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BREATHING APPARATUS HAVING AN ARRANGEMENT FOR ARTIFICIAL RESPIRATION

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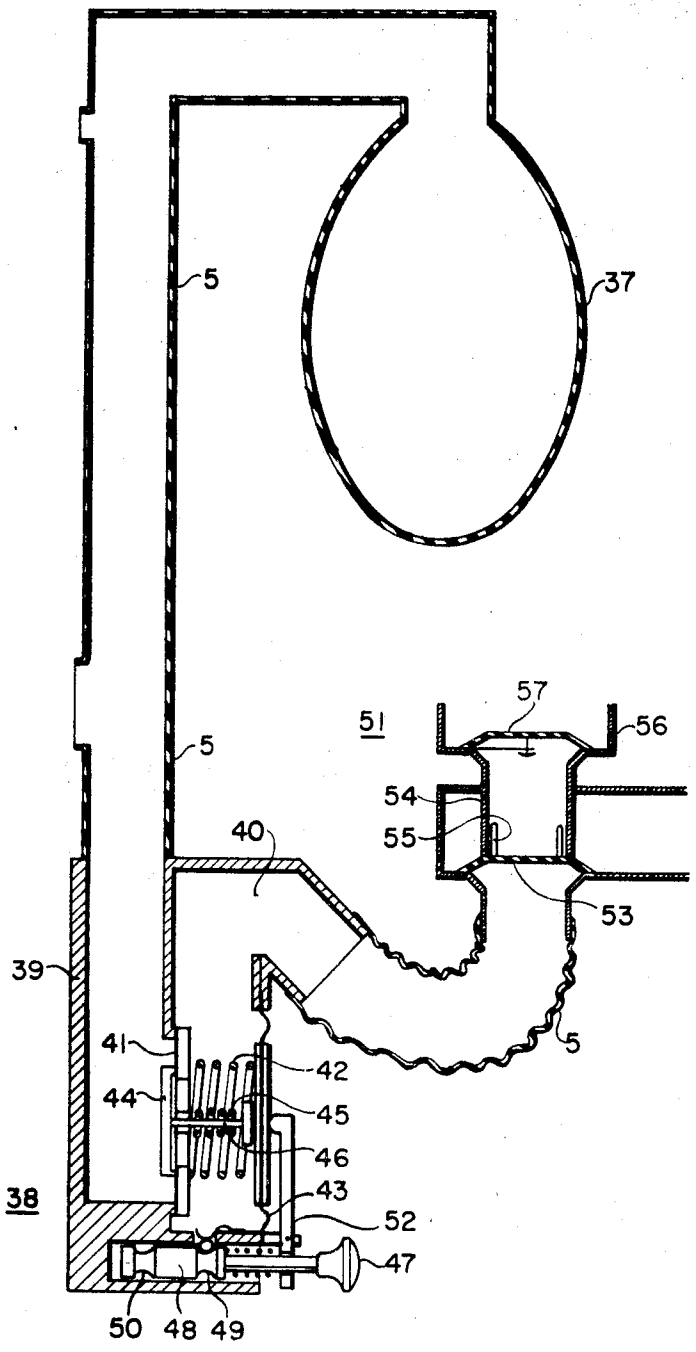

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BREATHING APPARATUS HAVING AN ARRANGEMENT FOR ARTIFICIAL RESPIRATION

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ABSTRACT OF THE DISCLOSURE

A breathing apparatus adapted for artificial respiration has a feeding device such as rubber bag for feeding gas through a conduit to a three-way breathing valve, which responds to pressure differences so as to connect a patient alternately with the feeding device for an inspiration and with an expiration outlet for an expiration. Auxiliary valve means in the form of a pair of oppositely directed non-return valves in the conduit separates the feeding device from the three-way valve, these non-return valves responding to predetermined pressure differences to open the conduit and permit flow to or from the three-way valve, depending upon the sense of the pressure difference. A manual control can hold one of the non-return valves open so as to permit continuous flow therethrough.

The invention relates to a breathing apparatus having an arrangement for artificial respiration and comprising a reservoir for the breathing gas, a feeding device for feeding from the reservoir to the patient, a conduit leading from the feeding device and adapted to be connected to the breathing organs of a patient, and a multi-way breathing valve with an expiration conduit provided in the said conduit and responsive to pressure from the feeding device for opening and admitting breathing gas to the patient and simultaneously closing the expiration conduit, and which responds to breathing pressure from the patient to open the expiration conduit.

