July 24, 1956 W. LOEWENSTERN 2,755,797

ADJUSTABLE HUMIDIFIER ASSEMBLY

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Fig. 1

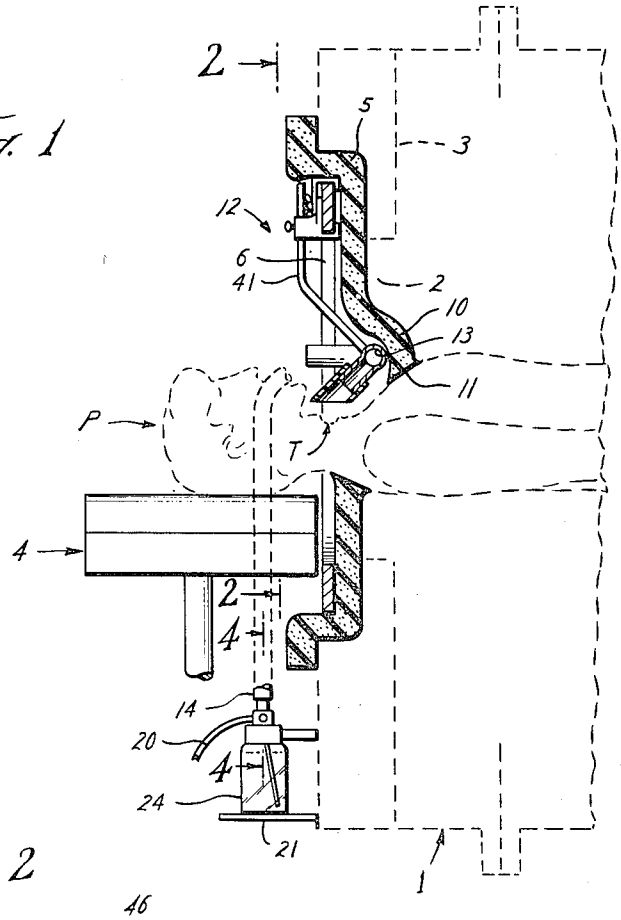
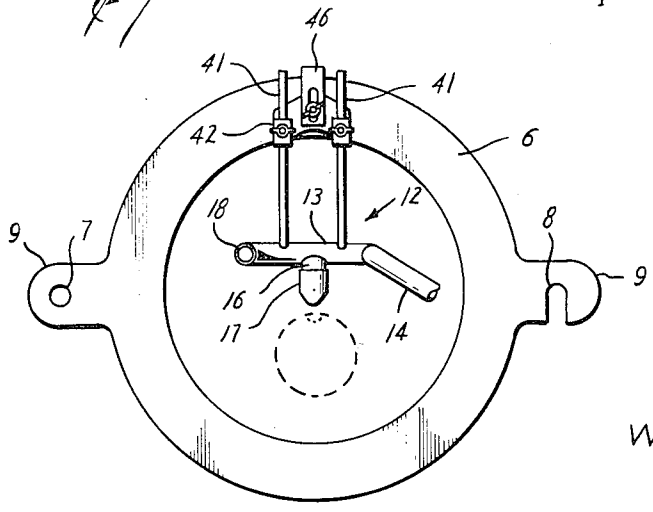



