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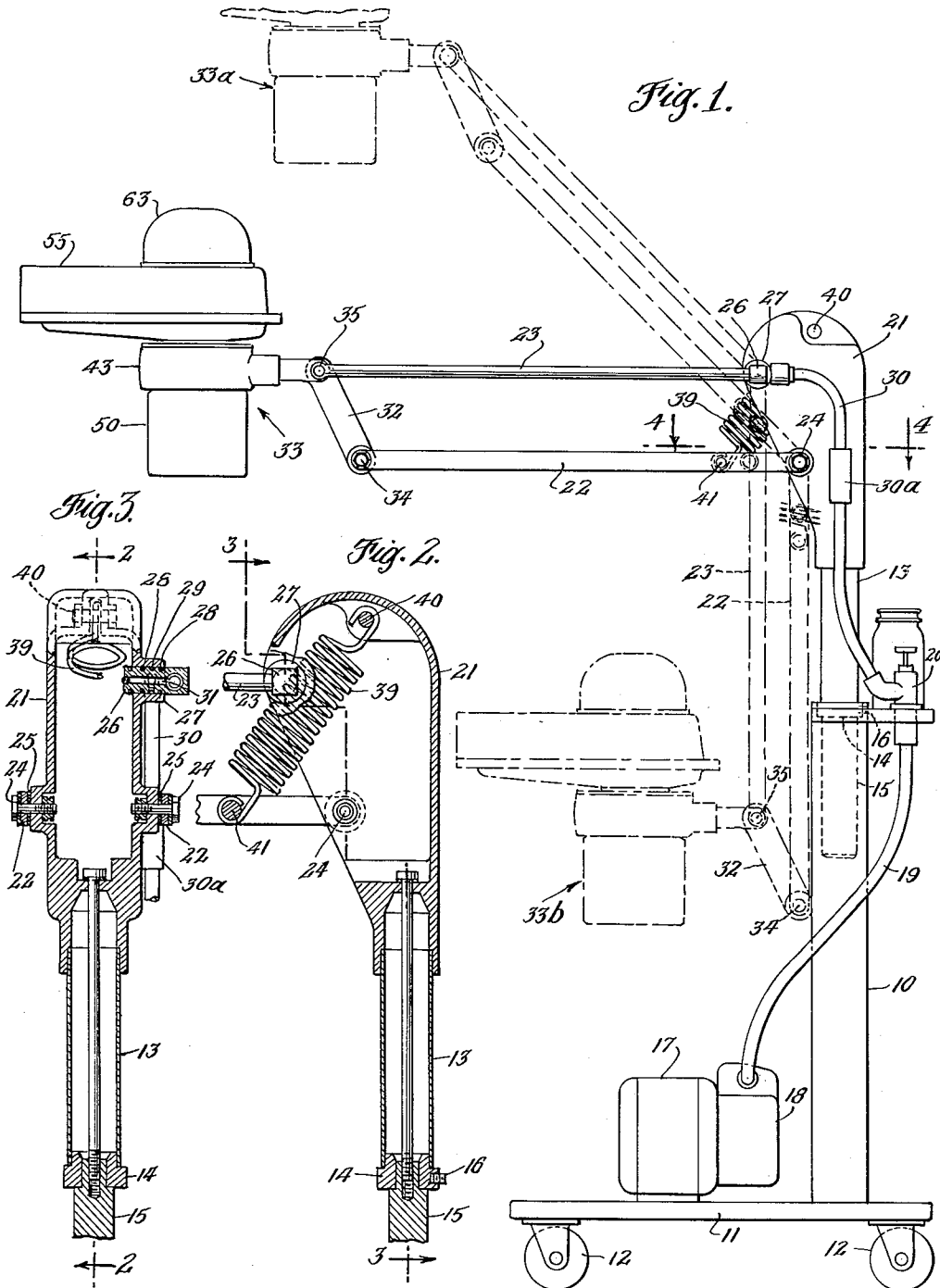
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THERAPEUTIC FOG GENERATOR

