Oct. 11, 1955 J. W. DORSAK 2,720,387

NEBULIZING DEVICE FOR INFANT INCUBATORS

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FIG. 1

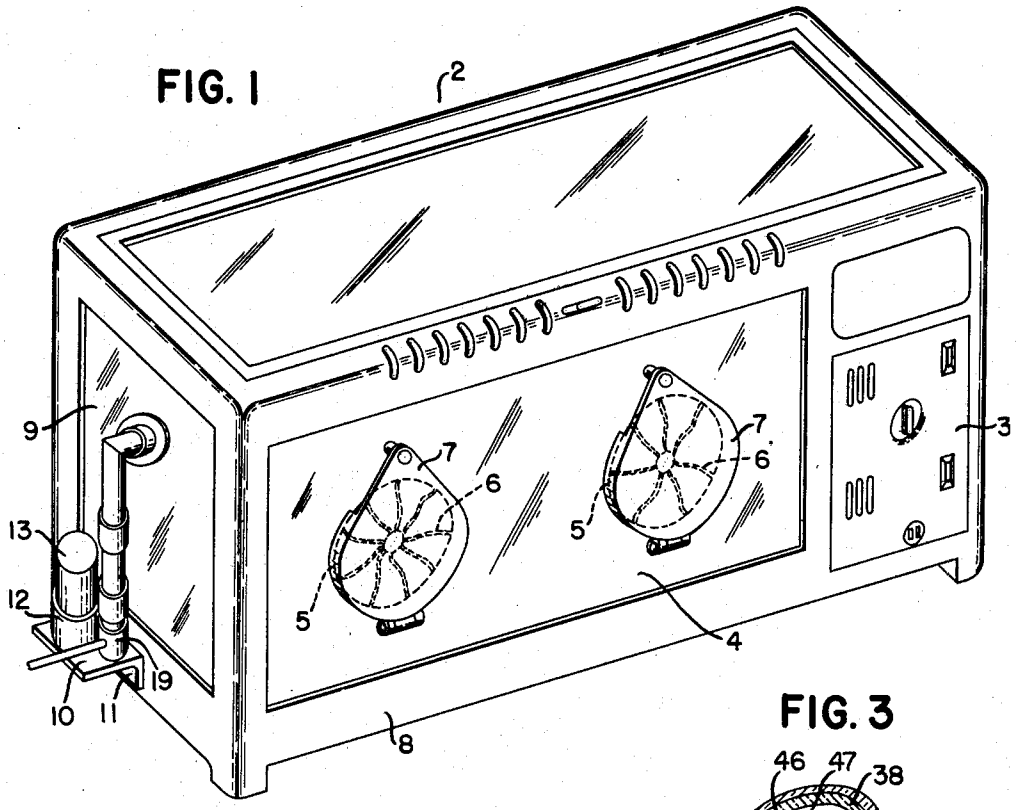


FIG. 2

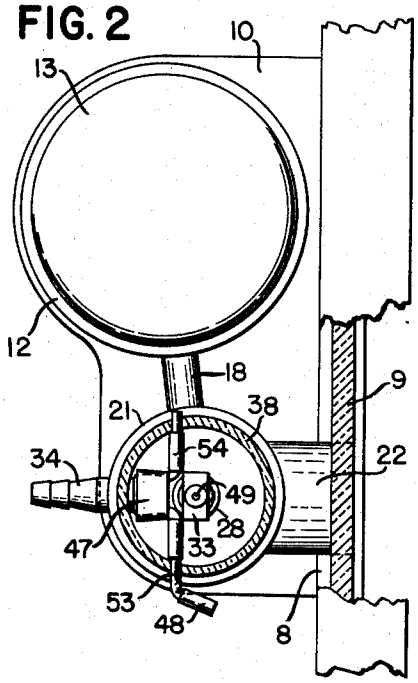
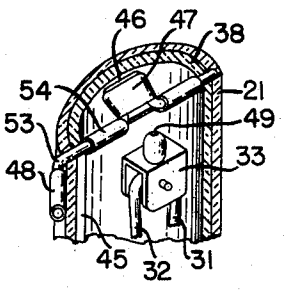


