United States Patent [19]

Huggins

[11] **3,825,000**

[45] **July 23, 1974**

[54] **DISPOSABLE HUMIDIFIER**

[75] Inventor: **James A. Huggins,** Libertyville, Ill.

[73] Assignee: **Baxter Laboratories, Inc.,** Libertyville, Ill.

[22] Filed: **Nov. 8, 1972**

[21] Appl. No.: **304,757**

[52] **U.S. Cl.** **128/194,** 239/370

[51] **Int. Cl.** **A61m 15/00**

[58] **Field of Search** ..... 128/193, 194, 173, 186, 128/185, 188, 272; 239/338; 215/73, 74, 79; 261/78 A, DIG. 65; 55/25 J; 222/400.7

[56] **References Cited**

UNITED STATES PATENTS

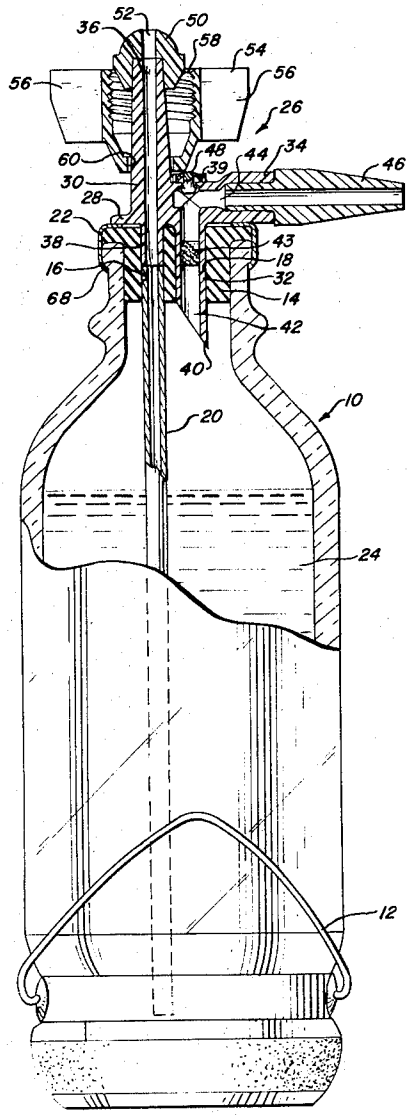
324,161	8/1885	Pond	128/186
1,286,109	11/1918	Richardson	128/194
2,684,674	7/1954	Archer	215/79 X
2,819,716	1/1958	Miller	128/186
3,572,660	3/1971	Mahon	128/186 X
3,682,168	8/1972	Deaton	128/194

Primary Examiner—Richard A. Gaudet
Assistant Examiner—Lee S. Cohen
Attorney, Agent, or Firm—Lettvin and Gerstman

[57] **ABSTRACT**

Oxygen to be administered to a patient is humidified by passing the oxygen through a standard water-containing intravenous solution bottle. A coupling assembly having an inlet tube and an outlet tube is inserted into the two openings defined by the stopper of the intravenous solution bottle, and is coupled to an oxygen supply. The connector assembly is capable of supporting the bottle, and carries a humidified oxygen outlet to which a nasal cannula is coupled.

