

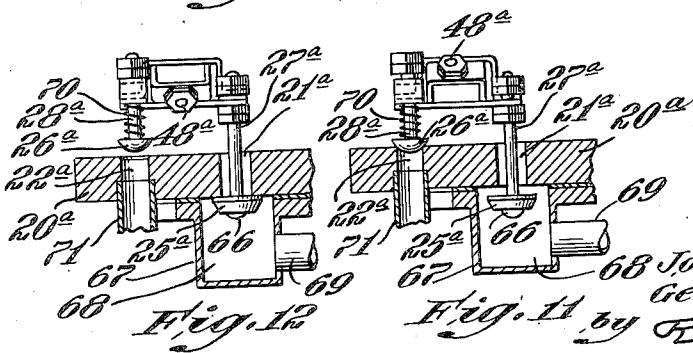
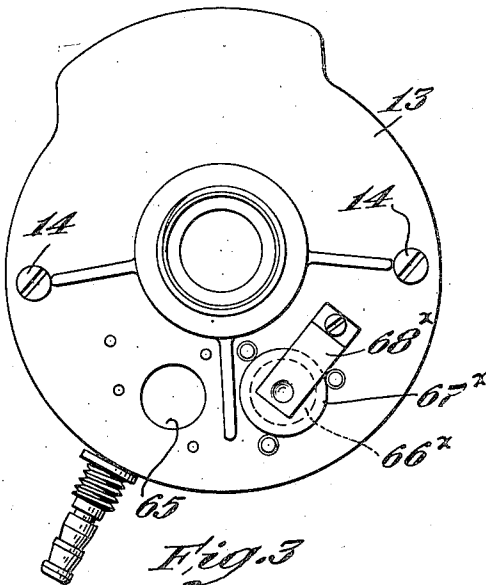
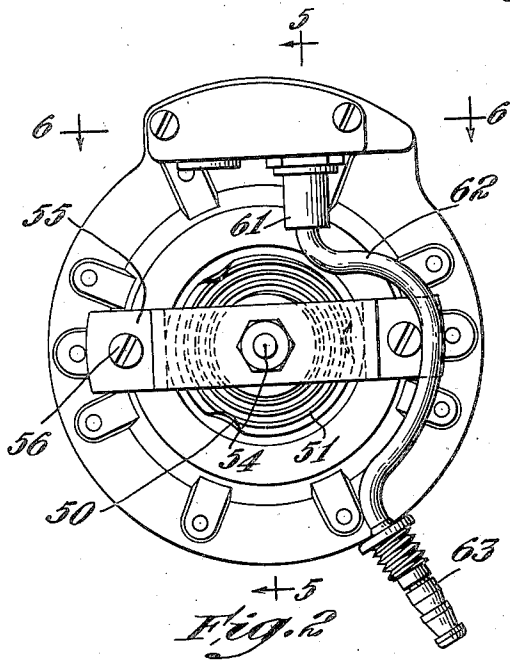
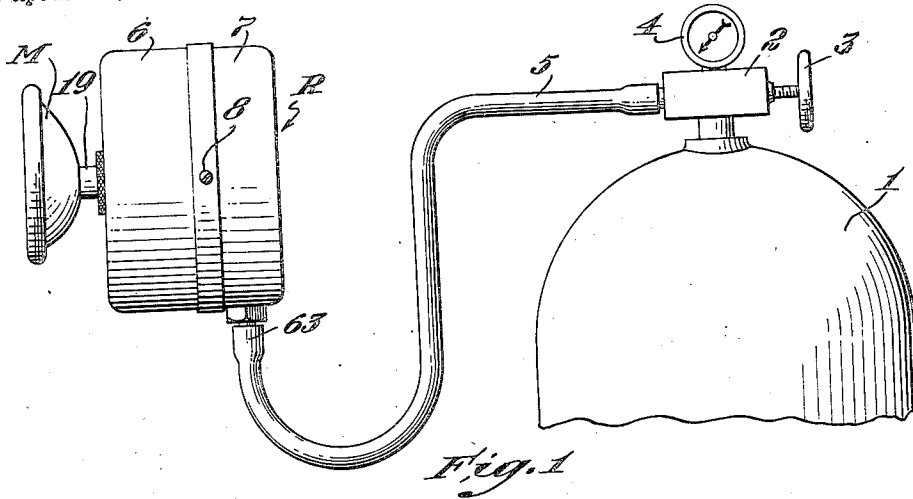
June 14, 1949.

