Dec. 23, 1930. D. N. LAMBERT 1,786,350

RESUSCITATOR

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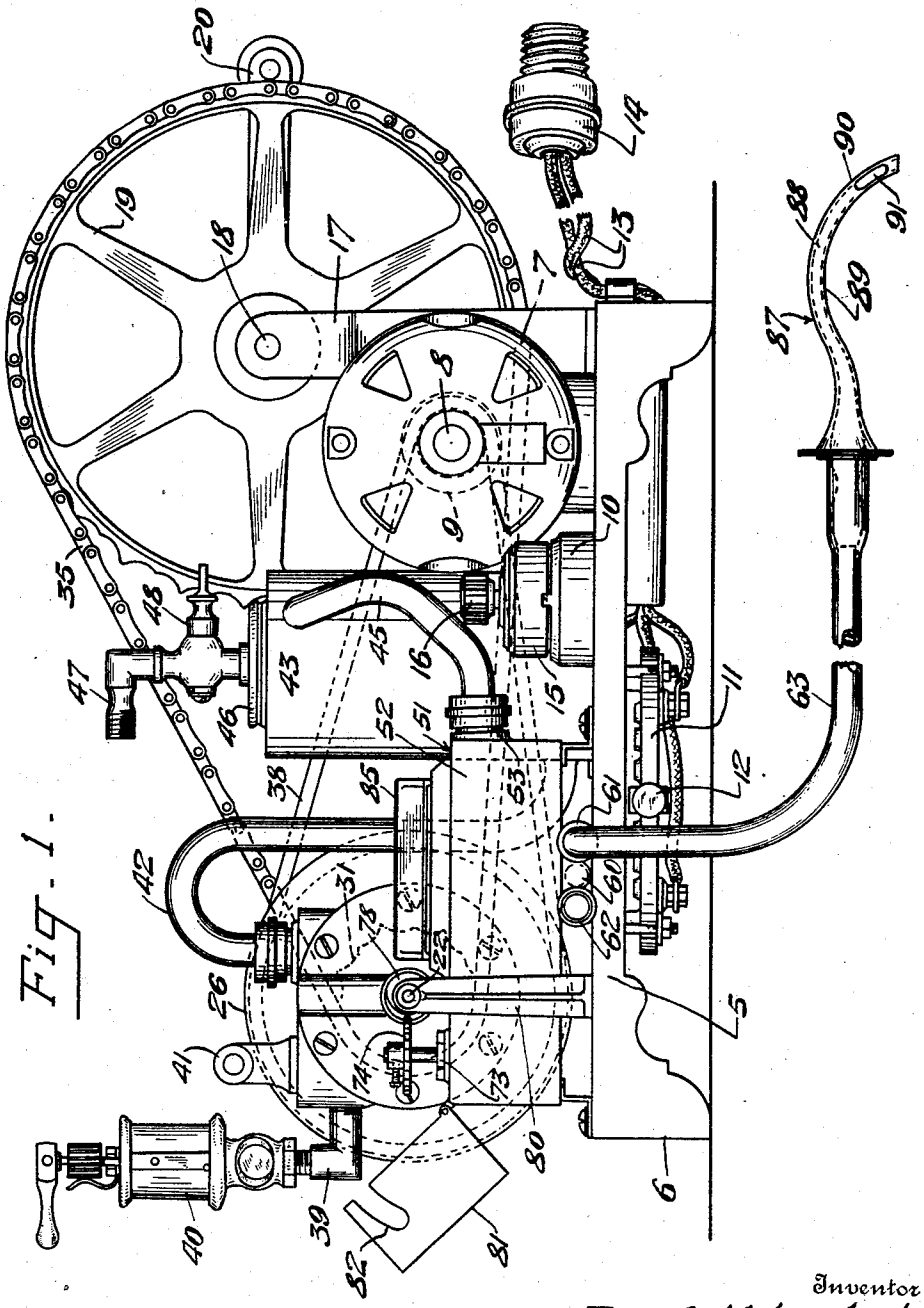


Fig. 1.