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2 Sheets-Sheet 1



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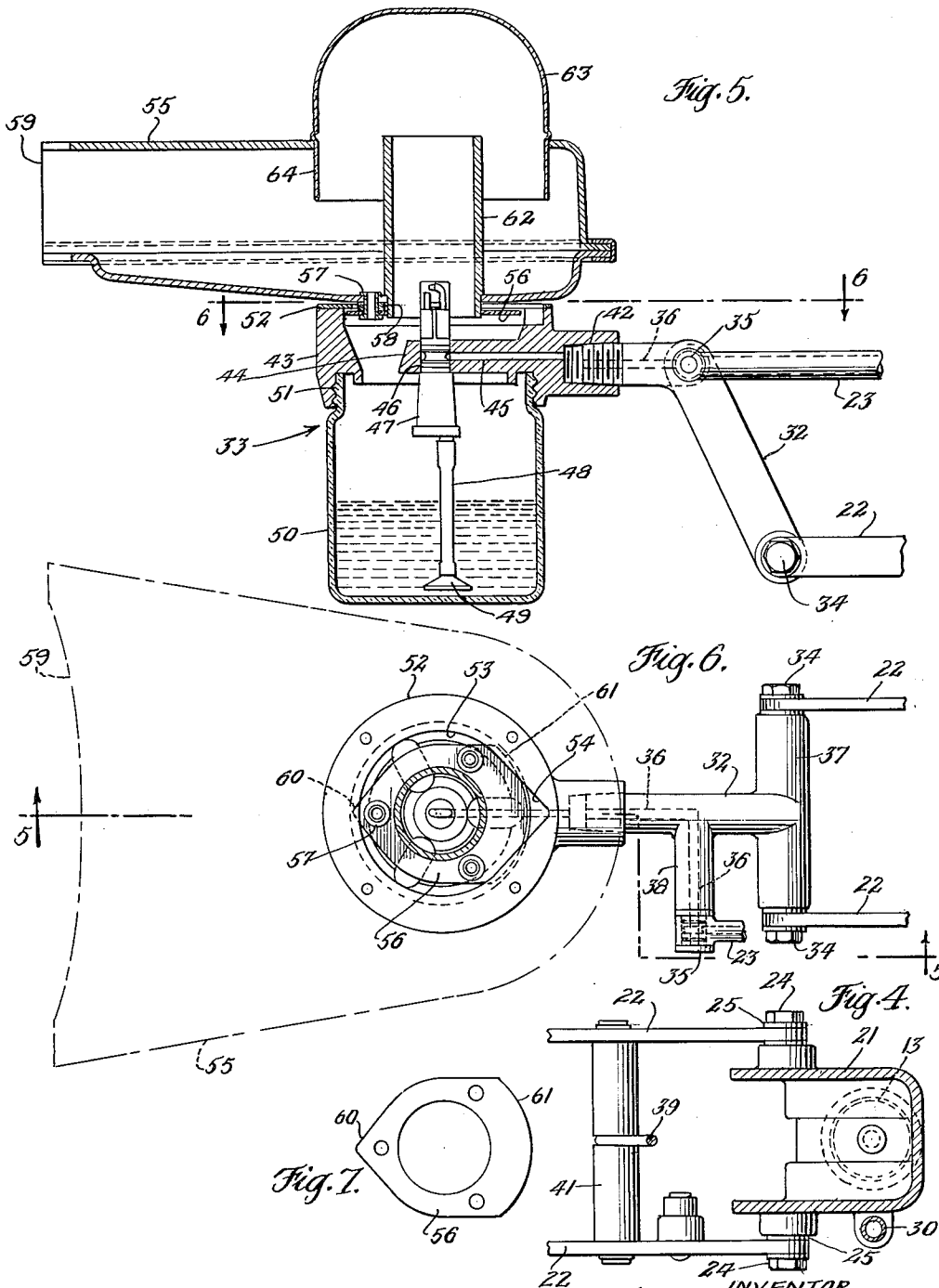
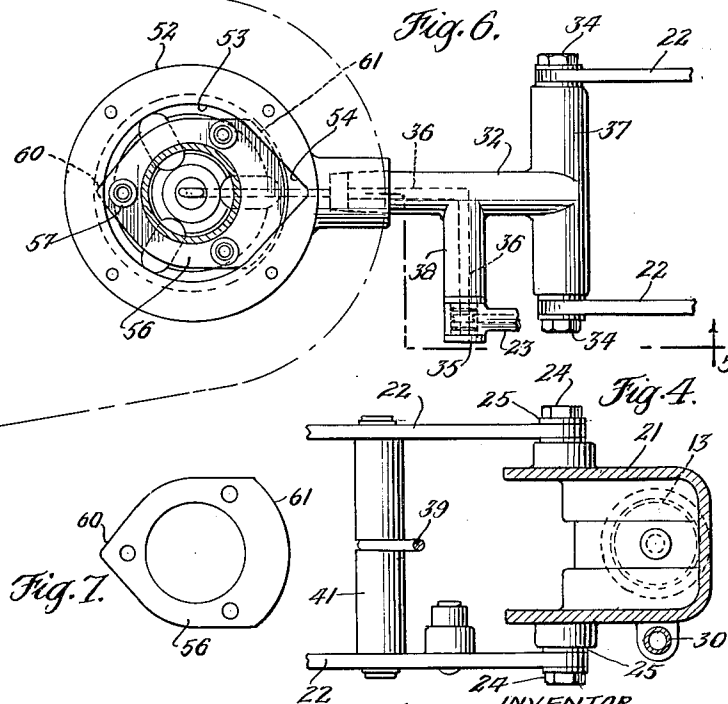
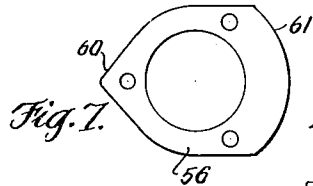
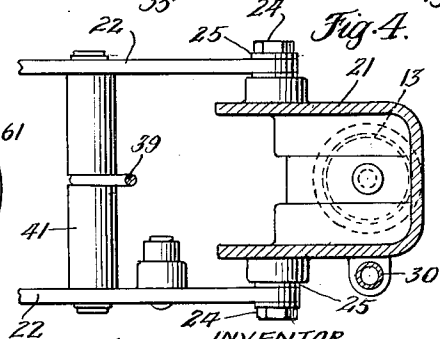
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2 Sheets-Sheet 2



