

Oct. 24, 1967

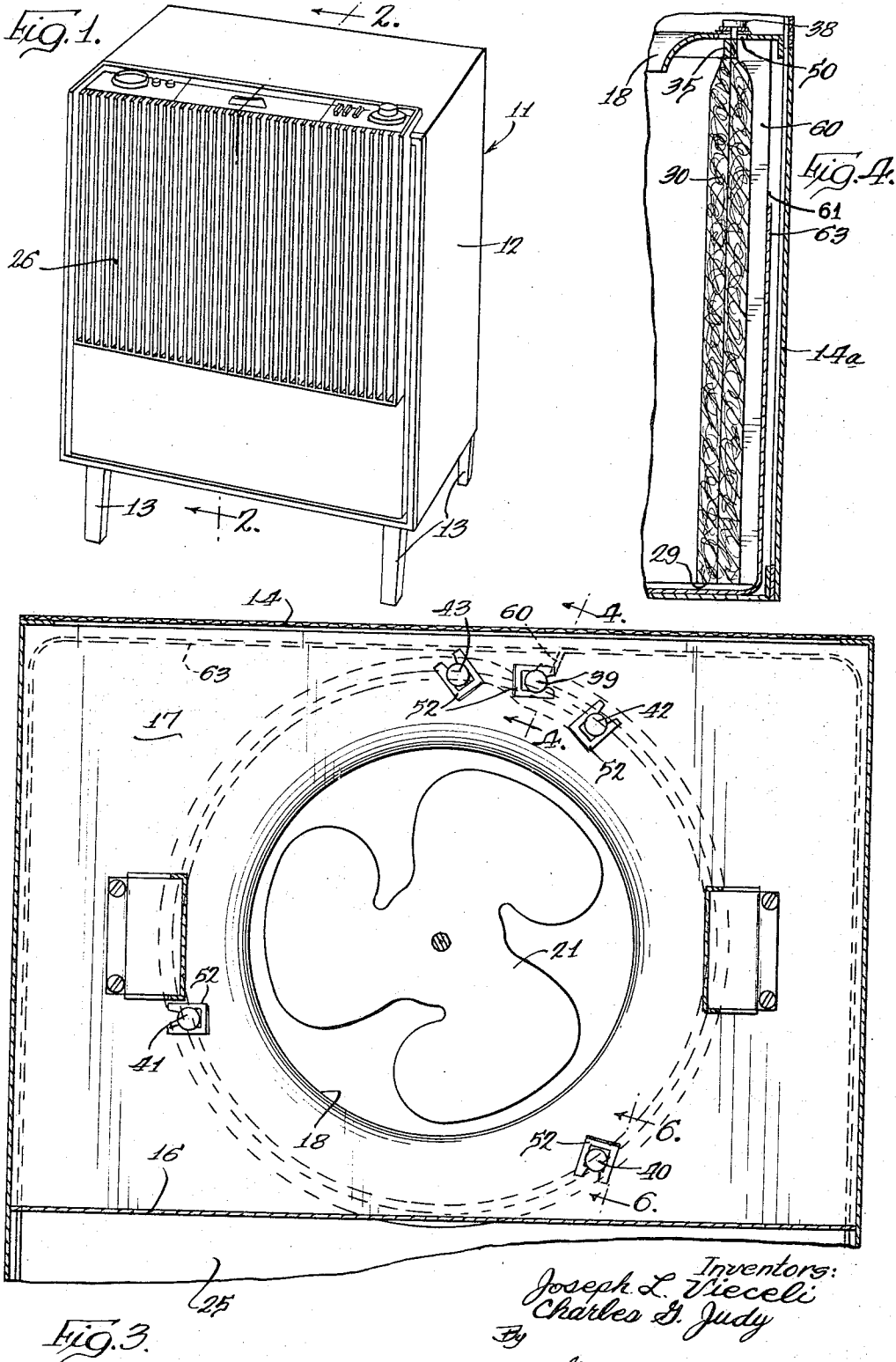
J. L. VIECELI ETAL

3,348,822

HUMIDIFYING DEVICE

Filed May 28, 1965

3 Sheets-Sheet 1



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