May 6, 1941. K. W. BINDING 2,240,830

ARTIFICIAL RESPIRATOR

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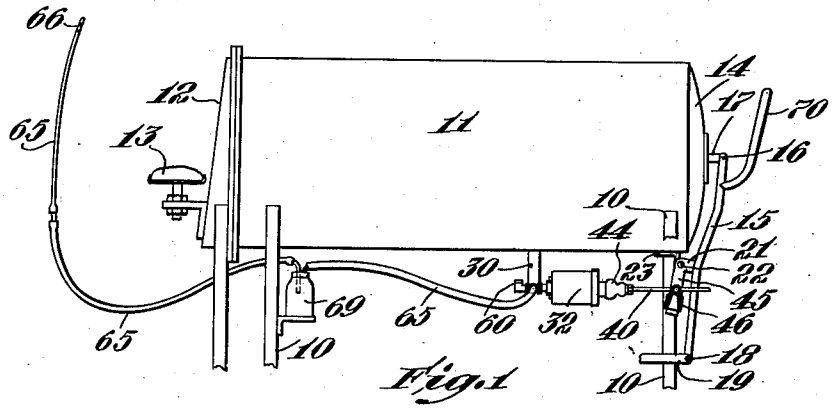


Fig. 1

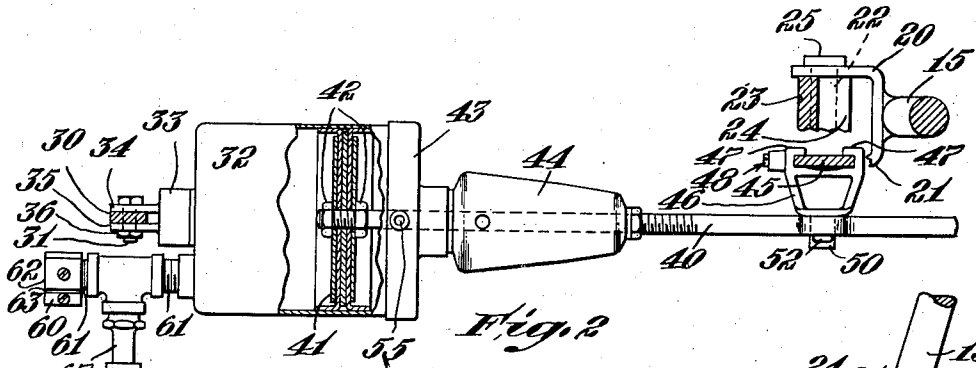


Fig. 2

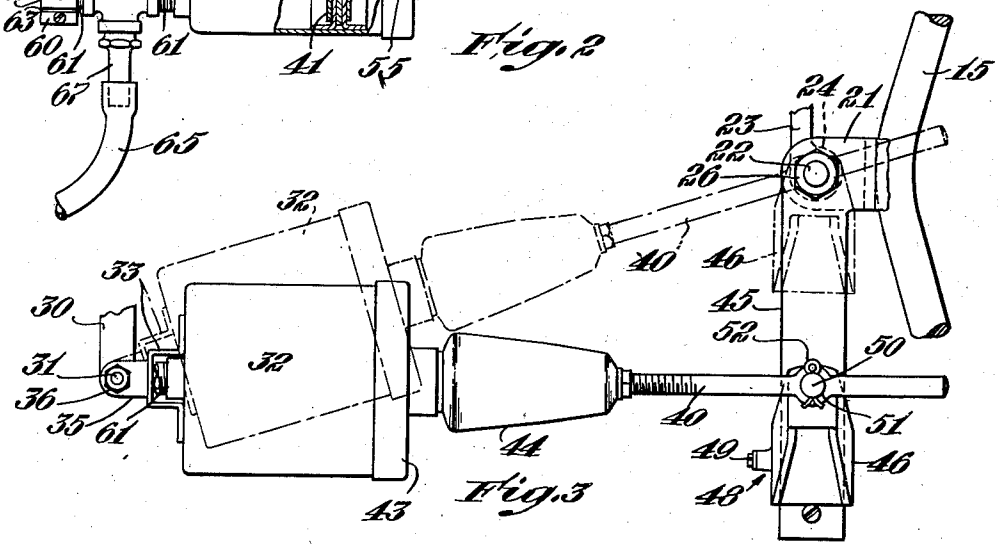


Fig. 3

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ARTIFICIAL RESPIRATOR

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3 Claims. (Cl. 128—30)

This invention relates to artificial respirators for stimulating breathing of persons suffering from drowning, suffocation, infantile paralysis, etc., and more particularly to a respirator embodying a mucous aspirator.