J. H. EMERSON ET AL
RESUSCITATOR

2,473,416

Filed April 13, 1946

3 Sheets-Sheet 1



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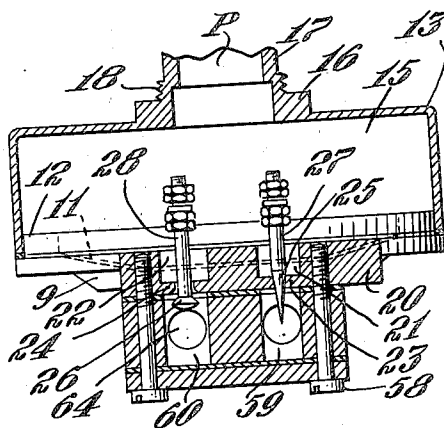
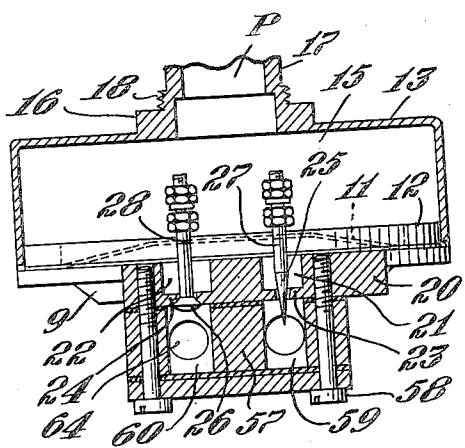
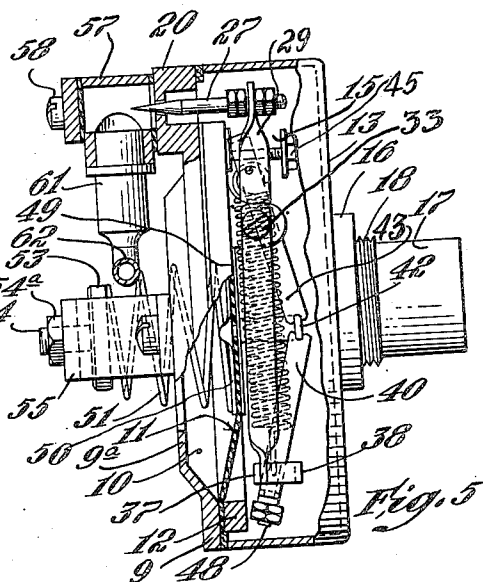
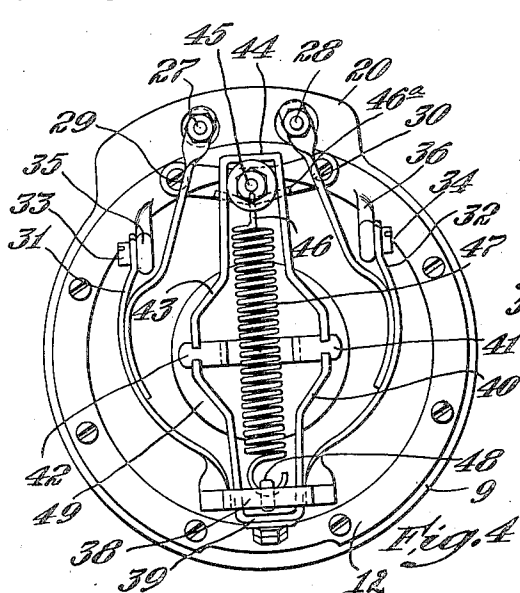
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3 Sheets-Sheet 3