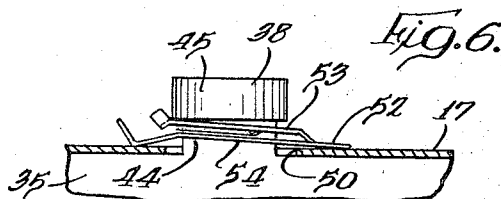
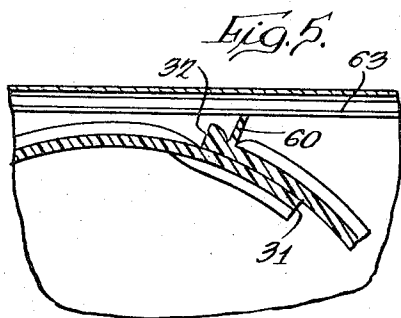
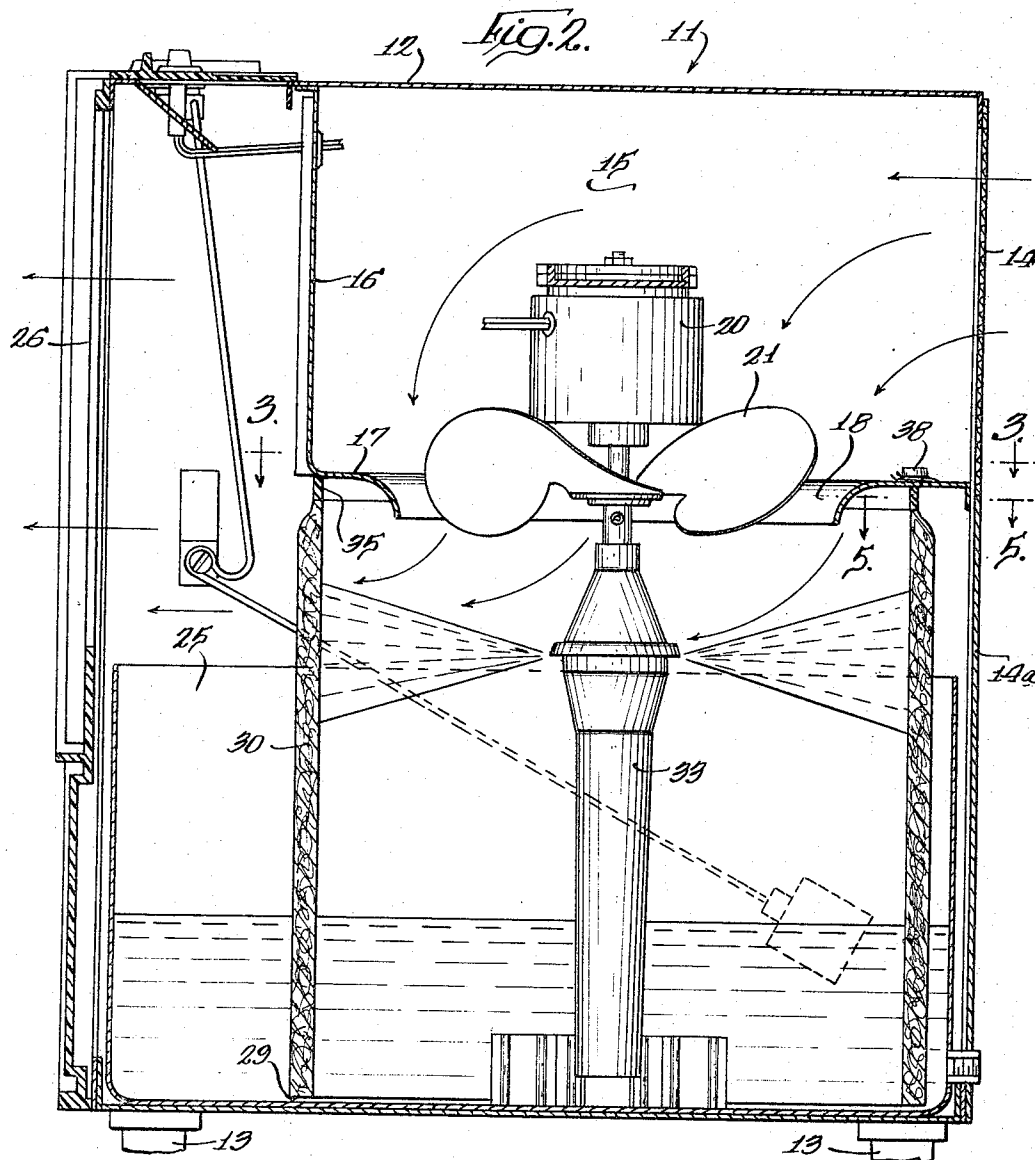
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Fig. 7.

