

May 25, 1965

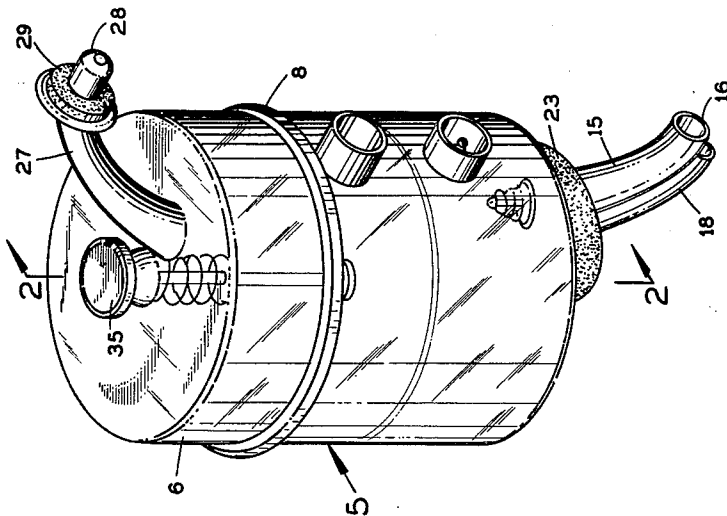
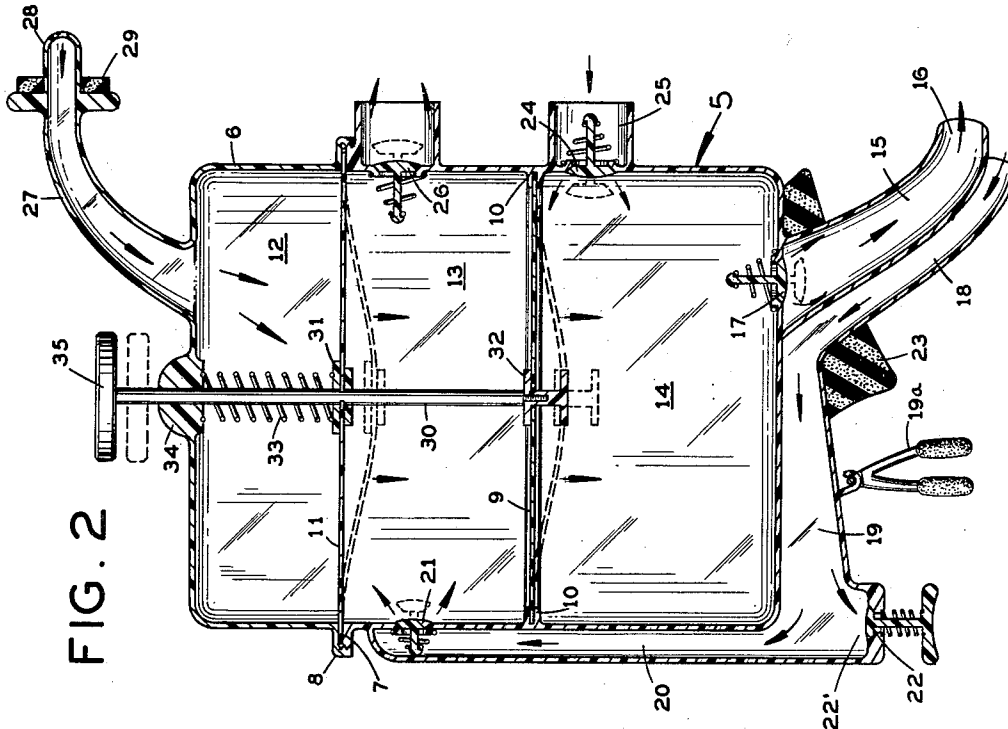
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3,185,147