11 Claims, 6 Drawing Figures



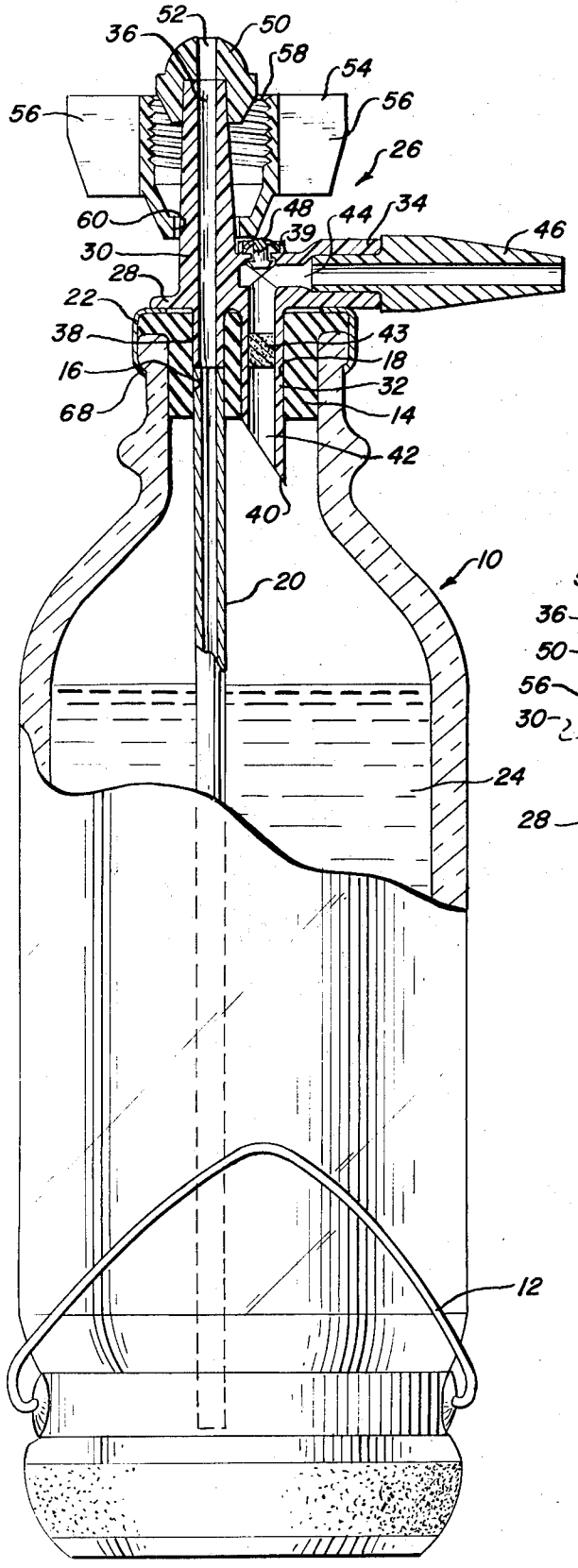

52
36
50
58
54
56
56
26
60
48
44
34
46
39
30
28
22
38
43
18
16
32
68
14
42
40
10
20
24
12