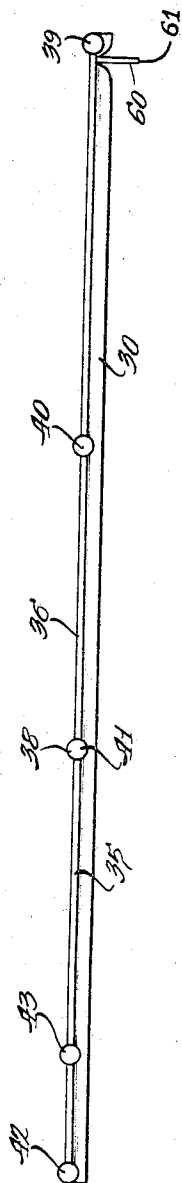


Fig. 8.

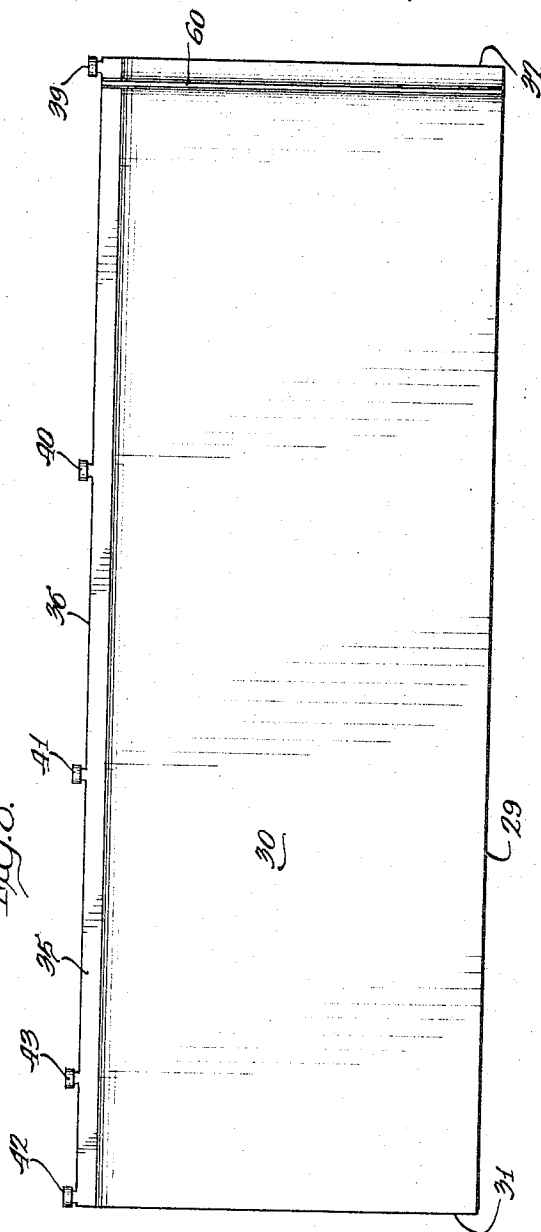


Fig. 9.



