March 29, 1966 H. W. SEELER 3,242,921

BREATHING CONTROL VALVE

Filed July 7, 1958 2 Sheets-Sheet 1

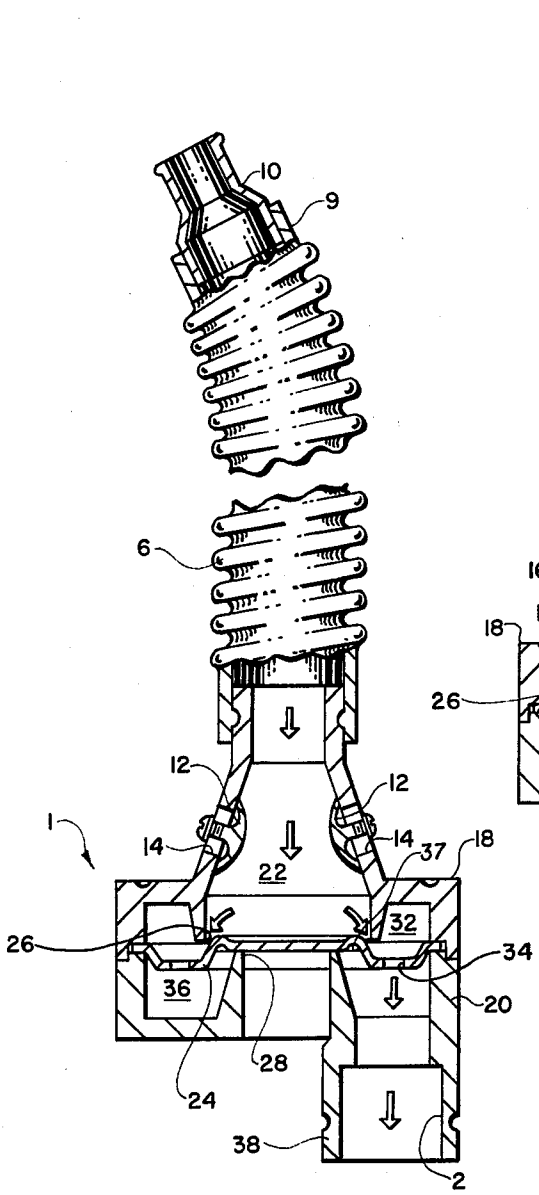

FIG. 2.

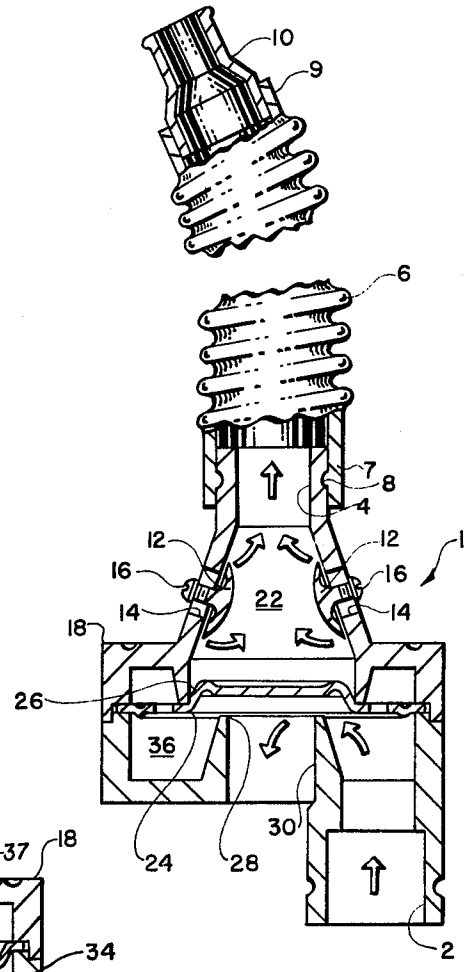

FIG. 1.

