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AUTOMATIC BAILING SELF-SEALING WATER TRAP AND EMERGENCY AIR INLET

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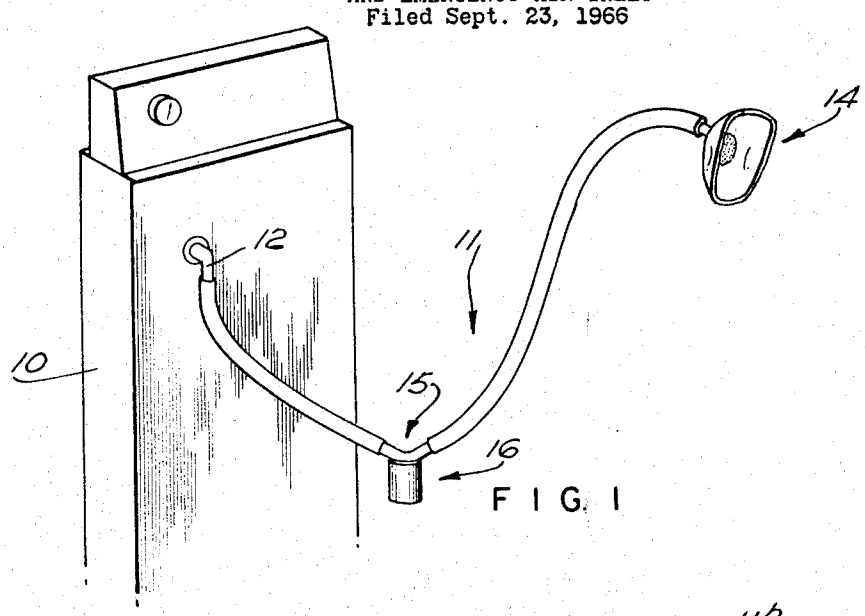

FIG. 1

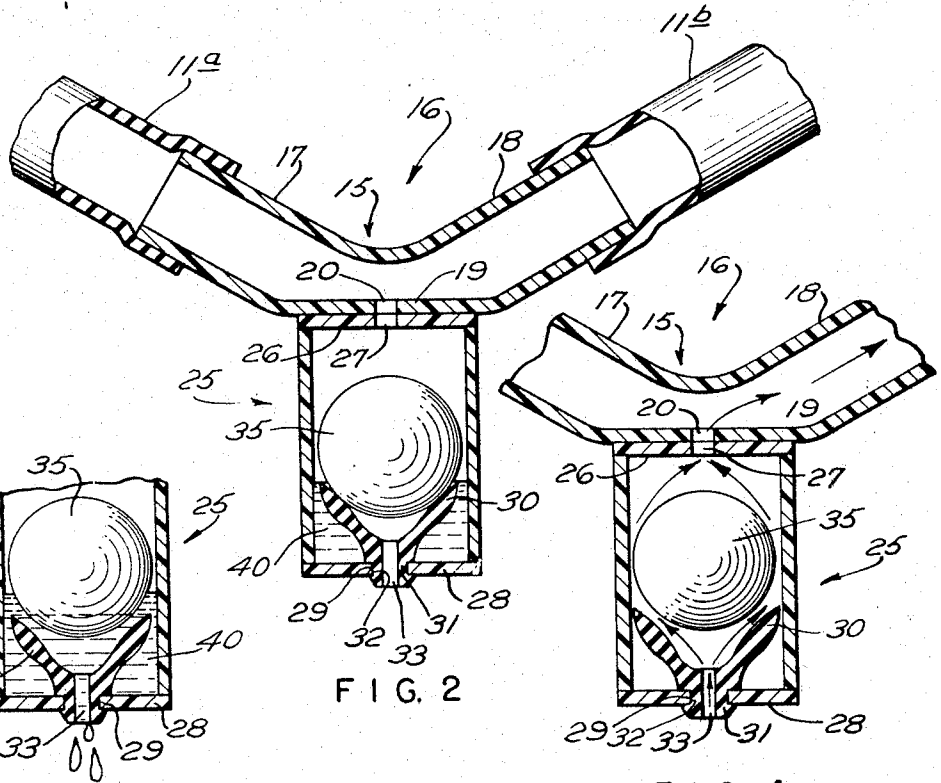

FIG. 2

FIG. 3

FIG. 4

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AUTOMATIC BAILING SELF-SEALING WATER TRAP AND EMERGENCY AIR INLET

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ABSTRACT OF THE DISCLOSURE

A conduit in the breathing tube from a humidified oxygen supply to the patient which has a trap inserted therein which will allow condensed moisture to drain thereinto and will be automatically discharged through an opening in its bottom as liquid accumulates therein to a certain level, while a ball will close off this bottom drain opening and will be forced onto the seat of the valve by gas pressure in the breathing line and will also act as a relief valve should the conduit in the portion adjacent the oxygen supply get plugged up.

This invention relates to an apparatus for supplying gases to a human.

A gas, such as oxygen or air, which is supplied to a human should not be administered without first passing it through a humidifying apparatus which puts moisture into the gas so as to minimize dehydration, irritation and other undesirable side effects. The moisture which collects because of condensation presents a problem which must be very carefully watched in the administration of gases to a patient. The moisture may be of sufficient quantity so that a patient might drown, and accordingly, great care must be taken.

Condensation is caused by an alteration of the dew-point temperature relationship which takes place as a humidified gas travels any length of tubing of varying surface temperatures. The resulting rainout will coalesce and drain by gravity and pool at the lowest point of the delivery tube. If this tube is the inspiratory tube of a ventilator, there is the threat of blowing a bolus of water into the patient's trachea. On the other hand, if the rainout collects in the expiratory tube, increased expiratory resistance will not only increase the work of expiration, but due to the Valsalva effect will create a positive intrapleural pressure which can produce a circulatory insult.