RESUSCITATOR

Filed Sept. 13, 1961

2 Sheets-Sheet 1



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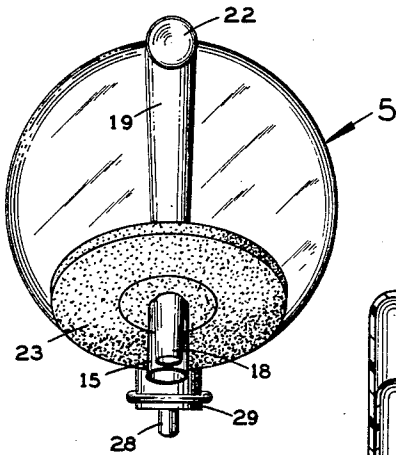


FIG. 3

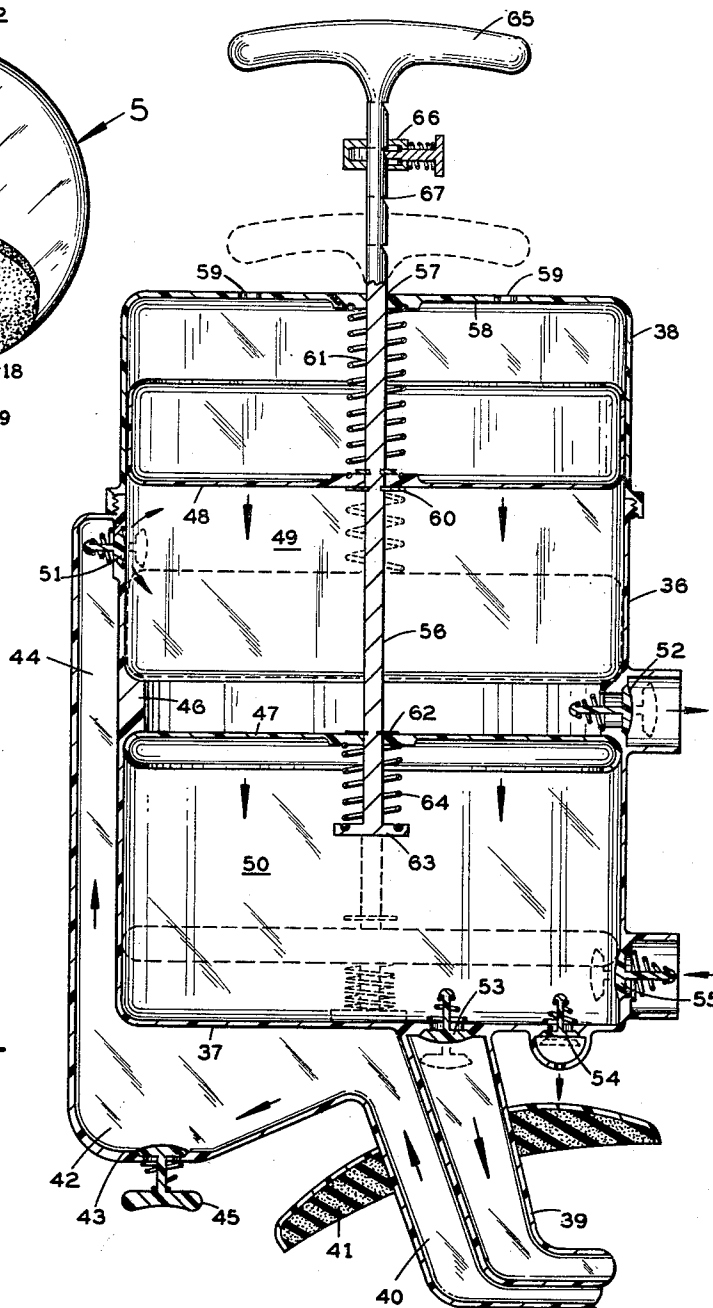


FIG. 4

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RESUSCITATOR

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This invention relates to a resuscitator that permits a low cost mouth-to-mouth apparatus of this type having unusual aseptic qualities not usually conducive in employing this method by usual procedures.

The device is also unique in respect that it can employ bottled oxygen in place of fresh air utilizing only a single low pressure oxygen tank regulator in the victim's intake air system thereby cutting down on expensive mechanical equipment. Fresh air can be utilized equally as well, employing only a simple filter arrangement to keep sand, dust, etc. from clogging or damaging working parts.