FIG. 3



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FIG. 4

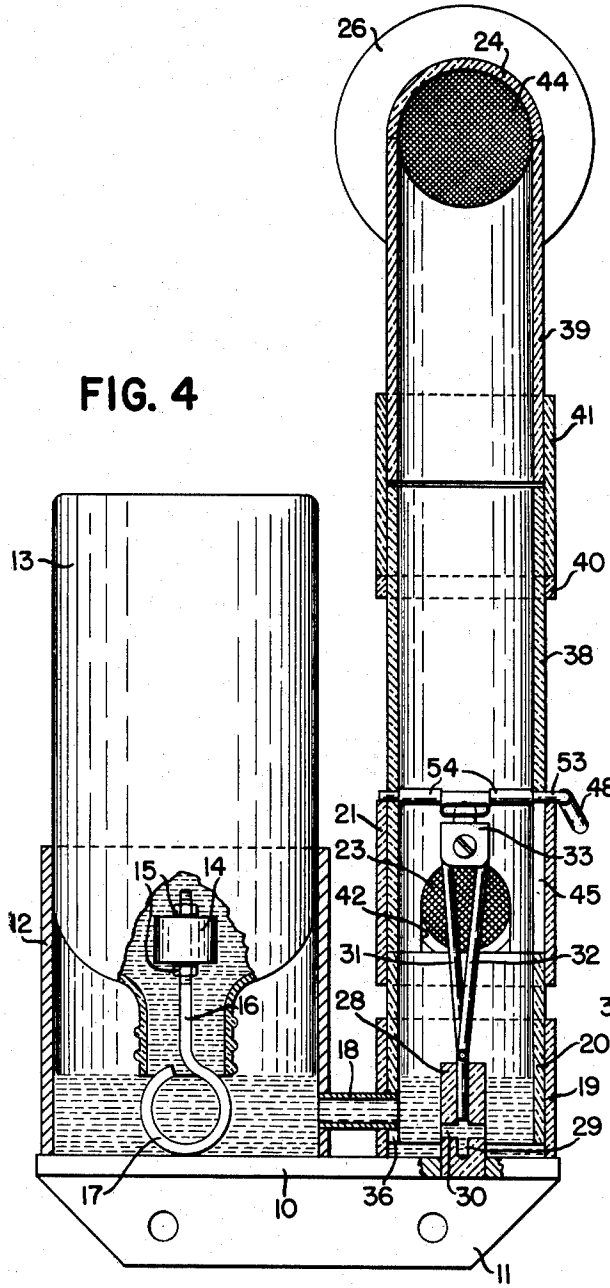
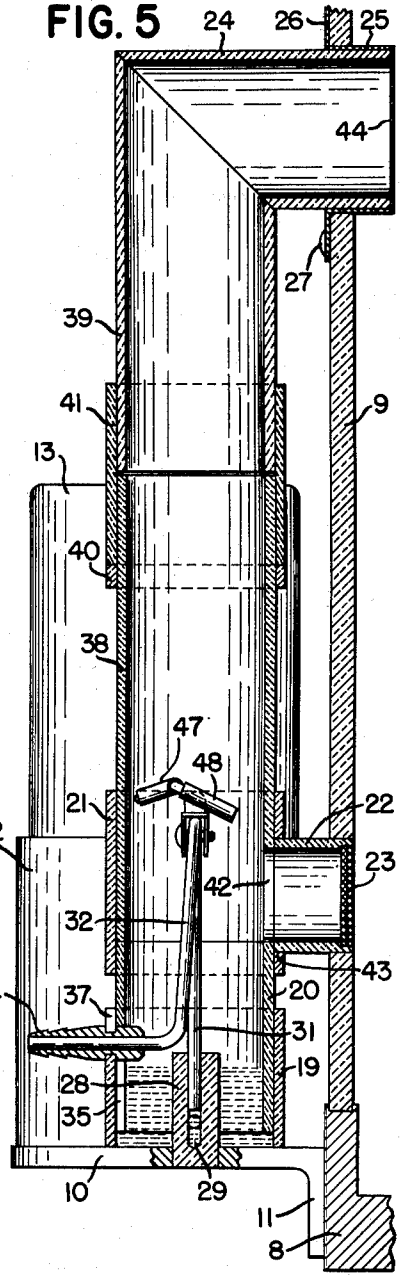