In an arrangement of this type, the feeding device may comprise a construction of the reservoir to make possible the delivery of gas from the same; for instance, the reservoir may be a rubber bag which can be compressed for feeding gas to the patient.

It may be desirable for the connection from the reservoir to the multi-way breathing valve not to be directly open but through an overflow valve, which, even if it does let the feeding pressure pass during artificial respiration, does not let pass the pressure with which gas is fed into the apparatus. If this arrangement were not provided, the last-mentioned feeding pressure, which is to fill the reservoir during the patient's expiration, would reach the multi-way valve and the patient would have to overcome this feeding pressure in order to open the multi-way valve.

According to the invention, this disadvantage is obviated by means of an auxiliary valve arrangement provided in the conduit between the feeding device and the breathing valve and comprising an overflow valve which is adapted to open in response to pressure from the feeding device and clear the conduit leading to the patient.

However, providing such an overflow valve may in its turn lead to a difficulty owing to the fact that at the termination of an artificial inspiration there is a high residual pressure between the overflow valve and the patient, which would have to be overcome by the patient if he is to actuate the multi-way valve for an expiration. To obviate this, it is preferable to provide also a nonreturn valve making possible a passage in the opposite direction

to that of the overflow valve, whereby the said pressure can be let off through the nonreturn valve and contribute to the filling of the reservoir. In this manner, the patient only has to overcome the inherent pressure of the multi-way valve itself, which is of a negligible order of magnitude.

An embodiment of the invention is shown on the drawing.

The embodiment shown has a conduit **5** adapted to be connected on one hand to a gas-source supplying oxygen or air and/or other gases, e.g. N_2O, with a predetermined pressure and on the other to the patient's breathing organs.

Conduits **5** communicates with a rubber bag **37** serving as a reservoir and leads to an auxiliary valve device **38** and from it on via a breathing valve to the patient.

Valve device **38** comprises a housing **39** having a valve chamber **40** with an overflow valve comprising a valve disc **41** therein, the valve disc being urged towards the closing position by a spring **42** acting against a membrane **43**. A central aperture is provided in valve disc **41** to cooperate with a smaller valve disc **44**, which is also urged towards the closing position by a spring **45** acting against a stem **46** and valve disc **41**.

A knob **47** is provided to be adjustable between two positions, the drawing showing the knob in its pushed-down position. Knob **47** is mounted on a shaft **48** having recesses **49** and **50** into which a spring-urged ball can snap so as to determine the two terminal positions to which knob **47** can be adjusted. A lever **52** is pivotally mounted on housing **39** to be actuated through a spring around the outer part of shaft **48**, to in turn control membrane **43**.

In its pushed-down position, knob **47** determines by means of lever **52** acting on the membrane an outer terminal position for membrane **43**, whereby valve discs **41** and **44** are normally closed. In the outer position of knob **47**, lever **52** pivots to move membrane **43** inwardly against stem **46**, hence unseating valve disc **44** and establishing a continuous opening.

The breathing valve **51** is provided with an easily flexible thin valve disc **53**, the edge of which seats on a larger valve seat, thereby closing off conduit **5**. The central portion of disc **53** seats on a smaller valve seat formed by a tube **54**. In the inactive position, disc **53** seats on both of the valve seats referred to; it is retained in position by pins **55** engaging tube **54**.

Tube **54** has a wider portion **56**, in which there is provided a valve disc **57** serving as a nonreturn valve for the patient's expiration.

OPERATION

Auxiliary valve 38: the essential function of this arrangement is in connection with giving the patient artificial respiration by means of a pressure on the rubber bag. By observing the rubber bag, it is possible to see if the patient's spontaneous breathing ceases, for the bag normally moves in the rhythm of the patient's breathing. If it is desired to give artificial respiration, the bag **37** is compressed. Air is then forced out through auxiliary valve **38**, the valve disc **41** of which is unseated by the pressure in conduit **5**. The gas mixture flows through chamber **40** and under the edge of valve disc **53** to the patient. The pressure in conduit **5** then presses valve disc **53** against tube **54**. When the inspiration is completed, this pressure must be removed to make possible for the patient to breathe out through tube **54** and valve **57**, since this expiration has to take place by means of the expiratory pressure acting on the peripheral part of valve disc **53** so as to unseat it from the tube **54**.

If this operation is to be possible, the pressure on the underside of valve disc **53**, as was mentioned above, must

be removed. To this end valve disc **44** can move away from disc **41** and makes it possible for the gas to flow from conduit **5** back to rubber bag **37**, thus relieving the residual pressure between breathing valve **51** and auxiliary valve **38**.

