

- [72] Inventor **Joseph M. Magrath**
P. O. Box 148, McCook, Nebr. 69001
- [21] Appl. No. **805,983**
- [22] Filed **Feb. 24, 1969**
- [45] Patented **Dec. 21, 1971**
- [32] Priority **July 26, 1968**
- [33] **Great Britain**
- [31] **35,766/68**
- Continuation-in-part of application Ser. No. 663,035, Aug. 21, 1967, now abandoned. This application Feb. 24, 1969, Ser. No. 805,983**

[54] **ASPIRATION AND RESPIRATION APPARATUS**
13 Claims, 7 Drawing Figs.

- [52] U.S. Cl. **128/145.8,**
128/351, 128/146, 128/186
- [51] Int. Cl. **A62b 7/00**
- [50] Field of Search. 128/145,
145.5, 145.8, 351, 19.4

[56] **References Cited**

UNITED STATES PATENTS

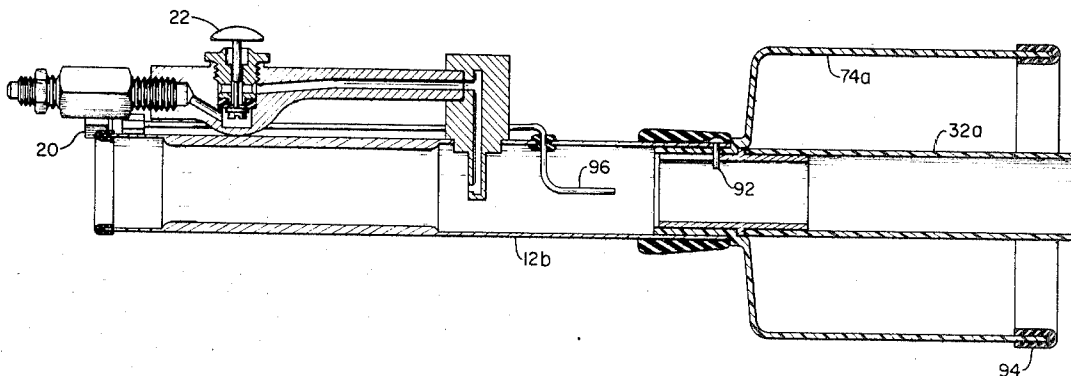
- | | | | |
|-----------|---------|-----------------------|--------------|
| 3,088,456 | 5/1963 | Stanton | 128/194 |
| 3,485,243 | 12/1969 | Bird et al. | 128/145.8 |
| 1,848,232 | 3/1932 | Swope et al. | 128/145.8 |
| 3,039,481 | 6/1962 | Schreiber et al. | 128/145.8 UX |
| 2,280,050 | 4/1942 | Alexander et al. | 128/145.5 |
| 3,205,890 | 9/1965 | Dritz | 128/351 |
| 3,297,027 | 1/1967 | Rusch | 128/351 X |
| 3,396,725 | 8/1968 | Schreiber | 128/145.8 |

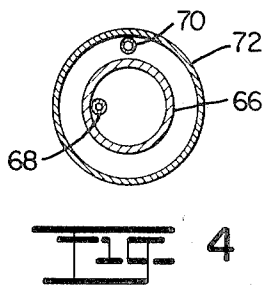
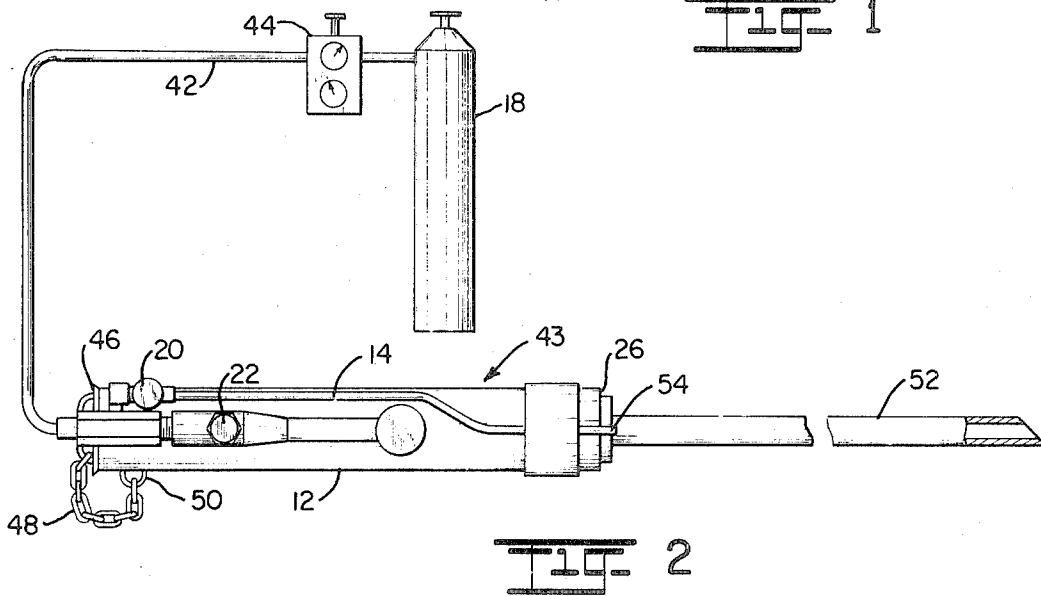
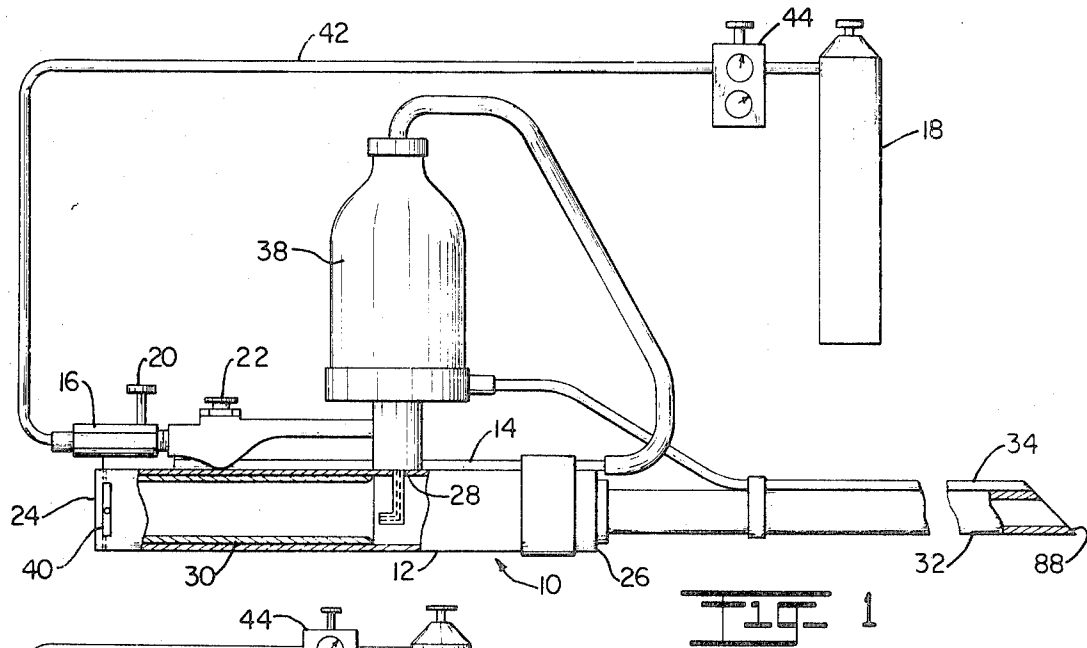
Primary Examiner—Richard C. Pinkham

