

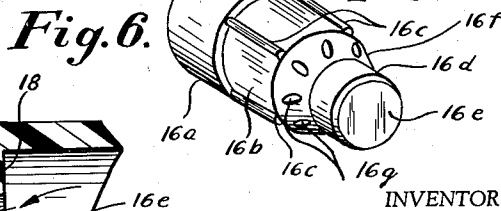
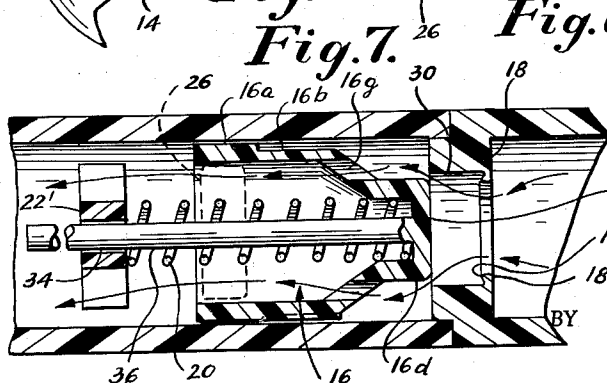
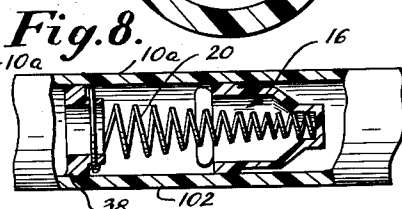
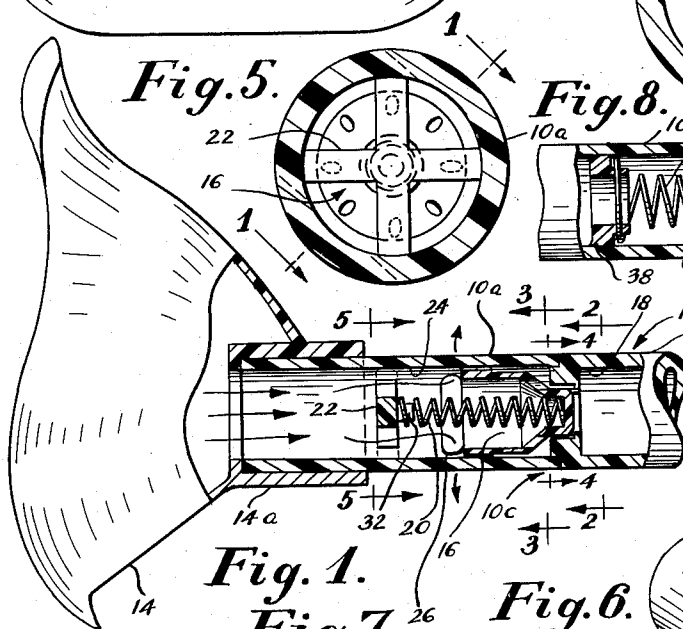
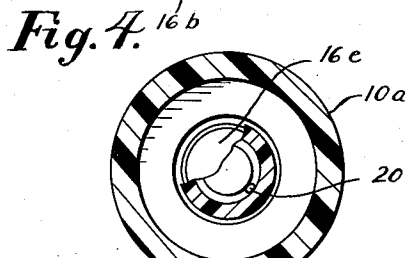
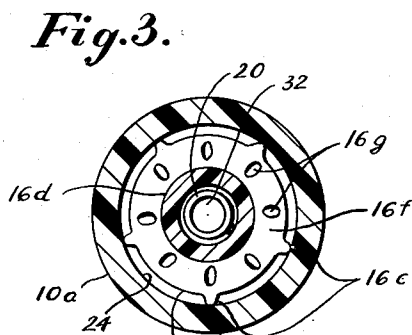
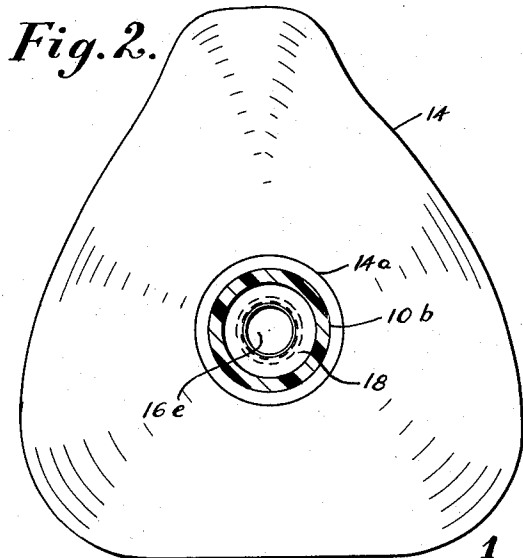
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RESUSCITATION DEVICE

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1

2,990,838

## RESUSCITATION DEVICE

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2 Claims. (Cl. 137-63)

This invention pertains to resuscitation devices of the type where a human operator blows air from his mouth through the apparatus and into the patient requiring resuscitation, and wherein the exhausted fluids from the patient are diverted to atmosphere and do not return to the operator's mouth.

