A device for moistening respiratory air comprises a housing having a hollow interior and having a side wall with an evaporator insert extending through the wall and into the interior of the housing which contains a conduit for the passage of water from a storage tank of the water into the interior of the housing. A heater is located within the insert for heating the water and the excess water is collected in a water collector at the bottom of the housing after the water passes through a nozzle drain and filter. The housing is provided with inlet and outlet connections for circulating the respiratory air through the housing and for passing it through the discharge water to moisten the air and to return it to the respiratory system.

5 Claims, 2 Drawing Figures
DEVICE FOR MOISTENING RESPIRATORY AIR FOR COLLECTING THE CONDENSATE

BACKGROUND OF THE INVENTION

1. Field of the Invention

This invention relates in general to the construction of respirators and in particular to a new and useful device for moistening respiratory air and for collecting the condensate.

2. Description of the Prior Art

There is known a respirator comprising a gas supply tube for the nourishing gas leading to the breathing organs and a device for moistening and heating the breathing air. In this device the supply tube including the inhaling valve and an air moistening device connected in the gas line are located within a housing which is heated to a temperature above approximately 35°C. A manometer, also located within the housing, is mounted on the gas supply line. An exhaling valve and a volume gage placed in the exhaling line are located within the housing. The air is moistened by means of an atomizer into which water is injected through a tube. The mouth of the tube faces a baffle plate. Water in excess is evacuated through an opening in the atomizer. The housing is provided with a heating element. A sterilization of this known device requires the sterilization of the whole apparatus.

There are further known atomizers for supplying liquid particles into a main gas stream furnished to the patient, in which the atomizing nozzle is enclosed in a jacket. To screen the liquid particles against the main gas stream, the lower end of the jacket is extended down below the location at which the liquid impinges on the baffle plate in order to disperse the liquid particles. The liquid particles are distributed within the jacket by the air stream of the atomizer. The larger liquid particles which are undesirable for the therapy drop down while the smaller moisture particles enter the main gas stream and are supplied to the patient. This device is expensive in construction and is intended for the supply of atomized medicaments in a long time therapy. It is disadvantageous that a heating of the breathing air is not possible. Insofar as a moistening is provided, it is not exactly controllable. The sterilization of the device is difficult.

Another known device for moistening and heating the air to be inhaled by the patient in artificial respiration comprises a receptacle for the water to be transformed into vapor at a desired temperature. The receptacle is heated from the outside. For purposes of sterilization, it can be removed from the heating device. The receptacle is equipped with a cover providing an air space above the water level. Heat is conducted to the evaporation surfaces in the air space above the water level through appropriate conduits. The water vapor present in the air space is absorbed by the breathing air flowing through the air space and supplied to the patient. Heat control devices control the temperature and the moisture content. Another heating device is provided in a tubular part of the moistening device and designed so that in this part, the temperature increase of the breathing air is equal to or greater than the temperature increase of the thus heated air during its passage from the outlet of this further heating device to the patient. The desired maximum temperature is not exceeded. This additional complicated construction is intended for preventing the formation of condensate.

SUMMARY OF THE INVENTION

In accordance with the invention, an evaporator insert is located within a housing (moistener) through which both the respiratory and the exhaling air is circulated. The evaporator insert includes a heating device and a water conduit extends through the insert. The housing has a water collector at the bottom thereof which has an overflow and the conduit discharges into the housing above an outlet orifice above the collector. The outlet orifice may be a nozzle and dirt filters may be mounted in advance thereof. The outlet orifice may be closed by means of a float valve.

The water supply conduit, extending through the evaporator insert, is connected through a controlling valve to a storage tank for distilled water. Water passes from the tank into the evaporator conduit in a continuous and controlled manner. The water vapor then formed mixes with the inhaling or exhaling air passing through the housing so that the air becomes moistened. The produced condensate can flow out through the outlet orifice. The invention has the advantage that the heating and the water volume entering the evaporator can be adjusted to the necessary evaporation in a simple manner and accurately, so that an excessive supply of water and energy is prevented. The clearance volume in the housing in which the water vapor is mixed with the breathing air may be very small. The condensate is drained in a simple manner. There are no spatial control devices for the water supply to be alternately controlled. Due to the simple adjustment of the water supply, the desired relative moisture content is obtained correctly and for long periods. The small clearance volume permits an accurate dosage of the breathing air. The carbon dioxide percentage passing into the inhaling air at the change from exhalation to inhalation is negligibly small. Also, due to its simple construction, the device may be easily sterilized. No sensitive components are used. The heating is located in a separate space and not susceptible to disturbances. The device can be mounted into a respiratory system in a simple manner.

According to a further development of the invention, the breathing air is heated by the moistener up to 30° to 37°C. The relative moisture content is approximately 100%. Such air temperatures can be easily maintained because the supply air is taken from the ambient air in the hospital whose temperature is kept sufficiently constant. Thus, the relative moisture content depends only on the water volume, the dosage of which is simple.