As an added optional feature to the unit, a simple single-action pump operated manually or electrically could be utilized rather than the operator's breath pressure, however this would substantially increase production costs; and would naturally limit the usefulness of the device. This basic unit can be mass produced almost entirely of a plastic material opaque or transparent in nature at extreme low cost. The use of transparent materials would make visible any possible malfunction of the unit for ready correction of the same.

In the event the operator for one reason or other is unable to use his own breath pressure or as a possible means of relieving himself of using his own breath-pressure, a rod could be attached to the upper end of the diaphragm operating rod, enabling the device to be used by manual means, much the same as a bicycle pump. It is believed that the personal breathing factor of the operator is important in restoring normal breathing to the victim and is the reason for stressing the primary use of the operator's breath-pressure rather than that of mechanical means.

In the accompanying drawings, wherein has been illustrated preferred forms of the invention and wherein like characters of reference are employed to denote like parts throughout the several figures.

FIGURE 1 is a perspective view of a resuscitator constructed in accordance with the invention,

FIGURE 2 is a vertical sectional view thereof taken substantially on line 2—2 of FIGURE 1,

FIGURE 3 is a bottom plan view of the form of the invention illustrated in FIGURES 1 and 2, and

FIGURE 4 is a vertical sectional view through a modified form of the device.

Referring specifically to FIGURES 1—3 there has been illustrated a cylinder 5, preferably formed of plastics or the like. The cylinder 5 is closed at its upper end by a cylindrical cap 6, having a threaded engagement with a marginal flange 7 of the cylinder 5, as shown at 8. The cylinder 5 is partitioned horizontally intermediate its height by a diaphragm 9, clamped around its marginal edges to an inner circumferential rib 10 of the cylinder 5. The cap 6 also clamps the marginal edge of a diaphragm 11, forming an upper chamber 12, an intermediate chamber 13 and a lower chamber 14.

The lower chamber 14 communicates with a mouthpiece 15 that is tubular and constitutes the victim's air inlet and tongue depressor. The mouthpiece 15 is open at its discharge end 16 and communicates from the chamber 14 by a downwardly opening spring actuated check valve 17. An air discharge or scavenging tube 18 is preferably formed integral with the mouthpiece 15 and communicates with a discharge conduit 19, communicating with a vertical conduit 20, that communicates with the intermediate chamber 13 through the medium of an in-

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wardly opening spring actuated check valve 21. The conduits 19 and 20 are offset at their points of meeting and is provided with a manually actuated inwardly opening check valve 22. The mouthpiece 15 and the scavenger tube 18 are surrounded by a compressible gasket 23 formed of any desirable material, such as sponge rubber or the like.

The chamber 14 is also provided with an inlet check valve 24 constituting the means for the entry of fresh air, oxygen or the like and the check valve 24 may be surrounded by an outwardly projecting tubular sleeve 25 for facilitating the air or oxygen supply. The intermediate chamber 13 is provided with an outwardly opening check valve 26 in addition to the inwardly opening check valve 21 and constitutes a relief valve for the scavenging of the chamber 13, check valve 26 being set at slightly higher tension than valves 17, 21 and 24. The cap 6 is provided with a tubular nozzle 27, having a mouthpiece 28 and a gasket 29 constituting the means whereby a person may manually engage the mouthpiece 28 into the mouth for forcing a normal air pressure into the chamber 12.

Connected to the diaphragms 9 and 11, is a control rod 30. The control rod 30 is fixedly connected to the diaphragm 11 by discs 31 and is movably connected with the diaphragm 9 by a spool-shaped coupling 32 and whereby the diaphragm 9 may have independent movement with respect to the rod 30 yet, may be forced downwardly by the rod when the device is functioning as a manually actuated pump. The rod 30 is cushioned against upward movement by a tension spring 33 and the rod extends through a bearing 34, formed upon the upper end of the cap 6 and carries a handle 35, whereby the rod may be shiftable manually for controlling the pumping action to the victim and the scavenging of the air from the victim's lungs to the chamber 13, where it is discharged through the check valve 26.