The present application describes and claims certain improvements upon resuscitation apparatus of the aforesaid type basically described and claimed in my copending application Serial No. 690,508, filed October 16, 1957. As reading of the aforesaid application and the present application explains, resuscitation apparatus as therein explained permits the increasingly popular style of resuscitation, sometimes called "mouth-to-mouth resuscitation," to be carried out very effectively and still actual physical contact between the operator and the patient is avoided, and fluids issuing from the patient do not reach the mouth of the operator. These features contribute materially to the resuscitation of patients where otherwise an operator would not normally desire to assist, due to the dangers of contracting a disease or for other reasons. It is, of course, to be understood that the apparatus is useful for the resuscitation not only of human victims, but for other air-breathing creatures. For example, there is wide application in the field of veterinary medicine with suitable mask means for covering the mouth and nostrils of the patient.

It is a primary object of the present invention to provide improved valving means for permitting fluid from the operator to pass to the patient while upon return of exhaust fluids from the patient causing these to vent to atmosphere and be prevented from returning to the mouth of the operator.

In keeping with the foregoing object, improvements are provided for reducing the adverse effect of condensation of moisture upon the movement of the valving device.

The present invention has as another of its objects the provision of means for precluding the unintended dislodgement of a coil spring from its intended position.

A further object of the present invention is to provide a mouthpiece for the resuscitation device which is rotatable with respect to the part of the device engaging the patient.

The foregoing and other objects of the invention will become more fully apparent from the following detailed description of illustrative forms of the invention. These illustrative forms may be best understood with reference to the accompanying drawing, wherein:

FIGURE 1 shows a sidewise elevational view partly in section of one form of structure embodying aspects of the present invention.

FIGURE 2 is a view taken along the line 2-2 of FIGURE 1.

FIGURE 3 is a section taken along the line 3-3 of FIGURE 1.

FIGURE 4 is a section taken along the line 4-4 of FIGURE 1.

FIGURE 5 is a section taken along the line 5-5 of FIGURE 1. The section line 1-1 indicated in FIGURE 5 relates to the view shown in FIGURE 1.

FIGURE 6 is an isometric view of the movable valve member otherwise shown in FIGURES 1 and 3-5.

2

FIGURE 7 is a fragmentary cross-sectional view of structure like that in FIGURE 1 except for different features of construction incident to the maintaining of a resilient coil spring in proper position, and

FIGURE 8 is again a fragmentary cross-sectional structure such as in FIGURE 1 except with differing details of construction incident to the maintenance of a coil spring in proper position.

In FIGURE 1 reference character 10 generally designates a body member comprised of sections 10a and 10b joined by complementary cylindrical interfitting portions at point 10c. At least, there will be such a joint 10c where the respective sections are made of so-called "plastic" materials and due to molding problems, the parts should be originally separate. However, once assembled joint 10c may be cemented or otherwise fixed. At the right-hand end of the body member 10 as shown in FIGURE 1, there is present a mouthpiece 12 having a reduced section 12a and at the extreme right-hand end thereof a surrounding ridge 12b, portions 12a and 12b being preferably of an oval cross-section (the lesser diameter being shown) to facilitate gripping between the lips of a human operator for blowing air through the central passage 12c in the direction suggested by arrow 12d.

Still referring primarily to FIGURE 1, at the left-hand end of the body member as viewed in this figure, there is provided a face mask 14. This is the type of mask otherwise known in the art, for fitting to the facial contour of a human for encompassing both the nose and the mouth. Mask 14 may be provided with a portion 14a for fitting about the left-hand end of section 10a of the body member for providing a good fit, and cement or other means may be provided for making this fit permanent. Or, the joint may be rotatable. It will now be observed that there is free fluid communication between the left-hand end of the body member portion 10a and the mask 14 for permitting bilateral passage of fluids between these two parts.

It should also be observed that the mask 14 may be of any suitable form for use in other than human resuscitation. For example, in the so-called veterinary field, the mask may be of suitable contour for use with dogs and various mask forms can obviously be arranged for other animals.