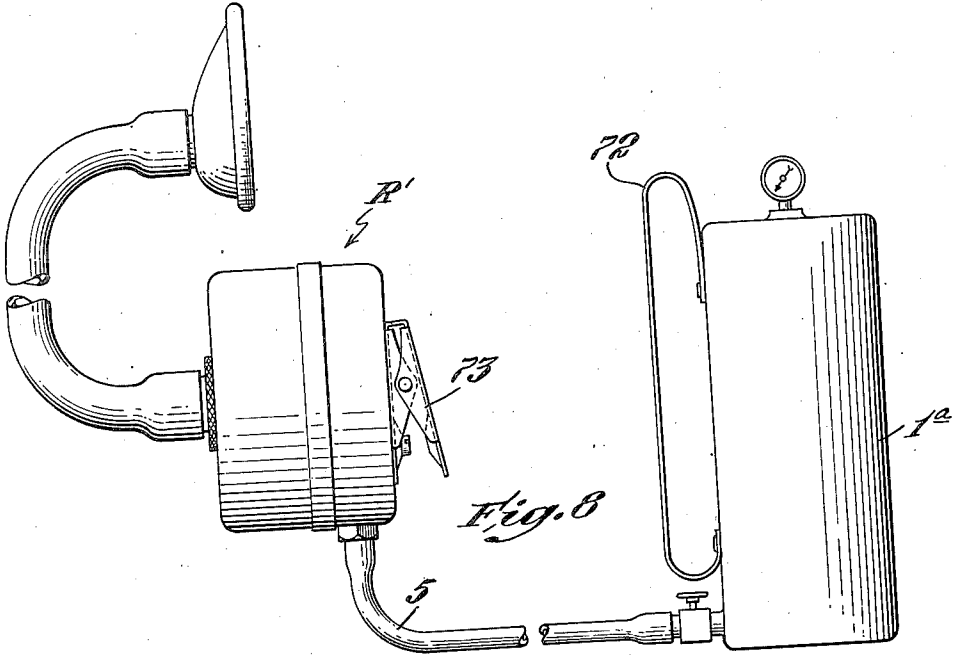


Fig. 8

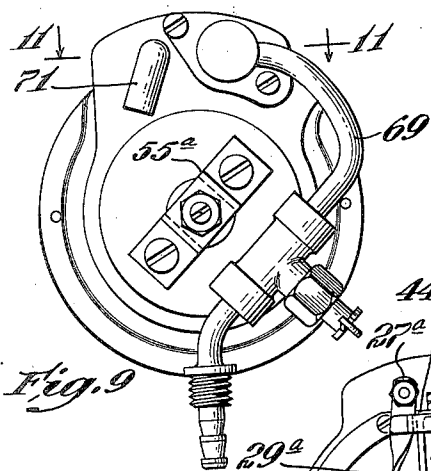


Fig. 9

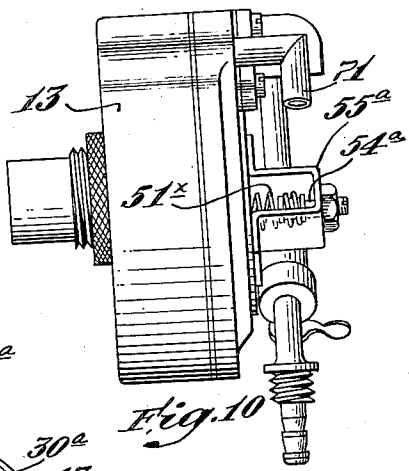


Fig. 10

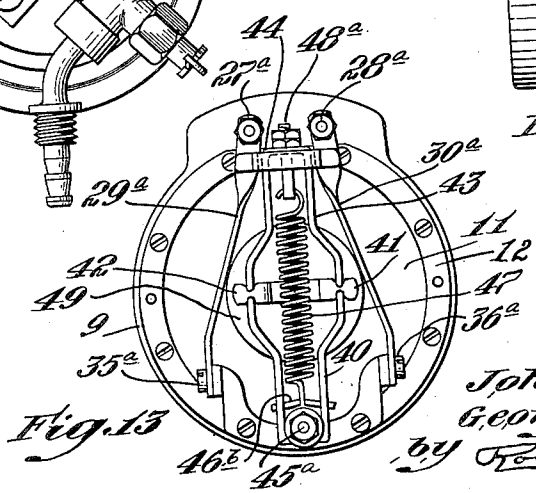


Fig. 13

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UNITED STATES PATENT OFFICE

2,473,416

RESUSCITATOR

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Application April 13, 1946, Serial No. 661,937

8 Claims. (Cl. 128—29)

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This invention relates to apparatus for and a method of treating persons unable to breathe normally, for example those suffering from asphyxiation, shock, or extreme weakness due to illness, surgical operations or the like.

It has heretofore been proposed to produce artificial respiration by means of apparatus designed automatically to inflate the patient's lung by supplying a revivifying gas, for instance oxygen, air or the like under pressure, to the lung, and then to deflate the lung by a suction action so as positively to withdraw gases therefrom. Apparatus of this general type is illustrated, for example, in the patent to Sinnett No. 2,268,172, dated December 30, 1941. The patented apparatus comprises a fluid-pressure motor, aspirating means, and valves automatically operated by the motor in response to changes in lung pressure. While apparatus of this type is very desirable, it is somewhat complicated and expensive to build. Moreover, there has been some criticism of this type of apparatus on the ground that the suction effect is harmful to the patient.

While we have discovered no evidence that the use of suction, properly controlled, is injurious, we do believe it desirable to provide simpler and less expensive apparatus than that customarily used in the pressure-suction system. Accordingly, one object of the present invention is to provide simple and relatively inexpensive apparatus operative automatically to maintain artificial respiration in response solely to the positive pressure of the gas supplied and to the contractile force of the patient's chest. A further object is to provide apparatus of light weight and compact construction, such that it may readily be worn by the user as a portable breathing device, for instance by persons obliged to work in air contaminated with poisonous gases or filled with smoke.