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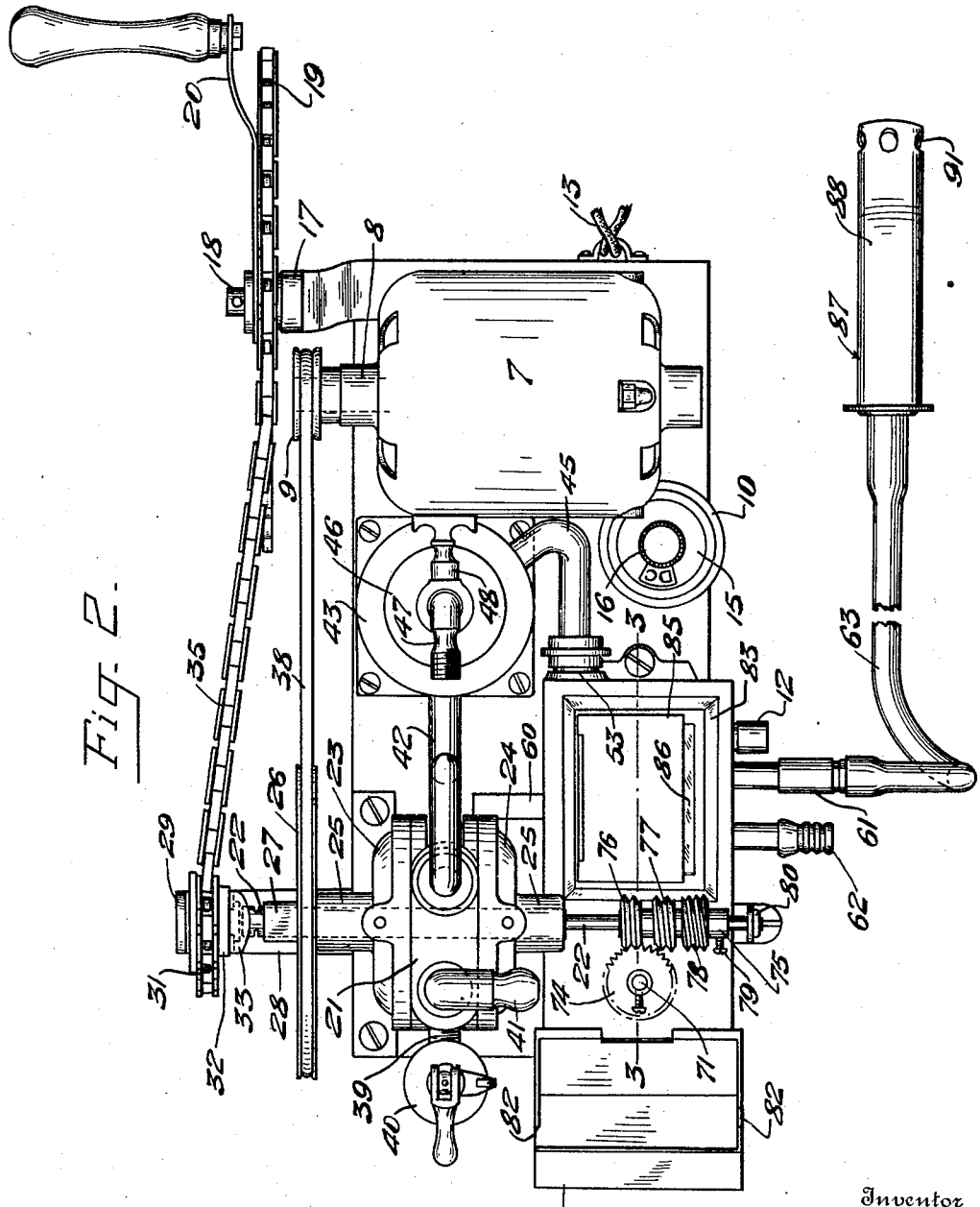
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Fig. 2.



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Fig. 3.