It should also be understood that insofar as the valving structures and other features to be primarily discussed in this application are concerned, the mask could be replaced with other forms of fluid passing devices for special circumstances. For example, in many resuscitation situations it is the practice to pierce the human trachea region or to create similar passages to the lungs in animals. Thusly, the mask 14 could be replaced by a suitable structure for use in the just mentioned fashions.

Within the portion 10a of the body member there is provided a movable valve member 16 (shown separately in FIG. 6). The movable valve member 16 cooperates with a fixed valve seat structure 18. The valve member 16 is urged into seating relationship with the valve seat member 18 by action of a resilient compression spring member 20 acting at its right-hand end as viewed in FIGURE 1 upon the valve member 16, and acting at its left-hand end upon a spring-retaining means 22 fixed within the body member. From the various figures it will be observed that the interior of the body portion 10a is provided with a cylindrical passage defined by the cylindrical interior surface 24.

In FIGURE 1 the valve member 16 is shown in its seated position, which is its extreme movement to the right as viewed in FIGURE 1. Attention is now drawn to an opening or port 26 in the wall of body portion 10a.

It will be understood that there may be more than one port about the periphery of body member 10a, in the longitudinal position or plane, however, of port 26 which is illustrated.

Referring to all of the figures of the drawing, where the valve member 16 is consistently shown for purposes of illustration, this valve member is characterized by a first portion of its length 16a having a radius just slightly less than the radius of the interior surface 24 of the body member section 10a so as to provide a close but freely sliding fit therein. A neighboring portion of the length of the valve member 16, designated 16b, is characterized by having a cylindrical surface mostly of a radius somewhat less than the radius of the first portion 16a. However, the portion 16b is characterized by having upstanding from its general surface, regions of radius substantially equal to the radius of the first portion. As shown best in FIGURE 6, these raised portions may be longitudinal ridges 16c. It is the purpose of these ridges—which might be dimples or other structures of minimum area—to maintain alignment of the movable valve member within the passage of the body member, but without contributing to friction or resistance due to surface tension of condensed moisture.

An additional portion of the length of the valve member 16 is a portion of substantially less radius, designated 16d, this having an uninterrupted cylindrical surface. At the right-hand end of the valve member as shown in all figures, there is an imperforate face 16e. Intermediate the portion 16b and the portion 16d of the valve member 16, there is a portion 16f provided with one or more apertures 16g for permitting fluids to pass therethrough as will become more fully apparent hereinafter.

The valve seat member structure 18 is provided with a central aperture 30 of radius just slightly larger than the radius of portion 16d of the valve member and again is intended to provide effective blockage of passage of fluid between the passage 30 and the valve portion 16d. The valve structure 18 is further provided with an inwardly extending ledge structure 18a having a fairly sharp edge 18b for axially engaging the face 16e of the valve member when the latter is in its seated position, which is its right-hand position as shown in FIGURE 1. The unseated position is diagrammed in FIGURE 7.

In accordance with the detail of spring construction and support in FIGURE 1, the fixed spring-retaining means 22 is in the form of a spider best shown in FIGURE 5 provided with a post 32 thereon for surrounding the spring 20 to prevent lateral movement thereof off of the spider 20. The spring at its other end nests within the end 16d and against the inside of face 16e of the valve member.

In FIGURE 7 the spider is designated 22' due to its modification as compared to the FIGURE 1 construction, to have a central aperture 34 within which freely passes a post 36 extending from the face portion 16e of the valve member 16. Thusly, the spring 20 is entirely surrounded throughout its length and cannot possibly become dislodged from the spider 22'. FIGURE 8 shows another arrangement for securely maintaining the desired position of the spring. In this case, an annular ledge member 38 is fixed within the body portion 10a so that the base of a conical spring 20' can seat therein. Clearly, this spring cannot move sidewise to disengage itself from the support 38, due to its diameter. The right-hand end of the conical flange 20' again nests within the portion 16d of the valve member.

It should be observed that in fact the member 38 could be simply in the form of a groove cut into the inside of the body member 10a to receive the end of the spring.

In operation it should first be observed that in all of the embodiments of FIGURES 1, 7 and 8 the manner of seating of the spring varies, but the operation of the remainder of the parts is nevertheless the same.