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BREATHING CONTROL VALVE

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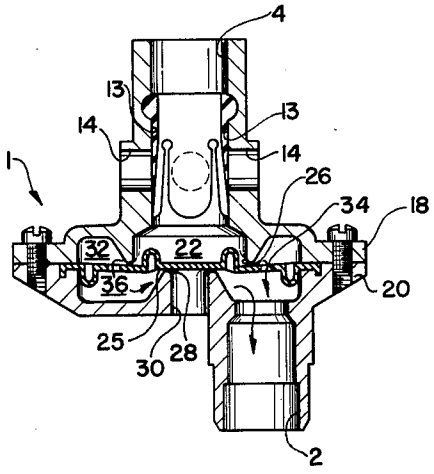

FIG. 4

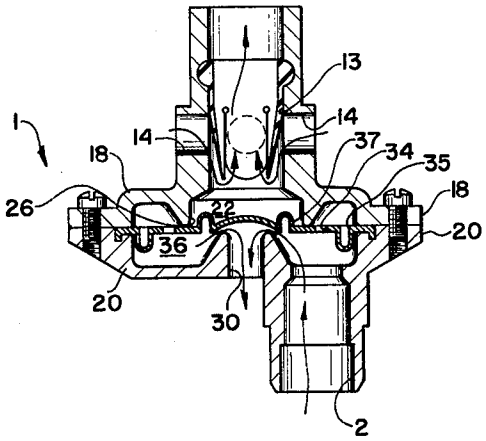

FIG. 3

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BREATHING CONTROL VALVE

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8 Claims. (Cl. 128—29)

This invention relates generally to a valve and particularly to a valve for controlling the flow of air.

Of particular concern is the application of an air control valve in resuscitation or other breathing apparatus. In the field of safety and life saving, it often becomes necessary to apply an immediate effort to revive a patient who has become unconscious and stopped breathing. In many instances large mechanical devices are unavailable, and often the only solution is to apply one of the well known methods of artificial respiration. Until recently the Schafer "prone pressure" system was the universally accepted practice, which has now been replaced by the Nielsen "back-pressure, arm-lift" method. It has recently been determined that neither trained nor untrained operators using either the Schafer or Nielsen methods under field conditions could move enough air into the victim to maintain adequate oxygenation of his blood. One of the difficulties with the artificial respiration methods known is that they are tiring also to the one administering first aid. Also, the rescuer's hands are not free to keep the victim's chin up and insure free air passage through his throat. One of the oldest known methods of artificial respiration is blowing air directly into the mouth of a person who has stopped breathing. However, there is a general distaste for touching an unconscious victim and especially from blowing directly into the mouth of such a person.

It is one object of this invention to provide a breathing control valve which will permit the outflow of air from a patient and also the inflow of air to a patient in a smooth and efficient operation. It is another object of the invention to provide a mouth-to-mouth breathing apparatus which is both portable and easily operable, and requires no source of power to operate. It is a further object of the invention to provide a mouth-to-mouth resuscitator employing a simple breathing control valve which insures that a fresh column of air is always administered to the patient, while also insuring the ready egress of air from the patient's lungs. These and other advantages will become more readily apparent upon a reading of the description following hereinafter, and upon an examination of the drawings, in which:

FIGURE 1 shows a breathing control valve of the invention as used in a mouth-to-mouth respiration apparatus,

FIGURE 2 shows the breathing control valve of FIGURE 1 in the alternate operating position,

FIGURE 3 shows an alternate modification of the breathing control valve of the invention, and

FIGURE 4 shows the control valve of FIGURE 3 in the alternate operating position.

As clearly shown in FIGURE 1 the breathing control valve **1** of the invention is provided with an egress passage way **2** and an inlet passageway **4**. The valve as shown in FIGURE 1 is indicated as being applied to a mouth-to-mouth respiration device which would consist of a tube **6** which is mounted at its lower end **7** on the valve **1** in communication with the outlet passageway **4** by means of a mounting groove **8**. The tube **6** is of sufficient length to contain a desired volume of air, and has mounted at its other end **9**, a mouthpiece **10** to enable the operator to inhale and exhale through the tube **6**. If desired, the end **9** of the tube **6** may be affixed to a face mask, or to another source of air or oxygen.