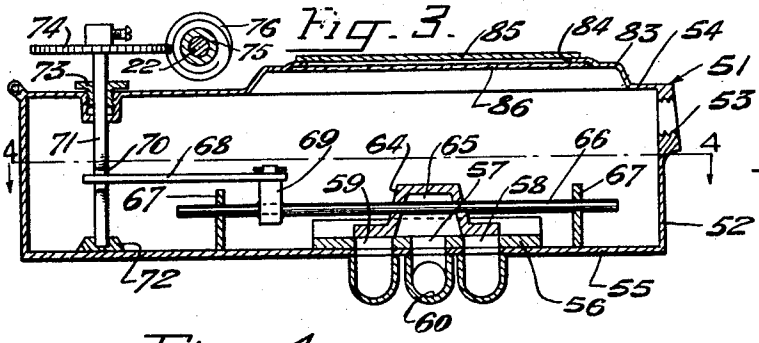


Fig. 5.

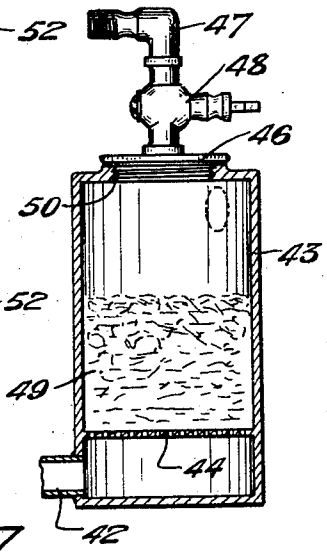


Fig. 4.

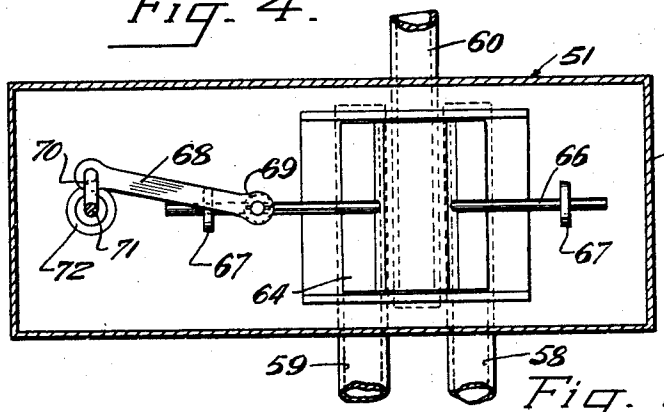


Fig. 7.

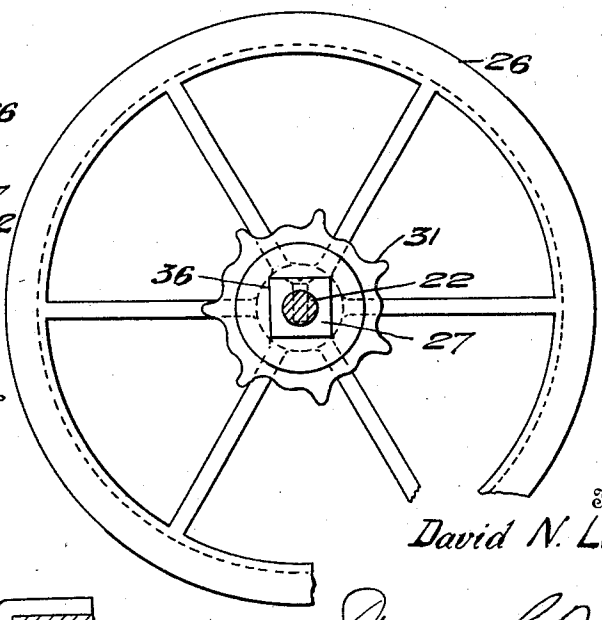
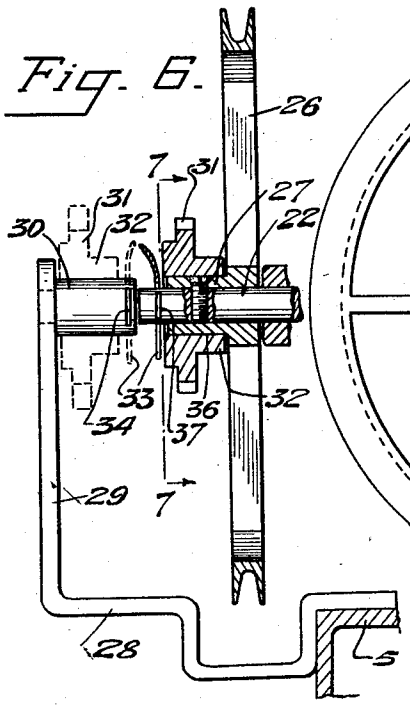


Fig. 6.



