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RESUSCITATING DEVICE.

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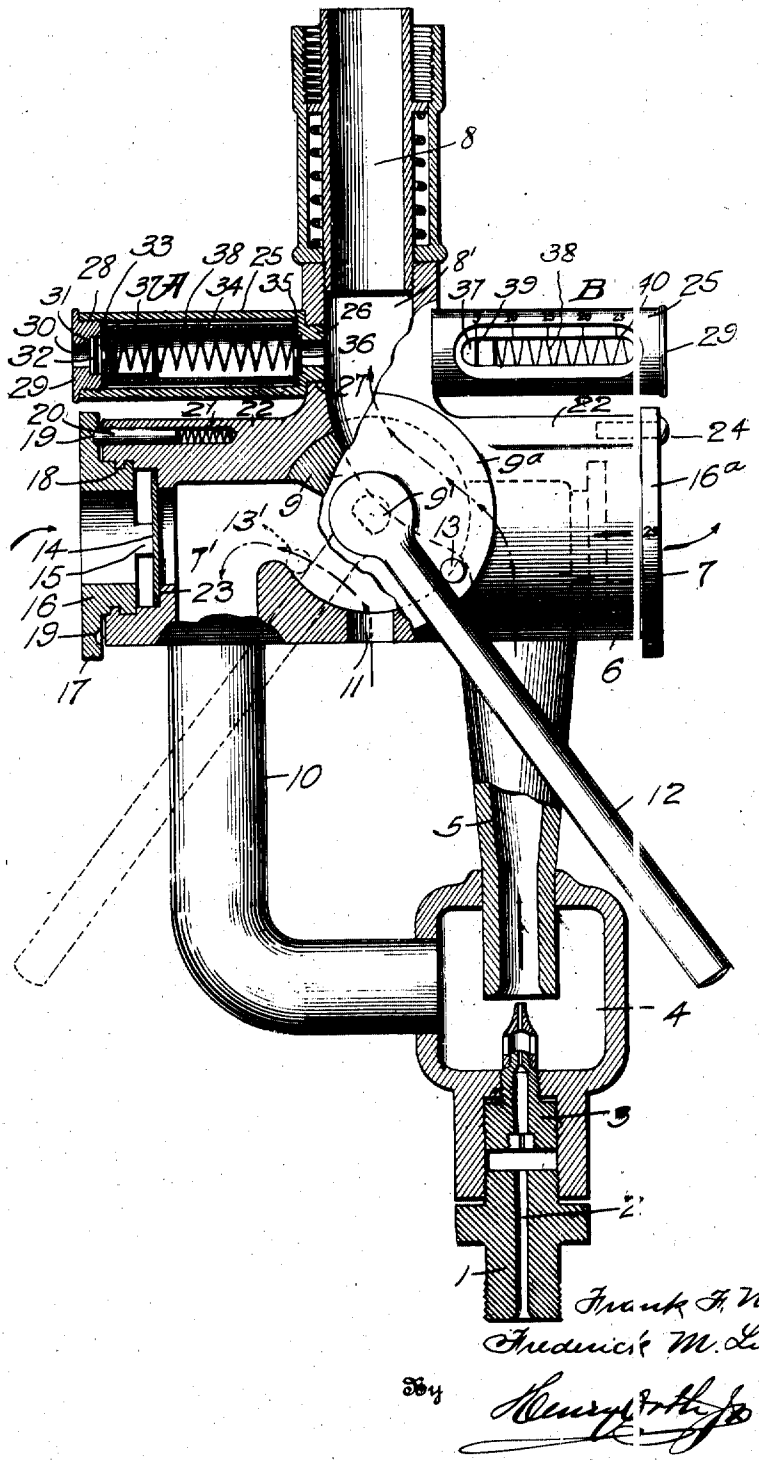

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RESUSCITATING DEVICE.

1,214,941. Specification of Letters Patent. Patented Feb. 6, 1917.

Application filed December 24, 1915. Serial No. 68,490.

