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RESUSCITATION APPARATUS

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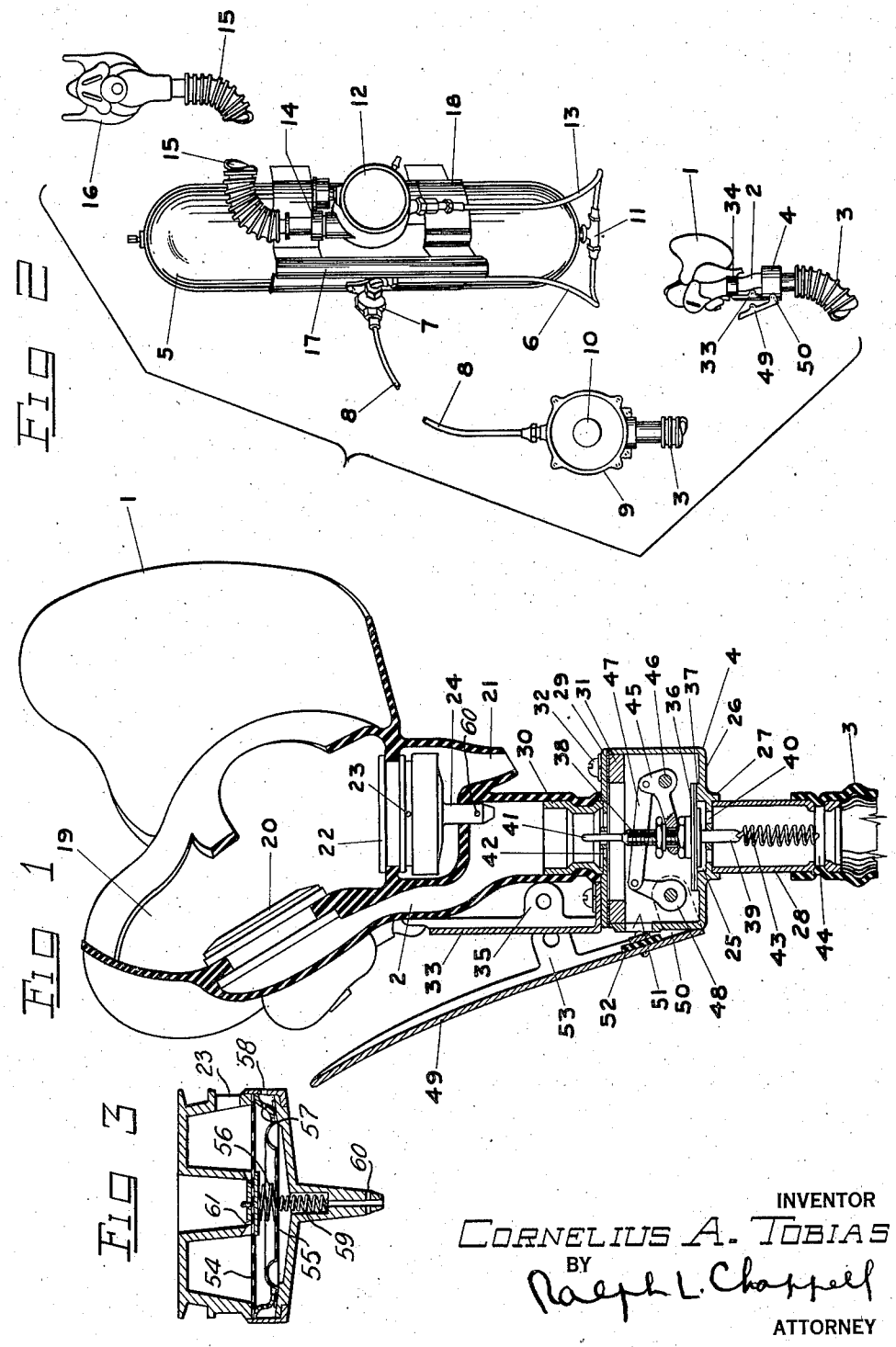

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RESUSCITATION APPARATUS

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3 Claims. (Cl. 128—29)

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This invention relates to resuscitation apparatus and particularly to manually controlled resuscitators.

An object of the invention is to provide an improved resuscitation apparatus of such construction as to facilitate the emergency administration of oxygen under pressure intermittently and to simultaneously furnish the requisite quantity of oxygen to the rescuer and the person being revived.

Other objects of the invention are to provide an improved resuscitation apparatus which is so constructed as to permit the administering of oxygen under such pressure and at such intervals as to induce artificial respiration for the relief of anoxemia and asphyxia; to provide an improved resuscitation apparatus, of the character described, having control means associated with a breathing mask in such manner that the mask and control means may be manipulated with one hand, said control means being arranged so as to intermittently relieve the pressure within said mask for permitting the expiration of previously supplied oxygen; to provide an improved resuscitation apparatus, of the character described, which is readily portable and which has separate discharge means to permit the furnishing of oxygen simultaneously to two persons in accordance with their particular requirements; and to provide improved elements and arrangements thereof in a resuscitation apparatus of the character described and for the purposes set forth.