Fig. 2




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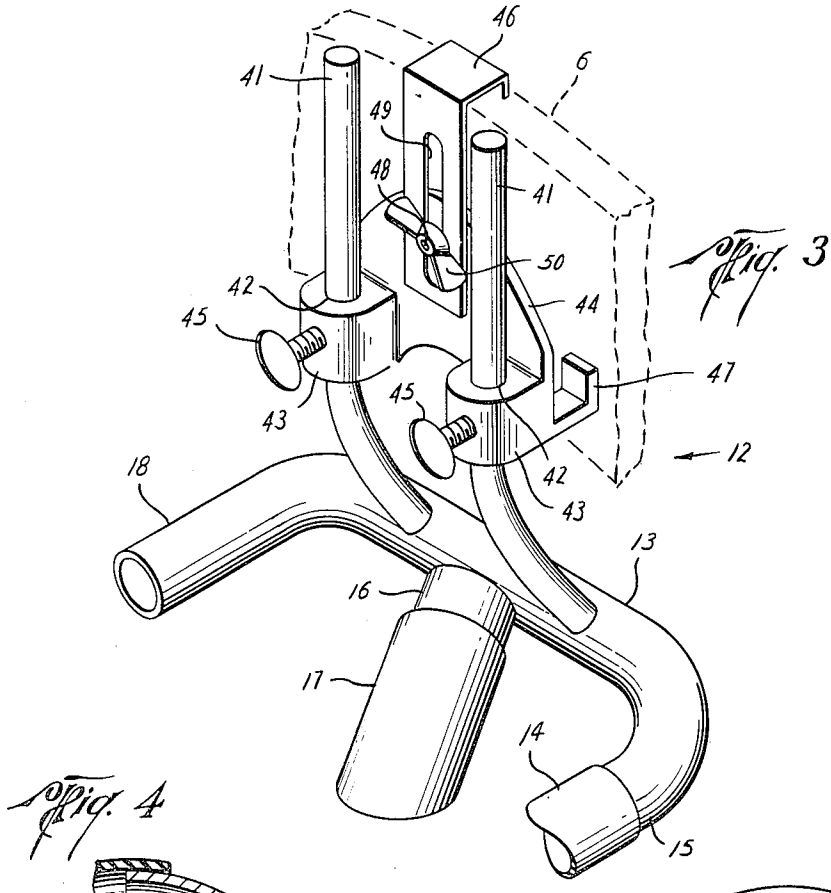



Fig. 3

Fig. 4

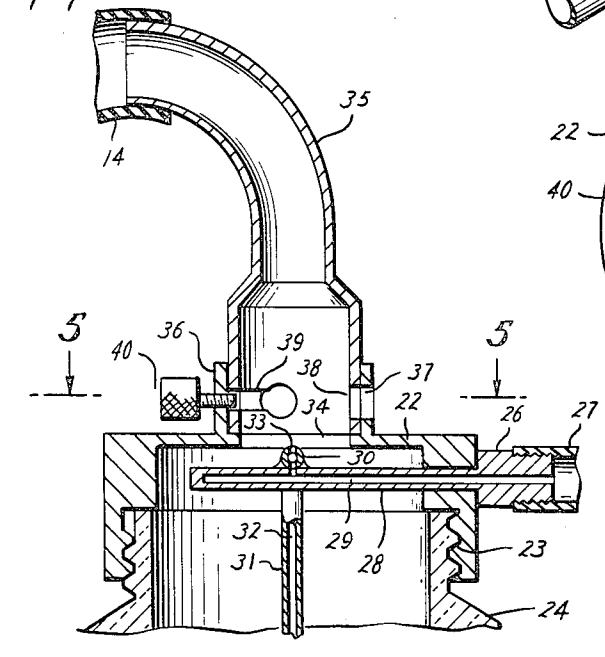
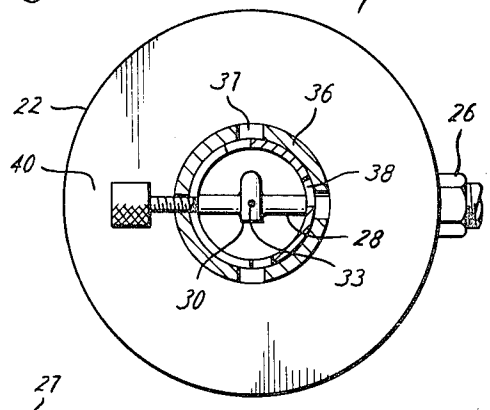



Fig. 5




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# ADJUSTABLE HUMIDIFIER ASSEMBLY

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Application October 15, 1954, Serial No. 462,437

6 Claims. (Cl. 128—30)

This invention relates to new and useful improvements in humidifiers and particularly humidifiers used in connection with poliomyelitis respirators.

With certain poliomyelitis victims whose breathing is seriously restricted, it is frequently necessary to circumvent the upper respiratory tract by performing a tracheotomy to create an opening directly into the trachea or wind-pipe. Because of this circumvention, however, the air that is drawn into the lungs is deficient in moisture which is usually supplied by the upper respiratory tract. Thus, it becomes necessary to provide means to increase the moisture-content of the air that is taken into the tracheotomy opening.