A further object is to provide apparatus of automatic type operative to inflate the lungs, even of an unconscious patient, in response to the direct pressure of the gas supplied, and which responds to a predetermined lung pressure, thereby automatically to cut off the gas from the supply and concomitantly to open free passage between the lungs and the atmosphere, or at least from the lungs to a space in which the pressure is lower than that of the gas supplied but not below that of the atmosphere. Other and further objects and advantages of the invention will be pointed out in the following more detailed description, and by reference to the accompanying drawings, wherein

Fig. 1 is a side elevation of the complete ap-

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paratus shown connected by a flexible conduit to a gas supply tank (the latter being broken away);

Fig. 2 is a rear elevation of the resuscitator device with the outer housing removed;

Fig. 3 is a front elevation of the device shown in Fig. 2;

Fig. 4 is a front elevation of the resuscitator with the inner cap removed to expose the motor mechanism;

Fig. 5 is a side elevation with the cap broken away and with the valve housing in vertical section substantially on the line 5—5 of Fig. 2;

Fig. 6 is a horizontal section substantially on the line 6—6 of Fig. 2 showing the inlet valve open and the exhaust valve closed;

Fig. 7 is a view similar to Fig. 6 but showing the valves in reversed position;

Fig. 8 is a side elevation of apparatus embodying a slight modification;

Fig. 9 is a rear view of the resuscitator of Fig. 8 with the housing removed;

Fig. 10 is a side elevation of the device shown in Fig. 9;

Fig. 11 is a fragmentary section, substantially on the line 11—11 of Fig. 9, showing the inlet valve open and the exhaust valve closed;

Fig. 12 is a view similar to Fig. 11, but showing the valves reversed; and

Fig. 13 is a front elevation of the device of Fig. 10, with the cap removed to expose the motor mechanism.

The apparatus of the present invention as herein disclosed generally resembles and embodies certain desirable features of the apparatus disclosed in the patent to Emerson No. 2,364,626, dated December 12, 1944. As in the patented device, the effective operation of the apparatus herein disclosed requires a source of gas at superatmospheric pressure, preferably at a substantially constant pressure. When herein reference is made to a gas, gaseous fluid or the like, such terms are used without limiting intent, being broadly inclusive of pure gases, for example, O₂ as well as mixtures of gases, for example, atmospheric air. As here illustrated, a source of gas under superatmospheric pressure is provided by the tank 1; for example, a conventional commercial oxygen tank having a fitting 2 provided with a valve controlled by the handle 3, a pressure gauge 4 and an outlet nipple to which one end of the flexible conduit 5 is secured. While a commercial gas tank may be employed as the source of gas under pressure, it is contemplated that air may be supplied under pressure to the resuscitator apparatus, for example from a tank of compressed air

or by means of a hand or power-driven pump preferably supplying the air to a tank or reservoir of substantial capacity in order that the air delivered to the resuscitator device may be at a substantially constant superatmospheric pressure.

The operative parts of the resuscitator R are all contained in the two-piece housing comprising the parts 6 and 7 which may be of sheet metal, molded plastic or the like, and which preferably have telescoping engagement at their meeting edges and which are normally connected by screws 8 or the like. This housing is hollow and preferably externally shaped and dimensioned to permit it to be held in the palm of one hand so as, in effect, to constitute a handle for the face mask M or equivalent device such as a breathing tube by means of which the gas is delivered to the patient. As illustrated, the face mask M is detachably secured to the resuscitator proper by means of a rigid telescopic connection, and the weight of the resuscitator is small enough so that when a patient reclines, his face may comfortably support the entire resuscitator device exclusive of the gas supply, the weight of the device being distributed over the area of his face by means of the mask.

All of the operative mechanism of the resuscitator device is carried by a rigid casting 9 (Fig. 5) which may, for example, be of metal, molded plastic or the like. At its rear side, this casting is provided with a depressed portion 9^a (Fig. 5) which defines one wall of an atmospheric pressure chamber 10; the other wall of this chamber is formed by a flexible diaphragm 11 of rubber, fabric or the like, constituting the pressure-actuated element of a fluid pressure motor which is sensitively responsive to lung pressure. The edges of this disk-shaped diaphragm 11 are secured to the casting 9 by the clamping ring 12 which is held in place by screws, rivets or the like.

A rigid hollow cap 13 is secured by screws 14 (Fig. 3) to the casting 9, the interior of this cap, together with the diaphragm 11, defining a motor chamber 15. The cap is provided with an annular boss 16 from which projects the tubular nipple 17, the latter preferably having external screw threads adjacent to its junction with the boss 16. This nipple 17 is designed to receive the tubular stem 19 (Fig. 1) of the mask M with a telescoping fit so that the mask may readily be removed from the resuscitator if desired. The tubular nipple 17 defines a passage P (Figs. 6 and 7) providing free communication between the chamber 15 and the interior of the mask M.