To all whom it may concern:

Be it known that we, FRANK FAIRCHILD MORRIS, a citizen of the United States, residing at Pittsburgh, and FREDERICK MELCHIOR LUCHS, a citizen of Switzerland, residing at Wilkinsburg, both in the county of Allegheny and State of Pennsylvania, have invented certain new and useful Improvements in Resuscitating Devices; and we do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same, reference being had to the accompanying drawings, and to letters or figures of reference marked thereon, which form a part of this specification.

This invention relates to life saving and resuscitating devices, and to any form of apparatus designed to administer oxygen to human beings for any desired purpose.

The apparatus includes an injector arranged to deliver an injecting current of oxygen through the apparatus on one side of a valve, and at the same time draw from the atmosphere a quantity of air to be mixed with said oxygen. This mixture is administered to the patient by any desirable means and at a slightly elevated pressure. Upon reversal of the valve a suction is produced instead of a forcing current.

This much of the apparatus has heretofore been known, and has been successfully used, and our invention comprises means for indicating the condition of the forcing and the suction current, and means for controlling these currents by a novel method, which consists in reducing the pressure of the forcing stream by venting it to the atmosphere, and reducing the suction of the suction stream by admitting atmospheric air thereto.

The invention further consists in structural features that enable the size and weight of the apparatus to be greatly reduced.

In the drawing is shown, partly in section, so much of an apparatus as is necessary to illustrate this invention.

The oxygen connection to this apparatus is made by the screw-threaded connector 1, which is arranged and constructed to connect the apparatus to a tank of compressed oxygen gas, or to a hospital generator, or any other source of high or low pressure oxygen, other gases or air.

The connector 1 has a central opening 2 discharging to the removable jet-forming nozzle 3 that projects into a combining chamber 4 and is in alinement with a pressure-reducing cone 5 which delivers a current of gas into a chamber 7 in a substantially cylindrical casing 6. This chamber 7 into which the gas from the reducing nozzle is delivered, discharges through a pipe connection 8′ into a delivery pipe 8, the entrance to which is arranged between the two chambers 7 and 7′ and to which the mask or equivalent is connected to administer oxygen to the patient.

The chamber 7 is separated from the like chamber 7′ by valve 9, and said chamber 7′ discharges through a pipe 10 into the combining chamber 4. The casing 6 has a port 11 arranged between the pipe 10 and the reducing cone 5 that is controlled by the valve 9.

The operation of this apparatus is as follows:

High pressure oxygen is admitted through 2 and 3 and produces a high pressure jet directed into the reducing nozzle 5, and at the same time draws air through port 11 and pipe 10 into the combining chamber 4 and entrains it through the pipe or reducing nozzle 5 into the chamber 7 and delivers it through pipe 8 to the patient. Upon reversal of the valve 9 port 11 is placed in communication with chamber 7 and pipe 8 with chamber 7′, suction is produced in pipe 8, the air passing from pipe 8 to chamber 7′, pipe 10, the combining chamber 4, reducing nozzle 5, chamber 7 and port 11 into the atmosphere.

We have found that a most decided improvement may be made in this apparatus, or in any other apparatus using pressure and suction, by providing means for indicating the amount of suction and pressure alternately produced in pipe 8, and also providing means for controlling the suction and pressure.

It will be understood that no two persons of the same sex and age have the same lung capacity, nor would they have the same vitality and strength, so that it is decidedly disadvantageous to deliver a fixed or measured quantity of oxygen to all patients,

and the quantity of oxygen should be varied according to the degree of recovery, and also according to the condition of the patient at the time the administration of oxygen became necessary.

It is well known that the administration of oxygen for overcoming asphyxiation, and the administration of oxygen for resuscitating drowning persons is done quite differently, and it is our aim to construct an apparatus as nearly universal in its uses as possible, and capable of all the variations required under varying conditions with varying types of patients.

To this end we make the valve 9 a manually actuated valve held in place by a plate 9^a and operated by a handle 12 which is detachably or otherwise secured to the valve spindle 9'. The movement of the valve is limited in its end positions by pins 13 and 13' on the casing 6, or on the plate 9^a, as shown.