FIG. 5



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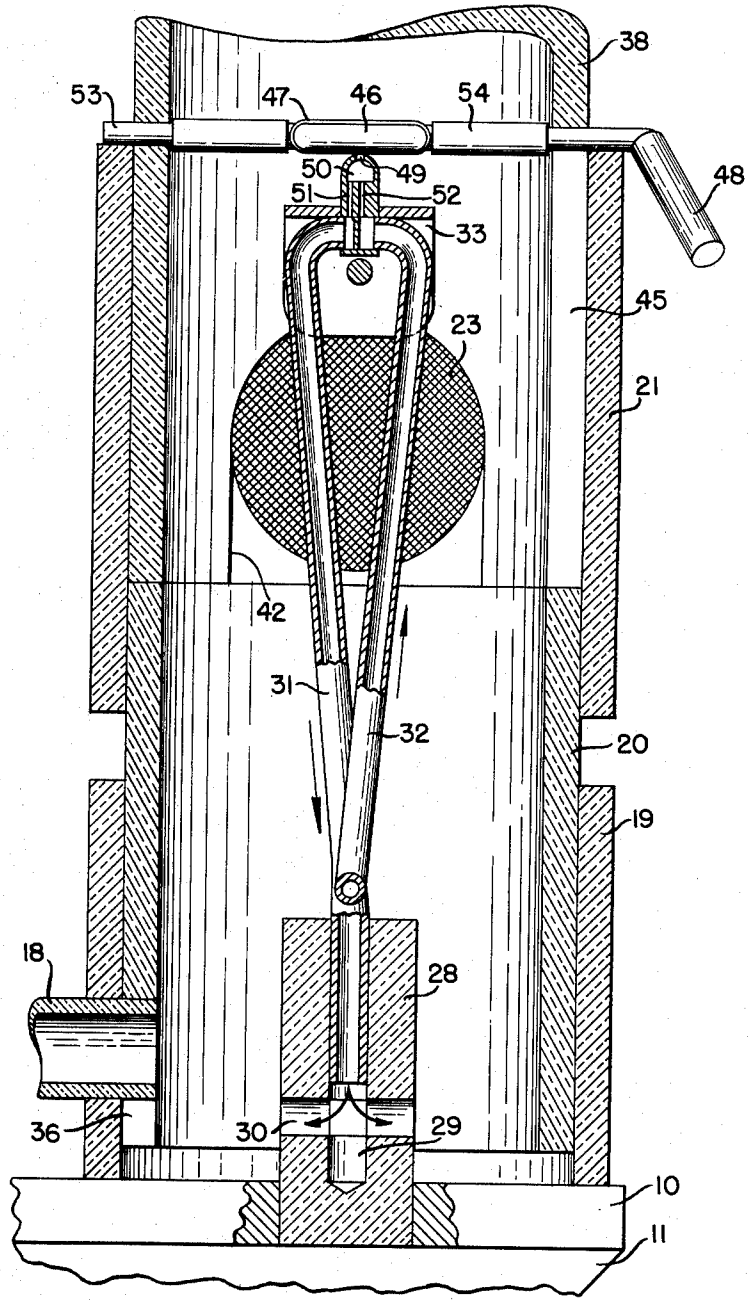
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NEBULIZING DEVICE FOR INFANT INCUBATORS

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FIG. 6



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NEBULIZING DEVICE FOR INFANT INCUBATORS

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17 Claims. (Cl. 261—76)

This invention relates to a nebulizing device for infant incubators and the like, and it more particularly pertains to such a edvice provided with a purging means, whereby the passage in the liquid supply conduit of said device can be readily freed from clogging.

The nebulizing device can be used with any conventional incubator and is illustrated as an accessory to one similar to that shown in Gordon Armstrong Patent No. 2,417,962. The nebulizing device is readily attached to the incubator, either as an original accessory or subsequently fitted thereto. It is for adding oxygen to and humidifying the atmosphere which is recirculated through the treating compartment of the incubator, and it is provided with an adjustment for controlling the flow of the recirculated air. An atomizer is mounted in a conduit connected with the top and bottom of the incubator and has tubing connected with a water supply and an oxygen supply.