Previous humidifiers have frequently failed to provide a sufficient amount of moisture to the patient's respiratory system without causing him an undue amount of discomfort. Such humidifiers usually either spread a distracting and disturbing fog or mist throughout a large area encompassing the patient's face, or, when the amount of fog was decreased, failed to provide an adequate amount of effective moisture. Other humidifiers, which were adapted to localize the dispersal of the moisture, frequently comprised a labyrinth of tubes and hose connections which, when arranged above the face of an "iron lung" patient, caused distraction or discomfort to him.

It is, therefore, an object of my invention to provide a humidifying apparatus that will effectively localize a spray or mist where required without shrouding the patient's head in fog.

It is a further object of my invention to provide a humidifier tube assembly that may be mounted on a poliomyelitis respirator without distracting or otherwise interfering with the patient.

It is a further object of my invention to provide a humidifying tube assembly which is simple in construction, reliable in operation, and which can be manufactured economically.

In carrying out my invention I provide a U-shaped tube within which a moisture laden mist may be accumulated. Communicating with the interior of the U-shaped tube is a depending outlet tube through which the moisture may be drawn into the trachea as the patient breathes. The entire tube assembly is adapted to fit compactly against the head end facing of an "iron lung" and because of the U-shaped configuration of the tube, the central portion thereof is carried away from the patient. Additionally, the tube may be vertically adjustable to provide maximum effective humidification of "inhaled" air without interfering with the patient's vision or his already limited head movements.

The features of my invention which I believe to be novel are set forth with particularity in the appended claims. My invention itself, however, together with further objects and advantages thereof, may best be understood by reference to the following description taken in connection with the accompanying drawings, in which



Fig. 1 is a partial section view of a poliomyelitis respirator showing my adjustable humidifier in operative position; Fig. 2 is a plan view of my adjustable humidifier in position on a head ring taken along line 2—2 of Fig. 1; Fig. 3 is a perspective view of my adjustable humidifier; Fig. 4 is a partial section view of an atomizer head taken along line 4—4 of Fig. 1; and Fig. 5 section view of the atomizer delivery head taken along line 5—5 of Fig. 4.

Referring now to the drawings, there is illustrated a human poliomyelitis patient P lying within the confines of the conventional poliomyelitis respirator or "iron lung" with his head extending outwardly from an opening 2 in the head-end 3 thereof and being supported by an adjustable headrest 4. The end wall 3 is recessed at 5 to accommodate a conventional head ring 6 which is clamped thereto by bolts (not shown) inserted through a hole 7 and slot 8 in extensions 9 at opposite sides of the head ring 6. A flexible sheet 10 of sponge rubber or the like having a central aperture 11 is slipped over the patient's head so as to snugly, though comfortably, engage and encircle his throat. The flexible sheet 10 is of sufficient dimension in all directions to cover the opening 2 in the end wall 3 of the "iron lung." The conventional head ring 6 is then mounted over the flexible sheet 10 and secured to the end wall 3 so as to clamp the flexible sheet 10 against movement. The flexible sheet 10 thus serves to effectively seal the interior of the "iron lung" 1, but is of sufficient flexibility so as to prevent uncomfortable binding of the patient's neck. The foregoing elements are conventional parts of a poliomyelitis respirator and form no part of my present invention.

My invention is adapted to be mounted directly on the conventional head ring 6 which forms a part of the "iron lung" and comprises an adjustable humidifier assembly 12. My adjustable humidifier assembly 12 includes a rigid accumulator tube 13 of metal, plastic or the like and which is preferably U-shaped to curve away from the paient's face, as shown in Fig. 1, to present a minimum amount of mental or physical encumbrance. A mist or fog rises slowly upwardly from a source to be hereinafter described, through an intake hose 14, and into the intake end 15 defined by one of the legs of the U-shaped accumulator tube 13. Because the mist enters at approximately atmospheric pressure it does not rush through the tube 13, but, instead, accumulates therein until it is drawn out as the patient inhales. Thus, there is no irregularity of flow to the lungs and an adequate amount of moisture is continuously available for every inhalation. Communicating with the interior of the central portion of the tube 13 is a tracheotomy port 16 having a tracheotomy tube 17 connected thereto. The tracheotomy tube 17 is directed in the area of a tracheal opening or incision T which is formed in the patient's throat to circumvent a restricted upper respiratory tract. Of course, my device may also be employed simply to supply moisture-laden air to the area around a patient's nose and throat. As the patient inhales, the mist is drawn from the accumulator 13, through the tracheotomy tube 17, and into the patient's respiratory system. Should the volume of the fog or mist exceed the capacity of the accumulator 13, the excess is permitted to drift out through the exhaust end 18 thereof and is carried away from the patient by an exhaust tube 19.