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UNITED STATES PATENT OFFICE

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RESUSCITATOR

Application filed September 12, 1925. Serial No. 56,028.

This invention relates to a resuscitator or pulmotor, and the objects of the same are, to provide a comparatively simple and compact portable apparatus embodying both electrically driven and manually operative means to adapt the same for use either where electrical current is available or in mines and other places distant from electrical installations; to provide means for regulating the operation of the apparatus to accurately conform to the rate of respiration of patients of various ages; to provide purifying means for the air, oxygen or other gas or gas mixture supplied to the patient, and also means for effecting a proportionate mixture of gas and atmospheric air or of different gases in the treatment of patients variously affected; and to generally improve devices of the class specified to render them convenient and readily and expeditiously serviceable for treatment in cases of asphyxiation and gas poisoning or for other purposes where a resuscitator may be practically used.

The invention consists in the preferred construction and arrangement of the several parts which will be more fully hereinafter described and claimed.

In the drawings:

Fig. 1 is a side elevation of a resuscitator or pulmotor embodying the features of the invention and showing the applicator or tube broken away.

Fig. 2 is a top plan view of the resuscitator or pulmotor.

Fig. 3 is a longitudinal vertical section on the line 3—3, Fig. 2, showing the cover for part of the mechanism removed.

Fig. 4 is a horizontal section on the line 4—4, Fig. 3.

Fig. 5 is a transverse vertical section of the purifier embodied in the apparatus.

Fig. 6 is a sectional elevation of a part of the operating mechanism, showing the means for changing from power to a manual drive.

Fig. 7 is a transverse vertical section taken on the line 7—7, Fig. 6.

The numeral 5 designates a base of suitable construction, preferably formed of metal, and having corner legs 6. On one end of the base 5 is mounted an electric motor 7 embodying the usual armature shaft 8 provided with a grooved belt wheel 9 on its rear end, as clearly shown by Fig. 2. A switch 15 and transformer 10 and a controller 11 provided with the usual projecting handle or switch lever 12 are associated with the electric motor 7. Electrical wire connections 13 provided with a terminal plug 14 of the usual type extend beneath the base 5 to the transformer and switch. The motor 7, transformer 10, controller 11 and electrical wire connections 13 are features common in the electrical art and are utilized in the present instance simply as operative accessories, the transformer 10 adapting the motor 7 to either D. C. or A. C. current, the change being readily accomplished through the actuation of an ordinary switch 15 having an upwardly projecting switch knob 16. At the same end of the base 5 on which the motor 7 is mounted and projecting rearwardly from a suitable upright 17 is a stub shaft 18, on which is mounted a sprocket wheel 19 having a crank handle 20 connected thereto for manual operation. On the opposite extremity of the base is mounted a rotary pump 21 having a shaft 22 projecting outwardly beyond its opposite ends 23 and 24. It will be understood that the pump has the usual form of rotary piston therein and is in all respects similar to the usual form of pumps which may be readily obtained in the market. The projecting shaft extremities 22 of the pump are mounted in suitable bearings 25. A grooved band wheel 26 of larger diameter than the band wheel or pulley 9 on the motor shaft and in longitudinal alinement with the latter band wheel is fixed on the rear projecting extremity 22 of the shaft of the pump. Said band wheel or pulley has a rearwardly extending hub 27, which is angular in cross-section, the function of which will be presently explained. Secured to the rear portion of the base is an angularly shaped bracket 28 (Figure 6), which projects outwardly from the one side of the base and has a vertical member 29 to which is fixed a stud 30 which projects toward the hub 27 of the band wheel 26 in concentric alinement at its inner end with the end of the