One of the principal objects of the invention is a nebulizer, which is simple in construction and efficient in operation.

Another object of the invention is a nebulizer through which the air in the incubator is recirculated and humidified.

Another object of the invention is a nebulizer provided with means, readily accessible from the exterior of the incubator, for regulating the flow of recirculated air.

Still another object of the invention is a nebulizer provided with means for purging the liquid feed tubing of the humidifier from clogging or obstruction.

Further objects, and objects relating to details of construction and economies of operation, will readily appear from the detailed description to follow. In one instance, I have accomplished the objects of my invention by the devices and means set forth in the following specification. My invention is clearly defined and pointed out in the appended claims. A structure constituting a preferred embodiment of my invention is illustrated in the accompanying drawings, forming a part of this specification, in which:

Fig. 1 is a perspective view of an incubator equipped with a nebulizer embodying the invention.

Fig. 2 is a top plan view of the nebulizer device and a portion of the adjacent wall of the incubator partly in cross-section.

Fig. 3 is a detail view showing the discharge end of the atomizer in the nebulizer and a purging means associated therewith.

Figure 4 is an enlarged part sectional view and part elevation view of the nebulizer and vapor tube assembly shown at the left of Figure 1.

Figure 5 is a part sectional view and part elevation view of the structure of Figure 4.

Fig. 6 is an enlarged view in vertical section through the atomizer head showing the purging action.

Generally described, the nebulizer device comprises a conduit that is vertically disposed and arranged at one end of the incubator, the treating compartment end if it be

divided into compartments, to open into said incubator near its top and bottom for the air to be recirculated from the incubator through the nebulizer. A wall section of the conduit is provided with an opening which may be moved in and out of registration with one of the openings from the conduit into the incubator in order to regulate the flow of recirculated air. An atomizer is housed within the conduit and connected to a water supply and to an oxygen supply. Means are provided adjacent the atomizer nozzle for temporarily sealing the discharge opening thereof for causing the oxygen to be temporarily diverted through the water supply tube to purge or free it from any clogging. Only momentary covering of the atomizer nozzle is necessary to effect purging of the water supply tube.

Referring specifically to the drawings, in which like numerals designate like parts, there is indicated generally, at 2, an infant incubator of the type to which my improved nebulizer is applicable. This incubator shown may have a heating compartment at one end and a treating compartment at the other end. In the incubator shown, the heating compartment is behind the detachable front panel 3, which covers a heater unit mounted in the front wall of the heating chamber behind the panel 3. The front wall of the treating compartment is provided with a transparent panel 4 of material such as glass or plastic. The end wall shown also has a transparent panel 9, likewise of glass or plastic, and the lid of the incubator may likewise have a transparent panel, as may the rear wall and the opposite end wall. The incubator includes also a base 8. As shown, the front panel 4 has a pair of hand holes 5 formed therein to which a flexible sleeve or armlet 6 is attached, the same being covered by a hinged lid 7 when the flexible sleeve and hand hole are not in use. The hand holes and sleeves may likewise be provided in the rear panel, if desired.

The nebulizer is supported at the left end of the treating chamber by a shelf 10 having a depending flange 11, which is suitably secured as by bolts and nuts to the base 8 of the incubator. In some cases, where the incubator is mounted on a separate stand, this shelf 10 may be secured to the stand instead of to the incubator base. Mounted on one end of the shelf 10 is an upwardly opening water well 12 and alongside it is an upwardly opening vapor tube well 19, both these wells, as well as the shelf 10, being preferably made of transparent thermoplastic material and integrally secured together, as by welding, or cementing. A tube 18 establishes connection between the water well 12 and the vapor tube well 19 below the liquid level therein. A supply of water or other liquid is maintained in the water well 12, and the vapor tube well 19, from an inverted water bottle 13, the body portion of which fits within the upper portions of the wall of the water well 12. The mouth of the bottle 13 may be closed by a stopper 14 secured by nuts 15 to a stem 16 which extends downwardly through the neck of the bottle and ends in a loop 17 outside the neck. When the bottle 13 is placed in inverted position in the water well 12, as shown in Fig. 4, the loop 17 engages the bottom of the water well, that is, the shelf 10, and the stopper 14 is forced into the bottle, thus opening the mouth and permitting water to flow from the bottle into the water well 12 to maintain a supply of water therein at the desired level.