FIGURE 1 illustrates the inhalation cycle of the breathing control valve. With the mouthpiece **10** inserted in the mouth of the operator, the operator inhales through the tube **6**, which causes the valve **12**, to unseat. Valves **12** are flexible members which are mounted by a mounting means **16** on the upper portion of the valve **1** and which are disposed to cover and uncover openings **14** in the upper housing **18** of the valve **1**. Upon inhalation of the operator through the tube **6** the valve or valves **12** are unseated, as above described, and air will flow through the ports **14** into the chamber **22**, and up into the tube **6**. The valve **1** is comprised of upper and lower housing members **18** and **20** which enclasp a flexible valve member **24**. This valve member **24** is in effect a dual valve which alternately seats upon valve opening **26** and upon valve opening **28**. The valve opening **26** leads into chamber **22** and passageway **4**, and the valve opening **28** leads into passageway **30** and out to the atmosphere. As the operator inhales and draws a column of air into the tube **6**, he simultaneously creates sufficient suction in the chamber **22** to cause the valve member **24** to seat upon the valve seat **26** and thus prevent any egress or ingress of air through the valve.

When a desired volume of air has been drawn into tube **6**, the operator will then exhale through tube **6**. As the operator exhales he forces the fresh air which has been drawn into tube **6** downwardly as indicated in FIGURE 2. The increased pressure upon the small valves **12** will seat them upon their valve openings **14** and prevent any outflow of air through the valve ports **14**. The column of air will then pass from the tube **6** into the chamber **22** and will exert sufficient pressure upon the flexible valve member **24** to unseat it from the valve seat **26** and cause it to seat upon the valve opening **28**; thus permitting the column of air entering chamber **22** to flow past valve opening **26** and into an annular chamber **32** and out through a series of ports or openings **34** in the flexible valve member **24**. The ports **34** are arranged to communicate with another annular valve chamber **36** which is in turn in communication with the passageway **2** for egress from the valve **1** to be administered to the patient. A similar tube such as tube **6** may be connected to the valve **1** by mounting upon the lower member **22** at **38** and for insertion into the mouth of the patient. If desired, an ordinary breathing tube may be used. Alternately the tube can lead to a face mask. The column of air which was formerly within tube **6** is thus forced from tube **6** into chamber **22** past valve opening **26**, into chamber **32**, through ports **34**, into chamber **36** and out through passageway **2** into the patient. Upon the next inhalation cycle (see FIGURE 1) the valve member **24** will be drawn upwardly and seat upon valve seat **26** (as above described), and simultaneously the patient will be permitted to exhale through passive recoil through passage **3** to annular passageway **36**, past valve opening **28** and out passageway **30** to the atmosphere.

The breathing control valve of the invention thus has ready application to a mouth-to-mouth or mouth-to-mask or any other respiratory device and permits the application of the ancient mouth-to-mouth artificial repiration method in a more modern and satisfactory manner to reviving unconscious victims. The device permits untrained operators to use the mouth-to-mouth method with minimum exertion and with maximum effectiveness.

An alternate breathing control valve is shown in FIGURE 3. Equivalent elements are numbered with the same reference numerals as used in FIGURES 1 and 2. The control valve **1** of FIGURE 3 also consists of upper and lower housing members **18** and **20** which enclasp a flexible valve member **25**. The housing member **20** has an outlet passageway **2** and the housing member **18**