FIG. 1

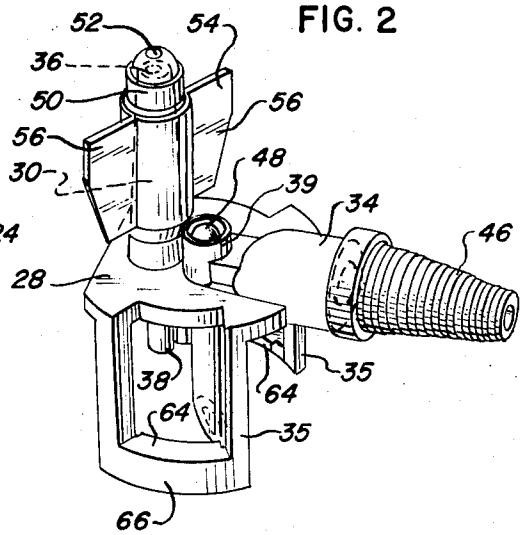

52
54
36
50
56
56
48
30
39
34
46
28
38
35
64
64
35
66

FIG. 2

FIG. 3

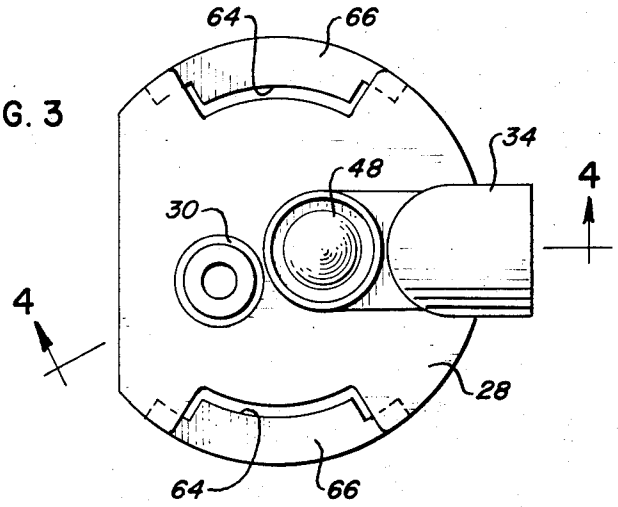


FIG. 6

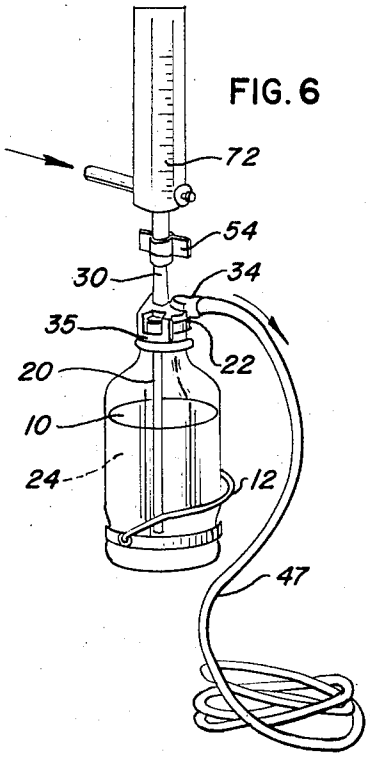


FIG. 4

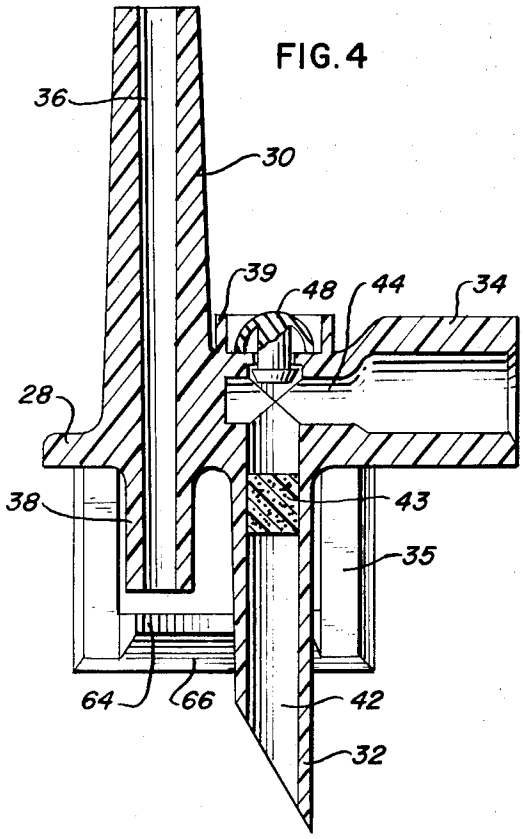
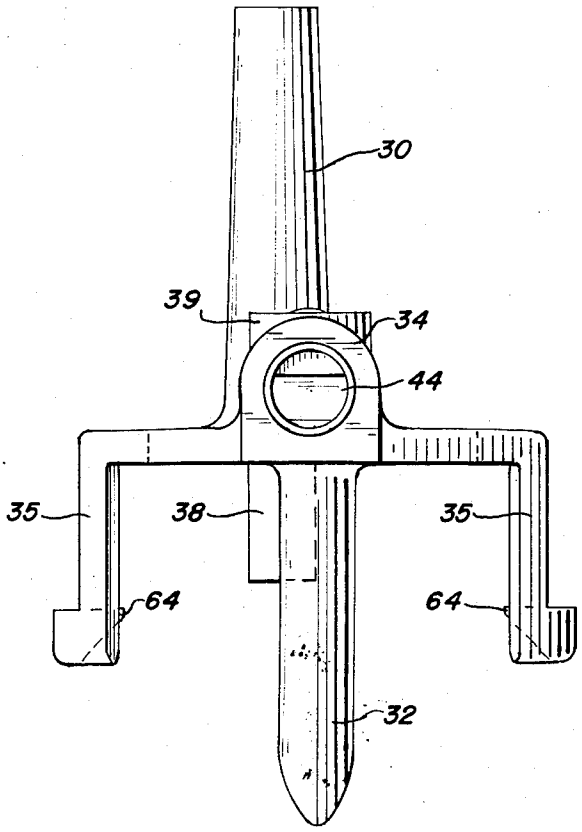


FIG. 5



DISPOSABLE HUMIDIFIER

BACKGROUND OF THE INVENTION

This invention relates to an improved system for humidifying oxygen that is administered to a patient.