The casting or base member 9 is provided at its upper part with a rearwardly projecting boss 20 (Figs. 5, 6 and 7) which is shaped to provide the inlet chamber 21 and the exhaust chamber 22, said chambers opening into the motor chamber 15. The chamber 21 has a rear wall 23 having a central inlet orifice shaped to provide a conical valve port which converges outwardly from the chamber 21. The exhaust chamber 22 has a rear wall 24 which is provided with an aperture or orifice defined by a conical valve seat which diverges outwardly from the chamber 22.

An inlet valve 25, here shown as a needle valve, cooperates with the inlet orifice in the wall 23, and an exhaust valve 26 cooperates with the annular seat defining the orifice in the wall 24. The needle valve 25 is provided with a stem 27 and the exhaust valve 26 is provided with a stem 28. These valve stems are connected, respectively to the upper ends of arms 29 and 30 (Fig. 4). The lower parts of the arms 29 and 30 are rigidly se-

cured to the arms 31 and 32 forming parts of a rigid actuating yoke. The upper ends of the arms 31 and 32 are pivotally secured by means of screws 33 and 34, respectively, to bosses 35 and 36 projecting forwardly from the ring 12. The lower ends of the arms 29 and 30 are united by a transverse bar 37 (Fig. 5) and also by a bridge piece 38, the central portion of the bridge piece being spaced forwardly from the bar 37 to provide a chamber for the reception of the closed end 39 of a U-shaped toggle link 40. The upper ends of the opposed legs of this toggle link 40 are pivoted to a pair of forwardly directed bracket arms 41 and 42 (Fig. 4). A second toggle link 43 has the lower ends of its respective legs pivoted to the bracket arms 41 and 42, and the closed upper end 44 (Fig. 4) of this toggle link 43 embraces a rigid post 45 projecting forwardly from the ring 12. The upper end 46 of a coiled tension spring 47 is secured to a transverse rod 46^a uniting the spaced legs of the toggle link 43 at a point just below the post 45. The lower end of the spring 47 is connected to an adjustable stud 48 which passes through an opening in the closed end 39 of the toggle link 40.

The bracket arms 41 and 42 are parts of a substantially U-shaped member whose central portion is rigidly connected to a rigid disk 49 (Fig. 5) disposed at the forward side of the diaphragm 11. A second rigid disk 50 is disposed at the rear side of the diaphragm side 11 and forms an abutment for the forward end of an open coil compression spring 51 which extends outwardly through a central aperture in the part 9^a of the casting 9 and which bears against an abutment disk 53 carried by a rigid adjustable stem 54 passing through an aperture in a rigid bridge member 55 (Fig. 2) attached by screws 56 (Fig. 2) to the rear side of the casting 9.

A housing block 57 (Figs. 5, 6 and 7) is secured by screws 58 to the rear side of the boss 20 and is shaped to provide the inlet chamber 59 for registry with the inlet valve orifice in the wall 23 and with an exhaust chamber 60 for registry with the valve orifice in the wall 24. A hollow boss or nipple 61 (Figs. 2 and 5) is secured to the lower part of the housing 57, and to the lower end of this boss 61 there is secured the upper end of a rigid conduit 62 whose lower end is provided with a nipple 63 (Fig. 2) for the reception of the end of the flexible conduit 5. The exhaust chamber 60 is provided with a port 64 (Fig. 6) which may lead directly to the atmosphere or which may, if desired, be connected by a suitable conduit, not shown, to some restricted space in which atmospheric pressure, or a substantially constant pressure somewhat above atmospheric pressure but below the pressure of the supply tank 1, is maintained.

The cap 13 is provided with an inlet orifice 65 (Fig. 3) which is guarded by means of a very light valve disk, for instance of sheet mica, normally held against the inner surface of the cap by a very light spring but which is free to open in response to inhalation by the patient. The cap is also furnished with a safety valve orifice 66^x (Fig. 3) which is normally closed by a valve disk 67^x, likewise of mica or similar stiff and thin material and which is normally held seated by the light spring 68^x. This spring is so designed that the valve will automatically open whenever the pressure inside the cap exceeds a safe lung pressure.