The artificial respirator to which this invention relates comprises a substantially air-tight casing which encloses the chest of the patient, leaving at least his nose and mouth exposed to the atmosphere. Alternate negative and atmospheric or positive pressures are created within the casing in time with the normal respiration periods of the patient. Each negative pressure period causes the patient's chest and lungs to expand and air is automatically drawn into his lungs through his nose and mouth, thereby causing an inhalation. Each atmospheric or positive pressure period causes the patient's chest to collapse forcing the air in his lungs to be expelled through his nose and mouth and thus an exhalation results.

The size of the casing may vary, for example it may be large enough to enclose a patient's entire body with the exception of his head, as shown in United States Letters Patent No. 1,834,580 and No. 2,060,706, or it may be large enough to enclose only his chest.

The pressure variations within the respirator may vary from twelve to sixty per minute, depending upon the normal rate of respiration of the patient and also upon the affliction for which he is being treated. The usual degree of negative pressure during each negative pressure period for an average patient is from five to fifteen centimeters of water. Usually the pressure is alternated from negative to atmospheric, but in cases where there is a lack of tone in the chest muscles the pressure is alternated from negative to positive.

A patient who is unable to breathe of his own accord is frequently so weak that he can not himself expectorate the fluids such as mucous, saliva and the like, which collect in his throat, and it is necessary to remove such fluids so that the respirator may function to maintain a flow of air to and from his lungs. Use of a mucous aspirator which creates a continuous suction at the entrance of the aspirator tube has been found undesirable because it operates to take in air as the air is passing to the patient's lungs during inhalation, thereby reducing the amount of air transmitted to the lungs and also greatly annoying many patients who are ordinarily in a nervous condition due to treatment by the resiprator and their generally weakened state.

The principal object of this invention is to provide a respirator embodying a mucous aspirator which operates to remove fluid from the patient's throat during periods of exhalation only.

Further objects are to provide such an aspirator which is operated by the respirator pressure alternating means and also which may be readily adjusted from inoperative poistion to various operative positions.

Other objects relate to the construction and mode of operation, and will be apparent from a consideration of the following description and accompanying drawing which exemplify one embodiment of my invention chosen for the purposes of illustration.

In the drawing:

Fig. 1 is a side elevation view of an artificial respirator embodying my invention;

Fig. 2 is an enlarged plan view of the aspirator with parts broken away; and

Fig. 3 is a side elevation view of the aspirator of Fig. 2 with parts broken away and with the dot-dash lines showing the aspirator adjusted to inoperative position.

The respirator illustrated comprises four legs 10 on which is mounted the substantially air-tight respirator casing 11 which forms an enclosure for the patient's body up to his neck. The patient reclines upon a horizontal bed (not shown) within the casing 11, and his neck extends through a restricted orifice in the end 12 of said casing, his head resting upon the head rest 13. A collapsible diaphragm or bellows 14 made of leather or other suitable flexible material forms the outer end of the casing 11. The diaphragm 14 is operated by an operating arm 15 which has its upper end pivotally secured at 16 to the rigid diaphragm extension 17, and its lower end pivotally secured at 18 to a connecting rod 19. Intermediate its ends the operating arm 15 is provided with a pair of spaced lugs 20 and 21 each of which is provided with a transverse annular hole adapted to freely receive the fulcrum bolt 22. A fulcrum arm 23 has its upper end secured to the bottom of the respirator casing 11. The lower end of the arm 23 is provided with an enlarged portion 24 which has a horizontal annular passage adapted to freely receive the fulcrum bolt 22. The fulcrum bolt 22 extends through the hole of the lug 20, the horizontal passage in the enlarged lower end portion 24 of the fulcrum arm 23 and the hole in the other lug 21; one end of the fulcrum bolt is provided with a head 25 (Fig. 2) and the other

end is screw threaded exteriorly and receives the nut 26 (Fig. 3).