In accomplishing these and other objects of the present invention, I have provided improved details of structure, the preferred form of which is illustrated in the accompanying drawing, wherein:

Fig. 1 is a transverse, vertical, sectional view of a resuscitation apparatus embodying the features of the present invention and showing a breathing mask with manual control means connected thereto.

Fig. 2 is a plan view of the complete resuscitation apparatus showing the supply tank and the masks for a rescuer and person to be revived.

Fig. 3 is an enlarged and somewhat diagrammatic cross-section of the exhalation valve of the mask of Fig. 1 with some features altered and proportions exaggerated for clarity.

Referring more in detail to the drawing:

In Fig. 1, the numeral 1 designates a preferably rubber breathing or resuscitator mask of the pressure type having its inlet 2 communicating with a flexible supply tube or hose 3, of rubber or other suitable material. As will be hereinafter more fully explained, manual control means in the form of an attachment or connecting body 4 is interposed between the inlet 2 and hose 3 for establishing communication therebetween.

Oxygen under pressure to be supplied to the

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mask 1 is confined within a preferably cylindrical, metallic tank or bottle 5 (Fig. 2, and is adapted to be delivered to the hose 3 through a metallic tube 6, reducing valve 7, rubber hose 8 and pressure regulator 9. The tube 6 and hose 8 are preferably of less diameter than the hose 3 and are formed of similar material, being provided with conventional couplings for connection with the valve 7 and regulator 9. In order to vary the pressure of the oxygen delivered to the hose 3, the regulator is provided with a control 10 for adjusting the discharge of said regulator. When the control 10 is in its "off" position, the regulator 9 functions on demand and oxygen must be drawn therethrough by suction or flows therefrom at ambient pressure. Manifestly, the reducing valve coacts with the pressure regulator and could be incorporated therein.

A suitable T 11 connects the inner end of the tube 6 to one end of the bottle 5 and a second pressure regulator 12 communicates with the T through a metallic tube 13. The regulator 12 is of the "demand" type so as to permit the passage of oxygen therethrough at ambient pressure or only when a suction is drawn on its outlet 14. A flexible hose 15, similar to the hose 3, is connected to the regulator outlet 14 for supplying oxygen upon demand to a mask 16 which is adapted to be worn by the rescuer, as will be hereinafter more fully explained.

In order to facilitate handling of the bottle 5, a handle 17 extends longitudinally of said bottle and is secured thereto by a suitable strap arrangement 18 which encircles the bottle and which has foot portions. The reducing valve 7 and pressure regulator 12 are preferably supported by the strap arrangement 18.

As shown in Fig. 1, a cavity 19 is formed in the mask 1 and is separated from the inlet 2 by a suitable transverse partition which has a flexible flap valve 20 mounted therein for admitting oxygen to the cavity from said inlet and preventing the reverse flow of oxygen. An outlet 21 is disposed below and to the rear of the cavity 19 intermediate the flap valve 20 and the lower portion of the inlet. Communication between the cavity and outlet is established by an exhalation valve 22 of conventional construction and having its upper end opening into said cavity. A complete description of the exhalation valve 22 is given ultimately hereinafter but only those details necessary for an understanding of its function in the apparatus are given immediately hereinafter. Radial ports 23 are formed in the exterior of said valve for discharging oxygen from the cavity into the outlet 21. The valve 22 has a depending, tubular shank or nipple 24 which projects into the inlet 2 and openings are formed in the nipple, whereby the lower surface of said valve is exposed to the pressure within said inlet so that the valve

remains closed when the pressures within the cavity and inlet are substantially equal. It is thus apparent that the flap valve 20 and the exhalation valve 22 constitute check valves for the mask 1 operating in opposite phase but on the same general principle of all usual check valves i. e. opening and closing in response to the pressure differential exerted on two actuating surfaces, each of which is exposed to the pressure in a particular region.

The body 4 is of enlarged, cylindrical shape and is formed of metal or other suitable material. An axial, circular opening 25 is provided in the flat bottom 26 of the body and is externally surrounded by a depending collar 27. For connecting the hose 3 to the body, a short sleeve 28 is secured within the collar 27 and depends therefrom. The open upper end of the body is closed by a flat plate or cap 29 which has an upstanding nipple 30 secured axially thereto so as to receive and connect the free end of the inlet 2 to said body. In order to provide an amplified support for the cap 29, an annular ring 31 is fixed within the upper end of the body and said cap is fastened thereto by suitable screws 32.