Assistant Examiner—Theatrice Brown

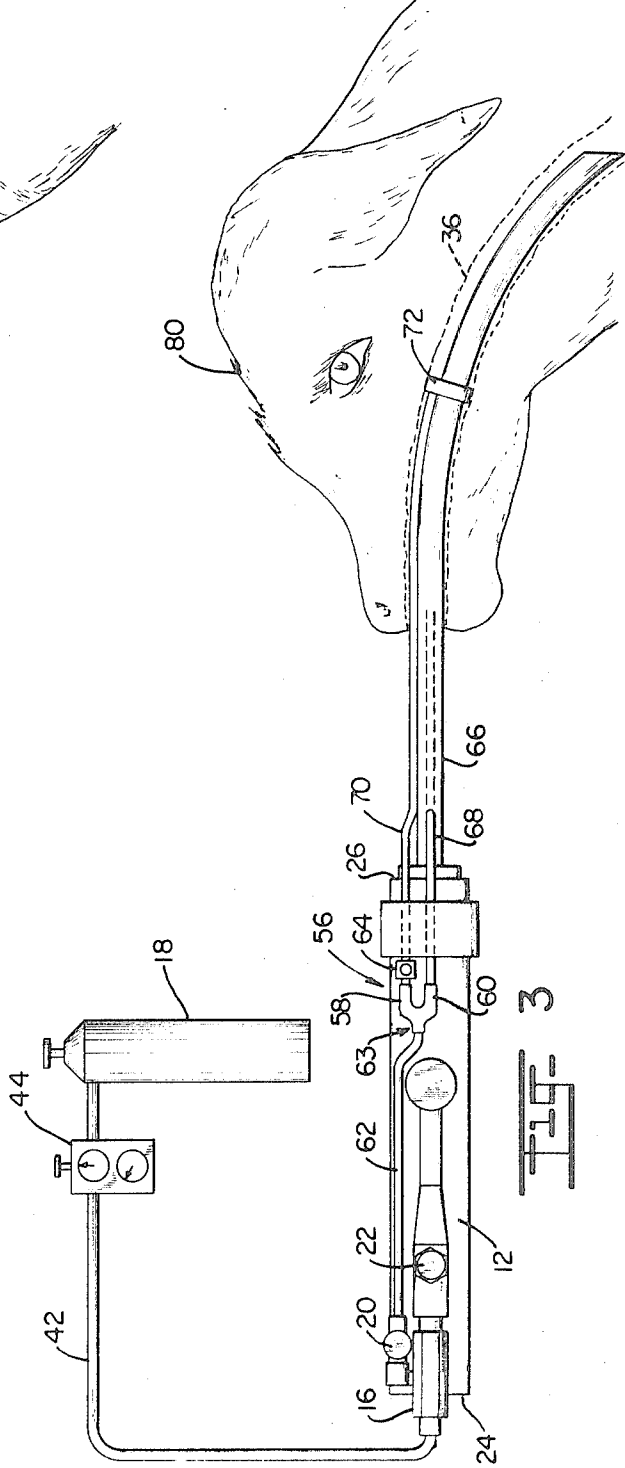
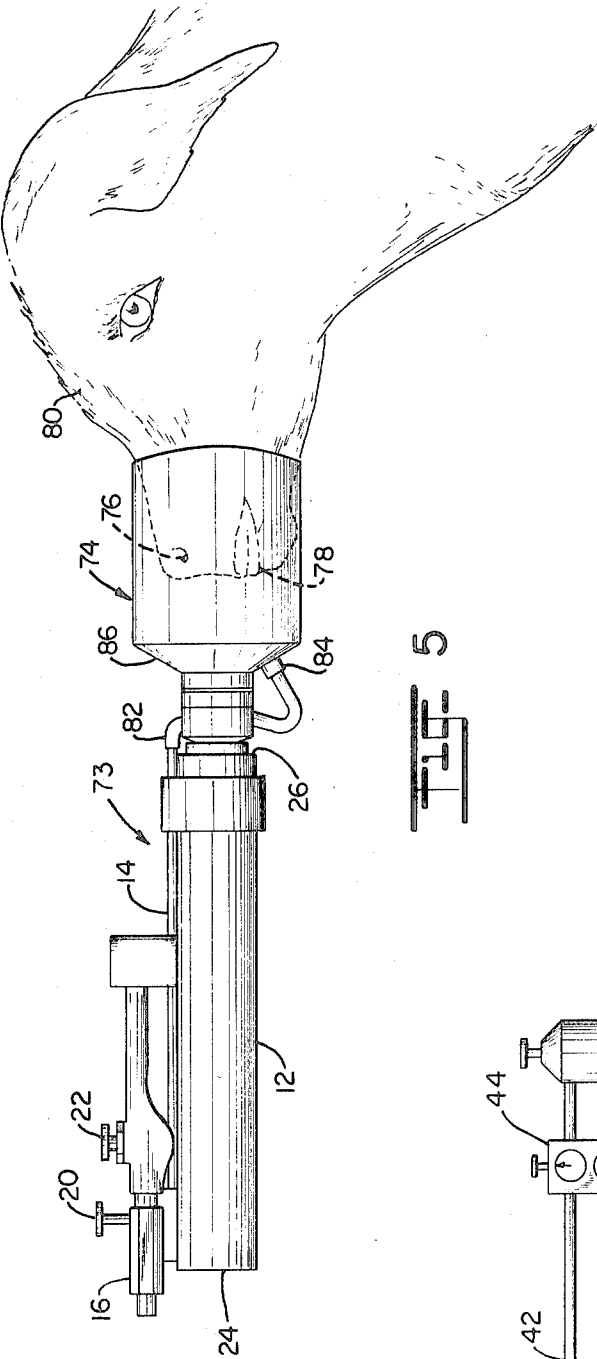
Attorney—Duane C. Burton