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HUMIDIFYING DEVICE

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13 Claims. (Cl. 261—34)

ABSTRACT OF THE DISCLOSURE

A pliant porous skirt for a humidifying device wherein the skirt has a strengthening element molded to its upper edge and has a closing rib molded to another edge normal to the upper edge for holding the skirt in a cylindrical configuration. The strengthening element is molded with integral fastening means for attaching the skirt to the humidifying device.

This invention relates generally to home humidifiers and more particularly, to improvements in humidifying elements and their mounting within humidifiers. This humidifying element and mounting is especially advantageous in the humidifier disclosed and claimed in the copending application Ser. No. 380,573, filed July 6, 1964, now Patent No. 3,304,066, and assigned to the same assignee as the instant application.

In home humidifiers of the type employing a porous or capillary sheet by means of which water is evaporated or otherwise introduced into the air, it is necessary that mineral deposits on the sheet be held to a minimum so that the rate at which water is transferred to the air is not limited by the lack of porosity in the sheet. In certain geographical areas, the available water supply contains relatively large amounts of mineral deposits and is commonly referred to as hard water. Through continued use, even the most desirable humidifier design has a problem of the minute pores in the sheet becoming clogged by mineral deposits which consequently reduce the effectiveness of the humidifier. Obviously this problem is more severe in areas having hard water. Under these circumstances, it is desirable that the humidifying element be readily and quickly removable from the humidifier by the user. Furthermore, it is highly desirable that the humidifying element be constructed as inexpensively as possible in order to reduce the replacement cost.

Accordingly, an object of the present invention is to provide a humidifying element which is easily installed and removed from a humidifier.

Another object of the present invention is to provide a humidifying element which is inexpensive to manufacture.

A further object of the invention is to provide a pliant humidifying element which retains its proper functional shape when subjected to operating pressure.

A still further object of the invention is to provide a humidifier having a pliant humidifying element which is securely retained in the operating position and is easily removable.

An additional object of the invention is to provide a pliant humidifying element which may be stored in the flat state requiring a minimum amount of space and assume a cylindrical shape when installed within a humidifier.

Further objects and advantages of the present invention will become apparent as the following description proceeds and the features of the novelty which characterize the invention will be pointed out with particularity in the claims annexed to and forming a part of the specification.

For a better understanding of the present invention reference may be had to the accompanying drawings in which:

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FIG. 1 is a front perspective view of a home humidifier employing the humidifying element of the instant invention;

FIG. 2 is an enlarged fragmentary sectional view taken substantially along line 2—2 of FIG. 1;

FIG. 3 is an enlarged fragmentary sectional view taken substantially along line 3—3 of FIG. 2;

FIG. 4 is a fragmentary sectional view taken substantially along line 4—4 of FIG. 3;

FIG. 5 is a fragmentary sectional view taken substantially along line 5—5 of FIG. 2;

FIG. 6 is an enlarged fragmentary sectional view taken substantially along line 6—6 of FIG. 3; and

FIGS. 7, 8 and 9 are top plan, front side elevational and right side elevational views of the humidifying element when in the flat or storage state.

Briefly the present invention utilizes a pliant humidifying element having an integrally molded strengthening element along its upper edge with fastening means spaced along the strengthening element. The fastening means secures the humidifying element within a humidifier and holds it in a cylindrical shape with the ends thereof in overlapping relationship. To assist in holding the humidifying element overlapped section closed, a rib is associated therewith and is positioned to cooperate with a humidifier water reservoir.

Referring now to the drawings in which like numerals designate like parts throughout the several views, the humidifier is generally designated by the reference numeral 11. The details of construction for a similar humidifier are set forth in the copending application, Ser. No. 380,573, filed July 6, 1964. The humidifier 11 has a rectangularly shaped housing 12 which is supported by a plurality of feet 13. In operation relatively dry air enters, as indicated in FIG. 2, through air inlet openings 14a defined in an easily removable rear wall 14 of the housing 12 and enters into a motor chamber 15 which is defined by portions of the housing 12, internal vertical wall 16 and a horizontally disposed wall 17. In order to properly channel the flow of air, the walls 16 and 17 extend to both sides of the housing and wall 17 has a large circular throat 18 defined therein. For the purpose of inducing air into the motor chamber 15, an electric motor 20 drives fan blade 21 which is coaxial with throat 18 and disposed therein.

