost position, snapping over the toggle mechanism and raising the valve stem 24, closing the valve 27 and opening the valve 26. The diaphragm 18 at maximum pressure in the chamber 17 will have a positive pressure above atmospheric of 13 mm. on the side towards the chamber 17, but the chamber 21 is ported to the atmosphere at 35 and, thus, the diaphragm can actuate the snap-over toggle.

After the maximum pressure has been achieved in the chamber 17 and container 3, the bellows 1 will be deflated, forcing the anesthesia into the patient's lungs. After the diaphragm 18 has snapped over the toggle will open the valve stem 24. The air in the chamber 17 and container 3 will be sucked out through the port 36 by the Venturi tube 30, through the cross passages 37 and 38, into the cross passages 31a, 31 and cross port 32 into the chamber 33 and out past the valve 26 and port 39 until the minimum desired pressure in chamber 17 is achieved. This minimum desired pressure is a minus pressure of 9 mm. As the pressure decreases in chamber 17 and container 3 the pressure in the patient's lungs will inflate the bellows 1 and the anesthesia will be exhaled into the bellows 1.

Upon the pressure in the chamber 17 being reduced to the desired minimum, the diaphragm 18 will move to its position, snapping over the toggle and closing the valve 26 and opening the valve 27 to repeat the action.

To prevent any excessive pressure on the positive side from forcing too much gas into the patient's lungs, I provide a pressure regulator which comprises a housing 40 in which a flat plate valve 41 is adapted to seat and close an opening 42. The spring 43 is adjusted to hold the flat plate valve 41 closed unless the pressure in the chamber 17 exceeds the maximum.

A negative safety valve 44 is incorporated and comprises a housing 45 having ports 46 from the chamber 17. A spring-loaded flat plate valve 47 is adapted to close the opening 48 and prevent air from entering or leaving the interior of the housing 45, and thus, the chamber 17, unless the pressure in the chamber 17 becomes less than

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the desired minimum, whereupon the flat plate valve 48 will open and permit atmospheric air to pass into the chamber 17 and prevent an excess of minimum pressure.

As Venturi tubes are noisy and as my apparatus is designed for use in the surgical rooms of hospitals, I attach a band 50 on the exterior surface of the toggle mechanism 5 adjacent the port 39. Under the band 50 and covering the port 39 is placed a piece of felt or other material 60 to dampen the noise of the rush of compressed air.

Having fully described my invention, it is to be understood that I do not wish to be limited to the details herein set forth, but my invention is of the full scope of the appended claims.

I claim:

1. A pressure regulating device comprising: a chamber divided by an airtight diaphragm into an airtight compartment and a compartment open to the atmosphere, a source of air under pressure, a passage communicating with said source of air pressure and said airtight compartment, a toggle mechanism attached to said diaphragm, a valve actuated by said toggle mechanism to open and close said passage, a second passage from said source of air pressure to said airtight compartment, and a Venturi tube arranged to withdraw air from said second passage.

2. A pressure regulating device comprising: a chamber divided by an airtight diaphragm into an airtight compartment and a compartment open to the atmosphere, a source of air under pressure, a passage communicating with said source of air pressure and said airtight compartment, a toggle mechanism attached to said diaphragm, a valve actuated by said toggle mechanism to open and close said passage, a second valve actuated by said toggle in opposite stroke to said first valve to open a port in said first passage to port air therein to the atmosphere, a Venturi tube positioned in said first passage and arranged to withdraw air from said second passage and to exhaust same to the atmosphere when said second valve is opened.

3. A pressure regulating device comprising: a chamber divided by an airtight diaphragm into an airtight compartment and a compartment open to the atmosphere, a source of air under pressure, a passage communicating with said source of air pressure and said airtight compartment, a toggle mechanism attached to said diaphragm, a valve actuated by said toggle mechanism to open and close said passage, a second valve actuated by said toggle in opposite stroke to said first valve to open a port in said first passage to port air therein to the atmosphere, a Venturi tube positioned in said first passage and adapted to withdraw air from said second passage and to exhaust same to the atmosphere when said second valve is opened, said diaphragm arranged to open said first valve and close said second valve when the pressure in said airtight compartment falls to a desired minimum negative pressure, and adapted to close said first valve and open said second valve when the pressure in said airtight compartment achieves a desired maximum positive pressure.

4. In a machine of the class described, a bellows adapted for connection to an anesthetic administering machine, an air container surrounding said bellows, means for increasing the pressure of the air in said container to a desired maximum, means for decreasing said pressure to a desired negative minimum, and means actuated

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by the pressure in said container to alternately actuate said pressure means.

5. In a machine of the class described, a bellows adapted for connection to an anesthetic administering machine, an air container surrounding said bellows, a chamber connecting with said container divided by an airtight diaphragm to form two chambers, one airtight and connected to said container and the other containing air at atmospheric pressure, means for admitting air under pressure to said container, means for removing air from said container, a valve opened by said diaphragm to port air into said container when the pressure in said container reaches its minimum and closed by said diaphragm when said pressure reaches its maximum.

6. In a machine of the class described, a bellows adapted for connection to an anesthetic administering machine, an air container surrounding said bellows, a chamber divided by an airtight diaphragm to form two chambers, one airtight and connected to said container and the other containing air at atmospheric pressure, a source of air under pressure, a passage communicating with said source of air pressure and said container, a valve actuated by said diaphragm to open and close said passage, a second passage from said source of air pressure to said container, a Venturi tube in said passage arranged to withdraw air from said container.

7. In a machine of the class described, a bellows adapted for connection to an anesthetic administering machine, an air container surrounding said bellows, a chamber divided by an airtight diaphragm to form two chambers, one airtight and connected to said container and the other containing air at atmospheric pressure, a source of air under pressure, a passage communicating with said source of air pressure and said container, a valve actuated by said diaphragm to open and close said passage, a second passage from said source of air pressure to said container, a second valve actuated by said diaphragm in opposite stroke to said first valve to open a port in said first passage to port air therein to the

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atmosphere, a Venturi tube positioned in said first passage and arranged to withdraw air from said second passage and to exhaust the same to the atmosphere when said second valve is open, said Venturi tube in said passage arranged to withdraw air from said container.

8. In a machine of the class described, a bellows adapted for connection to an anesthetic administering machine, an air container surrounding said bellows, a chamber divided by an airtight diaphragm to form two chambers, one airtight and connected to said container and the other containing air at atmospheric pressure, a source of air under pressure, a passage communicating with said source of air pressure and said container, a valve actuated by said diaphragm to open and close said passage, a second passage from said source of air pressure to said container, a second valve actuated by said diaphragm in opposite stroke to said first valve to open a port in said first passage to port air therein to the atmosphere, a Venturi tube positioned in said first passage and arranged to withdraw air from said second passage and to exhaust the same to the atmosphere when said second valve is open, said Venturi tube in said passage arranged to withdraw air from said container, said diaphragm arranged to open said first valve and close said second valve when the pressure in said airtight compartment falls to a desired minimum negative pressure, and arranged to close said first valve and open said second valve when the pressure in said airtight compartment achieves a desired maximum positive pressure.

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