The chamber 7' is provided with a valve 14 comprising a circular plate connected to, and held spaced from a tubular screw 16 at two or more points adjacent its periphery by lugs 15. A flanged head 17 on this screw projects over the end of the casing 6. The tubular screw 16 is provided with a single high pitched thread 18 and screws into one end of the casing 6. The underface of the flange of head 17 is provided with recesses 19 into which engages a pin 20 urged by a spring 21 to hold the screw against rotation from its adjusted position.

The pin 20 and spring 21 are placed in a drill hole in a slight shoulder 22 on the casing 6. The valve plate 14 seats on a valve seat 23 formed in the casing 6.

Inasmuch as the tubular screw 16 has a high pitched thread it is intended that one revolution of the screw shall move the valve 14 its maximum extent and in order to prevent the screw, during its operation, from entirely leaving the casing, a suitable stop, such as a screw 24, is passed through the flange 17 and abuts against a shoulder 22 as a stop when the screw 16 is rotated to its full extent in one or the other direction. The screw is held in its adjusted position by the pin 20 entering any one of the peripheral notches 19 on the underface of the flange 17, whereby the valve 14 will be held in any desired position toward or from its seat 23. The chamber 7 is provided with a valve and a screw 16^a of like construction.

That portion of the casing 6 which is extended to form the connection 8' of pipe 8, in other words, the suction and forcing conduit, is provided with two indicators, A and B, one of which, for example, A, is adapted to indicate suction, and the other, B, to indicate pressure, these indicators are preferably, but not necessarily, identical in construction, the only difference being that the piston of the indicator A is distant from the conduit 8', while the piston of the indicator B is adjacent said conduit.

The structure of these indicators is as follows: They comprise a metal tube 25 having a reduced end 26 that screws into a threaded hole 27 in the extension 8', the opposite end of said tube is screw-threaded at 28 to receive a nut 29 having a central perforation 30, leading to an enlarged recess 31 containing a wire gauze or other suitable screen 32. The tubular nut 29 holds in place a centrally perforated flexible washer 33, and forces this washer against one end of a glass tube 34, the other end of which tube engages a like washer 35 at the opposite end of the tube 25. A screen 36 is interposed between washer 35 and the opening in the reduced end 26.

Within the glass tube 34 is a cylindrical piston 37, and between this piston and the washer 35 is a light spring 38. The piston 37 is provided with a peripheral surface mark 39, more clearly shown on the indicator B, and this mark is exposed to view through a slot 40 in the tube 25, the edges of which slot are graduated to indicate, preferably centimeters of water column.

If the valve 9 be set as indicated in the drawings, with the handle 12 resting against the stop pin 13, and oxygen is supplied through the nozzle 3, the combined stream of air and oxygen will be directed through chamber 7 into pipe 8 and into the lungs of the patient. The pressure developed at the end of the forcing or inhalation period will be indicated on the indicator B, its piston 37 being moved to the right as soon as back-pressure sets in. The degree of back pressure indicated on the edges of slot 40 showing that the lungs have been filled and that it is desirable for the patient to be caused to exhale.

The pressures used vary from 5 centimeters of water column for infants, to 50 centimeters of water column for adults under some conditions, but the usual high limit is about 25 centimeters of water column.

Under normal conditions the pressure of the oxygen, or other gas or air at the source of the compressed supply, or generator may be too great for the condition of the patient; if this is the case, the screw-plug 16^a is opened, so that the pressure in chamber 7 will pass around the edge of valve plate 14 and through the interior of this plug into the atmosphere; and the apparatus can be so adjusted that at no time will the indicator B indicate a greater pressure than that deemed necessary for the particular patient being treated.

When valve 9 is reversed, so that the handle 12 engages stop 13', suction is produced in pipe 8, chamber 7' and pipe 10 by the nozzle 3, thus drawing the contents of the

lungs through said chamber and pipes into the combining nozzle 5, and discharging them through chamber 7 and port 11 into the atmosphere. Suction will thus be indicated on the indicator A in centimeters of water column; and in a like manner suction in chamber 7′ can be watched by the operator, and adjusted by the tubular screw 16, air being admitted through the center of screw 16 around the edge of the valve plate 14 into chamber 7′.