For storing water within the humidifier 11, there is provided an upwardly opening or cup shaped water reservoir 25 which rests on the bottom of the housing 12 and is disposed beneath the horizontal wall throat 18. After the air is forced from the motor chamber 15 through throat 18, it egresses from the interior of the humidifier through an outlet grill 26 which is located at the front of the humidifier housing 12. In order to have the water contained in the reservoir efficiently enter into the air stream passing through the humidifier, a humidifying element 30 depends from the horizontal wall 17 and is substantially coaxial with and spaced outwardly from the throat 18. As seen in FIG. 2, the humidifying element or skirt 30 depends into the reservoir 25 constituting an obstruction to the normal flow of air. However, the skirt 30 is fabricated from porous or plastic foam material and allows the air to pass therethrough with a minimum of pressure build-up within the area defined by the skirt. To permit the transfer of the water contained within the reservoir 25 to the humidifying element 30, there is provided a centrifugal pump 33 which both lifts the water from the reservoir and propels it outwardly on to the humidifying element 30. The pump 33 is secured to the motor 20 and is coaxial with throat 18 and fan blade 21. With this arrangement, a single motor operates the fan forcing the air through the humidifier and humidifying element and also powers the pump 33 which lifts water

from the reservoir and throws it onto the humidifying element 30, as indicated in FIG. 2.

The skirt 30 is fabricated from foam material having pores which are sufficiently large to permit air easily to pass therethrough while at the same time being sufficiently small to prevent the water thrown by pump 33 from passing unimpeded therethrough. In the preferred embodiment, skirt 30 is fabricated from a rectangular sheet of plastic foam material which has ends 31 and 32, bottom edge 29 and upper edge, and is $\frac{1}{2}$ " thick having twenty five pores per inch. This material is found to be very pliant and consequently has little rigidity. Preferably, the outer surface of the skirt 30 is flocked to assist in preventing fluids from passing through the skirt and to improve the wetting of the outer surface. Thus, as relatively dry air is forced through the moistened skirt material, a considerable amount of water vapor is added to the air.

After prolonged use, the pores in the skirt 30 become clogged with minerals contained in the water which is sprayed thereon. The tendency for the skirt to clog depends to a great extent upon the hardness of the water used with the humidifier. Thus, for proper maintenance the skirt 30 is removably attached to horizontal wall 17. For the purpose of securing the skirt 30 to the wall 17 and forming a relatively air tight air seal therebetween, there is provided an integrally molded strengthening element 35 which extends along the entire upper edge of the skirt 30 and is molded to the skirt material as may be easily seen in FIGS. 7 through 9. In a preferred form, the strengthening element 35 has a rectangular cross section which is approximately $\frac{3}{16}$ " thick, $\frac{1}{2}$ " high and molded of polypropylene. The major axis of the element cross section lies in the plane of the skirt. Inasmuch as the horizontal wall 17 is relatively flat in the area where the strengthening rib is secured thereto, the upper or outer edge 36 of the strengthening element is coplanar in order to form a seal therewith. The skirt 30 is rectangular in the unassembled state as shown in FIG. 8 and is approximately $10\frac{1}{2}$ " high and 37" long. Thus, the skirt 30 is flat prior to insertion in the humidifier housing 12 and consequently, may be stored in the minimum of space.

