

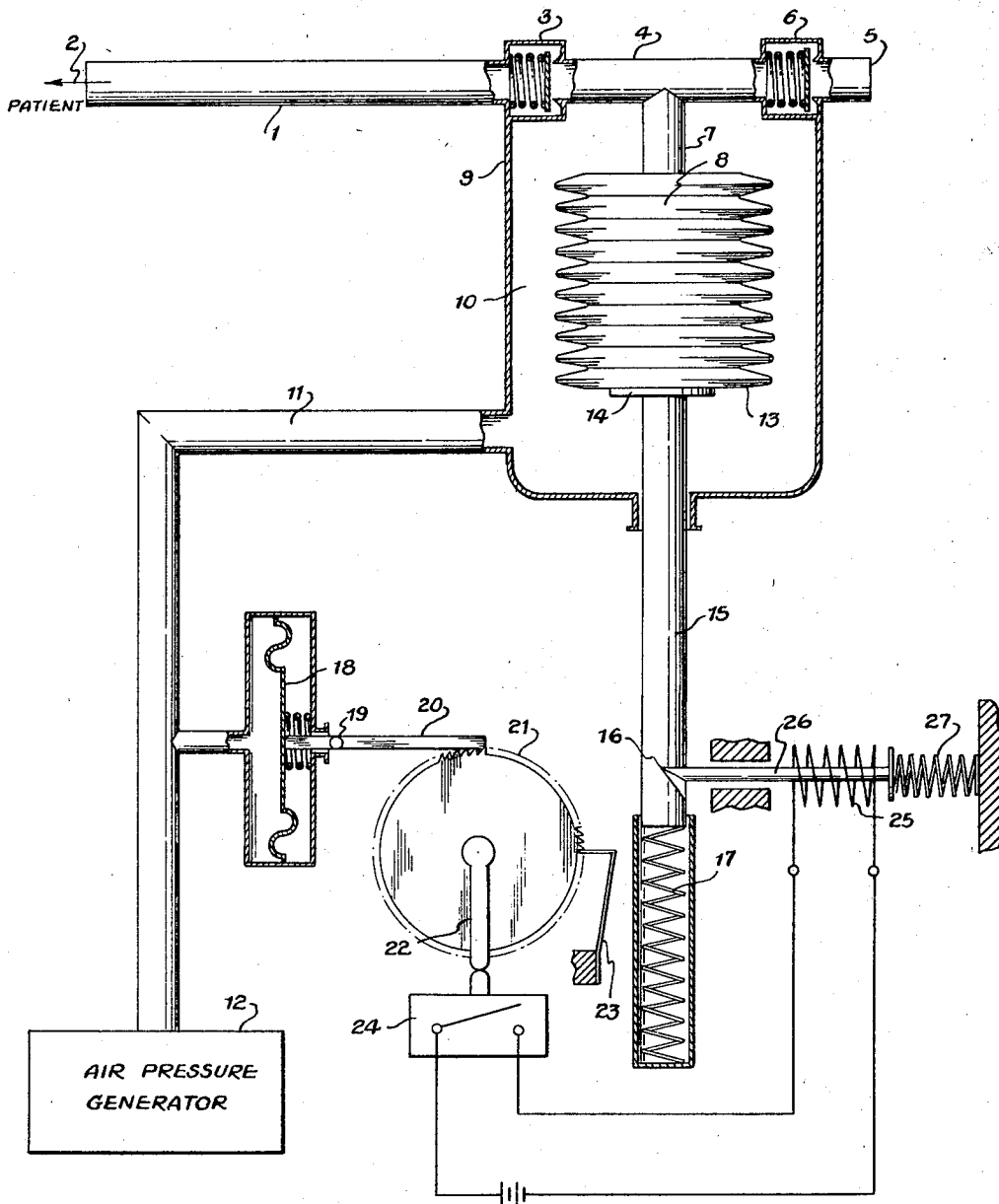
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BREATHING APPARATUS WITH PERIODIC VOLUME CHANGE

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BREATHING APPARATUS WITH PERIODIC VOLUME CHANGE

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4 Claims. (Cl. 128—145.6)

This invention relates to a breathing apparatus and in particular to a breathing apparatus for forcing a deep breath into the lungs of a person.

A conventional breathing apparatus is used to force air into the lungs of a patient at predetermined intervals and for drawing air out of the lungs during intervening intervals. Such an apparatus has a housing containing a breathing bag and the pressure in the housing is alternately changed from greater than to less than atmospheric pressure in order to compress and expand the bag. An adjustable stop is used to limit the maximum expansion of the bag.

Atelectasis, that is lung collapse, can occur during the continuous breathing with such apparatus because the breathing cycle is very uniform.