The oxygen which is supplied to hospital patients must be humidified because of the inherently low humidity of the oxygen exiting conventional oxygen tanks. Generally the oxygen is passed through bubbler-type humidifiers which add water to the oxygen and the humidified oxygen flows through a nasal cannula to the patient.

The term "oxygen" as used herein is intended to include all oxygen-containing gases, such as air, substantially pure oxygen, etc. The term "water" as used herein is intended to include distilled water, tap water and other water-containing liquids, such as saline solution.

One type of oxygen humidifier comprises a reusable glass container which serves as a water reservoir and bubbling chamber, in association with a metal cover assembly that seals the chamber and provides inlet, outlet and pressure relief ports. The major disadvantage of this type of humidifier assembly is the need to clean and refill the unit with water prior to each use. Ideally, the humidifier is cleaned and wrapped after each use to maintain sterile conditions. However, there is a risk of contamination because the same humidifier is used for the treatment of many patients. Ambient bacteria may contaminate the humidifier and the humidifier may be reused without proper sterilization. Further, proper sterilization is costly and time consuming and is sometimes avoided by the hospital staff.

Contamination may also result because the first type of humidifier uses water which is obtained from the tap, or purchased in a separate container, or distilled by the hospital and transferred from a container to the humidifier. This practice generates a non-sterile open water supply which provides a potential breeding ground for bacteria.

A second type of oxygen humidifier assembly is similar to the first type described above, but is manufactured as a disposable item for single patient use. Although this type of humidifier eliminates some risk of contamination by providing a single use product, it depends on an open water supply and thus risk of contamination exists.

A third type of oxygen humidifier comprises a disposable molded product which incorporates a water reservoir, bubbling chamber inlet and outlet ports as a single molded assembly to be discarded after use. This type of humidifier obviates the contamination problem described above, but is relatively costly and takes up a large amount of storage space at the hospital.

It has been found that a very effective oxygen humidifier can be provided utilizing a standard intravenous solution bottle, of the type which is disposable after use and which is normally stored by hospitals in substantial quantity. The intravenous solution bottle contains its own distilled water supply and thus there is no need for the hospital staff to introduce water to the bottle from an open water supply. Further, the intravenous solution bottle is discarded after use and thus contamination resulting from reuse of a humidifier container is obviated. Additionally, the hospital is not required to have a separate inventory of intravenous solution bottles and humidifier bottles because the same bottle is used for both purposes.

Thus it is an object of the present invention to provide an effective system for coupling an intravenous solution bottle to an oxygen supply, in order to provide humidified oxygen to a patient.

A further object of the present invention is to provide an oxygen humidifier which significantly avoids risk of contamination, in that it utilizes a single use bottle which is prefilled with sterile water.

Other objects and advantages of the present invention will become apparent as the description proceeds.

BRIEF DESCRIPTION OF THE INVENTION

In accordance with the illustrative embodiment of the invention, there is provided an oxygen humidifier set which uses, as the water supply, an intravenous solution container having a stopper defining a first opening and a second opening, with an airway tube connected to the wall of the stopper defining the first opening. The airway tube is coaxial with the first opening and extends to the lower portion of the container, and the first and second openings are in communication with the inside of the container.

A connector assembly is provided for coupling the intravenous solution container to an oxygen supply. The connector assembly includes an oxygen inlet member and means for coupling the upper portion of the oxygen inlet member to the oxygen supply. The lower portion of the oxygen inlet member comprises an oxygen inlet tube which is adapted for coupling to the first opening for communication therewith.