As will be appreciated by the reader, the resuscitation

cycle involves a period while the operator blows into the mouthpiece 12 and causes air to pass into the lungs of the patient. The next part of the cycle is where the operator terminates blowing into the mouthpiece and the lungs of the patient deflate, causing fluids to pass into the mask 14 or other attachment in its place. FIGURE 7 shows the position of the valve member 16 during the first phase of the cycle, while the operator is blowing air into the mouthpiece 12. When this fluid pressure is presented to the seated valve (FIG. 1) pressure is exerted upon face 16e and there is a minimum of leakage of this fluid until the portion 16d of the valve member has substantially removed itself from the aperture 30 of the valve seat structure. Unseating movement of the valve member 16 will not terminate until a position is achieved more or less as shown in FIGURE 7, whereupon, however, the fluid is now escaping around the outside of the aperture 30 and around the portion 16d of the valve member. This fluid passes through the apertures 16g of the valve member, thence past the spider 22 (or 22', or structure 38, as the case may be) and to the patient. While the valve member is thus in its unseated position, attention is drawn to the fact that the first portion 16a of the valve member is blocking or obstructing the port opening 26 in the wall of the body member 10a. This is necessary in order to preclude the possibility of the operator's air passing to atmosphere rather than to the patient. In order to achieve complete obstruction of the port 26, it will be noted that the longitudinal unobstructed dimension of the port 26 in the seated position of the valve (FIG. 1) should be no greater than substantially the length of the aperture 30, so that when the valve member reaches its extreme left-hand position (FIG. 7) and thereafter fluid from the operator passes to the patient rather than causing further movement, the port 26 should be totally obstructed by the presence of the portion 16a of the valve member.

In the next portion of the resuscitation cycle, when the operator has ceased blowing into the mouthpiece 12, the resiliency of the spring 20 (or 20', FIG. 8) will cause the valve member 16 to move so that seating occurs between the edge 18b and the face 16e. In this position of the valve member the port 26 becomes unobstructed and fluids issuing from the patient now pass freely through the port 26 to atmosphere. Insofar as there may be such pressure of fluid issuing from the patient as to cause an accumulation of pressure within the body member 10a due to resistance of passage through the port 26, this will only more firmly seat the valve member into the valve seat structure and the passage of these possibly contaminated fluids to the operator's mouth will be completely precluded.

It is unavoidable that the fluids issued from an operator into mouthpiece 12 contain a great deal of water vapor and/or water in its liquid phase. Under typical circumstances the water vapor could be expected to condense upon reaching the surfaces of the various parts of the resuscitation device, particularly where the ambient temperature is fairly low. Where the scale of the structure may be such that the diameter of the body member in FIGURE 1 of the herewith drawings is one inch, the various clearances and tolerances are such that droplets of moisture can exert appreciable forces and resistances, due to surface tension effects. It is to be appreciated that the pressure applied to fluids moving into a patient's lungs cannot exceed modest amounts. Conversely, the pressures exerted upon fluids due to the collapsing of the lungs of the patient cannot be expected to generate great pressures. Accordingly, the resistance offered by the spring 20 (or 20') must be quite small, and of such magnitude that the aforesaid resistance offered by surface tension of moisture droplets can be an appreciable factor. Therefore, in accordance with features of the present invention only a portion, the portion 16a (of the length of the valve member 16) is of constant diameter just less

than the inside of the passage in the body member to provide a "piston-ring" effect and the remainder of the length of the valve member necessary to provide reasonable alignment and to prevent "cocking" of the valve member in the passage is provided with the raised portions such as ridges 16c. These provide the alignment function, but greatly reduce the close-fitting cylindrical surfaces that could be effected by surface tension of moisture droplets. And to further reduce resistance or sticking due to presence of moisture, the ultimate valve seating parts are given a sharp edge 18b formation.

Quite often a patient requiring resuscitation has been involved in an accident or is otherwise in a situation from which he cannot be readily moved. A patient may be pinned in the wreckage of a conveyance, or may be a lineman who has suffered an electrical shock and is hung on a utility pole. In such circumstances, it has been found important that the mouthpiece 12 be rotatable with respect to the position of the face mask 14. For this reason, a rotatable joint between these ends of the resuscitation device is preferable. It has been provided in the illustrative embodiment as shown in FIGURE 1 by having a ridge 12e in one of the complementary cylindrical interfitting parts between the mouthpiece 12 and body section 10b, with a complementary groove 12f in the other part. Due to resiliency of the parts the mouthpiece may be moved longitudinally into position whereupon the ridge 12e will snap into the groove 12f and thusly prevent easy longitudinal movement, which would be undesirable, while nevertheless preventing convenient rotational movement. Of course, the rotational movement could be provided as between the face mask 14 and the body member 10a, using the same principles. It should further be understood that there may be a piece of flexible tubing extending from the right-hand end of body section 10b to a suitable mouthpiece so that even more maneuverability can be achieved between the operator and a patient presenting difficulties in accessibility.