In the use of this form of the invention the operator, after having placed the victim on his back, places the clamp 19a on the victim's nose, obstructing the nostrils and making sure that the victim's mouth is free of any obstructions. The operator then places the mouthpiece 15 in the victim's mouth ensuring that the tongue is properly depressed to prevent the victim from swallowing his own tongue and that the gasket 23 is properly fitted about the mouth so that there is no leakage of air, this being accomplished by a relatively light pressure of the gasket over the oral cavity. The operator then places the mouthpiece 28 in his own mouth and using his own breath pressure blows into the device and into the chamber 12, holding the maximum pressure momentarily, then removing his mouth from the mouthpiece sufficiently to let the air escape from the device and excess air from his own lungs. The operator then repeats the procedure with his next exhaling breath repeating the cycle. The operator can then use his own breathing rhythm as a control to induce normal breathing to the victim.

The air pressure exerted by the operator passes through the nozzle 27, causing the upper diaphragm 11 to flex downwardly, pushing the operating rod 30 down to engage and flex the lower diaphragm 9, causing it to create a pressure in the lower chamber 14, forcing air into the victim's lungs through the mouthpiece valve 17, inlet to the chamber 14 being from the valve 24. When the operator releases the air pressure in the upper chamber, the mouthpiece valves 17 close, both diaphragms return to their normal positions. As the lower diaphragm 9 returns to its normal position, a vacuum is created in the chamber 14, opening the inlet valve 24, admitting fresh air or oxygen into the chamber 14 and the valve 24 closes by a regulated spring pressure when the pressure in the chamber 14 has been equalized. The upper diaphragm 11 with the operating rod 30 securely

fastened, continues to travel upward aided by the tension spring 33 and shifting the upper diaphragm 11 upwardly to its normal position, and such upward motion of the diaphragm creates a vacuum in the middle chamber, causing the scavenging valve 21 to open and draw out the victim's exhausted air through the scavenging tubes 19 and 20 and the scavenging tube 18, taking with it water, mucous etc., which drains to the reservoir 22' and can be manually released by the operator by depressing valve 22, whenever the fluid has accumulated in the reservoir. These various movements of the parts and the flow of any fluids or other matter through the mechanism can be readily observed in view of the fact that the device is primarily formed of the transparent plastic. The vacuum action is only necessary to a slight degree, because of the natural contraction of the victim's lungs forcing the air out through a scavenger tube 19 and 20 and from the valve 21, into the intermediate chamber 13 and then forced outwardly from the valve 26 to the open air. The lower diaphragm 9 remains in normal position until engaged by the lower end of the operating rod 30, causing the lower diaphragm 9 to flex or distend slightly upwardly creating a further vacuum in the lower chamber 14 and admitting more air or oxygen through inlet valve 24. The unit is then ready for the next cycle and the operator upon applying breath pressure to the unit causes the upper diaphragm to distend downwardly, creating first a pressure in the middle chamber causing it to exhaust the air through the outlet valve 26 into the open air, before the operating rod 30 engages the lower diaphragm to complete the downward cycle.

The emergency handle 35 can be used to successfully operate the system independent of breath-pressure but possibly lacks the natural rhythm of normal breathing except when used by an experienced operator. However it is believed that anyone could operate this device capably without prolonged instructions. An important feature of this device is that the device will aid the victim in breathing only to a sufficient degree as to assure adequate air to the lungs. As the victim starts breathing on his own and his strength gains to the point where he is completely breathing on his own, the victim's normal breathing will overpower any efforts by the operator that are counteractive to the victim's natural breathing. The victim as he gains strength in breathing-in will open valves 24 and 17 and in breathing out will open valves 21, bypassing any action on the operator's part.

In FIGURE 4, there has been illustrated a somewhat modified form of the invention but functionally substantially duplicating the operation of the first form.