An angular bracket 33 is connected to the forward portion of the cap by the screws 32 so as to project upwardly therefrom and forwardly of the inlet 2. As shown in Fig. 2, the bracket 33 is fastened to the mask 1 by a yoke or U-shaped clamp 34 which is carried by the upper end of said bracket and which engages around the forward portion of said mask. A pair of lateral, rearwardly-extending ears or lugs 35 are preferably made integral with the lower portion of the bracket.

For controlling the flow of oxygen from the hose 3 to the inlet 2 and through the body 4, a circular valve element or disc 36 overlies the opening 25 and is adapted to coact with an annular valve seat 37 which surrounds said opening. A valve stem 38 extends axially through the disc 36 and has its depending shank portion 39 slidably engaging within a guide spider 40 placed in opening 25 intermediate the external collar 27 and the seat 37. The upper portion of the stem 38 is reduced in diameter to provide a guide pin 41 which received by a spider 42, similar to the spider 40 and preferably made integral with the cap 29 in axial alinement with the nipple 30. For holding the valve disc in engagement with its seat, a toiled tension spring 43 fastens the lower end of the shank 39 to a pin 44 which extends diametrically across the lower portion of the sleeve 28.

In order to permit manual actuation of the valve disc, a bellcrank 45 is loosely confined upon the stem 38 above said disc by suitable nuts screw-threaded upon said stem. The bellcrank 45 extends rearwardly from the stem and is pivoted upon a transverse pin 46 which is supported by the body 4. A forwardly-extending link 47 pivotally connects the bellcrank to a crank 48 which is disposed forwardly of the stem and parallel to the pin 46. The ends of the crank 48 project beyond the body and an upwardly-extending operating lever 49 has its lower end rigidly secured to the crank ends by means of rearwardly-directed lateral ears 50.

Due to this arrangement, depressing or inward swinging of the lever 49 rotates the crank 48 in a clockwise direction so as to move the link 47 rearwardly and thereby pivot the bellcrank 45 in a clockwise direction about the pin 46. The valve disc 36 is lifted out of engagement with its seat 37 by this movement against the tension of the coiled spring 43, whereby said disc is returned to its seated position upon release of the lever 49.

For releasing pressure from the inlet 2 and body 4, an exhaust opening or port 51 is formed in the forward portion of said body adjacent its upper end. The lever 49, when depressed, overlies the port 51 and is provided with a valve disc or member 52 secured to its inner surface for closing said port upon depressing of said lever and opening movement of the valve disc 36. A pair of lateral lugs 53 extend rearwardly from the intermediate portion of the lever and are adapted to overlie the lugs 35 of the bracket 33 when said lever is depressed. The lugs are preferably formed with suitable openings for receiving a pin (not shown) so as to lock said lever in its depressed position to provide a constant supply of oxygen to the inlet 2 of the mask.

As hereinbefore mentioned, the valve 22 is a conventional exhalation valve. However, to facilitate a complete understanding of its structure and operation a description is herewith included with reference to Fig. 3. Hermetically sealed around their circumferences to the interior of the valve body are a main diaphragm 54, of rubber-like or other suitable material, and a compensating diaphragm 55, of similar material, separated by a hairspring 56. The chamber between the diaphragms is open to atmospheric pressure through communication via the openings 57 and 58 with the outlet 21. The opening 58 is actually 90° circumferentially removed from port 23 and hence does not appear in the view in Fig. 1, but has been rotated for clarity in Fig. 3 into the same plane as port 23. The lower side of compensating diaphragm 55 is subject to the action of another light spring 59 and the pressure of the oxygen supply communicated through port 60. Upon exhalation the increased pressure on the upper side of the main diaphragm 54 acts against the spring pressure and atmospheric pressure on the lower side of the diaphragm to depress the diaphragm and create an annular passage 61 through which exhaust breath is forced on its way to port 23, outlet 21, and thence to the atmosphere. Upon cessation of exhalation the oxygen supply pressure acts through the port 60, the compensating diaphragm 55, and hairspring 56 to seal the main diaphragm against the body of the valve thus closing off the passage 61.

Operation

The operation of a resuscitation apparatus constructed as described is as follows:

In resuscitating an unconscious person, the mask 1 is placed over the person's face with one hand by the rescuer and the operating lever 49 is depressed with the palm of the same hand. Due to the connection between the lever and the valve disc 36, said disc is raised from its seat 37 and oxygen is permitted to flow through the opening 25, body 4 and nipple 30 into the inlet 2 of the mask. Simultaneously with the opening movement of the disc 36, the exhaust port 51 is closed by the valve member 52 carried by the lever. The pressure of the oxygen is determined by the adjustment of the control 10 of the pressure regulator 9 and such pressure is sufficient to inflate or distend the lungs of the unconscious person. Since only one hand of the rescuer is required to hold the mask and manipulate the lever, the other hand is free to adjust the control 10 or support the bottle 5 by means of the handle 17. If necessary, the mask 16 may be worn by the

rescuer while approaching the unconscious person and during the resuscitation operation.