Referring to Figs. 8 to 13 inclusive, a modified apparatus is disclosed which in most particulars is like that already described. The resuscitator device R' comprises a base casting 9 (Fig. 13) like

that above described, which, together with the flexible diaphragm 11 and the cap 13, defines an atmospheric pressure chamber and a motor chamber like those above described. In this instance the casting or base member 9 is provided with an elongate boss 20^a (Figs. 11 and 12) having the inlet chamber 21^a and the exhaust chamber 22^a. The inlet valve comprises an annular member 25^a which may be of rubber, fiber or the like and whose flat forward face is designed to engage the rear face of the boss 20^a so as to close the entrance to the chamber 21^a when the member 25^a engages the rear surface of the boss. This member 25^a is loosely mounted on the valve stem 27^a, the latter having a retaining head 66 at its rear end. The forward end of the exhaust chamber 22^a is shaped to provide a rearwardly convergent or beveled valve seat which cooperates with the valve 26^a carried by the stems 28^a. The valve stems are secured to the arms 29^a and 30^a (Fig. 13) respectively, of an actuating yoke, the lower ends of the yoke arms being pivoted by screws 35^a and 36^a to bosses projecting forwardly from the ring 12. The toggle link 40 has its closed lower end arranged to embrace a fixed stud 45^a projecting from the ring 12, and the lower end of a coiled tension spring 47 is secured to a crossbar 46^b connecting the legs of the link 40 just above the stud 45^a. The opposite end of the spring 47 is secured to an adjustable stud 48^a passing through an opening in the closed upper end 44 of a second toggle link 43. The adjacent ends of the toggle arms are pivotally connected to the bracket members 41 and 42 which project forwardly from a disk 49 disposed at the front face of the diaphragm 11. A spring 51^x (Fig. 10) generally similar to the spring 51 above described, bears at its forward end against the disk at the rear of the diaphragm, the rear end of this spring engaging a shoulder carried by an adjustable stud 54^a which passes through an aperture in a bridge-piece 55^a.

A housing 67 (Figs. 11 and 12) is secured to the rear side of the boss 20^a and defines an inlet chamber 68 which is connected by a rigid pipe 69 to the flexible conduit 5 (Fig. 8) which leads from the gas tank 1^a. A rigid conduit 71 (Fig. 12) is connected to the rear side of the boss 20^a and arranged to conduct exhaust gases from the exhaust chamber 22^a. This conduit 71 may terminate within the outer housing or it may lead to some other point, for example to a container in which a uniform pressure is maintained, slightly above atmospheric pressure but below that of the gas tank 1^a.

As illustrated in Fig. 8, the tank 1^a is provided with a strap 72 by which it may be carried, for example over the shoulder of the user, and the resuscitator housing is provided with a spring clip or clasp 73 by means of which it may be attached to the clothing of the user, for instance, when the device is used as a respirator in an atmosphere filled with smoke or poisonous fumes.

Referring again to Figs. 1 to 7, it is assumed that the spring 51 has been adjusted by turning the nut 54^a so that the diaphragm 11 normally occupies the position shown in Fig. 6 when no gas is being supplied from the gas tank. In this position the valve 25 is unseated and the valve 26 is seated. Assuming that gas from the tank 1 is now admitted under a predetermined reduced pressure to enter the chamber 59, the gas will pass through the port controlled by the valve 25 and into the motor chamber 15, and thence directly into the lungs of the patient. The gas at this predetermined pressure inflates the patient's lungs and builds up pressure therein until a predetermined lung pressure (and like pressure in

chamber 15) has been attained. The area of the diaphragm is such relative to the strength of the spring 51 that when this predetermined lung pressure is reached, the diaphragm will move rearwardly to the position shown in Fig. 7. In so moving, it moves the brackets 41 and 42 and thus causes the toggle mechanism to snap rearwardly, thus quickly moving the valves 25 and 26 rearwardly so as to close the inlet port and to open the exhaust port. The constrictive force of the patient's chest now expels gaseous materials from the lungs through the mask, the passage P, the chamber 15, and the exhaust valve and exhaust port 64. This continues until the lung pressure has dropped to a predetermined amount which should be slightly above atmospheric pressure, whereupon the spring 51 reasserts itself, pushes the diaphragm forwardly, and by the toggle mechanism reopens the inlet valve and closes the exhaust valve, whereupon the cycle is repeated.

The operation of the arrangement shown in Figs. 8 to 13 is slightly different in respect to the fact that the rearward movement of the diaphragm in response to a predetermined lung pressure causes both valves 25^a and 26^a to move forwardly. However, in so moving the inlet valve is closed and the exhaust valve is opened, the same as above described, thus permitting the air from the lung to exhaust direct to the atmosphere. Under some conditions one of these arrangements may be preferred and under other conditions the second arrangement may be preferable, it being noted that each of these mechanisms responds to the pressure of the supply gas to admit gas freely to the patient's lungs, and then responds to a predetermined lung pressure to cut off the supply of gas from the source and exhaust air from the lungs down to but not below atmospheric pressure.

Thus, with either arrangement, the lung pressure is always positive, no suction effect is developed within the lung so that no injurious effects can possibly occur from any suction action, while, on the other hand, the device is completely automatic and does not require the assistance of an operator in causing the device to perform its normal cycle.