rear extremity 22 of the pump shaft. The latter extremity 22 of the pump shaft, however, as shown by Fig. 6 is not connected to the stud 30 and, when the operating mechanism is to be driven by electric power, a sprocket wheel 31 having a hub 32 is rotatably mounted on the stud 30 and held thereon by a key 33, which extends through a slot 34 in the forward end of the said stud. The sprocket wheel 31 is materially smaller in diameter than the sprocket wheel 19 of the manual driving mechanism, and continually trained over the sprocket wheels 19 and 31 is an endless chain belt 35. When the improved resuscitator or pulmotor is used in places where electric current is not available, the key 33 is withdrawn from the inner end of the stud and the sprocket wheel 31 with its hub 32 is pushed forwardly over the angular hub 27 of the band wheel or pulley 26, the hub 32 of the sprocket wheel 31 having an angular opening 36 therethrough corresponding to the contour of the hub 27. When the sprocket wheel 31 is mounted on the hub 27 of the pulley 26 the chain belt 35 is caused to rotate the pump shaft 22 upon rotation of the sprocket wheel 19 through the medium of the crank handle 20. After the sprocket wheel 31 and its hub 32 are engaged with the hub 27 of the band wheel or pulley 26, the key 33 is reversed and passed through a transverse aperture 37 in the rear extremity 22 of the pump shaft to hold the hub 32 of the sprocket wheel 31 on the hub 27 of the pulley 26, as shown by Fig. 6. When the resuscitator or pulmotor is used in localities or places where electric current is available, the sprocket wheel 31 is pushed over onto the stud 30 and secured against removal therefrom, as shown in broken lines in Fig. 6. In changing the operating mechanism from a manual to an electrical drive, it will be noted that no disturbance of the connection between the grooved band and belt wheels 9 and 26 is necessary, the said connection being in the form of an endless belt 38, and the change from one form of drive to the other may be readily accomplished. The pump has an oil feed 39 comprising the usual form of oil cup 40, it being preferred to use a sight oil feed. To the top of the outer portion of the pump an angular inlet nipple 41 is also secured, and connected to the opposite portion of the pump top is an outlet connection 42.

The improved resuscitator or pulmotor also includes a purifier 43, in the form of an upright cylinder clearly shown by Fig. 5 and having in the lower portion thereof a screen or strainer 44 and also having an upper outlet connection 45. A screw-threaded opening 50 is formed in the top of the purifier or cylinder 43 which opening is closed by a removable screw cap 46, to which is attached an angular inlet nipple 47 having a valve 48. The outlet connection 42 from the pump 21 is connected to the lower portion of the purifier or cylinder 43 below the screen or strainer 44, and suitable absorbent material, such as absorbent cotton, is placed above this screen or strainer as at 49. The absorbent material may be placed within the purifier or cylinder 43 through the opening 50 when the screw-threaded cap 46 is removed, and this material will take up all oil particles or greasy matter that may come through the outlet 42 of the pump 21 with the air or gas that is forced into and through the said purifier or cylinder 43 by the pump, so that the air or gas passing from the purifier by way of the outlet pipe 45 will be free of contamination by oil or other matter that may be taken up thereby in the pump. The angular inlet nipple 47 with its valve 48 provides means for admitting gas of any desired or proper kind into the upper end of the purifier, to commingle or be mixed with the air or gas that is forced into the lower portion of the said purifier by the pump and rising to the upper of the said purifier to be liberated through the outlet 45. By this means the scope of treatment of the improved resuscitator or pulmotor is increased and the same is thereby adapted for administering various combinations of gas and air. It will also be understood that, if desired, any preferred medicament may be held within the purifier and carried, for instance, by the absorbent cotton or other means.