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THERAPEUTIC FOG GENERATOR

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8 Claims. (Cl. 239-278)

This invention relates to humidifier apparatus and is particularly concerned with a fog producing device for therapeutic use in connection with respiratory ailments.

The apparatus of the present invention is used primarily for generating a localized fog to supply moisture super-saturated air for delivery from the apparatus in the region of the patient's face. If desired the air may be enriched with oxygen and the moisture may be supplied with suitable medication such as a therapeutic aerosol.

An important object of the invention is the provision of a mobile unit which may be readily transported to the patient's location and which is easily adjusted to bring the delivery nozzle to an advantageous position with respect to the patient's face.

Another object of the invention is the provision of a compact and efficient fog-generating assembly in a fashion which may be readily dismantled part by part for cleaning purposes.

A further object of the invention is the provision of a supporting structure for the humidifier involving improved parallel linkage supports having a compact spring mechanism to balance the delivery unit.

How the foregoing objects and advantages are obtained will be clearly understood from the following description of the drawings in which—

FIGURE 1 is a side elevation of the complete humidifier unit showing the adjustable supporting structure in several positions of adjustment.

FIGURE 2 is an enlarged sectional view taken through the upper portion of the supporting post, the view being generally in the direction of arrows 2—2, FIGURE 3.

FIGURE 3 is a view, partly in section, of the same portion of the structure, the view being taken in the direction of arrows 3—3, FIGURE 2.

FIGURE 4 is a view, partly in section and to an enlarged scale, taken in the direction of the arrows 4—4, FIGURE 1, showing the attachment of the lower parallel links to the supporting post.

FIGURE 5 is a sectional elevation to an enlarged scale of the fog generating and delivery unit taken along the line 5—5, FIGURE 6.

FIGURE 6 is a plan view partly in section taken along the line 6—6, FIGURE 5, illustrating certain assembly features for the support of the delivery nozzle.

FIGURE 7 is a detail view illustrating the shape of the assembly plate attached to the delivery nozzle.