ABSTRACT: An aspiration and respiration apparatus including a unit comprising first and second conduit means, means for connecting each of said conduit means to a single source of pressurized gas, and means for controlling the flow of pressurized gas through each of said conduit means. The first conduit means includes a pair of openings, an inlet disposed intermediate said openings, and means for forming during flow of gas therethrough a zone of reduced pressure, said latter means being disposed intermediate said inlet and a first one of said openings. Each of the first and second conduit means is constructed for connection to a corresponding one of a pair of tubes each of which is adapted to have one end thereof disposed in a trachea of an air-breathing vertebrate whereby pressurized gas and a suitable medication may be introduced into the trachea through said second conduit means and one of the tubes, and whereby matter may be removed from the trachea by the other one of the tubes as a result of the flow of pressurized gas through said inlet into said first conduit means, through said means for forming a zone of reduced pressure and out of said first one of said openings. The apparatus as described may also include means for closing the first one of said openings and said first conduit means for causing the inflation of the respiration system of a vertebrate for overcoming hypoxia. Additionally, the first one of said openings is constructed to be closeable by the hand of an operator for causing the inflation of the respiration system. The apparatus of this invention may also include a face mask means for enclosing the nasal and oral openings of an air-breathing vertebrate. The apparatus of this invention may also include a means connected to the second conduit means for injecting liquid into at least a portion of said second conduit means and thus function as an irrigator. The apparatus of this invention may also be used in a combination with a catheter to assist in removal of various fluids from the organs of animals.