Mounted on the base 5 is a main controlling valve 51, consisting of a suitable casing 52, as shown in detail by Figs. 3 and 4, having at the end nearest the purifier or cylinder 43 an inlet 53 adjacent the top 54 thereof, for attachment to the outlet pipe 45 from the said purifier or cylinder. On the bottom 55 of the casing 52 a valve seat 56 is mounted and formed with three ports or passages 57, 58 and 59. The port or passage 57 has a rearwardly projecting pipe 60 connected thereto which serves as the exhaust, and respectively connected to the ports or passages 58 and 59 are forwardly projecting nipples 61 and 62, to which flexible tubes or pipes 63 are attached for delivery to the patients of the mixture of air or gas, or gas alone, or mixture of gases, in accordance with the treatment desired. The tubes or pipes connected to the two nipples 61 and 62 are intended for treatment of two patients at one time. Only one tube 63 is shown and that is shown as applied to the nipple 61, but it will be understood that a similar tube or applicator may be applied to the nipple 62. Over the valve seat 56 a longitudinally reciprocating or slide valve 64 is mounted and has an intermediate chamber 65, preferably of the shape shown by Fig. 3, and which serves to alternately connect or establish communication between the ports or passages 58 and 59

and the exhaust port or passage 57, and also to alternately permit the contents of the casing 52, coming by way of the pipe 45, to flow into the said ports 58 and 59. The valve 64 is secured to the intermediate portion of a slide rod 66 mounted in bearings 67 rising from the bottom 55 of the casing 52 at suitable distances from opposite ends of the valve seat 56. A pitman 68 extends between a suitable coupling clip or member 69 secured to the rod 61 and the crank 70 of a vertical crank shaft 71 having its lower end mounted in a foot bearing 72 on the bottom 55 of the casing 52 and its upper end rotatable in an opening in the top 54, a packing or gland 73 being mounted in said opening around the said shaft 71 so as to prevent leakage of the contents of the casing 52 at this point and also to provide a stable bearing for the shaft. On the upper end of the shaft 71 at a suitable distance above the top 54 a worm wheel 74 is secured. A sleeve 75 is longitudinally adjustable on the forward extremity 22 of the pump shaft adjacent the worm wheel 74 and carries worms 76, 77 and 78 of different pitch. The sleeve 75 may be so adjusted on the pump shaft as to cause any of the worms 76, 77 or 78 carried thereby to engage the worm wheel 74 and vary the rate of the reciprocation of the valve 64 controlling the ports 57, 58 and 59 of the valve seat and the supply of air, air and gas or gas alone or mixture of gases passing out through the nipples 61 and 62 in accordance with the age and normal respiration of the patient treated.

The sleeve 75 is readily shiftable lengthwise of the forward shaft extremity 22 of the pump to bring the different worms 76, 77 and 78 into mesh with the worm wheel 74, the said sleeve 75 being held in adjusted position by a set screw 79. It will therefore be understood that the sleeve 75 with the worms thereon regularly rotates with the shaft extremity 22. The forward end of the shaft extremity is shown as mounted in an upright bearing projection 80 at the front of the machine. Normally the upwardly projecting extremity of the shaft 71, the pinion or worm wheel 74 and the sleeve 75 with its worms are enclosed by a hinged cover or lid 81, which is slotted in the front and rear as at 82 to fit over the forward projecting extremity 22 of the pump shaft in advance and in rear of the said sleeve. The top 54 of the casing 52 is also formed with an upstruck portion 83 through which is formed an opening 84 normally covered by a hinged lid 85, a transparent plate 86 being held at the underside of the rim of the opening 84, so that, by raising the lid 85 the interior of the casing and the valve 64 may be examined or inspected.

The operation of the improved device is very simple. After it has been set for operation by either power or manual drive, a suitable connection for air, air and gas, or gas alone is made with the nipple 41 and the pump in its operation forces the air or air and gas through the pipe 42 into the lower end of the purifier or cylinder 43 below the screen or strainer 44, and the air or gas then passes up through the said purifier and any deleterious matter that may be carried thereby is retained within the purifier. The purified air or gas or air and gas mixture, as the case may be, passes off through the pipe 45 into the valve casing 52 and is liberated through either one or both of the ports 58 and 59 to the patient or patients treated, a regular exhaust from the patient being effected through the port 57 and pipe 60. Prior to starting the machine the sleeve 75 will be adjusted to bring the proper worm 76, 77 or 78 into engagement with the worm wheel 74 in accordance with the rapidity of respiration of the patient or patients. This adjustment of the worms may be made without displacing or in any wise disorganizing the slide valve structure, and moreover, when two patients, for instance, are treated at one time, they will be assumed to have the same normal respiratory rapidity, and when only one patient is treated, the unused nipple 61 or 62 will be suitably closed for the time being or it may be left open and the air or gas liberated into the surrounding atmosphere.