In the illustrative embodiment, an outlet tube is provided for forming an outlet path for the humidified oxygen. The outlet tube is adapted for insertion into the second opening. A humidified oxygen outlet is provided in communication with the outlet tube, with the humidified oxygen outlet being adapted for coupling to a nasal cannula. The connector assembly carries means which are engageable with the intravenous solution container, for retaining the connector assembly in engagement with the container and for supporting the container.

A more detailed explanation of the invention is provided in the following description and claims, and is illustrated in the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1** is a front elevational view, primarily in cross-section, of an oxygen humidifier set including a standard intravenous solution bottle having a connector assembly connected thereto, in accordance with the principles of the present invention;

FIG. **2** is a perspective view of the connector assembly of FIG. **1**;

FIG. **3** is a top plan view of the connector assembly of FIG. **2**, with the coupling, nipple and cannula adapter removed;

FIG. **4** is a cross-sectional elevation of the connector of FIG. **3**, taken along the plane of the line **4—4** of FIG. **3**;

FIG. **5** is a side elevational view of the connector assembly of FIG. **3**; and

FIG. **6** is a perspective view of an oxygen humidifier set of the present invention, coupled to an oxygen supply.

DETAILED DESCRIPTION OF THE ILLUSTRATIVE EMBODIMENT

In the illustrative embodiment, a plastic connector assembly is provided for coupling a conventional oxygen supply to a standard intravenous solution container having water therein, in order to humidify the oxygen. Referring to FIGS. **1** and **6** in particular, the container shown therein is a standard intravenous solution bottle, such as disclosed in U.S. Pat. Nos. 2,878,808, 2,923,293 and 2,969,158. These bottles generally are formed of glass and are obtainable in various sizes, such as 250 ml, 500 ml, etc. The bottles are maintained under sterile conditions, since they contain solutions which are intended to be introduced into the human body.

Bottle **10** has a bail member **12** connected thereto for suspending the bottle during intravenous administration. However, the bail member has no utility in connection with the present invention. The mouth of bottle **10** is closed by means of a rubber stopper **14** defining two openings **16** and **18** which communicate with the inside of the bottle. First opening **16** is smaller in diameter than second opening **18** and has a plastic airway tube **20** mounted therein. Airway tube **20** extends downwardly in the bottle **10** to a point adjacent the bottom thereof.

The stopper **14** is maintained in place by a metal clamping ring **22.** Prior to use, clamping ring **22** forms part of a bottle top closure which is partially removed for use, as disclosed in U.S. Pat. No. 2,969,158.

The intravenous solution bottles **10** used with the present invention are those containing water **24** (i.e., distilled water or saline solution). Such intravenous solution bottles are standard items in many hospitals and thus the present invention enables the effective humidification of oxygen (i.e., substantially pure oxygen or air) without the need to store additional humidifier bottles. Further, since the water **24** carried by the intravenous solution bottles is already sterilized, the danger of contamination resulting from the use of tap water or an outside water source is obviated.

The connector assembly **26** which couples the intravenous solution bottle to a conventional supply of oxygen comprises a base **28** carrying an oxygen inlet member **30,** an outlet tube **32,** a humidified oxygen outlet **34** and a pair of downwardly extending fingers **35.** Oxygen inlet member **30** defines a central bore **36** with the lower portion thereof comprising an oxygen inlet tube **38** adapted for insertion into first opening **16.** An annular retaining wall **39** is formed integrally with humidified oxygen outlet **34** for maintaining an umbrella valve **48,** discussed below, from becoming disengaged by an operator's finger.

The internal diameters and external diameters of the inlet tube **38** and the airway tube **20** substantially match and the external diameters are large enough so that a compression fit of the inlet tube and airway tube with opening **16** is permitted. When the inlet tube **38** is in opening **16,** the lower end of the inlet tube **38** will be adjacent to or in abutting relationship with the upper end of airway tube **20.** The compression fit of the tubes in opening **16** aids in providing an effective seal.