One of the objects of this invention is to remove the objectionable condensed moisture from a breathing tube so that condensed moisture in excessive amounts cannot reach the patient.

Another object of the invention is to minimize expiratory resistance due to moisture condensation.

Another object of this invention is to provide a device insertable in a breathing tube which will be automatic in its operation and thus one which will need a minimal amount of handling or manipulation.

Another object of this invention is to provide a simple and inexpensive device which will be positive and efficient in its operation.

With these and other objects in view, the invention consists of certain novel features of construction as will be more fully described and particularly pointed out in the appended claims.

In the accompanying drawings:

FIG. 1 is a perspective view illustrating a face mask, the breathing tube, and the breathing tube leading from a source of humidified gas;

FIG. 2 is a sectional view through the device which is the subject of this invention with parts of the breathing tube attached to the same;

FIG. 3 is a view similar to FIG. 2 but showing a portion thereof and with the ball valve in raised position for discharge of liquid from the container; and

FIG. 4 is a similar view showing the device acting as a relief valve.

In proceeding with this invention, we insert at a low point in the arcuate path of the breathing tube as it extends to or from the patient to a trap comprising a container which, by reason of beng located at the low point in the breathing conduit, will allow condensed moisture to drain thereinto. An opening at the bottom of the trap with a valve seat and a ball which will be forced onto the seat ordinarily by gas pressure is of such a character that it will float off of the seat should a liquid in the container rise to a certain point, thus permitting the liquid in the container to discharge from the trap container, all automatically and with less need for human or manual attention than heretofore.

With reference to the drawings which illustrate one form of this invention **10** designates generally a source of gas which has been humidified in a manner which is known to the art. **11** designates generally a conduit or breathing tube which extends from a connecting point **12** in the source of a humidified gas to a face mask **14** at the other end of the tube **11**, it being well known that this mask is placed over the face for the patient to use in breathing. This conduit **11** or breathing tube is disposed in a depending arcuate path in its passage from the source of humidified gas to the face mask **14** and at a low point in this tube which may be designated generally **15**, we place our improved apparatus designated generally **16** and which is shown in a larger scale in FIG. 2.

The apparatus **16** here illustrated comprises a U-shape conduit having branches **17** and **18** which are connected to the portions **11***a* and **11***b* of the breathing tube designated generally **11** and which has a low portion at **19** with an opening **20** while at this low portion there is connected a trap comprising a container **25** having a top wall **26** with an opening **27** registering with the opening **20** so that any condensed moisture which may collect in the breathing tube **11** will drain to this low point and thence through the openings **20** and **27** into the container **25**. The bottom wall **28** of this container is provided with an opening **29** in which there is positioned a cup-like seat of resilient material, such as rubber or synthetic rubber **30**, which has a neck portion **31** provided with a recess **32** to extend into and receive the edges of the bottom wall **28** about the opening **29**. This neck is also provided with an opening **33** leading from the interior of the container to the exterior thereof.

A ball valve **35** is located in the container **25** and is of a size to engage the cup-like seat at a point just inwardly from its upper peripheral edge, and at this seat **30** is generally an inverted cone and of a size to receive the lower portion of the ball, a good circular contact is provided in a seat which may flex slightly due to the pressure of the gas being conveyed and entering the container so as to provide a good seal against the leakage of any gas. The ball valve **35** is usually of Celluloid and hollow, it being essentially lighter than water. A ping-pong ball may serve this purpose. Thus, this ball being light, should water in the container designated **40** in FIG. 3 rise to a point to float the ball **35** off its seat such as shown in FIG. 3, will permit water to pass into the cup and out through the bottom thereof by gravity.

The container **25** is generally cylindrical and is of a size so as to guide the ball sufficiently so that when it rises from its seat, it will descend back onto the seat as the water escapes so as to again provide a seal for the container. Of course, when the ball floats from its seat, the water will prevent the escape of gas through the discharge opening **33**.

In the event that a gas being supplied to the patient is for a reason interrupted, then the patient's normal breathing will lift the ball or valve off of its seat as seen in FIG. 4, permitting air to enter at the bottom opening **33** as seen by the arrows and will act as a relief valve for the patient's normal breathing.

We claim:

1. In a respiratory therapy apparatus for a human, a conduit for connection to a human from the outside of the body along a depending arcuate path for the passage of humidified gas therethrough, a liquid trap attached to said conduit at a low point in said path having a container in communication with said conduit for the draining of liquid from said conduit thereinto, said container having an opening in its bottom portion for the discharge of liquid therefrom, and means to automatically discharge liquid from said container comprising a float valve for controlling said opening and operating upon the rise of liquid in said container to a predetermined point to discharge liquid through said opening, said valve being of such weight that human breathing suction on said conduit will cause said valve to open to permit the entrance of air should the conduit to the trap become obstructed for breathing.

2. In an apparatus as in claim **1** wherein said float valve comprises a ball.

3. In an apparatus as in claim **1** wherein said float valve comprises a cup-like valve seat and a ball engaging said seat to close said opening.

4. In an apparatus as in claim **1** wherein said float valve comprises a resilient cup-like seat adjacent its upper edge and connected through its bottom to said opening and a ball floatable on water of a size to engage said seat and close said cup, said container being of an interior size and shape to guide said ball onto said seat.

References Cited

UNITED STATES PATENTS

2,972,412 2/1961 Lundeen ---------- 137—399 X

FOREIGN PATENTS

6,328 1914 Great Britain.

WILLIAM E. KAMM, *Primary Examiner.*

U.S. Cl. X.R.

137—192, 204, 399