has an inlet passageway 4. The valves 12 of the modifications of FIGURES 1 and 2 are replaced with a simple skirt type inhalation valve 13 which is mounted to cooperate with similar ports 14. The valve member 24 is provided with two convolutions 35 and 37 instead of the single convolution 37 as found in the valve member 24 of the embodiment of FIGURES 1 and 2. The employment of two convolutions 35 and 37 enables a more flexible and smoother operation of the valve member 24. The operation of the breathing control valve of FIGURES 3 and 4 is similar to that of FIGURES 1 and 2 and is as follows: When the pressure in chamber 22 is caused to decrease (such as by inhalation and the creating of a vacuum in passageway 4) the inhalation flapper valve 13 is caused to move inwardly to uncover the passageway openings 14 and permit air to enter into the chamber 22 and upwards into the passageway 4. At the same time, the valve member 24 is seated upon the valve seat 26. When a sufficient volume of air is drawn through the valve ports 14, then pressure is exerted upon the air in chamber 22 to force the flapper valve 13 to seat and seal off the passageways 14, and simultaneously to force the valve member 24 downwardly to seat upon the valve seat 28 (see FIGURE 4) and permit the air within the chamber 22 to pass into the annular chamber 32 through the ports 34 into the annular chamber 36, and out through passageway 4 to the patient.

It is thus seen that a simple breathing control valve is provided which has varied applications, which acts essentially as a two-way check valve, and which lends itself readily to use in artificial respiration or other breathing devices. Although the valve has been specifically illustrated in several embodiments, it is to be readily understood that various modifications and rearrangements of structure may be made while still coming within the scope of the invention as defined in the appended claims.

What I claim is:

1. A control valve comprising: a housing having an inner chamber; a first, second and third passageway within said valve leading from said chamber; said first passageway being adapted to be connected to a source of positive pressure fluid; said second passageway being adapted to be alternately sealed and opened; said third passageway being alternately in communication with said first and second passageways; a flexible valve member of substantially planar configuration rigidly affixed at its outermost periphery within said housing and extending completely across said chamber; said valve member having an imperforate central area and a plurality of perforations outside of said central area; said first and second passageways being arranged on opposing sides of said valve member and terminating in a first and a second valve seat, respectively; said valve seats being arranged opposite to the imperforate central area of said valve member; said valve member and passageways being so constructed and arranged that said valve member is movable into a first position wherein it is seated on said first valve seat thus preventing communication between said first and third passageways, while simultaneously permitting communication between said second and third passageways; and said valve member is further movable into a second position sealing said second passageway while simultaneously permitting communication between said first and third passageways.

2. The valve of claim 1 wherein said first and second passageways lie on a substantially common axis in alignment with one another centrally of said housing, and said third passageway being located towards the periphery of said housing and on the same side of the valve member as said second passageway.

3. A breathing control valve for use with a face mask comprising: a housing having an inner chamber; a first, second, third and fourth passageway leading to and from said housing; said first passageway interconnecting the chamber to the exterior of said housing and having a first valve member associated therewith to alternately permit inflow of fluid from a source external to said valve into said passageway, and to seal said passageway against egress of fluid from said chamber; said second passageway interconnecting said first passageway to a source of intermittent negative and positive pressure; said third passageway being adapted to be alternatively sealed and opened to ambient; said fourth passageway being alternately in communication with said first and third passageways; and a second valve member of substantially planar flexible construction rigidly affixed at its outermost periphery within said housing and extending completely across said chamber; said valve member having an imperforate central area and a plurality of perforations outside of said central area; said second valve member being alternatively movable into a first and a second position; said second valve member being so arranged with respect to said passageways that while it is in said first position the central imperforate area seals said first and fourth passageways from intercommunication while simultaneously permitting communication between said third and fourth passageways; said second valve member while in said second position sealing said third passageway while simultaneously permitting communication through said perforations between said first and fourth passageways.

4. The valve of claim 3 wherein said first and third passageways lie on a substantially common axis in alignment with one another centrally of said housing, said latter passageways terminating in first and second valve seats, respectively, juxtaposed one on each side of said second valve member; said second valve member while in said first position seating on said first valve seat, and while in said second position seating on said second valve seat.

5. The valve of claim 4 wherein said fourth passageway is located towards the periphery of said housing and on the same side of the valve member as said second passageway.