For the purpose of securing the skirt 30 to the underside of wall 17, there are provided a plurality of upwardly projecting mushroom shaped heads 38 integrally molded along the upper edge of strengthening element 35. As best seen in FIG. 8, a first head 39 is positioned adjacent skirt end 32 and second and third heads 40 and 41, respectively, are spaced along strengthening element 35. Fourth head 42 is positioned adjacent the skirt end 31 and fifth head 43 is positioned a relatively short distance from head 42. Each of the heads has the same basic configuration with a neck portion 44 extending upwardly from strengthening element 35 and being of the same width as the strengthening element with an enlarged portion 45 which has a cylindrical shape. The diameter of the enlarged portion 45 is greater than the length of the neck portion 44 and is approximately $\frac{1}{2}$ " giving it an overall mushroom configuration. In the embodiment illustrated in FIGS. 7 through 9, the spacings between heads 39, 40, 41, 43 and 42 are $12\frac{3}{32}$ ", $10\frac{1}{16}$ ", $10\frac{1}{16}$ " and $3\frac{3}{4}$ " respectively. For receiving heads 38, the horizontal wall 17 is formed with an equal number of openings 50 which are disposed to hold the rectangular skirt 30 in a cylindrical shape. The openings 50 have a diameter slightly in excess of the diameter of the enlarged portion 45 in order to let the enlarged portion to pass upwardly therethrough. Thus, when it is necessary to install a skirt 30 which in its natural state is flat, it is bent in a circular form so that the enlarged head portions 45 extend upwardly through openings 50 in the wall 17. Once the locking heads 38 are inserted through openings 50, spring fasteners 52 lock the heads to the wall 17. The spring fasteners 52 are standard commercially available items

and are sometimes referred to as speed clips. Basically, the fasteners 52 are fabricated from spring steel and have a generally V-shaped construction including legs 53 and 54. Therefore, when a head 38 is inserted through opening 50, fastener 52 may be quickly inserted between the enlarged head portion 45 and the upper surface of wall 17 adjacent the opening 50. It should be appreciated that as the fastener 52 is positioned between the wall 17 and the enlarged portion 45, its legs 53 and 54 are biased together which results in an upwardly directed force being exerted on the bottom surface of enlarged head portion 45. In this manner, fasteners 52 tend to force all of the heads 38 upwardly and consequently, bias the upper coplanar edge 36 of strengthening element 35 against the bottom surface of wall 17 thereby establishing a relatively air tight seal between skirt 30 and wall 17 so that air forced within the skirt 30 by the rotation of fan blade 21 must pass through the skirt 30 and is not permitted to pass over the upper edge 36. Heads 40 and 41 and corresponding openings 50 are positioned as shown in FIG. 3 so that the strengthening element 35 when assembled to the humidifier conforms to a nearly perfect circle. Thus, with the use of strengthening element 35 and heads 38, a relatively pliant skirt 30 assumes a uniform cylindrical shape which is desirable for the successful operation of the humidifier 11.

As best seen in FIGS. 3 and 5, the skirt 30 when assembled to wall 17 has ends 31 and 32 in overlapping relationship due to the positioning of heads 39 and 42. With this construction, the skirt 30 has a continuous cylindrical surface although it is formed from a rectangular sheet. To insure against the escape of air from within the cylindrical skirt 30 between the overlap section of strengthening element 35, the openings 50 for heads 39, 42 and 43 are positioned so that head 39 is positioned between heads 42 and 43 and is positioned sufficiently inwardly or toward the throat 18 to insure an interference fit between the strengthening element adjacent head 39 and the portion of the strengthening element between heads 42 and 43. Another advantage with positioning the opening 50 for head 39 so that there will be an interference fit in the overlap section is that the strengthening element 35 assumes a near perfect circular configuration in the area adjacent these heads.