Referring now to Figs. 1 and 5, I have illustrated a preferred means for delivering a mist or fog to the accumulator tube 13. An atomizer assembly 20 is supported at or near the "iron lung" in any desired manner as, for example, by means of a bracket stand 21. The atomizer assembly includes a delivery head 22 which is internally threaded as at 23 to cover a glass jar 24 or similar receptacle. Extending radially from one side of the delivery

head 22 is a fitting 26 having a longitudinal passage 26a therethrough. A hose 27 leading from a source (not shown) of oxygen, compressed air or other gaseous substance is connected to the fitting 26. In communication with the fitting 26 is a horizontal tube 28 which extends radially into the interior of the delivery head 22. The longitudinal passage 29 through the tube 28 communicates with a port 30 through which the oxygen or air may exit. Also supported in the delivery head 22 is the vertical vapor tube 31 of the atomizer unit which extends downwardly into the vessel. The top portion of the tube 31 is bent horizontally so as to extend transversely across the top of the oxygen tube 28, covering the port 30 therein. In communication with the vapor passage 32 of tube 31 and with port 30 of the oxygen tube 28 is the atomizer nozzle 33 comprising a vertical passage extending completely through tube 31 and in axial alignment with port 30. Thus, when oxygen is passed through the tube 28 and the port 30 a vacuum is created across the vapor passage 32 of tube 31 to draw water particles upwardly through the nozzle 33 to create, with the oxygen, a mist or fog. The mist then rises upwardly through an opening 34 in the top of the delivery head 22 to which is connected a delivery pipe 35 in communication with the intake hose 14. The delivery pipe 35 is inserted into a vertical sleeve 36 which surrounds the opening 34. Spaced around the sleeve 36 are several ports 37 which may be aligned with similarly spaced ports 38 in the delivery pipe 35 to permit the introduction of air therein. Two of the ports 38 are interconnected by a slot 39 into which is extended a screw 40 threaded into the sleeve 36. Thus, the delivery pipe 35 may be rotated relative to the sleeve, to the extent of the length of the slot, while relative axial movement thereof is prevented by screw 40 so that the pipe may not become disengaged from the sleeve. In this manner, the effective opening of the ports 37, 38 may be varied to control the amount of air that is introduced and, hence, the amount of fog or mist delivered. Thus, my atomizer assembly is adapted to provide a mist comprising a mixture of air, oxygen and water which may be controlled to drift slowly upwardly or pass very rapidly.

Referring now to Figs. 1, 2 and 3, I have illustrated the means for adjustably mounting my humidifying device. Secured to the central portion of the U-shaped accumulator tube 13, as by welding, are a pair of substantially vertical, parallel adapter rods 41 which are longitudinally slidable for vertical adjustment in slideways 42 bored through bosses 43 integral with a bracket plate 44. A manually rotatable screw member 45 is threaded into each boss 43 to releasably engage the adapter rods 41 and secure them in any selected position. The bracket plate 42 is clamped on to the head ring 6 of the "iron lung" by means of an adjustable clamping member 46 which cooperates with a pair of opposing, rigid clamping members 47. A screw 48 secured to the bracket plate 42 engages in a slot 49 in adjustable member 46 to permit relative sliding movement thereof. Thus, in positioning my accumulator tube assembly, the nut 50 on screw 48 is loosened to permit sliding of the member 46. Bracket plate 42 is then positioned against the head ring 6 with rigid members 47 engaged around the inner edge. Member 46 is then firmly engaged around the outer edge of the head ring and the manually rotatable nut 50 is tightened to firmly clamp the bracket thereon. It is clear that the bracket plate 42 may be secured in any position around the head ring 6 according to the direction in which the patient's head is turned. The lower portions 51 of the adapter rods 41 are curved rearwardly so that at least the central portion of the accumulator tube 13 actually extends through the head ring 6 and against the flexible sheet 10 so as to be remote from the patient's face to leave his view unobstructed. Additionally, the curvature of the adapter rods 41 and the accumulator tube which carry them through the head ring 6, forces the flexible sheet rearwardly away from the tracheal incision to prevent any irritation. Thus, the rearwardly curved adapter rods cooperate with the U-shaped accumulator to provide a compact, out-of-the-way assembly with only the vapor supply and exhaust lines extending outside of the conventional "iron lung" head ring.