While a toggle and spring constitutes desirable means for effecting a snap action operation of the valves, it is contemplated that equivalent snap action means may be employed, for instance, means such as is employed in snap action electrical switches, for example, in a so-called "Mu" or "Micro" switch, or one such as disclosed in patent to Shaw No. 2,170,341, August 22, 1939.

This method of inflating and deflating the lung automatically is apparently novel, and while two forms of apparatus have herein been illustrated whereby this method may be carried into effect, it is contemplated that the method may be performed automatically by other apparatus, or by the use of hand-actuated instrumentalities if desired.

The cycle of operations thus consists in admitting gas under pressure to the patient's lung, so as thereby to inflate the lung; automatically shutting off the gas from the supply as soon as the lung pressure reaches a predetermined value and at the same time providing a free passage from the lung to the atmosphere; and then when the lung pressure has fallen to a predetermined value, not less than atmospheric, in response to chest contraction (natural or artificially induced) again admitting gas from the supply, automatically to initiate a new cycle.

In the description some reference has been

made to the "upper" and "lower" parts of the device and to the "front" and "rear," but these terms are used merely for convenience in description and not by way of limitation. Likewise, while it has been suggested that air or oxygen may be supplied in this way to the patient, it is contemplated that other gaseous substances or mixtures may be administered to the patient in the same way if desired.

We claim:

1. Breathing apparatus of the kind wherein gas under pressure supplies the energy for inflating the lungs and having a face mask and a case which houses all of the operating mechanism of the resuscitator and which has therein a pressure motor including a pressure-responsive element defining one wall of a chamber, and means providing a constantly open passage leading from the interior of the mask to said chamber, means within the case providing an inlet passage through which the gas at a predetermined superatmospheric pressure may enter the chamber and an exhaust passage leading from the chamber to the atmosphere, valves operative at times to close the inlet and exhaust passages respectively, the valves being so related that when one is closed the other is open, and vice versa, and mechanical connections operative to transmit motion from the movable wall of the pressure motor to said valves, the motor and actuating mechanism being constructed and arranged to open the inlet passage in response to a predetermined superatmospheric lung pressure thereby to admit gas from the supply, and to close the inlet passage and to open the exhaust passage in response to a greater predetermined superatmospheric lung pressure.

2. Breathing apparatus of the kind wherein gas under pressure supplies the energy for inflating the lungs and having a face mask and a case which houses the operating mechanism and which has therein a pressure motor including a pressure-responsive element defining one wall of a chamber, and means providing a constantly open passage leading from the interior of the mask to said chamber, means within the case providing an inlet passage through which the gas under pressure may enter the chamber and an exhaust passage leading from the chamber to a space in which the pressure is less than that of the pressure of the gas supplied to the inlet passage, but greater than atmospheric pressure, each passage including an orifice defined by a valve seat, a valve cooperable with each seat respectively, the inlet valve and seat being so arranged that the inlet valve closes by moving outwardly from said chamber, and the exhaust valve and seat being so arranged that the exhaust valve is unseated by movement outwardly from the chamber, and mechanism for transmitting motion from the pressure-responsive element of the motor to the valves, said mechanism including a spring operative normally to hold the inlet valve open and the outlet valve closed, the motor and motion-transmitting means being so constructed and arranged that when a predetermined superatmospheric pressure has been built up in the lung by the admission of gas through the inlet passage, the valves are suddenly reversed so as to close the inlet passage and open the exhaust passage.

3. Breathing apparatus of the kind wherein gas under pressure supplies the energy for inflating the lungs and having a face mask and a case which houses the operating mechanism and which has therein a pressure motor including a pres-

sure-responsive element defining one wall of a chamber, and means providing a constantly open passage leading from the interior of the mask to said chamber, means within the case providing an inlet passage through which gas may enter the chamber, and an exhaust passage through which gas may escape from the chamber to the atmosphere, each passage including an orifice defined by a valve seat, a valve cooperable with each seat respectively, the inlet valve and seat being so arranged that the inlet valve is unseated by moving away from said chamber and the exhaust valve is seated by moving away from said chamber, and snap-action mechanism for transmitting motion from the pressure-responsive element of the motor to the valves, said mechanism including a spring operative normally to keep the inlet valve open and the exhaust valve closed, the motor and motion-transmitting mechanism being so constructed and arranged that when a predetermined superatmospheric pressure has been built up in the lung by admission of the gas thereto, the valves are automatically and suddenly reversed so as to close the inlet passage and open the exhaust passage.