In operation, the fan blade 21 generates a positive pressure in the volume encircled by the skirt 30 which produces a force which tends to open the overlap section of the skirt. This problem is magnified as the water level drops within the reservoir 25 since the tendency to open the skirt in the overlap section is the greatest at the bottom of the skirt and the force on the skirt increases as more of the skirt area is exposed to the air pressure. To insure that the overlap section of the skirt 30 remains closed, there is provided a closing rib 60 which is molded to the skirt 30 and integrally molded with strengthening element 35. The vertically extending closing rib 60 is positioned adjacent and parallel to the entire end 32 and extends outwardly from the flocked side of the skirt. Preferably, the distance between the end 32 and the rib 60 is approximately $\frac{1}{2}$ " and the thickness of the rib is approximately $\frac{3}{16}$ " as is best shown in FIG. 5. The integral relationship between the humidifying element 30, strengthening element 35 and closing rib 60 insures structural strength of the unit as well as controlled assembled shape. The rib 60 is normally disposed to the skirt 30 and extends outwardly approximately $1\frac{1}{8}$ ". For effecting a good seal in the overlapped section, the head 39 is positioned between skirt 32 and rib 60. When the skirt is in its cylindrical assembled state, the rib 60 extends radially therefrom. As may be best seen in FIGS. 3 and 5, the overlap section of the skirt is so formed that end 32 is on the outside which also positions closing rib 60 on the outside. For maintaining the overlap section of the skirt 30 closed, the rib 60 abuts against a wall 63 of the reservoir 25 along the outside edge 61 thereof as may be seen in FIGS. 3 and

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4. Thus, as the pressure within the skirt 30 increases during operation, the rib 60 prevents the overlapping skirt section from opening since it retains the skirt adjacent end 32 against the skirt adjacent end 31 by being located between the reservoir wall 63 and the skirt adjacent end 31. Preferably, the skirt 30 is orientated with respect to the rectangularly shaped reservoir so that the rib 60 abuts against one of the longer sides of the reservoir and so that it is positioned closer to said wall in order that the rib does not have to extend a great distance from the cylindrical skirt. Inasmuch as the skirt is closest to the reservoir wall at the overlapped section, the rib 60 affords this section additional rigidity to prevent it from overhanging the wall when the pressure within the skirt increases which might allow water to drip outside of the reservoir.

When it becomes necessary to remove the skirt for cleaning or replacement, it is merely necessary to remove the back wall of the housing 12 exposing the skirt 30 and upper surface of wall 17. Once the rear cover has been removed, the fasteners 52 may be quickly disengaged from heads 38 leaving the skirt free to be withdrawn from the humidifier housing 12. Conversely, a new replacement skirt or a skirt which has been cleaned may be easily installed into the humidifier by placing it through the rear housing, inserting the heads 38 through the appropriate openings 50 and locking each head with a fastener 52. A good working seal will be maintained between the skirt 30 and the lower surface of wall 17 by the strengthening element 30 which is forced upwardly by the spring action of fasteners 52 upon the enlarged portion of heads 38. In addition, the overlapping section of the skirt will be maintained in a closed position even when subjected to operating pressure due to the closing rib 60 being positioned between the reservoir wall 63 and the outside end of the skirt in the overlapping section.

While there have been shown and described a particular embodiment of the present invention, it will be apparent to those skilled in the art that various modifications may be made without departing from the invention in its broader aspects, and it is, therefore, aimed in the pending claims to cover all such changes and modifications as followed in the true spirit and scope of the present invention.

What is claimed as new and desired to be secured by Letters Patent of the United States is:

1. A replaceable humidifying element for a humidifier comprising a pliant porous skirt having an upper edge and a side edge substantially normal to said upper edge, an elongated strengthening element being molded to said skirt upper edge so that said skirt in its assembled state within the humidifier hangs downwardly therefrom and is solely supported thereby, said strengthening element formed with integral upwardly extending fastening means, closing means being secured to said skirt near said side edge and extending therealong for maintaining said skirt in cylindrical shape within the humidifier.

2. The humidifying element of claim 1 wherein said fastening means includes integrally molded heads positioned near each end of said strengthening element and at least two spaced molded heads positioned therebetween.

3. The humidifying element of claim 2 wherein said heads have a mushroom shape.

4. The humidifying element of claim 1 wherein said closing means comprising a rib molded to said skirt side edge and projects normal to said skirt, and said rib extends a substantial length of said skirt side edge.