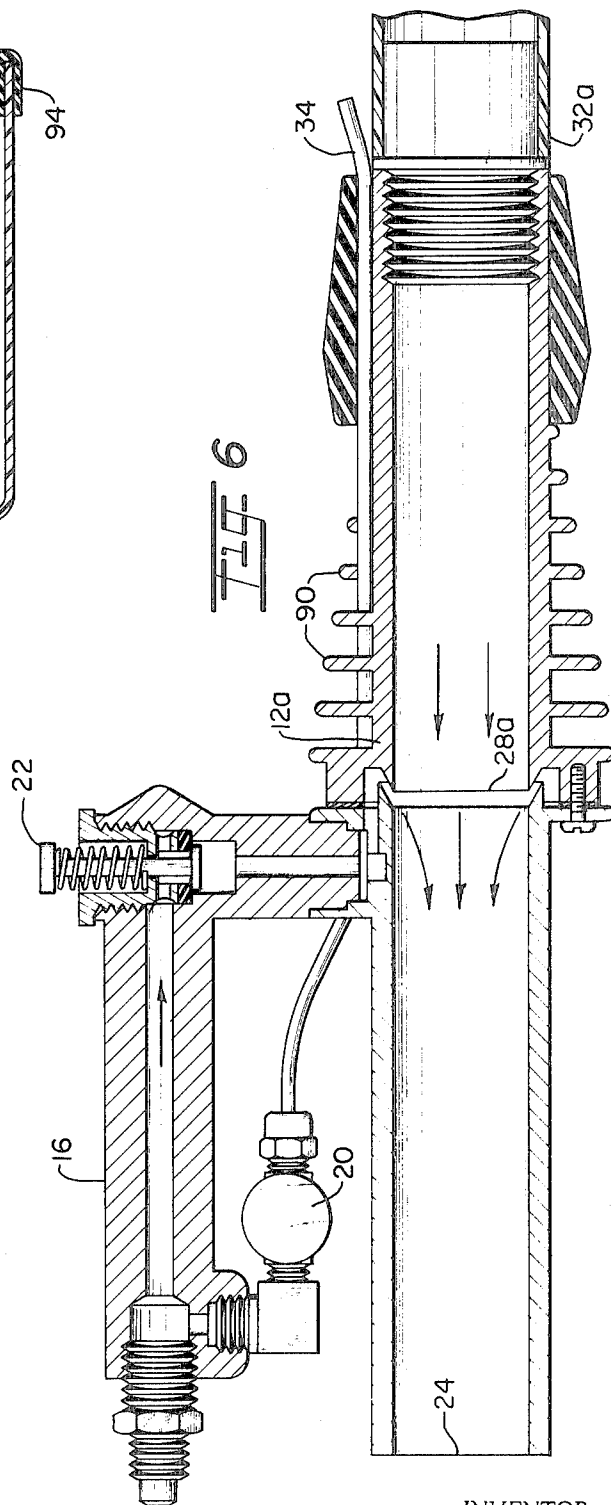
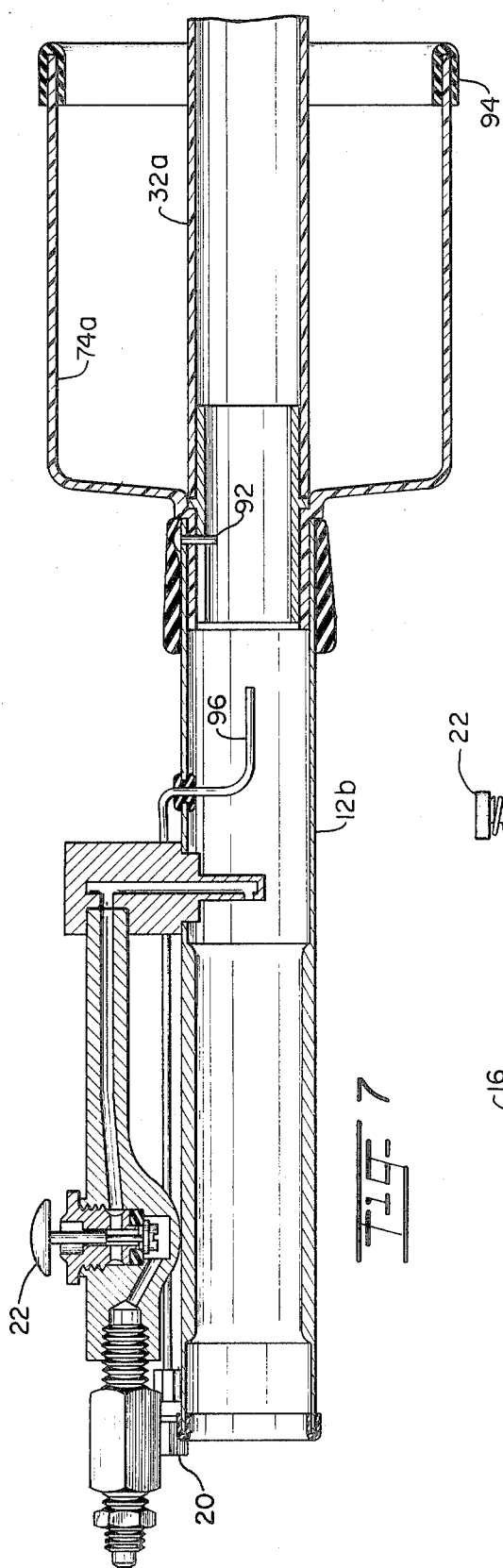




INVENTOR
JOSEPH M. MAGRATH
BY *Sheridan and Ross*
ATTORNEYS



INVENTOR
JOSEPH M. MAGRATH
BY *Sheridan and Ross*
ATTORNEYS



INVENTOR.
JOSEPH M. MAGRATH
BY *Sheldon and Ross*

ATTORNEYS

ASPIRATION AND RESPIRATION APPARATUS

This is a continuation-in-part of application Ser. No. 663,035, filed Aug. 21, 1967 (and since abandoned).

BACKGROUND OF THE INVENTION

Heretofore, only a few items of unsophisticated equipment have been proposed or made available to veterinarians for supplying emergency oxygen to an animal, for aspiration purposes including the removing of mucous from the trachea of an animal, for removing fluid from the organs of an animal, for introducing medicine into the trachea of an animal, for assisting an animal to breathe, to produce a cough response in an animal, and for combating hypoxia and asphyxiation. Each item of equipment heretofore proposed or otherwise available has suffered from a number of disadvantages. For example, each item of equipment was either complex in operation, cumbersome to handle, expensive, or limited in application. Additionally, none of the aforementioned equipment could operate from a single source of pressurized fluid to provide simultaneously fluid or air to the animal and effecting aspiration as well. Further, none of the aforementioned equipment could be used to produce a cough response which facilitates an animal in ridding itself of mucous or the like and overcoming breathing difficulties. Additionally, none of the aforementioned equipment could be used to introduce medicine into the trachea or windpipe of an animal to obtain certain desired results.