4. Breathing apparatus of the kind wherein gas under pressure supplies the energy for inflating the lungs and having a face mask and a case which houses the operating mechanism and which has therein a pressure motor including a pressure-responsive element defining one wall of a chamber, and means providing a constantly open passage leading from the interior of the mask to said chamber, means within the case providing an inlet passage through which gas under pressure may enter the chamber, and an exhaust passage leading from the chamber to the atmosphere, each passage including an orifice defined by a valve seat, a valve cooperable with each seat respectively, and mechanism for transmitting motion from the pressure-responsive element of the motor to the valves, said mechanism including a toggle-linkage and a spring, and means so connecting the valves to the toggle-linkage that when one valve is open the other is closed, and vice versa, the spring being so desired as normally to hold the toggle-linkage in a position to keep the inlet valve open, and the pressure-responsive element of the motor being of such area that in response to a predetermined superatmospheric lung pressure resultant from admission of gas through the inlet passage, the toggle-linkage is moved to a position such as suddenly to close the inlet passage and to open the exhaust passage.

5. Breathing apparatus of the kind wherein gas under pressure supplies the energy for inflating the lungs and having a face mask and a case which houses all of the operating mechanism of the resuscitator and which has therein a pressure motor including a pressure-responsive diaphragm defining one wall of a chamber, and means providing a constantly open passage leading from the interior of the mask to said chamber, means within the case providing an inlet passage for the admission of gas under pressure to the chamber, and an exhaust passage leading from the chamber to the atmosphere, each passage having a valve seat and a valve cooperable with each seat respectively, and snap-action mechanism for transmitting motion from the pressure-responsive element of the motor to the valves, said mechanism including an open coil compression spring which bears against the outer side of the diaphragm, means for adjusting the tension of the spring thereby to determine the

lung pressure at which exhalation shall begin, and means so connecting the valves to said mechanism that when one valve is open the other is closed, and vice versa, the strength of the spring being so related to the area of the pressure-responsive element of the motor that when the lung pressure has been built up to a predetermined value, in response to the admission of gas through the inlet passage, the snap-action mechanism will suddenly close the inlet and open the exhaust valves, the area of the pressure-responsive element of the motor being such that when the lung pressure drops to a lesser predetermined value, greater than atmospheric pressure, the mechanism will open the inlet valve and close the exhaust valve.

6. Breathing apparatus of the kind which inflates the patient's lung by the admission of gas at superatmospheric pressure and which allows the lung to deflate in response to chest contraction alone, said apparatus including a gas admission valve and a gas exhaust valve and means for automatically actuating said valves, cycle after cycle, including a spring tending normally to hold the inlet valve open and a pressure motor which is responsive to lung pressure, and snap-action mechanism actuated by the pressure motor and operative to close and to open the inlet and exhaust valves, said mechanism being so designed and arranged that when the inlet valve closes the exhaust valve simultaneously opens.

7. In a resuscitator of the kind wherein gas under pressure supplies energy for inflating the lung and having a face mask rigidly connected to a case of a size such that it may be held in the palm of one hand and which houses all of the operative mechanism of the resuscitator and which has connected thereto one end of a single flexible supply conduit through which gas under pressure is supplied from a suitable source, means within the case defining a motor chamber having a movable wall, said motor chamber communicating freely at all times with the interior of the mask, means providing an exhaust passage leading from said motor chamber to the atmosphere, a valve controlling the admission of gas from the supply conduit to the motor chamber and a valve controlling the discharge of gas

from the motor chamber to the atmosphere, and mechanical means for transmitting motion from the movable wall of the motor chamber to said valves, said movable wall being responsive to a predetermined superatmospheric lung pressure to open the inlet and to close the exhaust valve, and being responsive to a greater predetermined superatmospheric lung pressure to open the exhaust valve and to close the inlet valve.

8. Breathing apparatus of the kind wherein gas under pressure supplies the energy for inflating the lungs and having a case which houses all of the operating mechanism of the resuscitator, said case having therein a motor chamber provided with a movable wall, a supply conduit leading from a source of gas under superatmospheric pressure, a breathing conduit leading to the patient's lungs, an inlet valve controlling a passage leading from the supply conduit to the breathing conduit, an exhaust valve controlling an exhaust passage leading from the breathing conduit to a passage in which the pressure is approximately atmospheric, and mechanical means within the case for transmitting motion directly from the movable wall of the motor chamber to the inlet and exhaust valves, the transmission means being so constructed and arranged that when the inlet valve is closed, the exhaust valve is open and vice-versa, the movable wall being responsive to a predetermined superatmospheric lung pressure to open the inlet valve and to close the exhaust valve, said wall also being responsive to a greater predetermined superatmospheric lung pressure to close the inlet valve and to open the exhaust valve.

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REFERENCES CITED

The following references are of record in the file of this patent:

UNITED STATES PATENTS

Number	Name	Date
1,044,031	Drager	Nov. 12, 1912
2,288,436	Cahan	June 30, 1942
2,376,348	Fox	May 22, 1945