As shown in Figs. 4 and 5, a plug 28 is cemented in position in a hole in the shelf 10 and extends upwardly within the vapor tube well 19 axially thereof. The plug 28 has an axial passage 29 communicating through a port 30 with the interior of the vapor tube well. An atomizer nozzle 33 has a water tube 31 leading to the discharge end of the nozzle and the lower end of this water tube

31 is mounted in the central passage 29 of the plug 28 and the nozzle is supported thereby. The nozzle 33 is also provided with a gas supply tube 32, which extends downwardly alongside the water tube 31 and is bent laterally, at a point just above the upper end of the plug 28, extending through a notch 37 provided in the side wall of the vapor tube well 19. An adapter 34 is secured to the free end of the gas supply tube 32, resting in the notch 37, and may be connected by hose to a supply of gas under pressure, such as an oxygen supply tank.

A short tube 20, slightly less in diameter than the internal diameter of the vapor tube well 19, is mounted in said well, being provided with a downwardly opening notch 35, fitting over the inner end of the adapter 34, and with a downwardly opening notch 36 fitting over the inner end of the tube 18. Thus, the tube section 20 is supported in the vapor tube well 19 by the engagement of the tops of notches 35 and 36 with adapter 34 and conduit 18, respectively, and such engagement also prevents rotation of the tubular section 20 in the vapor tube well 19. The upper end of the tubular section 20 is received within a sleeve 21 having an opening 43 therein, which receives the end of a short pipe 22 cemented, or welded, in place in said opening. The pipe 22 extends through a hole in the transparent panel 9, near the bottom thereof, and the end of the pipe may be covered by screening 23, but this screen is not used in all cases. A lower vapor tube 38 is also mounted in the sleeve 21 with its lower edge resting on the upper edge of the short tubular section 20. A downwardly opening notch 42 is formed in the lower portion of the wall of the lower vapor tube 38, in position to be brought into total or partial registry with the hole 43 and the pipe 22 by rotation of the lower vapor tube 38 within the sleeve 21. As will be pointed out later, this permits regulation of the amount of air to be recirculated from the inside of the incubator through the pipe 22 and the notch 42. A stop ring 40 is secured to the upper portion of the lower vapor tube and a sleeve 41 rests thereon, embracing the upper portion of the lower vapor tube 38 and being movable longitudinally thereof and rotatable with respect thereto. An upper vapor tube 39 has its lower end received within the sleeve 41 adjacent the upper end of the lower vapor tube 38. The upper vapor tube 39 is provided at its upper end with an elbow section 24 extending laterally at right angles to the main portion of the upper vapor tube. The elbow section 24 extends through a sleeve 25 fitted into an opening in the upper portion of the transparent panel of the incubator. This sleeve 25 is part of a plate 26 secured at 27 to the upper portion of the panel 9. The discharge end of the elbow 24, within the occupant's enclosure of the incubator, may be covered by suitable screening 44, but this is not needed in all cases. The upper vapor tube 39 including the elbow 24 may be rotated about the axis of the sleeve 25, when the sleeve 41 is raised so as to clear the upper end of the lower vapor tube 38. When that has been done, the lower vapor tube 38 may be lifted out of the sleeve 21, sleeve 21 and pipe 22 may be removed from engagement in the hole in the panel 9, and the short tubular section 20 may be removed from the vapor tube well 19, thus giving ready access to the atomizer nozzle 33 and permitting the ready disassembly of the parts for cleaning or sterilizing.