Outlet tube **32** is greater in length than inlet tube **38** and has a downwardly pointing sharp forward edge **40** which aids in permitting the connector assembly **26** to be inserted into stopper **14** and further aids in providing an effective seal. Outlet tube **32** has a central bore **42** which communicates with bore **44** of humidified oxygen outlet **34.**

During humidification of the oxygen, some frothing may occur at the water surface. As a result of the shape of the neck of a conventional intravenous solution bottle and the height of the water therein (see FIG. **1**), the frothing is high enough to cause some of the water, in droplet form, to be expelled through oxygen outlet **32.** To obviate this problem, there is a filter plug **43** interposed in bore **42.** Filter plug **43** is utilized to prevent water from being forced out, i.e., to obviate the problem of liquid droplets passing to outlet **34.** In a preferred embodiment, filter plug **43** is formed of a polyolefin material, such as polypropylene, having a pore size of 300 microns.

Humidified oxygen outlet **34** includes a nasal cannula adapter **46** which is connected to the assembly with a frictional fit and it tapers to permit an effective coupling of the assembly to a conventional nasal cannula **47,** as shown in FIG. **6.**

An umbrella valve **48** is interposed in communication with bore **42** for safety purposes. For example, if the back pressure exceeds 2 psi, umbrella valve **48** will provide a relief vent as one side thereof is forced upwardly.

A plastic nipple **50** is fastened to the top of inlet member **30.** Nipple **50** defines a bore **52** which communicates with bore **36.** Nipple **50** becomes connected to a conventional oxygen supply by means of threaded coupling **54** which comprises grip wings **56** and an internally threaded bore **58** which threadedly engages a standard externally threaded outlet of a conventional oxygen supply. Coupling **54** defines opening **60** which is greater in diameter than the external diameter of inlet member **30,** and thus can slide along inlet member **30,** but is restrained from removal by means of nipple **50.**

Each of downwardly extending fingers **35** is formed in a generally U-shape and has a flange **64** extending inwardly from the bight **66** of the U. Referring to FIG. **5,** the vertical distance between the top of flange **64** and the underside of base **28** is substantially equal to the height of clamping ring **22** so that when connector assembly **26** is inserted into stopper **14,** the fingers will overlie the clamping ring and flange **64** will snap under the inwardly extending portion **68** of ring **22.** Fingers **35** will aid in providing a strong retention of the water-filled bottle to the connector assembly. The resilience of the plastic base **28** and downwardly extending fingers **35** will aid in providing a snug, snap fit.

To operate the oxygen humidifier set of the present invention, a water-containing standard intravenous solution bottle is selected and the closure is torn in the conventional manner. Connector assembly **26** is then forced into the two-hole stopper, with the oxygen inlet tube **38** entering first opening **16,** as described above, and the underside of base **28** resting upon the top of clamping ring **22.** A nasal cannula **47** is then frictionally connected to adapter **46** and the assembly is connected to a conventional oxygen supply **72** by threading coupling **54** onto the outlet of the oxygen supply.

It can be seen that a novel oxygen humidifier has been provided which utilizes a standard intravenous solution container of the type which is disposable after

use and which is normally stored by hospitals in substantial quantity. The connector assembly is relatively simple in construction and provides a secure seal and retention with respect to the intravenous solution container.

Although an illustrative embodiment of the invention has been shown and described, it is to be understood that various modifications and substitutions may be made by those skilled in the art without departing from the novel spirit and scope of the present invention. For example, the intravenous solution container could be a plastic container, such as the VIAFLEX container sold by Travenol Laboratories, Inc., Morton Grove, Illinois 60053. To this end, an airway tube could be inserted into one of the two container outlets and the connector assembly could be connected to the outlets in a similar manner that the connector assembly is connected to stopper **14** of the illustrative embodiment. The connector assembly could then be retained with respect to the plastic container by means of hooks carried by the connector assembly which are placed into the openings that are normally defined by the outlet end of the intravenous solution container.