In this form of the invention, there has been provided a cylinder 36, having a lower closure wall 37 and with the cylinder 36 being open at its upper end and marginally threaded to receive in threaded engagement, a cap 38. The lower wall 37 has molded or otherwise connected thereto a mouthpiece of tubular form 39 for a scavenger tube 40 connected thereto for engagement into the mouth of the victim. The tubes 39 and 40 are provided with an adjustable oronasal-type face mask 41, constituting a closure means for engagement over the mouth and nose of the patient. The tube 40 communicates through a chamber 42, having a lower point 43, for the collection of mucous, water or the like and this chamber is extended upwardly along one side of the cylinder 36 as shown at 44. At the lowermost point 43 there has been provided a manually controlled upwardly opening check valve 45. Intermediate the height of the cylinder 36, there has been provided a circumferential rib 46, constituting a stop for a piston 47 and a limit stop for an upper piston 48. The piston 47 provides an upper chamber 49 and a lower chamber 50. The scavenger tube 44 has communication with the chamber 49 through an inwardly opening spring actuated check valve 51 and the chamber 49 is also provided with an outwardly

opening spring actuated check valve 52. The mouthpiece 39 has communication with the chamber 50 through the medium of a downwardly opening spring actuated check valve 53 and a safety valve 54, outwardly opening as provided in the lower end wall 37, for a purpose to be described. The chamber 50 is also provided with an inlet spring actuated check valve 55, constituting the inlet for air or oxygen.

The pistons 47 and 48 are movable under the influence of a piston rod 56, passing through a guide opening 57 in the top wall 58, of the cap 38. The top wall 58 is also provided with air escape openings 59. The rod 56 is fixedly connected to the piston 48 and the piston is limited in its downward movement upon the rod 56 by a washer 60. The piston 48 is normally biased upwardly by a tension spring 61 attached to the upper wall 58 and the wall of the piston 48, spring 61 having less tension than spring 64. The piston 48 in its complete downward movement will stop against an upper shoulder shown by the rib 46, shown in dotted lines in FIGURE 4. The piston 47 is held against upward movement by the rod 56, by a washer 62 and a head 63 upon the lower end of the rod 56 which limits the movement of the piston 47 upon the rod and is biased to a position against the washer 62 by a spring 64, bearing against the head 63 and the piston 47. The piston 47 is thus forcibly shifted down under the influence of the piston rod 56 creating in the chamber 50 a pressure that is previously accumulated, such as the oxygen from the valve 55 and will force the oxygen past the valve 53 and through the mouthpiece 39 to the lungs of the victim. The rod 56 extends axially of the cylinders and projects above the top wall 58 where it is provided with a manual control handle 65. The motion of the rod 56 is controlled or regulated by a stop device 66, having engagement into any selected notches 67 and longitudinal areas suitably color-coded whereby the rod in its downward motion is limited for controlling the degree of injection of oxygen or fresh air to the lungs for persons of different ages, and lung capacities.

The operation of this form of the invention it is believed, will be apparent. The unit is operated after the mouthpiece has been inserted into the mouth of the victim and with the stop 66 having been previously adjusted in accordance with the age and/or lung capacity of the individual, the rod is then moved downwardly until the stop 66 has contacted the top of the cap 38. The handle 65 can then be released, returning to its normal position and ready for the next stroke, maintaining twelve to fifteen strokes per minute or as recommended by competent medical authorities for normal methods of resuscitation. Based on the theory that an average person breathes about four quarts of air per minute and inhales and exhales about twelve times per minute, the unit is designed to supply an average of one third quart of air per stroke being also capable of providing more air for large adults (above average) or proportionately less for small children and tots, and always with adequate safety.