6. A portable respiration device comprising, in combination: a breathing tube connected at one end to a breathing control valve; said control valve comprising a housing having an upper and lower inner chamber; a first, second and third passageway within said valve leading from said chamber; said first passageway interconnecting the upper chamber to the exterior of said housing and having a first valve member associated therewith to alternatively permit inflow of fluid from a source external to said valve into said passageway, and to seal said passageway against egress of fluid from said upper chamber; said breathing tube being connected to said first passageway; said second passageway being adapted to be alternatively sealed and opened to ambient; said third passageway being alternatively in communication with said first and third passageways; a second valve member of substantially planar flexible construction rigidly affixed at its outermost periphery within said housing and forming a common wall separating said upper and lower inner chambers; said second valve member having an imperforate central area and a plurality of perforations outside of said central area; said first and second passageways being arranged on opposing sides of said second valve member and terminating in a first and a second valve seat, respectively; said valve seats being arranged opposite to the imperforate central area of said valve member; said second valve member and passageways being so constructed and arranged that said second valve member is movable into a first position wherein it is seated on said first valve seat thus preventing communication between said first and third passageways, while simultaneously permitting communication between said second and third passageways; and said second valve member is further movable into a second position sealing said second passageway while simultaneously permitting communication between said first and third passageways.

7. The portable respiration device of claim 6 wherein said first and second passageways lie on a substantially common axis in alignment with one another centrally of said housing, and said third passageway being located towards the periphery of said housing and on the same side of the valve member as said second passageway.

8. A resuscitator device comprising an inlet chamber to which pressure is adapted to be supplied intermittently, a delivery chamber adapted to be placed in communication with a user's air way, a pressure relief chamber adapted to communicate with a pressure relieving atmosphere, a single flexible diaphragm forming a wall of each of, and separating, said inlet and pressure relief chambers, means at an end of said inlet chamber forming an inhalation valve seat at one side of said diaphragm and cooperating with said one side of said diaphragm to provide an inhalation valve providing communication between said inlet chamber and said delivery chamber when it is open, and closing said communication when it is closed, means at an end of said pressure relief chamber forming an exhalation valve seat at the other side of said diaphragm and cooperating with said other side of said diaphragm to provide an exhalation valve providing communicaton between said delivery chamber and said pressure relief chamber when it is open, and closing said communiction when it is closed, said inhalation valve seat being spaced a greater radial distance from the center axis of the diaphragm than said exhalation valve seat, the axial distance between the valve seats being substantially the same as the thickness of said single diaphragm, said diaphragm being urged into sealing relationship with said exhalation valve seat in response to the application of said pressure to said inlet chamber, the resistance of said exhalation valve seat against movement of the portion of said diaphragm urged into sealing relationship with said exhalation valve seat causing the portion of said diaphragm opposite the inhalation valve seat to buckle away from said inhalation valve seat in response to said pressure to close communication between said delivery chamber and said pressure relief chamber and provide free communication between said inlet chamber and said delivery chamber so that said pressure is delivered to said delivery chamber and to said air way and expands the user's lungs when said delivery chamber is in communication with said air way, said diaphragm being urged into sealing relationship with said inhalation valve seat by the residual pressure in said delivery chamber and the user's air way in response to discontinuation of the application of said intermittent pressure to said inlet chamber while said delivery chamber is still in communication with said air way, the resistance of said inhalation valve seat against movement of the portion of said diaphragm urged into sealing relationship with said inhalation valve seat causing the portion of said diaphragm opposite the exhalation valve seat to buckle away from said exhalation valve seat in repsonse to said residual pressure to close communication between said delivery chamber and said inlet chamber and provide communication between said delivery chamber and said relief chamber to thereby release said residual pressure in said delivery chamber and the user's lungs, said device comprising casing means housing said chambers and diaphragm, said casing means forming a cavity, said inhalation valve seat comprising an end of a hollow tubular-shaped projection extending inwardly toward said diaphragm from a wall of said casing means and the bore of which comprises said inlet chamber, said exhalation valve seat comprising an end of a hollow tubular-shaped projection extending inwardly toward said diaphragm from a wall of said casing means opposite said first-mentioned wall and in a direction opposite to the direction in which said first-mentioned projection extends, the bore of said exhalation valve seat projection comprising said relief chamber, said projections and said diaphragm dividing said cavity into said three chambers.

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