SUMMARY OF INVENTION

It has been discovered that the foregoing disadvantages may be quickly and easily overcome through the use of an apparatus including a unit comprising first and second conduit means, means for interconnecting each of said conduit means to a single source of pressurized gas, and means for controlling the flow of pressurized gas to each of said conduit means, said first conduit means including a pair of openings, an inlet disposed intermediate said openings, and means for forming during flow of gas therethrough a zone of reduced pressure, said means being disposed intermediate said inlet and a first one of said openings, each of said first and second conduit means being constructed for connection to a corresponding one of a pair of tubes each of which is adapted to have one end disposed within a trachea of an air-breathing vertebrate whereby pressurized gas may be introduced into the trachea through said second conduit means and one of the tubes, and whereby matter may be removed from the trachea through the other one of the tubes as a result of flow of pressurized gas through said inlet into said first conduit means, through said means for forming a zone of reduced pressure and out of said first one of said openings. The apparatus of this invention may be used in combination with a face mask means for enclosing the nasal and oral openings of an air-breathing vertebrate. Further, the apparatus of this invention may be used in combination with a catheter to remove fluids from the organs of animals. Additionally, the apparatus of this invention may be used in combination with a pair of tubes as aforesaid which has an inflatable means mounted thereabout, said apparatus including a third conduit means for supplying a pressurized fluid through said inflatable means.

Accordingly, one of the primary objects of this invention is to provide a novel aspiration and respiration apparatus for use with air-breathing vertebrates.

Another object of this invention is to provide a novel apparatus including a face mask to cover the nose and mouth portions of an animal's head to accomplish both nasal and oral respiration.

Another object of this invention is to provide an apparatus in accordance with the previous object which includes a removable conduit which may be introduced into a trachea of an air-breathing vertebrate, whereby the conduit or face mask may be optionally used.

Another object of this invention is to provide an apparatus which can be used for aspiration and respiration purposes as well as irrigation purposes.

Another object of this invention is to provide an apparatus which can be used for aspiration and respiration purposes as well as in combination with a catheter.

Another object of this invention is to provide a novel aspiration and respiration apparatus which functions from a single source of pressurized fluid.

Another object of this invention is to provide an aspiration and respiration apparatus comprising first and second conduit means, each of said conduit means being adapted to have an end introduced into a trachea of an air-breathing vertebrate, means for forming a partial vacuum in said first conduit means, and means for introducing a pressurized fluid into said second conduit means for emission into the trachea of the vertebrate for assisting in the aspiration and respiration of the vertebrate.

Another object of this invention is to provide an aspiration and respiration apparatus as aforescribed which also includes oxygen storage means for supplying oxygen to said second conduit means, a manifold means, means for conveying oxygen from said oxygen storage means to said manifold means, and pressure and flow regulator means in said oxygen-conveying means, and said second conduit having an outer end connected to said manifold means.

Another object of this invention is to provide an aspiration and respiration apparatus as aforescribed including means connected to said second conduit means for injecting liquid into at least a portion of said second conduit means.

Another object of this invention is to provide an aspiration and respiration apparatus as aforescribed including inflatable means mounted about at least a portion of said first and second conduit means, and a third conduit means for supplying a pressurized fluid to said inflatable means.

Another object of this invention is to provide an aspiration and respiration apparatus comprising a face mask means for enclosing the nasal and oral openings of an air-breathing vertebrate, said face mask means having an outer end normally open to atmospheric air, first and second means for introducing oxygen into said face mask means for assisting in the respiration of the air-breathing vertebrate, and the oxygen being moisturized for respiration from condensate formed on the inner surface of said mask means from air expired by the vertebrate, and said first means including an opening closable by hand of an operator for causing the inflation of the respiration system of the vertebrate for overcoming hypoxia.

Another object of this invention is to provide an aspiration and respiration apparatus as aforesaid described including a heat exchanger for preventing undesired cooling of same resulting from oxygen expansion in a venturi-type suction pump.

BRIEF DESCRIPTION OF THE DRAWINGS

The foregoing objects and other advantages of the invention will become apparent from the following description and claims and the accompanying drawings wherein:

FIG. 1 is an elevational view, in partial cross section, of a unit included within an aspiration and respiration apparatus constructed according to the subject invention;

FIG. 2 is another embodiment of a unit, in plan view, useful in an aspiration and respiration apparatus constructed in accordance with invention shown in combination with a catheter;

FIG. 3 shows another embodiment of a unit useful in an aspiration and respiration apparatus constructed in accordance with this invention and showing also the use of an inflatable means;

FIG. 4 is a cross-sectional view of the inflatable means shown in FIG. 3;

FIG. 5 shows an embodiment of a unit useful in an aspiration and respiration apparatus constructed according to the subject invention in combination with a face mask means;

FIG. 6 is a central longitudinal section of an embodiment of the invention employing a heat exchanger to prevent undesired cooling; and

FIG. 7 is a central longitudinal section of an embodiment of the invention employing both a face mask and a removable trachea tube.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

It is to be understood that this invention is not limited to the details of construction and arrangement of parts shown in the drawings and hereafter described in detail, but is capable of being otherwise embodied and being practiced and carried out in various ways. It is to be further understood that the terminology employed herein is for the purpose of description and there is no intention to limit herein the invention beyond the requirements of the prior art.

It is to be understood that the apparatus of this invention can be applied or adapted for application to all air-breathing animals or vertebrates, and that this invention is not considered as restricted to farm animals and pets generally handled by veterinarians.