Accordingly it is an object of the invention to provide a device for measuring respiratory air which includes a housing through which the respiratory air is circulated...
and which has an insert extending into the interior of the housing for the passage of a water conduit for water which is sprayed into the housing into the respiratory air and which also carries heating means for heating the water passing through the conduit in a controlled amount and wherein the housing includes a water collector at the bottom for receiving the water which is circulated.

A further object of the invention is to provide a device for moistening respiratory air which is simple in design, rugged in construction and economical to manufacture.

For an understanding of the principles of the invention, reference is made to the following description of typical embodiments thereof as illustrated in the accompanying drawing.

BRIEF DESCRIPTION OF THE DRAWINGS

In the drawings:
Fig. 1 is a schematic partial elevational and sectional view of the moistening device for respiratory air constructed in accordance with the invention; and
Fig. 2 is a view similar to Fig. 1 of a portion of the device shown therein showing another embodiment.

GENERAL DESCRIPTION OF PREFERRED EMBODIMENTS

Referring to the drawings in particular the invention embodied therein in Fig. 1 comprises a respiratory air moistening device which includes a housing generally designated 1 having an upper hollow portion with a rectangular insert generally designated 2 extending into the interior and provided with means for positioning a conduit 4 for conducting water which is supplied from a container or storage tank 6 through a flexible conduit 5 and which is discharged at an opening 7 into the interior of the housing 1. The walls of the evaporator insert 2 are insulated and a heater 3 is provided within the insert chamber 4a in a position directly below the conduit 4 and the rate of heating may be controlled by an electrical supply 3a to effect the desired heating of the water which flows through the conduit.

Distilled water in an adjustable volume flows from the storage tank 6 through the tube 5 and is discharged continuously through the discharge 7 into the hollow interior 8 of the housing 1.

Respiratory air from a patient supplied from the respiratory system (not shown) through a connection 9 into the interior 8 of the moistener housing 1 and leaves the housing after being heated up by the heater acting through the water of the conduit 4 and being moistened by the water vapor which is discharged into the hollow space 8 it is passed back through a connection 10 to the respiratory system.

The exhaling air of the patient passes through the moistener in the inverse direction and it enters through the connection 10 and leaves through the connection 9a.

In accordance with a feature of the invention a collector 11 for the water of condensation is located directly below the discharge 7 and is connected to the hollow space 8 through an open nozzle or drain 12. A dirt filter 13 is mounted above the nozzle 12 in a position to trap any dirt which has passed therethrough. The container 14 of the collector 11 is provided with openings 15 through which the interior of the collector communicates with the outer atmosphere. The openings 15 may be located at a level below the nozzle 12 so that they act as an overflow. The container 14 may also be provided with a water outlet 16 at the bottom if desired. The collector 11 is open to the ambient air in order to prevent any buildup of pressure in the interior.

The storage tank 6 may be a conventional infusion bottle from which the distilled water is supplied in an adjustable manner.

In the embodiment shown in Fig. 2 the interior chamber 8' of the housing 1' is separated from the collector 11' by a float valve 20. The valve 20 comprises a float 22 resting on a bowl shaped seat 21. The water of condensation accumulates on the bottom of the space 8' and elevates the float 22 until the water flows out past the seat 17 into the collector 11'.

While specific embodiments of the invention have been shown and described in detail to illustrate the application of the principles of the invention, it will be understood that the invention may be embodied otherwise without departing from such principles.

What is claimed is:

1. A device for moistening respiratory air comprising a housing having a hollow interior defining a moisture chamber, an evaporator insert extending into said moisture chamber and defining a separate closed insert chamber, a water supply connected into said housing and having an elongated discharge conduit extending through said insert chamber and into said moisture chamber and terminating in a discharge opening in said moisture chamber for discharging water and vapor therein, means for continuously moving water through said discharge conduit, heater means located in said insert chamber adjacent said portion of said discharge conduit therein for heating said insert chamber and the portion of said discharge conduit therein for vaporizing at least a part of the water passing therethrough, means defining a water collection area at the bottom of said moisture chamber for collecting the surplus water delivered into said housing moisture chamber through said discharge conduit and for also collecting condensate from respiratory air, said means defining a water collection area including an outlet for the water, an inlet in said moisture chamber for delivering respiratory air into said moisture chamber and through the water and vapor discharged by said discharge conduit and over said collection area, and an outlet in said moisture chamber for the respiratory air for returning the heated moistened air to the user for further respiratory use.

2. A device according to claim 1, including a separate condensed water collection chamber below said collection area and a drain between said collection area and said collection chamber for the passage of water from said collection area into said collection chamber.

3. A device according to claim 2, including a nozzle in said drain through which the water passes.

4. A device according to claim 2, including a filter in said drain.

5. A device according to claim 2, including a valve in said drain having a float portion in said moisture chamber which is floatable on the water of said moisture chamber to open and close the drain for the water from said collecting area to said collection chamber.