The operating arm 15 is reciprocated back and forth about the fulcrum bolt 22 by any suitable means (not shown) associated with the connecting rod 19 and such reciprocation causes the diaphragm 14 to create alternate negative and atmospheric or positive pressures in the respirator casing 11. In the position shown in Fig. 1 the diaphragm 14 is in its outermost position and negative pressure has been created in the casing 11; as the operating arm 15 is moved in a counterclockwise direction (looking at Fig. 1) the diaphragm 14 moves toward or within the adjacent end of the casing 11 thereby creating either atmospheric or positive pressure within the reciprocator casing. When the arm 15 is subsequently moved in a clockwise direction returning the diaphragm to the position shown in Fig. 1, negative pressure is again created in the respirator casing. The arm 15 is continuously reciprocated about its fulcrum 22 in this manner, thereby creating alternate periods of negative and atmospheric or positive pressures within the respirator casing in time with normal breathing periods of the patient.

A metallic aspirator suspension member 30 has its upper end secured to the respirator casing 11 and is provided adjacent its lower end with a transverse hole adapted to freely receive the horizontal bolt 31 (Figs. 2 and 3). The substantially air-tight aspirator chamber 32 has secured to one end a member 33 which is provided with parallel spaced arms 34 and 35, each of which has a transverse hole large enough to freely receive the bolt 31. The bolt 31 pivotally secures the member 33 to the suspension member 30 and passes through the hole in the arm 34, the hole in the member 30 and the hole in the arm 35; it is secured in said position by an enlarged head on one end and a nut 36 on the other end. The aspirator piston consists of a piston rod 40 and piston head 41 secured to one end of said rod by the nuts 42 (Fig. 2), the piston rod passing through a transverse hole in the center of the end 43 of the aspirator casing 32.

A tubular resilient rubber dirt guard 44 surrounds the piston rod adjacent the end 43 of the aspirator casing to protect the piston rod from any accumulation of dirt or dust which would cause friction between the piston rod and the periphery of the hole in the end 43 of the aspirator casing through which the rod passes. The guard 44 is shown in contracted position in Fig. 1 and expanded position in Figs. 2 and 3.

A rectangular extension member 45 has its upper end integral with the lug 21 of the operating arm 15. A slide 46 is provided with flanges 47 which fit loosely about the member 45 so that the slide 46 is slidable vertically of the member 45. The slide is provided at one side with a spring catch 48 consisting of a coil spring (not shown) the outer end of which abuts the inner end of the screw 49 and the inner end of which abuts a movable pin (not shown) the end of which releasably fits in recesses (not shown) provided in the adjacent edge of the member 45, so that the catch 48 releasably holds the slide 46 in any desired vertical position relative to the member 45. A cylindrical lug 50 extends outwardly from the slide 46 and is firmly secured thereto. The lug 50 passes freely through a transverse passage 51 (Fig. 3) in the piston rod 40 and the piston rod is pivotally secured to the lug by a cotter pin 52 which passes through a transverse hole in the lug 50.

When the slide 46 is in the position shown in Fig. 1 reciprocation of the operating arm 15 about the fulcrum bolt 22 causes corresponding reciprocation of the piston rod 40, since the piston rod is connected by the slide 46 to the member 45 which in turn is secured to the rod 15 and continuously reciprocates therewith. When the slide 46 is elevated to the dot-dash position of Fig. 3, however, the lug 50 is in direct horizontal line with the end of the fulcrum bolt 22 and consequently reciprocation of the arm 15 and member 45 causes no movement of the piston 40. When the slide 46 is elevated or lowered the aspirator chamber moves pivotally about the bolt 31. The length of stroke of the piston rod 40 may be controlled by various adjustments of the slide 46 along the member 45.

A hole 55 (Fig. 2) in the aspirator chamber 32 provides communication between the atmosphere and the interior of the aspirator chamber on one side of the piston head 41.

A flap valve 60 (Figs. 1 and 2) closes an orifice (not shown) which is provided at the top of and adjacent the outer end of the pipe 61 thereby communicating with the interior of the aspirator chamber 32. This valve consists of a movable horizontal flap member 62 which is hinged at 63. When positive pressure is created in the aspirator chamber 32 the flap member 62 moves upwardly about the hinge 63 thus opening the valve and releasing the positive pressure. When atmospheric or negative pressures are created in the casing 32 the valve 62 closes and remains closed.

An aspirator tube 65 (Fig. 1) made of flexible rubber is provided with an aperture 66 adjacent its free end and the free end is adapted to extend into the patient's throat where the aperture receives fluids transmitting them to the interior of the tube. The interior of the aspirator tube communicates with the aspirator chamber 32 by means of the deposit jar 69 (Fig. 1) and the extension 67 (Fig. 2) on the pipe 61.