Referring now to FIG. 1, a unit 10 useful in an aspiration and respiration apparatus constructed in accordance with the subject invention is shown comprising first and second conduit means, 12 and 14, means 16 for interconnecting each of said conduit means 12 and 14 to a single source of pressurized gas, represented by the oxygen storage tank 18, and means 20 and 22 for controlling the flow of pressurized gas through each of said conduit means 12 and 14. The first conduit means 12 includes a pair of openings 24 and 26, an inlet 28 disposed intermediate said openings 24 and 26, and means 30 for forming during flow of gas through said first conduit means 12 a zone of reduced pressure, said latter means 30 being disposed intermediate said inlet 28 and a first one 24 of said openings. Each of the first and second conduit means 12 and 14 is constructed for connection to a corresponding one of a pair of tubes 32 and 34. Each of the tubes 32 and 34 is adapted to have one end thereof disposed within a trachea 36 (see FIG. 3) of an air-breathing vertebrate such as a cow whereby pressurized gas may be introduced into the trachea 36 through said second conduit means 14 and tube 34, and whereby matter such as mucus may be removed from the trachea 36 through tube 32 as a result of the flow of pressurized gas through said inlet 28 into said first conduit means 12, through said means 30 for forming a zone of reduced pressure and out of said first one 24 of said openings. The unit 10 shown in FIG. 1 also includes a means 38 connected to one end of conduit means 14 and one end of tube 34. Means 38 which may comprise a jar or other suitable container is used for injecting liquid into the trachea 36 of an air-breathing vertebrate. The unit 10 as shown in FIG. 1 also includes a butterfly valve 40 installed adjacent the opening 24. The butterfly valve 40 may be used to close the opening 24 and thereby prevent pressurized gas from flowing out of the first conduit means 12 through opening 24.

The means 16 of unit 10, which may be manifold, is connected to a single source of pressurized gas such as the oxygen storage tank 18, by pipe 42. A pressure and flow regulator means 44 is connected within the pipe 42 between the oxygen and storage tank 18 and the manifold means 16.

In FIG. 2 is shown a unit 43 useful in an aspiration and respiration apparatus constructed according to this invention. Unit 43 differs from unit 10 in that a plug means 46, which is used for the same purpose as a butterfly valve 40, has been used in lieu of the butterfly valve 40 and the conduit means 14 is not connected to any other part such as is the case with the unit 10 shown in FIG. 1. The plug means 46 is secured by a suitable means such as a chain 48 to an eyelet 50 formed on the first conduit means 12. The purpose for the plug means 46 and the butterfly valve 40 will be hereinafter explained in greater detail. The unit 43 shown in FIG. 2 is used in combination with a catheter 52. The catheter 52 is threadedly mounted within the opening 26 of the unit 43. As previously indicated, the end 54 of the second conduit means 14 is not connected or attached to any other part. In addition, it will be appreciated that the plug 46 shown in FIG. 2 will normally be removed

from the opening 24 during use of the unit 43 in combination with the catheter 52. Further, it will also be understood that the unit 43 and the catheter 52 may be beneficially used without the necessity of requiring flow of pressurized gas from the storage tank 18.

In FIG. 3 is shown another unit 56 which is in an aspiration and respiration apparatus constructed according to the subject invention. Unit 56 is quite similar in construction and operation to the units 10 and 43, shown respectively in FIGS. 1 and 2. However, unit 56 includes a third conduit means unit 58 in addition to the first and second conduit means 12 and 60. It will be noted that a common tube or pipe 62 interconnects the control means 20 and the Y-connection 63. Additionally, the third conduit means 58 includes a means 64 for controlling flow of pressurized gas through said third conduit means 58. The unit 56 is used in combination with a plurality of tubes 66, 68 and 70 and an inflatable means 72. Tube 66 is similar to tube 32 shown in FIG. 1. Tube 68, which is much smaller in diameter than tube 66, serves the same general purposes as tube 34 shown in FIG. 1; however, tube 68 has a substantial portion thereof disposed within tube 66 as is more clearly shown in FIG. 4. Tube 70 interconnects the third conduit means 48 and the interior of the inflatable means 72. Thus, when pressurized gas is admitted into the interior of the inflatable means or cuff 72, said means 72 expands and contacts the adjacent surrounding surface of the trachea 36.

In FIG. 5 is shown another unit 73 useful in an aspiration and respiration apparatus constructed in accordance with the subject invention. It will be noted that unit 73 is constructed without benefit of either a plug means or butterfly valve. The unit 73 shown in FIG. 5 is used in combination with a generally bottle-shaped face mask 74 adapted to enclose the nasal and oral openings 76 and 78, respectively, of the animal 80 shown in FIG. 5. Pressurized gas or oxygen is supplied from the oxygen storage tank (not shown) into the face mask 74 by a tube 82 which has one end thereof connected to the second conduit means 14 of unit 73. The other end of tube 82 is connected to a conventional hose connection 84 which is integrally attached to the frustoconically shaped shoulder 86 of the face mask means 74.

Referring now to FIG. 5, operation of the aspiration and respiration apparatus constructed in accordance with this subject invention is now described. First, the unit 73 is connected with the oxygen storage tank in the manner shown in FIGS. 1 and 2. The face mask 74 is suitably connected to the opening 26 of the unit 10 such as by a threadable connection. The tube 82 is attached to the second conduit means 14. The control means 22 is opened a predetermined amount to permit the flow of pressurized oxygen to flow through the second conduit means 14, the tube 18 and into the interior of the face mask means 74. The face mask means 74 is positioned to cover the oral and nasal openings 76 and 78 of the animal 80. The control means 20 is opened to permit the flow of pressurized oxygen through the first conduit means 12 and out of the openings 24. Upon alternately opening and closing the opening 24, such as with the hand of the operator, large quantities of pressurized oxygen are supplied to the animal 80. When the opening 24 is opened as by removal of the operator's hand or opening of a butterfly valve (not shown) while valve 22 is closed, the animal 80 is permitted to exhale. By opening valve 22 simultaneously with the opening of opening 24, the animal 80 is forced to exhale thereby resulting in the removal of all traces of CO₂ emitted by the animal and insuring a high concentration of oxygen in the air passages. If desired a valve may be mounted in opening 24 wherein said valve is spring biased to close the opening 24 but openable under the influence of pressurized gas or oxygen. By appropriately timing the opening and closing of the opening 24, the animal can be given artificial respiration and forced to breathe in a desired manner.