While I have described the features and principles of use of an assembly which I now consider to comprise the preferred embodiment of my invention, I desire to have it understood that the showing is primarily demonstrative, and that those skilled in the art may make further modifications. Therefore, I contemplate that the appended claims cover any such modifications as fall within the true spirit and scope of my invention.

Having described my invention I claim:

1. In a poliomyelitis respirator comprising a horizontal cylindrical shell adapted to substantially enclose a patient lying prone therein, said cylindrical shell having an opening in one end thereof to enable a patient's head and neck to extend therethrough, a flexible sheet adapted to snugly encircle the patient's neck and cover said opening, and a rigid head ring surrounding said opening and secured to said one end of the cylindrical shell, the edges of said flexible sheet being clamped between said head ring and said one end, the combination with said apparatus of a humidifying device comprising a bracket removably mounted on the top portion of said head ring, a pair of parallel adapter rods slidably mounted in said bracket for vertical adjustment thereof, an accumulator tube secured to the lower ends of said adapter rods to move therewith, a flexible exhaust tube connected to one end of said accumulator tube, a flexible intake tube secured to the other end of said accumulator tube, an atomizer unit connected to said intake tube, and a tracheotomy tube connected to said accumulator tube to communicate with the central portion thereof.

2. A humidifying device as defined in claim 1 wherein said atomizer unit is operative to deliver to said accumulator tube a mist comprising a mixture of oxygen, air and water.

3. In a poliomyelitis respirator comprising a cylindrical chamber adapted to enclose the shoulders and body of a patient, said cylindrical chamber having an opening in one end thereof to enable a patient's head and neck to extend therethrough, a rigid head ring surrounding said opening and removably secured to said one end of the cylindrical shell, a flexible sheet having an aperture therein adapted to encircle a patient's neck in sealing engagement therewith, the edges of said flexible sheet being clamped between said one end of the cylinder and said head ring to seal said opening, the combination with said head ring of a humidifying device comprising a bracket removably mounted on top of said head ring, a pair of parallel, substantially vertical adapter rods slidably mounted in said brackets for vertical adjustment thereof, a U-shaped accumulator tube secured at the central portion thereof to the lower ends of said adapter rods to move therewith, one end of said tube comprising an intake port and the other end comprising an exhaust port, said accumulator tube having a tracheotomy port intermediate the ends thereof, and a vapor delivery tube connected at one end to said intake port, said vapor delivery tube being connected at its other end to an atomizer unit.

4. A humidifying device as defined in claim 3 wherein said atomizer unit comprises a delivery head having a delivery duct leading from the top thereof for connection to said vapor delivery tube, an oxygen tube for conducting oxygen from a source of supply to said delivery head, a water vessel attached to the lower end of said delivery head, a vertical tube in communication with said oxygen tube and extending downwardly into said vessel, and valve means in said delivery duct to permit the introduction therein of air from the surrounding atmosphere.

5. A humidifyng device as defined in claim 3 wherein said parallel adapter rods are of curvilinear configuration with the lower end thereof extending rearwardly through

said head ring to maintain said accumulator tube in a position remote from the patient's face.

6. A device for the treatment of respiratory ailments comprising a fixed bracket, an accumulator tube having an intake port and an exhaust port at opposite ends thereof and a tracheotomy port intermediate the ends thereof, an atomizer unit operative to deliver a mist comprising a mixture of water, air and oxygen, and attaching means for said accumulator tube, said attaching means comprising at least one substantially vertical adapter rod



slidably mounted in said fixed bracket and means to secure said adapter rod in any adjusted vertical position.

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