Referring to FIGURE 1 it will be seen that the equipment incorporates a lower supporting post 10 which is attached to a platform 11 equipped with caster wheels 12. An upper supporting post 13 includes flange 14 and a telescoping portion 15 to hold it in assembled relationship in lower post 10. A small pin 16 projects from the flange 14 and fits in a co-acting slot at the upper end of the lower post portion 10. This pin and slot relationship prevents relative rotation of the two parts 10 and 13 of the post, but permits them to be readily disassembled for shipping or storage purposes. An electric motor 17 and an air pump 18 are supported on platform 11 and when the equipment is in operation air may be delivered to the apparatus through a tube 19 and a control valve 20.

As will be more clearly seen in FIGURES 2 and 3 the upper end of post 13 includes an enlarged hollow housing 21 to which the parallel linkage mechanism is at-

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tached. The parallel linkage includes lower links or rods 22 and an upper tube member 23.

The parallel linkage is attached to the top part or housing 21. The lower rods 22 which are generally flat-shaped are connected to housing 21 by pivots in the form of bolts 24. A resilient friction washer 25 is placed between the end of each rod 22 and the hollow housing 21 to provide restraint which assists in holding the parallel linkage mechanism in any position to which it may be moved. The upper parallel link tube 23 is attached to hollow housing 21 by a cylindrical pivot member 26. From FIGURE 3 it will be seen that pivot member 26 is supported in a housing boss 27 and incorporates a pair of sealing rings 28 with a groove 29 between the rings 28. The gas for operation of the device is delivered to tube 23 from a delivery tube 30 by means of groove 29 which connects to a cylindrical channel 31 leading to tube member 23. In this manner a rotating joint is provided for the delivery of gas through tube 23 while permitting the parallel linkage to be moved for adjustment purposes. A quick disconnect fitting 30a is provided in tube 30 to allow rapid disassembly of the upper structure including post 13 from the lower supporting tube 10. Fitting 30a may also serve to connect to an oxygen supply when desired.

It will be noted that upper pivot member 26 and lower pivots 24 are not in line vertically, upper pivot 26 being offset to provide an angular relationship about 30° displaced from the vertical. The parallel link rods 22 and tube 23, are equal in length and the outer ends of the links are connected to a bracket part 32, see FIGURES 1 and 5. Attached to bracket part 32 is the humidifier assembly 33. It will be noted that bracket 32 lies at an angle to the vertical and provides attachment for pivots 34 connecting rods 22 to the bracket 32 and pivot 35 connecting tube member 23 to the bracket 32. The pivotal connection at 35 may include sealing rings somewhat similar to that shown for the pivot member 26 thereby allowing the gas transmitted through tube member 23 to pass through a channel 35 in bracket 32, channel 36 extending into the humidifier unit 33.

It will be noted that the bracket 32 incorporates a transverse cylindrical portion 37 at the lower end, see FIGURE 6, to provide the proper spacing for the twin link rods 22. Another lateral tubular extension 38 at the upper end of bracket 32 provides for the mounting of the end of upper tube member 23 in an off center position generally above one of the rods 22. With this arrangement of parts it will be seen from FIGURES 2, 3 and 4 that the hollow housing 21 is unobstructed so that a spring 39 can be centrally located with its upper end connected to a bolt 40 located generally above pivot member 24. The lower end of spring 39 is connected to a cross beam 41 supported between the two lower rods 22. Cross beam 41 is located outwardly a short distance from pivot 24 so that the tension in spring member 39 in large part supports the weight of unit 33 at the outer end of the parallel linkage. Thus spring 39 is supported in a position where the maximum moment about pivot 24 is developed by the spring when the parallel linkage is in approximately horizontal position. When the linkage swings above this point the effective arm increases slightly but the effective spring force decreases so that the moment from the spring actually decreases as the apparatus is raised. Since the unit 33 is swinging in toward the post the moment required for balancing its weight is less than when the rods are horizontal. Likewise as the parallel linkage is swung downwardly into its lower position the moment required reduces. While the spring force is increasing during this portion of the movement the effective arm of the spring is reducing so that the balancing moment reduces approximately in propor-

tion with the reduction in moment due to the weight of unit 33.

Thus when the unit is moved to the lower position illustrated at 33b in FIGURE 1, the axis of spring 39 will be approximately through the axis of pivot 24 and therefore no spring moment will be developed in this position. As a matter of fact the axis is slightly to the right of pivot 24 so that the spring develops a slight retention moment to hold the linkage in its retracted position when moved thereto. The washers 25 introduce sufficient friction moment so that the apparatus will remain in any adjusted position in which it is placed by the attendant, the range of adjustment extending from upper position 33a to lower position 33b.