Referring now to the apparatus shown in FIG. 1, the combined tubes 32 and 34, tube 34 being connected to tube 32 by suitable means, is inserted into the trachea of an animal. The control means 20 is opened to admit pressurized oxygen to

flow through the second conduit means 14, through the container 38 through the tube 34 and into the trachea of the animal. In this manner, oxygen is continuously supplied into the trachea of the animal. The butterfly valve 40 is rotated to permit passage of pressurized gas out of the opening 24. The control means 22 is actuated to permit flow of pressurized gas through the inlet, through the means 30, said means 30 serving to cause the first conduit means 12 to function as a venturi, outwardly of the opening 24. The flow of pressurized gas from the first conduit means in this manner produces a partial vacuum in the region of means 30 or a zone of reduced pressure, as compared with the area disposed intermediate the inlet 28 and the opening 26 of the first conduit 12. Since tube 32 is connected with the first conduit 12, the flow of pressurized gas through first conduit 12 as aforesaid, produces an aspirating effect at the end 88 of tube 32. As a result of this aspirating effect, mucous or other matter is removed from the trachea adjacent the end 88 of tube 32. At the same time, oxygen is being supplied into the trachea by tube 34 thereby facilitating the breathing of the animal and assisting in dehydrating the tissues which is sometimes quite beneficial. In some instances it has been found that the mucous cannot be removed as a result of the aspirating effect without first being broken up. The breaking up of mucous is accomplished by injecting a liquid demulsifier into the trachea. The injecting of such a liquid is accomplished by filling the container 38 with a predetermined quantity of such liquid and then opening control means 20. Alternatively, the foregoing may be accomplished in the absence of the container 38 by using a syringe (not shown) to inject the liquid or medication directly into the tube 34. Since the aspirating effect can be maintained during the injection of liquid into the trachea, the chance of the animal becoming choked upon the emission of this liquid into the trachea is substantially eliminated since any excess liquid is immediately removed as a result of the aspirating effect being maintained.

Referring to FIG. 3, the aspiration and respiration apparatus in FIG. 3 functions in substantially the same manner as the aspiration and respiration apparatus shown and described above in connection with FIG. 1, except that the apparatus shown in FIG. 3 includes the inflatable means or cuff 72 which can be expanded to close the trachea 72 and thereby permit more accurate control of the pressure within the trachea 36 and inwardly of the inflatable means 72. It will be understood that the control means 64 may be eliminated if the pressure being applied from the interior of the inflatable means 72 is below a predetermined amount. This may be accomplished in a number of ways such as through the pressure regulator 44 or by increasing the pressure drop through the tube 70.

Referring to FIG. 6, this embodiment is similar to that of FIG. 1 in that a manifold 16 and a needle valve 20 are employed to control flow of oxygen through conduit 34. It will be understood that conduit 34 may be positioned to supply oxygen directly into the tube itself much in the same manner as is shown in FIG. 7. One of the principal differences resides in the use of an annular nozzle 28a which delivers a convergent stream of oxygen into conduit 12a, providing a venturi-type suction pump for conduit 32a. Another difference resides in the use of a heat exchanger formed of annular-spaced fins 90 on conduit 12a which transfer atmospheric heat to same to compensate for the cooling effect of the expansion of oxygen through annular nozzle 28a.

Referring to FIG. 7, this embodiment is similar to the other embodiments differing principally in that both a face mask 74a and a trachea tube 32a are employed, the tube being removably secured to the mask by a bayonet connection 92. As shown, with the trachea tube attached, the latter is employed whereas when removed the face mask is employed. As will be apparent, this provides a single device which includes the features of the face mask version and the trachea tube version, previously described. Mask 74a is preferably constructed of flexible material, such as a transparent plastic, the rim of which is provided with a rubberlike lip 94 to effect sealing

thereat. Oxygen supply tube 96 terminates within tube 12b so that it may supply oxygen through tube 32a, when attached, or to mask 74a when tube 32a is removed.

An aspiration and respiration apparatus constructed according to the subject invention has been found to be useful in a large number of applications. As a matter of fact, the apparatus has been found to be particularly useful for newborn animals and particularly to treat dyspnea and asypnea. There are a number of situations occurring during the birth of a newborn animal which require immediate application of emergency oxygen or the newborn animal will die. For example, in situations of a breech birth, the first born of an animal, or where the delivery of the animal takes too long, many of these newborn animals will die; however, by immediately aspirating the trachea of the newborn animal, followed by supplying nearly 100 percent oxygen to the animal, nearly all such animals now survive this birth hazard as well as aspiration pneumonia in the days following birth. In another situation, this so-called "blue" (cyanotic) newborn animal can also be saved by the use of the apparatus of this invention. The "blue" or cyanotic newborn animal includes those animals in which the mother has quit breathing for the newborn or near newborn animal and the animal itself cannot do the job, such as occurs when the umbilicus has parted.

The apparatus of this invention is also useful in connection with older animals. For example, the unit shown in FIG. 2 may be used in combination with the catheter 52 as heretofore described. Additionally, the apparatus of this invention may be used to treat injured animals or animals in a state of shock. Also, the apparatus of this invention can be used to treat infection of the uterus following parturition.