What is claimed is:

1. An oxygen humidifier set which comprises: an intravenous solution bottle having a stopper defining a first opening and a second opening, an airway tube connected to the wall of the stopper defining said first opening with said airway tube being coaxial with said first opening and extending to the lower portion of said bottle, said first and second openings being in communication with the inside of the bottle; a connector assembly for coupling said intravenous solution bottle to an oxygen supply, said connector assembly comprising an oxygen inlet member, means for coupling the upper portion of said oxygen inlet member to the oxygen supply, the lower portion of the oxygen inlet member comprising an oxygen inlet tube coupled to said first opening, an outlet tube for providing an outlet path for the humidified oxygen, said outlet tube being inserted into said second opening, a humidified oxygen outlet in communication with said outlet tube, said humidified oxygen outlet being adapted for coupling to an oxygen administration device; and means carried by the connector assembly and engaging the intravenous solution bottle for retaining said connector assembly in engagement with said bottle and for supporting the bottle.

2. An oxygen humidifier set as described in claim **1,** in which the lowest extremity of the inlet tube is in a higher plane than the plane in which lies the lowest extremity of the outlet tube, with the inlet tube being incapable of extending below the stopper while the outlet tube extends into the bottle below the stopper.

3. An oxygen humidifier set as described in claim **1,** wherein said connector assembly is formed of plastic and includes a base member carrying said oxygen inlet member, said outlet tube and said humidified oxygen outlet; said retaining means comprising downwardly extending fingers engaging the neck of the bottle.

4. An oxygen humidifier set as described in claim **1,** wherein said first opening has a smaller diameter than said second opening and wherein said outlet tube has a greater external diameter than the diameter of said first opening.

5. An oxygen humidifier set as described in claim **1,** wherein said outlet tube has a downwardly pointing sharp forward edge.

6. In an oxygen humidifier set using, as a water supply, an intravenous solution bottle having a stopper defining a first opening and a second opening with an airway tube connected to the wall of the stopper defining said first opening and the airway tube being coaxial with the first opening and extending to the lower portion of the bottle, and with the first and second openings being in communication with the inside of the bottle, the improvement comprising, in combination: a connector assembly for coupling said intravenous solution bottle to an oxygen supply, said connector assembly comprising an oxygen inlet member, means for coupling the upper portion of said oxygen inlet member to the oxygen supply, the lower portion of the oxygen inlet member comprising an oxygen inlet tube coupled to said first opening for communication therewith, an outlet tube for providing an outlet path for the humidified oxygen, said outlet tube being inserted into said second opening, a humidified oxygen outlet in communication with said outlet tube, said humidified oxygen outlet being adapted for coupling to an oxygen administration device; and means carried by the connector assembly and engaging said bottle for retaining said connector assembly in engagement with said bottle and for supporting the bottle.

7. In an oxygen humidifier set as described in claim **6,** in which the lowest extremity of the inlet tube is in a higher plane than the plane in which lies the lowest extremity of the outlet tube, with the inlet tube being incapable of extending below the stopper while the outlet tube extends into the bottle below the stopper.

8. In an humidifier humidifer set as described in claim **6,** wherein said connector assembly is formed of plastic and includes a base member carrying said oxygen inlet member, said outlet tube and said humidified oxygen outlet; said retaining means comprising downwardly extending fingers engaging the neck of the bottle.

9. In an oxygen humidifier set as described in claim **6,** wherein said first opening has a smaller diameter than said second opening and wherein said outlet tube has a greater external diameter than the diameter of said first opening.

10. In an oxygen humidifier set as described in claim **6,** wherein said outlet tube has a downwardly pointing sharp forward edge.

11. In an oxygen humidifier set using, as a water supply, a standard intravenous solution container having a first opening and a second opening with the first and second openings being in communication with the inside of the container, the improvement comprising, in combination: a plastic, disposable connector assembly for coupling said standard intravenous solution container to an oxygen supply, said connector assembly comprising an oxygen inlet member, means for coupling the upper portion of said oxygen inlet member to the oxygen supply, the lower portion of the oxygen inlet member comprising an oxygen inlet tube communicating with said first opening and with an airway tube extending to the lower portion of the container, an outlet tube for providing an outlet path for the humidified oxygen, said outlet tube communicating with said second opening, a humidified oxygen outlet in communication with said outlet tube, said humidified oxygen outlet being adapted for coupling to an oxygen administration device; and means carried by the connector assembly and engaging said container for retaining said connector assembly in engagement with said container and for supporting the container.

* * * * *