The flap valve 20 is forced open by the pressure of the oxygen admitted to the inlet 2 so as to enter the cavity 19 and be supplied to the person being resuscitated. After a suitable interval of time, the lever is released to permit seating of the disc 36 by the tension of the spring 43, thereby shutting off the flow of oxygen through the body to the inlet. The downward movement of the disc swings the lever outwardly and moves the valve member 52 out of engagement with the port 51 to permit the escape of oxygen trapped within the body and inlet by the closing of said disc. Since the lower surface of the exhalation valve 22 is exposed to the pressure within the inlet through the openings of its nipple 24, the escape of such pressure causes said valve to open in response to the pressure of the oxygen within the cavity of the mask and permit the discharge of said oxygen through the ports 23 and outlet 21, thereby deflating the lungs of the person being resuscitated.

By alternately depressing the operating lever at predetermined intervals, oxygen may be administered intermittently to induce artificial respiration for the relief of anoxemia and asphyxia until the person regains consciousness or normal respiratory activity is restored.

In the event of complete respiratory arrest, it is necessary to insert a small rubber tube, known as an airway and not illustrated, in the person's mouth after pulling his tongue forward to assure the free passage of oxygen to the lungs. The lever is actuated rather slowly and preferably from six to fifteen times per minute. Ordinarily inspiration requires 40% of the time and expiration 60%.

Upon the restoration of normal respiratory activity, the valve disc 36 may be locked in its open position by depressing the lever and passing a pin (not shown) through the lugs 35 and 53. In addition, the control 10 of the pressure regulator 9 is turned to its "off" position so that oxygen will be supplied at ambient pressure or as required by the resuscitated person. Thus, when desired, the mask may be used in the customary manner.

By the use of a mask of the type shown and described herein, it is unnecessary for the moist, exhaled oxygen to pass through the body 4 and only dry oxygen contacts the interior of said body or the elements disposed therein. Therefore, the resuscitation apparatus may be used at high altitudes and freezing temperatures without any danger of said apparatus becoming inoperable, the exhalation valve 23 being constructed so as to discharge the moist oxygen under such conditions.

While I have shown but one embodiment of my invention, it is susceptible to modification without departing from the spirit of the invention. I do not wish, therefore, to be limited by the disclosures set forth, but only by the scope of the appended claims.

I claim:

1. A resuscitation apparatus including a breathing mask; a manually controlled valve attached to said mask and communicating on its low pressure side with the interior of said mask and on its high pressure side with a source of compressed gas; said valve comprising a valve body, a spring-seated valve disk therein and manually operated means including a control handle for actuating said valve disk; said valve body having on its low pressure side a port communicating with the atmosphere and said manually operated means including means for closing said port simultaneously with unseating of said valve disk; a first check valve interposed in the passage between said valve body and the interior of said mask, opening and closing in response to relatively inferior and superior pressure, respectively, within the interior of said mask; and a second check valve for controlling the flow of gas between the interior of said mask and the atmosphere through a passage independent of said manually operated valve, said second check valve opening and closing in response to pressure within the interior of said mask, superior and inferior, respectively, relative to the pressure in said valve body, whereby gas may be expelled from said mask without contacting said manually operated valve.

2. A resuscitation apparatus including a breathing mask; a manually operated valve comprising a valve body and a valve disk attached to said mask so arranged that one hand can be employed both to apply said mask and to control said valve; said manually operated valve communicating on its high pressure side with a source of compressed gas and on its low pressure side through a first check valve with the interior of said mask, said first check valve closing in response to relatively superior pressure within the interior of said mask; a second check valve opening in response to pressure within the interior of said mask superior relative to that in said valve body, for controlling flow of fluid between the interior of said mask and the atmosphere through a passage independent of said valve body; a port communicating between said valve body and the atmosphere; and means for opening said port simultaneously with the seating of the disk of said manually operated valve.

3. A resuscitation apparatus including a breathing mask; a manually operable valve attached to said mask for controlling flow of gas thereto from a relatively high pressure source; a first check valve interposed between said manually operated valve and said mask, said check valve closing in response to relatively high pressure within the interior of said mask; a second check valve for controlling the flow of gas between the interior of said mask and the atmosphere through a passage independent of said manually operated valve, said second check valve opening in response to relatively high pressure within the interior of said mask; and means operating simultaneously with the seating of said manually operated valve to subject said check valves to atmospheric pressure on one of their actuating surfaces whereby said check valves are actuated by the differential in pressure between the atmosphere and the interior of said mask.

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