In cases of drowning, or when some bronchial condition exists where there is considerable water and mucous in the victim's air passages, the control rod 56 is pulled upwardly until resistance is met, then released, returning to its normal position ready for the next stroke either down or upward for scavenging again. The upward pull of the control rod 56 by the handle 65, creates a scavenging action removing water and mucous from the victim's throat and air passages where it will flow through the conduits 40 and 44 to exhaust through the valve 51 to the chamber 49 however, the device will not collapse the lungs as fresh air or oxygen will be admitted through valves 55 and 53, creating turbulence in the throat, scavenging all water and mucous out through the tube 40 to the reservoir 42 where it may be intermittently drained by the valve 45. On the down stroke of the rod 56, the

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piston 48 pressurizes the chamber 49 and forces the accumulated exhausted air through the discharge valve 52 simultaneously moving the piston 47 downwardly, forcing the accumulated oxygen through the valve 53 and into the throat of the victim.

When circumstances are encountered where the victim begins breathing on his own, and it is deemed necessary to keep the resuscitator on the victim for possible further assistance, should a relapse occur, the control rod 56 should be left in its normal resting position as shown in FIGURE 4. The victim can then breathe normally, inhaling opening valves 53 and 55 and exhaling opening valves 51 and 52. This feature also make it possible where the optional oxygen hook-up is used for the victim to continue breathing on his own, straight oxygen if deemed necessary, fresh air and oxygen gas mixture, or straight fresh air depending on the position of the air oxygen proportioner, not shown. The downward stroke of the rod 56 forces fresh air or oxygen into the victim's lungs through valve 53 and holds it there normally as the upper piston 48 is moved upwardly to uncover the valve 51, allowing the normal lung contraction to force the valve 51 open and also open valve 52 and exhaling the air. The lower piston 47 in returning to its normal position forces valve 53 to close and forces valve 55 to open admitting fresh air or oxygen into the chamber 50, ready for the next breathing stroke. The lower piston 47 remains in its normal resting position during any scavenging strokes upwardly. The upper piston 48 during scavenging strokes, creates a vacuum in the middle chamber 49, opening valve 51 thereby creating the scavenging action, the piston 48 in returning to its normal position forces valve 51 to close and valve 52 to open, discharging the excess scavenged air. Safety valve 54 is vented to the open air and is provided as an added safety factor, such spring tension having been predetermined or adjustable and such valve being capable of emitting a warning whistle or signal, should unsafe pressures be developed in chamber 50, tube 39 and the victim's lungs while chamber 50 and tube 39 are in communication through valve 53 being open.

It will be apparent from the foregoing that a very simple mechanism has been employed to successfully function as a resuscitator in cases of drowning or other bronchial conditions, is easily operated, cheap to manufacture, strong, durable and most effective in its operation.

It is to be understood that the invention is not limited to the precise construction shown, but that changes are contemplated as readily fall within the spirit of the invention, as shall be determined by the scope of the subjoined claims.

What I claim is:

1. A resuscitator comprising, a cylindrical housing provided at one end with an outlet terminating in a mouthpiece, a closure cap at the opposite end of the housing, a pair of spaced flexible diaphragm within the housing dividing the same into upper, lower and intermediate chambers, a rod axially movable through the housing, said rod being fixedly attached to the upper diaphragm and attached with a lost-motion connection to the lower diaphragm whereby the rod has a limited axial movement relatively to the lower diaphragm, a check valve in the lower chamber permitting the egress of air therefrom into the mouthpiece, a second check-valve in the lower chamber permitting the entry of air thereinto from atmosphere, a mouthpiece attached to the closure cap and communicating with the upper chamber, a check valve permitting the egress of air from the intermediate chamber, a scavenging passage extending co-extensively with the mouthpiece and communicating with the intermediate chamber, and a check valve permitting the egress of air from said scavenging passage and the entry of such air into the intermediate chamber.