It is to be understood that the foregoing detailed descriptions of illustrative embodiments have been given only so that the basic principles of the inventive features can be understood. The scope of the present invention is to be determined from the following claims.

What is claimed is:

1. In a resuscitation device, a body member having a cylindrical inner surface, an elongated generally cylindrical movable valve member within the body member for reciprocating movement therein, the valve member being characterized by the outer surface thereof having a first portion of the length thereof or radius sufficient to present a close but free fit to the inner surface of the body member, an additional portion of the length of the valve member being of substantially lesser radius than said first portion, the movable valve member being further provided with a section intermediate said first portion of length and said additional portion of length, this section being provided with at least one opening therethrough for passage of fluid therethrough, valve seat structure fixed within said passage in the body member with a central aperture therein of such radius as to provide a close but free sliding fit of said additional portion of the movable valve member therewithin, means acting between the movable valve member and the body member for urging the movable valve member into valve seating relation with the valve seat structure, at least one port opening in the body member in proximity to the movable valve member and unobstructed for a given lengthwise distance with the movable valve member in its seated position in the valve seat structure, the unobstructed dimension of said port lengthwise of the body member with the valve member in its seated position being no greater than the length of said aperture in said valve seat structure, said unob-

structed lengthwise dimension of the port opening also being no greater than the axial length of the said first portion of the length of the movable valve member, the arrangement being such that fluid pressure applied through the valve seat structure causes unseating movement of the movable valve member, and the unseating movement of the movable valve member does not terminate until the said additional portion of the movable valve member has substantially withdrawn said additional portion from the aperture in the valve seat structure, at which position the first portion of the length of the movable valve member has completely obstructed said port opening.

2. In a resuscitation device, a body member having a cylindrical inner surface and inlet and outlet ends, an elongated generally cylindrical movable valve member within the body member for reciprocating movement therein, the valve member being characterized by the outer surface thereof having a first portion of the length thereof or radius sufficient to present a close but free fit to the inner surface of the body member, an additional portion of the length of the valve member being of substantially lesser radius than said first portion, valve seat structure fixed within said passage in the body member with a central aperture therein of such radius as to provide a close but free sliding fit of said additional portion of the movable valve member therewithin, means acting between the movable valve member and the body member for urging the movable valve member into valve seating relation with the valve seat structure, at least one port opening in the body member in proximity to the movable valve member and unobstructed for a given lengthwise distance with the movable valve member in its seated position in the valve seat structure, the unobstructed dimension of said port lengthwise of the body member with the valve member in its seated position being no greater than the length of said aperture in said valve seat structure, said unobstructed lengthwise dimension of the port opening also being no greater than the axial length of the said first portion of the length of the movable valve member, the device including means defining a fluid flow passage from the valve seat to the outlet end of the body member when the valve member is unseated, the arrangement being such that fluid pressure applied through the valve seat structure causes unseating movement of the movable valve member, and the unseating movement of the movable valve member does not terminate until the said additional portion of the movable valve member has substantially withdrawn said additional portion from the aperture in the valve seat structure, at which position the first portion of the length of the movable valve member has completely obstructed said port opening.

#### References Cited in the file of this patent

##### UNITED STATES PATENTS

|           |           |                |
|-----------|-----------|----------------|
| 228,532   | Hoyt      | June 8, 1880   |
| 764,642   | Stenwall  | July 12, 1904  |
| 1,292,613 | Kessler   | Jan. 28, 1914  |
| 1,398,967 | Humason   | Dec. 6, 1921   |
| 1,913,664 | Finger    | June 13, 1933  |
| 2,280,050 | Alexander | Apr. 21, 1942  |
| 2,449,683 | Akerman   | Sept. 21, 1948 |
| 2,619,162 | Feilden   | Nov. 25, 1952  |
| 2,670,751 | Wilson    | Mar. 2, 1954   |
| 2,887,104 | Sovinsky  | May 19, 1959   |
| 2,930,401 | Cowan     | Mar. 29, 1960  |

##### FOREIGN PATENTS

|           |         |               |
|-----------|---------|---------------|
| 496,982   | Belgium | July 31, 1950 |
| 535,918   | Canada  | Jan. 15, 1957 |
| 1,159,530 | France  | Feb. 10, 1958 |