The nipple 47 is adapted to have a connection thereto from a source of supply of the particular gas that may be desired to be mixed with the air or gas or gas alone coming from the pump into the purifier, as for instance in certain gas poisonings, and when this additional service is effected, the valve 48 is opened and the auxiliary gas is permitted to enter the upper end of the purifier and commingle or be mixed with the air or gas or gas alone that is being supplied to the purifier from the pump and the mixture then passes out through the pipe 45 and is administered as above specified.

It is well known that, in cases of asphyxiation, the tongue of the patient falls back into the throat and it is necessary to normally place the same in order to avoid strangulation and permit administration of a resuscitating fluid such as air and gas or gas alone, and as a convenient means for holding the tongue a combined discharge nozzle and tongue depressor 87 is preferably secured to the end of each tube or pipe 63. This combined nozzle and depressor consists of a flattened tube 88, which is arched or convexed as at 89 and has a downwardly projecting curved free extremity 90 with outlets or openings 91 formed therein for the free outlet or liberation of the air, air and gas or gas alone into the throat of the patient. It will be noted that the openings or outlet apertures 91 are located a distance from the free downwardly bent end or ex-

tremity 90 of the combined nozzle and depressor and that a number of these openings are used, which will insure a liberation of the air or air and gas into the throat of the patient. The arched formation of this combined nozzle and depressor will maintain the tongue of the patient in normal position, the said arched portion of the nozzle conforming to the physical contour of the tongue. While it is preferred to use this combined discharge nozzle and tongue depressor, it will be understood that the invention is not limited to the use of this preferred form of device.

What is claimed as new is:

1. In a resuscitator or pulmotor of the class specified, means having an inlet for a gaseous medium and outlets for the delivery of such medium to and its discharge from a patient, a pump connected to said inlet for delivering gaseous medium to said receiving means, said pump having a rotatable shaft, means comprising a reciprocating valve for alternately establishing communication between the inlet and delivery outlet and between the delivery and discharge outlets of said receiving means, means including a worm wheel for reciprocating said valve, and a plurality of worms of different pitch mounted on the shaft of said pump and selectively engageable with said worm wheel.

2. A resuscitator or pulmotor, comprising a rotary pump; a purifier to receive a gaseous medium from said pump; a casing having an inlet connected to said purifier, an outlet for delivery of gaseous medium directly to a patient, and an outlet to the atmosphere; a valve in said casing shiftable either into position to establish communication between said inlet and the first-named outlet or into position to establish communication between said first and second-named outlets; a worm wheel associated with said valve and operable in its rotation to shift said valve alternately into said two positions; and a plurality of worms of different pitch carried by the shaft of the pump and selectively engageable with said worm wheel.

3. In a resuscitator or pulmotor of the class described, a pump, a rotating shaft driven by said pump, a casing to receive gaseous medium from said pump, said casing having a plurality of outlets for delivery of gaseous medium to and its return from a plurality of separate patients and an exhaust outlet, a reciprocating valve associated with said delivery and exhaust outlets for alternatively establishing communication between said casing and one of said delivery outlets and between one of said delivery outlets and said exhaust outlets, and means operable by said rotating shaft for reciprocating said valve at timed intervals, said last named means being regulatable to vary the intervals between the movements of said valve.

4. In a resuscitator or pulmotor of the class described, a casing to receive a gaseous medium, said casing having a port for delivery of such gaseous medium to and its return from a patient and also having a second port for the discharge of the gaseous medium returned by the patient, a pump for delivering gaseous medium to said casing, said pump having a rotatable element, a reciprocatory valve operable first to close said second port and open said first port and then to establish communication between said first and second ports, means including a worm wheel for reciprocating said valve at timed intervals, and a member mounted on the rotatable element of said pump and comprising a plurality of worms of different pitch, said member being adjustable on said rotatable element to selectively bring said worms into mesh with said worm wheel.

In testimony whereof I have hereunto set my hand.

DAVID N. LAMBERT.