The object of this invention is to avoid the disadvantages of the heretofore described apparatus. In this invention, the stop for limiting the maximum expansion of the breathing bag is adjustable and held under constant spring pressure. A stop tongue means actuated by a means for counting the cycles of greater than and less than atmospheric pressure applied to the bag engages the stop and can be unlocked for adjusting the position of the stop. By this means, a deep breath can be produced after a predetermined number of breathing cycles. This is because the tongue means can be disengaged from the stop from time to time so that the breathing bag can expand more than it did through the preceding breathing cycles so that a larger amount of air is forced into the lungs of the patient and the lungs are inflated by a deep breath.

The means by which the objects of the invention are obtained are described more fully with reference to the accompanying schematic drawing.

The drawing illustrates a breathing apparatus in which the air forced into the lungs is spontaneously exhaled. However, the invention can be applied to a breathing apparatus which not only forces air into the lungs but withdraws air from the lungs.

Air is supplied to the patient through the pipe 1 in the direction of the arrow 2. Pipe 1 is connected by way of a check valve 3 to a T-joint 4. This T-joint is also connected to a pipe 5 leading to the atmosphere by way of check valve 6. Valves 3 and 6 open in the same direction. A third pipe 7 of the T-joint 4 leads to the breathing bag 8 in the form of an accordion bellows and which is contained within housing 9. This housing is closed on all sides and forms a chamber 10 which is connected by pipe 11 with the air pressure generator 12, not shown in detail.

Generator 12 produces in predetermined and controlled cycles alternate greater than and less than atmospheric pressures. The bottom of bag 8 contacts but is not joined to stop plate 14. This plate is connected to a rod 15 having a notch 16 and is urged toward membrane 18 by

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spring 17. Thus the position of stop plate 14 can be adjustable to change the breathing volume at any given time.

When generator 12 produces a greater than atmospheric pressure in chamber 10, bag 8 contracts and in so doing pushes air out of the bag through valve 3 and line 1 into the lungs of the patient. Following this, a less than atmospheric pressure is produced by generator 12 and bag 8 expands. In so doing, valve 3 closes, valve 6 opens, and air is drawn in from the atmosphere through pipe 5 and pipe 7.

The membrane 18 is connected to pipe 11. This membrane is attached by a pivot joint 19 to a pawl 20 which engages ratchet 21. Ratchet 21 carries a cam 22 and is kept from freely rotating by leaf spring 23 which engages the ratchet teeth. As ratchet 21 is intermittently rotated, cam 22 moves to contact electrical switch 24 for actuating a solenoid 25. Locking tongue 26 is joined to the armature of the solenoid and, as shown in the drawing, is normally held in the notch 16 by the pressure of spring 27. The alternating pressures produced by generator 12 are transmitted to membrane 18 which is moved back and forth. Such movement intermittently moves ratchet 21 by pawl 20. Therefore, the switch 24 is contacted by cam 22 after a predetermined number of steps. When switch 24 is closed, solenoid 25 pulls tongue 26 out of notch 16. A following less than atmospheric pressure permits bag 8 to expand more than the normal maximum expansion and in so doing the bag pushes the stop plate down against the pressure of spring 17. Bag 8 expands to its fullest extent and is completely filled with fresh air. During the next greater than atmospheric pressure produced in chamber 10, bag 8 is compressed and forces the air from the expanded bag and into the lungs of the patient into a deep breath.

This greater than atmospheric pressure also causes a further rotation of ratchet 21 so that switch 24 is opened, solenoid 25 deenergized, and tongue 26 urged toward rod 15 by spring 27. The bag 8 being contracted, the spring 17 pushes rod 15 upwardly so that tongue 26 again becomes locked in notch 16.

The number of pressure cycles following which a deep breath is to be produced can be adjusted as desired.

Having now described the means by which the objects of the invention are obtained,

I claim:

1. A breathing apparatus comprising a housing, a breathing bag in said housing, pressure means for putting said bag under greater than or less than atmospheric pressure to expand or contract said bag, movable stop means for limiting the normal maximum expansion of said bag, pressure counting means for releasing said stop means after a predetermined number of greater than atmospheric pressures applied to said bag so that said bag is expanded to more than said maximum expansion during a following less than atmospheric pressure on said bag, and means for communicating said bag with a patient so that a deep breath is periodically forced into the lungs of the patient.

2. A breathing apparatus as in claim 1, said stop means comprising a stop plate engageable with said bag, a rod joined to said plate, a notch in said rod, and tongue means actuatable by said pressure counting means for engaging said notch.

3. A breathing apparatus as in claim 2, further comprising driving means responsive to the pressure changes

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on said bag for actuating said pressure counting means.
4. A breathing apparatus as in claim 3, said tongue means including solenoid means electrically connected to said driving means for actuating said tongue means.

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