The humidifier unit 33 is attached to bracket 32, by suitable means such as thread 42 which engages annular body part 43. A central support 44 is attached to body part 43 with channel 45 connecting thereto from channel 36. Supported in the aperture 46 in support 44 is an atomizer unit 47. This atomizer 47 has a depending hose 48 with intake strainer 49 at the lower end. The atomizer 47 is equipped with suitable ring seals to permit push-in mounting in the aperture 46 with a channel connecting to channel 45 to provide delivery of gas to the atomizer. The construction of the atomizer forms no part of the present invention per se but is described in detail in my copending application 472,329, filed December 1, 1954, and issued March 17, 1959, as Patent 2,878,067.

Transparent jar 50 is suitably attached as by threads 51 to body part 43 and serves as the container for water or other liquid used to feed atomizer 47. The strainer 49 preferably extends to a point close to the bottom of jar 50.

Attached in permanent fashion to the upper side of body part 43 is a plate 52 which incorporates an opening 53 which is generally circular except for a pointed extension 54 located at the side of the body next to the bracket 32. This plate 52 serves to retain the delivery nozzle unit 55 which is supplied with a co-operating engaging plate 56 attached to nozzle unit 55 by means of hollow grommets 57 and spacers 58. The shape of engaging plate 56 is clearly shown in FIGURE 6 as well as separately in FIGURE 7. Assembly of the nozzle unit 55 on body 43 is readily accomplished by setting the unit in position with the open end 59 of the nozzle reversed from the position shown in FIGURES 5 and 6. In this position the pointed part 60 of plate 56 is in line with pointed extension 54 of opening 53. Plate 56 can then be passed through the opening and by a slight amount of rotation it is then retained under plate 52. The nozzle unit 55 may then be rotated to any position and be suitably retained except in the reversed position mentioned. It will be noted in FIGURE 6 that the arc portion 61 of plate 56, as well as pointed part 60, engage plate 52 to prevent inadvertent separation of nozzle unit 55 from body 43.

A cylindrical standpipe member 62 is supported on the lower surface of nozzle unit 55 with the upper end of atomizer 47 extending into the cylindrical member. Supported on the upper surface of nozzle unit 55 is the domed member 63 with the skirt 64 extending down into nozzle unit 55 to a point below the upper end of cylindrical member 62.

With this apparatus air or gas may be fed to the atomizer through rod 23 and channel 36 where it picks up and atomizes water from the container 50. The mist generated is guided upwardly through cylindrical member 62 and directed against the domed member 63. Droplets impinging on the sides of members 62 or 63 condense and mingle to form drops which drip from the walls of the members. The drops from cylindrical member 62 run directly back into container 50 while the moisture from domed member 63 collects in the bottom of nozzle unit 55 and drips back to container 50 through

grommets 57. The mist circulates back down from domed member 63 and along nozzle unit 55 to the outlet end 59 where it is delivered as a cloud suitable for breathing as the larger particles of moisture have been removed.

Because of the spacers 58 and the shape of plate 61 air may enter from the room around the bottom part of nozzle unit 55 into the interior of body part 43. The flow of air and mist from the atomizer 47 upwardly through the standpipe cylinder 62 creates a venturi action which draws in air from the room to mix with the air and fog, thus producing a greater flow from the nozzle. In addition the combination of adiabatic expansion of air from the atomizer and vaporization which occurs in the delivery channel causes a distinct cooling effect. As a result the fog delivered from the nozzle may be as much as 10° F. cooler than the room air. This cool fog has a pleasant and soothing effect when it envelops the face and is breathed by the patient.

The construction of the present humidifier apparatus represents improvements in supporting structure and mist generating equipment over the apparatus disclosed in my co-pending application U.S. Serial No. 462,687, filed October 18, 1954, now Patent No. 2,928,664.