2. A resuscitator comprising, a cylindrical housing provided at one end with an outlet terminating in a patient's

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mouthpiece, the opposite end of the housing being closed, a pair of spaced flexible diaphragm located within the housing and dividing the same into upper, lower and intermediate air chambers, a rod axially movable through the housing and connecting the diaphragms and having a manipulating knob disposed beyond the closed end of the housing, said rod being fixedly attached between its ends to the upper diaphragm and having an end attached with a lost-motion connection to the lower diaphragm whereby the rod has a limited axial movement relatively to the lower diaphragm, spring means for biasing the rod to a raised position, a check valve in the bottom of the lower chamber permitting the egress of air therefrom into and through the mouthpiece, a second check valve in the lower chamber permitting the entry of air thereinto from atmosphere, an air inlet tube constituting an upper mouthpiece at the closed end of the housing, said tube communicating with the upper chamber, a check valve in the side wall of the housing and located to permit the egress of air from the intermediate chamber, a scavenging passage having a part extending co-extensively with the lower mouthpiece and having an inlet opening located at the outlet of the lower mouthpiece and communicating with the intermediate chamber, and a check valve permitting the egress of air from the scavenging passage and the entry of such air into the intermediate chamber.

3. In a resuscitator, a housing divided by diaphragms into a plurality of chambers, rod means connecting the diaphragms, a first mouthpiece being in communication with one of the chambers, a second mouthpiece leading from a second one of the chambers, there being an intermediate chamber located between the two chambers with which the mouthpieces communicate, the chamber with which the second mouthpiece communicates having a valve-controlled air inlet, said chamber also having a valve-controlled outlet between it and its mouthpiece, the intermediate chamber having a valve-controlled outlet, and a scavenging passage disposed alongside of the second mouthpiece and communicating with the intermediate chamber through a valve controlled opening.

4. In a resuscitator as provided for in claim 3, wherein the scavenging passage is provided with a valve-controlled drain outlet.

5. In a resuscitator, a housing having a mouthpiece leading into it, a pair of diaphragms dividing the housing into upper, lower and intermediate chambers, a rod axially movable through the upper and intermediate chambers and fixed to the upper diaphragm and engaging the lower diaphragm in such a manner that air pressure imposed on the upper diaphragm to flex the same will cause the rod to correspondingly flex the lower diaphragm, an outlet leading from the lower chamber and terminating in a patient's mouthpiece and through which air is forced by displacement of the lower diaphragm, air-admission means leading from atmosphere to the lower chamber, an outward-opening check valve constituting air-exhaust means for the intermediate chamber communicating with the patient's mouthpiece, an outwardly-opening check valve for the lower chamber and a scavenging passage having its inlet located adjacent to the outlet of the patient's mouthpiece and having its outlet in communication with the intermediate chamber through a check valve.

6. In a resuscitator, a cylindrical housing containing a pair of displaceable elements dividing the interior of the housing into a plurality of air chambers, a patient's mouthpiece leading from a lowermost one of the chambers, an inwardly opening check valve in said lowermost chamber, an outwardly opening check valve in said lowermost chamber communicating with the patient's mouthpiece to permit an air flow from said lowermost chamber and out of the mouthpiece, a rod extending through the head of the cylinder and axially of the housing and connected to each of the displaceable elements, a handle on the rod located externally of the housing for axially reciprocating the rod, a valve-controlled air outlet in the housing be-

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tween the displaceable elements, a scavenging passage having an inlet adjacent to the outlet of the mouthpiece and having an outlet in communication with a chamber in the housing between the displaceable elements and a check valve in the passage opening toward the outlet of the passage.

7. In a resuscitator as provided for in claim 6, wherein the displaceable elements are flexible diaphragms.

8. In a resuscitator as provided for in claim 6, wherein the displaceable elements are pistons, one of which is spring-mounted on the rod.

9. A resuscitator comprising, a cylindrical housing, a rod axially movable therethrough, said rod carrying a pair of spaced pistons dividing the interior of the housing into upper, lower and intermediate chambers, means externally of the housing for reciprocating the rod, a tube constituting a patient's mouthpiece leading from one of the chambers, an inwardly-opening check valve controlling an air inlet leading into said chamber, an outwardly-opening

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check valve controlling an air outlet in intermediate chamber of the housing above the lower one of the pistons, an outwardly-opening check valve for the mouthpiece, a scavenging passage extending from the mouthpiece and connecting into the housing at a point above the lower piston therein, and into the intermediate chamber, and an outwardly-opening check valve between said scavenging passage and the intermediate chamber.

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