It frequently happens in the use of an atomizer such as described, that the water passage 31 becomes clogged, either because of foreign material that gets in the water or because of gumming constituents used in medicated liquid that may be supplied in place of water. I have provided a simple but effective means for quickly purging the passage in the water supply tube 31, which may be conveniently and quickly operated to purge the passage, that is to say, clear it of foreign material. This purging device comprises a rod 53, shown in Fig. 3, extending transversely of the lower vapor tube 38 adjacent the atomizer nozzle 33. One end of the rod 53 is journalled in a hole provided in the lower vapor tube 38, and the other end of the rod 53 passes through the upper end of a downwardly opening notch 45 which is provided in the vapor tube 38. In use, the projecting ends of the rod 53 may rest on the upper edge of sleeve 21 and the end adjacent the notch 45 is bent laterally to form a handle 48. The central portion of the rod 53 is bent laterally to form an offset loop 46 over which is stretched a flexible gas-tight diaphragm 47, conveniently formed by taking a section of rubber tubing and stretching it over the loop 46. In normal position, the rod 53 is turned so that the loop 46 lies against the inner wall of the lower vapor tube 38 away from the nozzle, as shown in Fig. 3. When the water passage 31 of the atomizer is to be cleared, or purged, the operator, by means of the handle 48, rotates the rod 53 until the diaphragm 47 rests on and seals the discharge opening 49 of the nozzle. The diaphragm 47, being impervious to gas, seals the discharge opening 49 against the escape of the oxygen and that gas being supplied under pressure, is diverted by the diaphragm and forced back through the water tube or passage 31, thus clearing it of all foreign matter which will be forced out through the passage 29 and the port 30 into the vapor tube well 19. The construction of the atomizer head is shown in greater detail in Fig. 6, and it will be noted that the passages 31 and 32 communicate by ports 51 and 52 with a chamber 50, having a discharge opening 49. When the purging diaphragm 47 seals the discharge port 49, the gas, entering chamber 50 under pressure from port 52 and tube 32, leaves through port 51 and tube 31, the gas pressure thus purging the tube 31 of all obstructions. This action requires but an instant, when the loop 46 and the diaphragm 47 may be returned to the position shown in Fig. 3. These parts are shown in their purging position in Fig. 6. Spacer sleeves 54 may be mounted on the portions of rod 53 between the loop 46 and the side wall of the lower vapor tube 38, to keep the loop 46 and diaphragm 47 in register with the nozzle.

The operation of this nebulizer should be apparent from the foregoing description. A supply of water or other liquid is maintained in the water well 12 and the vapor tube well 19. A source of compressed gas, such as oxygen, is connected to the adapter 34 and the oxygen supply tube 32. Of course, a valve is provided to control the admission of oxygen to this passage. The discharge of oxygen through the nozzle from the oxygen supply tube 32 draws with it water or liquid passing through the liquid supply tube 31. The atomizer thus discharges into the lower portion of the lower vapor tube 38 and this discharge draws with it air by an aspirating or injector action, so that the vapor, consisting of air enriched with oxygen and humidified, passes upwardly through the lower vapor tube 38 and the upper vapor tube 39 and is discharged into the upper portion of the occupant's enclosure of the incubator through a screen 44, which may be added to help break up any large drops of moisture that may be carried along. This oxygen-enriched and humidified air circulates within the occupant's enclosure and may pass out therefrom through the screen 23 and the short pipe 22 into the lower vapor tube 38, below the nozzle, so as to be recirculated taking on more oxygen and moisture. By such recirculation the oxygen saturation of the air in the incubator may be increased and the amount of recirculation may be regulated or adjusted by rotating the lower vapor tube 38 in the sleeve 21, so as to control the size of the opening connecting the vapor tube 38 with the recirculation pipe 22. The water passage 31 may be conveniently purged or cleared of foreign material by the purging device as I have already described. The liquid in the well 12 may be water containing a detergent to lower the surface tension or other medicament and I have used the term "water" as including any such liquid.

I am aware that the devices herein described may be

varied considerably in detail without departing from the spirit of my invention and, therefore, I claim my invention broadly as indicated by the appended claims.

Having thus described my invention, what I claim as new and useful, and desire to sceure by U. S. Letters Patent, is:

1. A nebulizer for infant incubators and the like adapted to be mounted alongside a wall thereof comprising the combination of a water well, a vapor tube well communicating therewith, a pipe assembly mounted on said vapor tube well and extending upwardly therefrom into a terminal end adapted to be fitted in communication with an opening formed in the upper portion of said wall, said assembly including an upper vapor tube and a lower vapor tube disposed end to end with their adjacent ends telescoping with a connecting sleeve, a recirculation connection passing through the lower portion of said wall and adapted to register with a port in said pipe assembly, an atomizer head mounted on the vapor tube well and located above said port, a gas supply tube connecting said atomizer head with a source of compressed gas, a water supply tube connecting said atomizer head with the interior of said vapor tube well, and a sleeve fixed to and communicating with said recirculating connection, and the port being formed in said lower vapor tube.