Adjustment of the apparatus for elevation is easily accomplished by means of the parallel linkage. The construction permits easy accommodation of the delivery end of the nozzle to the region of a patient's face whether in bed or in a chair. The wheeled stand allows the unit to be moved to the desired position readily and the rotational adjustment of the nozzle unit adds to the ease of accurate positioning. The spring balancing mechanism assures ease of adjustment without bulky extensions or counterweight.

The arrangement of the delivery unit with the various parts readily separable from the supporting body provides an improved assembly which may be quickly taken apart for inspection or cleaning. The container may be easily removed for filling and the atomizer unit may be readily dismounted for cleaning or replacement when the container has been removed. The complete nozzle unit may be quickly lifted off by simply rotating to its reverse position and the domed member may be removed for easy cleaning. With these members removed good access to the inside of the nozzle unit is available through the opening for the dome part.

The arrangement of parts is particularly advantageous in providing a circuitous path for the mixture of gas and vapor coming from the atomizer to provide a satisfactory therapeutic mist at the outlet. Since no heat is used in the generation of the mist there is no condensation of the moisture at the outlet which might cause undesirable wetness upon delivery. The venturi action and expansion developed by this apparatus assures delivery of a refreshing fog in adequate volume.

I claim:

1. A humidifier having a delivery unit including a body, an atomizer device supported vertically in said body, a liquid container attached underneath said body, a horizontally extending mist delivery channel structure supported above said body, a vertical standpipe member having its upper and lower ends open, said standpipe member being mounted in said channel structure and extending approximately the height of said structure, said atomizer device having its upper end located near the lower end of said standpipe member, a dome shaped member having a diameter greater than said standpipe member and supported on said structure generally above said standpipe member, said dome shaped member having its lower end opening into said channel structure and spaced annularly from said standpipe.

2. A construction according to claim 1 in which said dome-shaped member has a skirt portion extending downwardly into said channel structure below the upper end of said standpipe member.

3. A construction according to claim 1 in which said

body incorporates a mounting connection having a retaining plate attached to the top of said body, said plate having a generally circular opening with a cut-out at one position, a plate member attached to said channel structure, said plate member having a projecting portion and being proportioned to extend underneath the edge of said retaining plate and engage it at all positions except where said projecting portion is aligned with said cut-out in said opening, at which position the plate member may be shifted to pass through said opening, thereby providing for rotation for operative adjustment of said delivery channel structure to all positions except the removal position.

4. A construction according to claim 1 in which said container is removable downwardly from said body, said body having a central cylindrical opening, said atomizer device having a body portion with a diameter to fit said opening and being insertable therein from the underside when said container is removed.

5. Therapeutic humidifying apparatus including a delivery unit having a body, a container, an atomizer and a delivery structure mounted on said body, attachment means on said body, adjustable supporting structure including a vertical post having an enlarged hollow upper portion, parallel rods each having a pivot at one end connecting it to the upper portion of said post, the centers of the pivots being on a line in angular relationship to the vertical, a bracket member attached to said body, the other end of said rods having pivots connecting to said bracket member, the centers of said bracket pivots lying on a line parallel to the line of the center of the post pivots, a spring attached to one of said rods and to the inside of said hollow portion of the post to provide a force tending to balance the weight of said delivery unit and a frictional device reactive at one end of said rod pivots, said frictional device having a capacity greater than the unbalance between said delivery unit and said spring.

6. A construction in accordance with claim 5 in which said post has an upper and lower part in telescopic relationship, the lower part being mounted on a movable

platform and the upper part having a telescoping portion with an enlarged diameter section above the telescoping portion, a projection from one of said parts, a notch located in the other of said parts to engage said projection to provide a fixed position relationship for the two post parts when in assembled position.

7. A construction in accordance with claim 5 in which there are two laterally spaced bottom rods and one upper rod, a bar extending between said two bottom rods, said spring being attached to said bar at its lower end and to said post at its upper end at a point approximately vertically above the center of the pivot connecting the bottom rods to said post.

8. A therapeutic humidifier having a delivery unit including a horizontal nozzle, a cylindrical standpipe having its top and bottom open and being mounted vertically in said nozzle, an atomizer supported in position at the lower end of said standpipe, a body on which said nozzle and said atomizer are supported, connecting means for attaching said nozzle to said body including an element shaped to provide space between portions of said connecting means and said body to allow entry of air from outside the nozzle to the bottom of said standpipe.

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