5. A replaceable humidifying element for a humidifier comprising a pliant porous skirt; a strengthening element molded along one skirt edge and having outwardly projecting fastening means thereon; a closing rib molded to said skirt near a second skirt edge which is normal to said one skirt edge; said rib projecting normal to said skirt and extending a substantial distance along said second skirt edge.

6. The replaceable humidifying element of claim 5

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wherein said strengthening element and rib are integrally molded in an L-shape, said skirt being rectangular with said strengthening element along the long edge thereof.

7. The replaceable humidifying element of claim 6 wherein said fastening means is formed with said strengthening element, a portion of said fastening means disposed near one end of said strengthening element, said portion of said fastening means positioned closer to said second skirt edge than said rib.

8. A replaceable humidifying element for a humidifier comprising a pliant porous rectangular skirt being relatively thin and having one side flocked, a strengthening lip having a substantially rectangular cross section molded to one longer edge of said skirt with the axis of the longer sides of said rectangular cross section lying in the same plane as said skirt, said lip being provided with a relatively straight outer surface which is on the side opposite from said skirt, a closing rib integrally molded to said skirt and lip and extending parallel to and spaced inwardly from one short edge of said skirt, said rib projecting from the flocked side of said skirt and lying in a plane normal to skirt, fastening means integrally molded with said lip and projecting from said straight outer surface away from said skirt, said means including mushroom shaped heads positioned near each end of said lip and at least two spaced places therebetween.

9. In a humidifier having a cup shaped water reservoir, horizontal wall disposed over the reservoir and defining locking openings therein, pump means for lifting water from the reservoir and propelling it outwardly below the wall, the improvement comprising a humidifying element extending from the wall into the reservoir including a pliant porous rectangular skirt, a strengthening element molded along the upper edge of said skirt and adapted for cooperating with the bottom surface of the horizontal wall to form a relatively air-tight seal, fastening means projecting from said strengthening element and positioned to pass through the openings in the horizontal wall to lock said skirt thereto, said fastening means positioned so that said skirt forms a cylindrical shape with the ends thereof in overlapping relationship, a closing rib molded to said skirt and projecting away therefrom, said rib positioned on the overlapped section of said skirt and shaped to abut against the reservoir whereby the humidifying element assumes a cylindrical shape with the upper edge against the horizontal wall and the side of the cylindrical element held closed.

10. In a humidifier comprising a housing, an upright cup-shaped water reservoir disposed within said housing, a horizontal wall associated with said housing and positioned above said reservoir, a pliant porous rectangular skirt provided with a strengthening element molded along the upper edge thereof, said strengthening element having at least five upwardly projecting locking heads with a first head near one end of said element, second and third heads spaced along said element, a fourth head near the other end of said element and a fifth head spaced relatively close to said fourth head, said skirt formed into a cylindrical shape with the ends slightly overlapping, said wall defining at least five openings arranged to receive said heads for holding said skirt in a cylindrical shape and for attaching said skirt to the underside of said wall so that said skirt depends into said reservoir, fasteners securing said heads to said wall, said wall openings disposed so that said first head is between said fourth and fifth heads causing the skirt ends to be closed in overlapping relationship.

11. The humidifier of claim 10 wherein said water reservoir is rectangularly shaped with a pair of spaced long and short sides, a rib molded to said skirt near the end adjacent said first head and extending outwardly from said skirt, said rib abutting against one of said reservoir long sides whereby holding the overlapping skirt ends closed.

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12. The humidifier of claim 10 wherein said first, fourth and fifth heads are arranged so that there is an interference fit between the overlapped section of the strengthening element.

13. A humidifier comprising a water reservoir, a horizontally disposed wall positioned over said reservoir, a rectangularly shaped pliant porous skirt having an elongated strengthening element molded along the upper edge thereof, fastening means secured to said element for attaching it to the underside of said wall whereby the skirt assumes a substantially cylindrical shape with the ends in overlapping relationship, closing means disposed between said reservoir and overlapped skirt ends for maintaining them closed while the humidifier is used.

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