2. The combination of claim 1 in which the lower vapor tube is rotatable in respect to the upper vapor tube.

3. The combination of claim 2 in which the adjacent ends of the upper and lower vapor tubes are embraced by a longitudinally shiftable sleeve.

4. The combination of claim 3 in which the pipe assembly includes a supporting tube nested in the vapor tube well and abutting the lower end of the lower vapor tube within the sleeve fixed to the recirculation connection.

5. The combination of claim 1 in which the upper terminal end of the pipe assembly is covered by a screen.

6. The combination of claim 1 including a plug axially mounted in the vapor tube well and having an axial passage with which the water supply tube communicates and a port connecting said passage with the interior of said vapor tube well.

7. The combination of claim 6 in which the atomizer head is supported by the water supply tube inserted in the said plug passage, and by the gas supply tube which is turned laterally through a notch in the wall of the vapor tube well.

8. In a nebulizer the combination of an upright vapor tube, an atomizer head mounted therein and having gas and liquid supply connections, and means for purging said liquid supply connection comprising a member rotatably mounted on said upright vapor tube and movable to a position in which it blocks the discharge opening of the atomizer head to divert gas from the gas supply connection through the liquid supply connection to purge the same, said member including a flexible diaphragm adapted to be positioned over the atomizer discharge opening.

9. The combination of claim 8 in which the member includes a rotatable rod having an offset loop formed centrally thereof and the diaphragm is formed by a section of rubber tubing stretched over said loop.

10. The combination of claim 9 in which the rod has a handle portion formed thereon outside the vapor tube.

11. A nebulizer for infant incubators and the like adapted to be mounted alongside a wall thereof comprising the combination of a water well and vapor tube well in communication, a tubular extension for the top of the vapor tube well and connected to a sleeve fixed to a recirculating pipe in communication with an opening in the incubator wall, a vapor tube section having one end rotatably mounted in said sleeve, another vapor tube section adapted to be connected to the wall of the incubator above the recirculating pipe and disposed end to end with the first mentioned vapor tube section, an atomizer mounted in the vapor tube well, and a longitudinally shiftable sleeve for connecting the adjacent ends of the vapor tube sections.

12. The nebulizer of claim 11 including a shelf on which the water well and the vapor tube well are mounted.

13. The nebulizer of claim 11 having a purging device for the atomizer.

14. The nebulizer of claim 13 in which the purging device for the atomizer is mounted on the rotatable vapor tube section.

15. In a nebulizer the combination of an upright vapor tube, an atomizer head mounted therein and having gas and liquid supply connections to a spray nozzle included in said head, and means for purging the liquid supply connection comprising a member mounted on and within said upright vapor tube for being moved, within said vapor tube by a means extending exteriorly of the vapor tube, in contact with the spray nozzle of the atomizer head to divert gas from the gas supply connection through the liquid supply connection to purge said liquid supply connection.

16. In a nebulizer the combination of an upright vapor tube, an atomizer head mounted therein and having gas and liquid supply connections to a spray nozzle included in said head, a purging device movably mounted within the vapor tube and disposed adjacent the atomizer head in normally spaced relation thereto to permit discharge of the sprayed liquid, and means, operable exteriorly of the vapor tube, for bringing the purging device and spray nozzle in abutting contact within the vapor tube for said purging device to close the spray nozzle for causing back pressure of the gas through the liquid supply.

17. In a nebulizer the combination of an upright vapor tube, an atomizing head mounted therein and having gas and liquid supply connections to a spray nozzle mounted in said head, means for purging the liquid supply connection comprising a member mounted on and within said upright tube in spaced relation to the spray nozzle, said atomizing head and purging device being so mounted that one is adapted to be moved relatively to the other for contacting said purging means and the spray nozzle of the atomizing head to divert gas from the gas supply connection to the liquid supply connection for purging said liquid supply connection, and means for effecting the relative movement between the purging means and the spray nozzle for contacting them.

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