When knob **47** is in the drawn-out position, membrane **43** acts against stem **46** to hold valve disc **44** open, and continuous flow of the gas mixture can take place.

I claim:

1. In a breathing apparatus having an arrangement for artificial respiration, the improvement comprising: conduit means for connection to a source of breathing gas; selectively actuatable feeding means for establishing intermittent variable pressures in said conduit so as to permit feeding gas to a patient intermittently at different pressures for artificial respiration; a three-way breathing valve connected in said conduit; said three-way breathing valve having a first passage connected in said conduit to receive gas from said feeding means, a second passage for connection to the breathing organs of a patient, a third passage forming an expiration outlet, and a breathing valve member responsive to pressure differences between said first and second passages for alternately communicating said second passage exclusively with said first passage for a patient inspiration or exclusively with said third passage for a patient expiration; an auxiliary valve means comprising a first non-return valve connected in and controlling gas flow through said conduit between said feeding device and said three-way breathing valve and a second oppositely directed non-return valve connected in and controlling gas flow through said conduit between said three-way breathing valve and said feeding means, said auxiliary valve means automatically opening said conduit to communicate said three-way breathing valve and said feeding device only in response to predetermined pressure differences in said conduit on opposite sides of said auxiliary valve.

2. In a breathing apparatus as claimed in claim **1** wherein each of said non-return valves includes means resiliently biasing it to its closed position.

3. In a breathing apparatus as claimed in claim **2** wherein said auxiliary valve means includes selectively actuatable opening means for holding one of said non-return valves open against its closing bias to provide free passage of gas in either direction through said auxiliary valve means.

4. In a breathing apparatus as claimed in claim **1** wherein said auxiliary valve means comprises a housing having first and second chambers communicable through a valve seat, a diaphragm flexibly mounted in a gas-tight manner in an aperture in a wall of the housing so as to be displaceable toward or away from said valve seat, means for limiting displacement of said diaphragm outwardly of the housing away from said valve seat, a first auxiliary valve member having an aperture therein and biased by a compression spring between said diaphragm and said first auxiliary valve member so that the periphery of the latter normally abuts said seat to prevent flow of gas from said first to said second housing chamber, and a second auxiliary valve member located on the side of said first auxiliary valve member remote from said diaphragm and spring biased to a normal position closing said aperture in said first auxiliary valve member, said

second auxiliary valve member having an integral stem portion extending therefrom through the aperture in said first auxiliary valve member toward the diaphragm, such that if the diaphragm is displaced inwardly of the housing it displaces said stem portion to unseat said second auxiliary valve member against the bias thereof from said first auxiliary valve member, thereby providing an open passage for free gas flow in either direction through the aperture in said first auxiliary valve member.

5. In a breathing apparatus as claimed in claim **4** wherein said second auxiliary valve member is biased by means of a compression spring surrounding said stem and located between the first auxiliary valve member and a portion of the stem of enlarged diameter adjacent the diaphragm.

6. In a breathing apparatus as claimed in claim **4** wherein said auxiliary valve means further comprises manual control means for controlling said diaphragm and movable between two positions in one of which displacement of the diaphragm outwardly of the housing is limited at a position such that both auxiliary valve members are spring biased normally to assume their seated positions and in the other of which said diaphragm is displaced inwardly of the housing and held in a position such that the second auxiliary valve member is held unseated from the aperture in said first auxiliary valve member, said control means comprising a rod axially displaceable in a bore in said housing between two positions, detent means for releasably retaining the rod in either of said positions, and a lever pivotally mounted on said housing and having a portion on one side of the pivotal mounting operatively coupled with said rod such that axial displacement of the rod produces angular movement of the lever relative to the housing, said lever having an end portion on the other side of the pivotal mounting which abuts said diaphragm on the side of the latter presented outwardly of the housing and which limits outward displacement of the diaphragm under the influence of the spring means biasing said auxiliary valve members.

7. In a breathing apparatus as claimed in claim **6** wherein the operative coupling between said portion of the lever on one side of the pivotal mounting and said rod comprises a compression spring surrounding the rod and acting between a shoulder on the latter and said lever portion whereby said end portion abutting the diaphragm is biased inwardly of the housing.

8. In a breathing apparatus as claimed in claim **1** wherein said selectively actuatable feeding means comprises a reservoir of variable volume.

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