Air affects the indicator A by passing through the central bore 30 of the screw 29, the screen 32, and the central perforation of washer 33 onto the end of piston 37, thus causing the piston to move to the right and compress its spring and indicate the pressure.

The device, when used, will show to the operator just the amount of pressure and the amount of suction developed in the lungs on each and every stroke of the valve 9, which is a great advantage. Another advantage is that the valve 9 is manipulated manually, and as soon as a patient commences to breathe this shallow breathing is at once shown by the indicators A and B, and the operation of the device regulated accordingly.

The desire to breathe is not always regular or in rhythm with a regular movement of the valve 9, and the discrepancy in the timed relation between the action of the apparatus and the action of the lungs causes an interference of one with the other, and the apparatus would at times hinder the resuscitation rather than assist it, were it not possible to operate the valve 9 according to the action of the lungs. With applicants' structure, however, and the accurate indications given of the suction and pressure developed, the operator of the apparatus will always know when the patient desires to exhale and when he desires to inhale, and will manually set valve 9 accordingly, irrespective of whether the periods be regular or irregular.

We claim—

1. In a resuscitating device, the combination with a casing having two chambers therein and a port between them, a conduit connection, a valve controlling the connection of said conduit connection with one chamber and the simultaneous connection of the port with the other chamber, one of said chambers having an inlet pipe and the other having an outlet pipe, and an injector arranged between the two pipes to discharge into one of them and to thereby entrain air or gas from the other pipe; of means controlling the connection of each chamber with the atmosphere.

2. A resuscitating device having a breathing conduit for attachment to a breathing mask, means to produce suction and pressure in said conduit, and a controllable valve between said means and conduit, in combination with a pressure indicator and a suction indicator on said conduit, said indicators being in permanent operative relation to the conduit and arranged to indicate pressure and suction in said conduit under all conditions of operation.

3. The combination with a breathing tube and manually operated means to direct a stream of gas into or from said tube; of means to indicate the suction and pressure produced throughout the whole duration of the suction and pressure periods, and means to control the energy of said stream of gas during the suction and pressure periods and thereby vary the suction and pressure produced by said stream in said conduit.

4. The combination with controllable means for producing alternately suction and pressure in the breathing conduit of a resuscitating device; of separate indicators respectively indicating the suction and pressure produced in said device, and separately operating valves respectively admitting air to said device during the suction period and venting pressure gas to the atmosphere during the compression period.

5. In a resuscitating device, a substantially cylindrical casing having a port between its ends, a pipe connection between its ends, a valve dividing the casing into two chambers, a suction pipe connected to one chamber and a forcing pipe connected to the other chamber, a plate closing each end of the casing, a tubular screw in each casing end connected to said plate, whereby said plates may vent said chambers to the atmosphere.

6. The method of operating injectors for resuscitating apparatus, which comprises producing a jet of gas having a suction and a forcing side, combining with said jet alternately fresh air and air from the lungs of the patient, alternately directing said combined stream to the patient and to the outside air, and controlling the suction and forcing action by venting the suction and forcing sides of the stream to the atmosphere.

7. The method of operating injectors arranged to produce both forcing and suction in which a forcing jet of gas combines with a current of air to produce a combined stream of reduced pressure, controlling the suction of said jet by venting the atmosphere to said current and controlling the combined stream by venting it to the atmosphere.

8. The method of operating injectors arranged to produce both forcing and suction by means of a jet of compressed gas combined with air to produce a combined stream of reduced pressure, which comprises controlling the suction of said jet by admitting atmospheric air to said stream, controlling

its pressure by venting the stream to the atmosphere, indicating the suction and pressure produced, and controlling the duration of the suction and pressure periods in accordance with said indications.

9. In the method of operating resuscitating devices in which alternate suction and pressure are produced within the lungs by alternately supplying within the lungs a respirable gas and withdrawing the respired gas therefrom, the improvement which consists in indicating during the supply and withdrawal the pressure and suction produced, and controlling the duration of the supply and withdrawal periods in accordance with the indications.

In testimony that we claim the foregoing as our invention, we have hereto signed our names.

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