From the foregoing, it will be readily appreciated that an apparatus simple in construction and operation, inexpensive to manufacture, and flexible in application has been described. Through the use of an apparatus constructed in accordance with the subject invention, it has been found possible to save the lives of a large number of newborn animals such as calves, which have heretofore been lost. Additionally, it has greatly facilitated the treatment of older animals as aforesaid. When it is considered that millions of calves which have heretofore died during birth can be saved, the significance of the herein invention will be all the more readily understood and appreciated.

It is understood that this invention is not limited to the exact embodiments of the apparatus as shown herein, which are merely by way of illustration and not limitation, as various other forms and modifications will be apparent to those skilled in the art, and it is therefore intended that the appended claims cover all such changes and modifications.

I claim:

1. Apparatus for use in the respiration of an air-breathing vertebrate and operable by source of pressurized gas containing oxygen, comprising:

- a. a tube having a suction end adapted to communicate with the lungs of the vertebrate and an exhaust end adapted to communicate with the atmosphere,
- b. a jet-type pump disposed between said ends adapted to discharge the gas in a direction toward said exhaust end, to thereby produce suction at said suction end,
- c. a first manually operated valve adapted to be adjusted to provide a continuous flow of the gas into the suction end of the tube at a rate compatible with the inhalation requirements of the vertebrate,
- d. a second manually operated valve for delivering the gas on desired occasion, to said jet pump and adapted to be manually, rapidly operated between open and closed positions,
- e. said exhaust end forming a third valve adapted to be manually opened or closed on desired occasion,
- f. the construction being such that:

1. when said second and third valves are manually closed, gas if delivered to the lungs of the vertebrate through said first valve, effecting forced inhalation, and

2. when said second and third valves are manually opened, gas is removed from the lungs of the vertebrate, effecting forced exhalation.
2. Apparatus in accordance with claim 1 wherein said exhaust end is so shaped to be closed by the palm of the hand of an operator.
3. Apparatus in accordance with claim 1 wherein said tube is of a size and shape adapted to be grasped within the palm of the hand of an operator.
4. Apparatus in accordance with claim 3 wherein said exhaust end is so shaped to be closed by the other palm of the hand of an operator.
5. Apparatus in accordance with claim 1 wherein said suction end is connected to a face mask for enclosing the nasal and oral openings of the vertebrate.
6. Apparatus in accordance with claim 5 including a removable conduit disposed partially within the face mask adapted to be inserted into the trachea of the vertebrate, the construction being such that either the face mask or conduit may be optionally used during respiration.
7. Apparatus in accordance with claim 1 including a heat exchanger on said tube for adding heat thereto from the atmosphere to compensate for reduction of temperature resulting from expansion of gas in said pump.
8. Apparatus in accordance with claim 1 including a trachea tube connected to said suction end, the trachea tube adapted to be inserted into the trachea of the vertebrate, and a conduit extending along the trachea tube through which the gas may be delivered to the vertebrate.
9. Apparatus in accordance with claim 8 including an inflatable device surrounding the trachea tube for sealing same within the trachea, and conduit and valve means communicating the inflatable device with the source of gas.
10. Apparatus in accordance with claim 1 wherein said pump includes an annular nozzle in said tube for delivering the gas into same in an annular convergent stream.
11. Apparatus in accordance with claim 1 wherein said second valve includes an actuator for moving same to fully open position by depressing it with a finger of the operator.
12. Apparatus for use in the respiration of an air-breathing vertebrate and operable by a source of pressurized gas containing oxygen, comprising:
 - a. a chamber having a suction opening adapted to communicate with the lungs of the vertebrate and an exhaust opening adapted to communicate with the atmosphere,
 - b. a jet-type pump in said chamber adapted to discharge the

- gas toward the exhaust opening, thereby to produce suction at the suction opening,
- c. a first manually operated valve adapted to be adjusted to provide a continuous flow of the gas to the lungs of the vertebrate and at a rate compatible with the inhalation of requirements of same,
 - d. a second manually operated valve for delivering the gas, on desired occasion, to said jet pump and adapted to be manually operated between open and closed position,
 - e. said exhaust opening forming a third valve adapted to be manually opened or closed on desired occasion,
 - f. the construction being such that the following breathing functions may be selected:
 1. when the second valve is closed and the third valve is opened, inhalation and exhalation are both permissive,
 2. when the second and third valves are closed during inhalation, inhalation is forced; and when the second valve is closed and the third valve is open during exhalation, exhalation is permissive, and,
 3. when the second valve is closed and the third valve is opened during inhalation, inhalation is permissive; and when the second valve is open and the third valve is open during exhalation, exhalation is forced.
13. A method of applying respiration to an air-breathing vertebrate with a source of pressurized gas containing oxygen comprising:
- a. communicating a suction opening in a chamber with the lungs of the vertebrate and an exhaust opening therein with the atmosphere,
 - b. delivering gas continuously at a controlled rate to form a source of breathing gas for the lungs of the vertebrate,
 - c. manually controlling delivery of gas, on desired occasion, to said chamber in a manner to produce a reduced pressure therein, whereby exhaled gas from the lungs may flow from the suction opening, through the chamber, and to the atmosphere through the exhaust opening, and
 - d. manually controlling the opening and closing of the exhaust opening, on desired occasion,
 - e. the manual controlling being effective to select the following combinations of breathing functions:
 1. render inhalation and exhalation permissive,
 2. render inhalation forced and exhalation permissive,
 3. render inhalation permissive and exhalation forced, and
 4. render inhalation and exhalation forced.

* * * * *

50

55

60

65

70

75