In operation the slide 46 is adjusted upon the member 45 to provide the desired stroke of the piston 40. The end of the aspirator tube 65 is then adjusted in the patient's throat. The respirator is then placed in operation by reciprocation of the rod 19 which causes reciprocation of the operating arm 15 and creates alternate negative and atmospheric or positive pressures in the respirator casing 11, thus causing the patient to inhale and exhale. On each positive or atmospheric pressure stroke of the diaphragm 14 the piston plunger 41 is moved to the position shown in Fig. 2, creating negative pressure in the aspirator chamber 32. This negative pressure is transmitted through the pipe 61 and extension 67 into the adjacent portion of the aspirator tube 65, thence into the deposit jar 69 and thence into the other portion of the aspirator tube 65 and mucous or other fluid is drawn from the patient's throat through the hole 66 and deposited in the jar 69. On each negative pressure stroke of the diaphragm 14 the piston plunger 41 is moved toward the member 33 creating positive pressure in the aspirator chamber; the positive pressure is immediately released by the flap valve 60 and atmospheric pressure created in the pipe 61, extension 67 and the tube 65. Thus when negative pressure is created in the respirator casing there is no suction at the hole 66 of the aspirator tube 65, whereas when positive

or atmospheric pressures are created in the respirator casing negative pressure is created at the hole **66** of the aspirator tube **65** and mucous or other fluid is removed from the patient's throat during each period of exhalation.

To make the aspirator inoperative the slide **46** is elevated to its uppermost position.

The respirator and the associated aspirator may be operated manually by means of the handle **70** which may be used for manual reciprocation of the operating arm **15**.

The aspirator may also be operated by a suitable connection between the piston rod **40** and the connecting rod **19** or by other suitable connections and devices other than those illustrated may be used to create the pressure variations in the respirator chamber and in the aspirator chamber, but the aspirator must operate in timed relation to the means for alternating pressures in the respirator.

While I have shown and described one desirable embodiment of the invention, it is to be understood that this disclosure is for the purpose of illustration and that various changes in shape, proportion and arrangement of parts and the substitution of equivalent elements may be made without departing from the spirit and scope of the invention as set forth in the appended claims.

I claim:

1. Apparatus for producing artificial respiration comprising a substantially air-tight respirator casing to receive the patient's chest, means for producing alternate negative and atmospheric or positive pressures within said respirator casing and a mucous aspirator comprising a tube having an aperture adjacent one end adapted to receive the mucous fluid from the patient's throat and means communicating with the interior of said tube and connected to said respirator pressure alternating means and adapted to produce negative pressure in said aspirator tube only during atmospheric or positive pressure periods in said respirator casing.

2. Apparatus for producing artificial respiration comprising a substantially air-tight respirator casing to receive the patient's chest, respirator pressure alternating means communicating with said respirator casing and adapted to produce alternate negative and atmospheric or positive pressures within said respirator casing, a substantially air-tight aspirator chamber, an aspirator piston adapted to reciprocate relative to said aspirator chamber, a mucous aspirator tube having its interior communicating with said aspirator chamber and an aperture provided adjacent one end to receive the mucous fluid from the patient's throat, and an operating arm secured to said respirator pressure alternating means and to said aspirator piston, said operating arm upon actuation in one direction causing said aspirator piston to move in a direction which creates negative pressure in said aspirator chamber and tube and upon actuation in the other direction causing said aspirator piston to move in a direction creating atmospheric pressure in said aspirator chamber and tube; said negative pressure being created in said aspirator tube only during atmospheric or positive pressure periods in said respirator casing.

3. Apparatus for producing artificial respiration comprising a substantially air-tight respirator casing to receive the patient's chest, respirator pressure alternating means communicating with said respirator casing and adapted to produce alternate negative and atmospheric or positive pressures within said respirator casing, a substantially air-tight aspirator chamber, an aspirator piston adapted to reciprocate relative to said aspirator chamber, a mucous aspirator tube having its interior communicating with said aspirator chamber and an aperture provided adjacent one end to receive the mucous fluid from the patient's throat, an operating arm having one end secured to said respirator pressure alternating means, a fulcrum engaging said operating arm intermediate its ends and a connecting member connected to said aspirator piston and to said operating arm, said connecting member being releasably movable from a position wherein the connection between the said aspirator piston and said operating arm coincides with said fulcrum to a position wherein said connection is spaced from said fulcrum whereby reciprocation of said operating arm about said fulcrum causes no reciprocation of said aspirator piston when said connecting member is in said first position but causes reciprocation of said aspirator piston when said connecting member is in said latter position.

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