United States Patent

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[54] **FURNACE HUMIDIFIER**
16 Claims, 5 Drawing Figs.

[52] **U.S. Cl.** **126/113,** 261/97, 261/106
[51] **Int. Cl.** **F24f 3/14**
[50] **Field of Search** 126/113; 261/97, 103, 106, 110

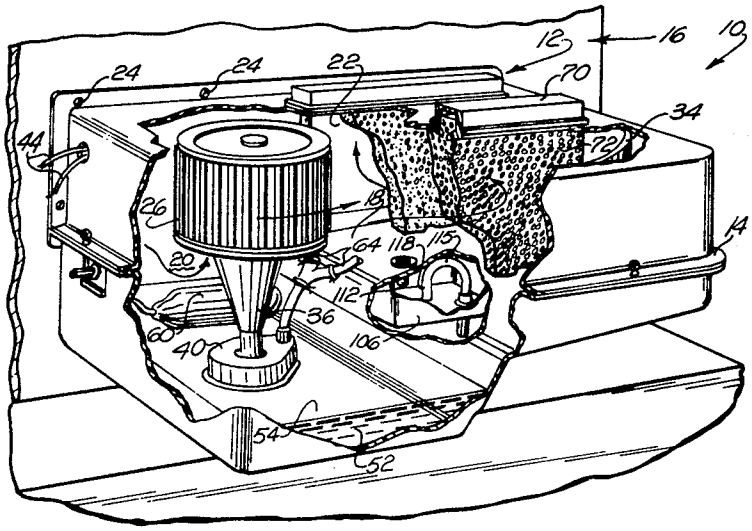
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ABSTRACT: A humidifier includes a housing in which vaporizer means for promoting vaporization of liquid is removably received. The vaporizer means includes a liquid manifold and a porous material. The liquid manifold is connected to a pump assembly by a conduit such that the manifold is supplied with a liquid thereby. The manifold has a portion which grips the porous material such that the porosity of the material is controlled and the flow of liquid from the manifold to the porous material is regulated thereby. The manifold is configured such that the vaporizer means and manifold are removable without disassembly of the humidifier.



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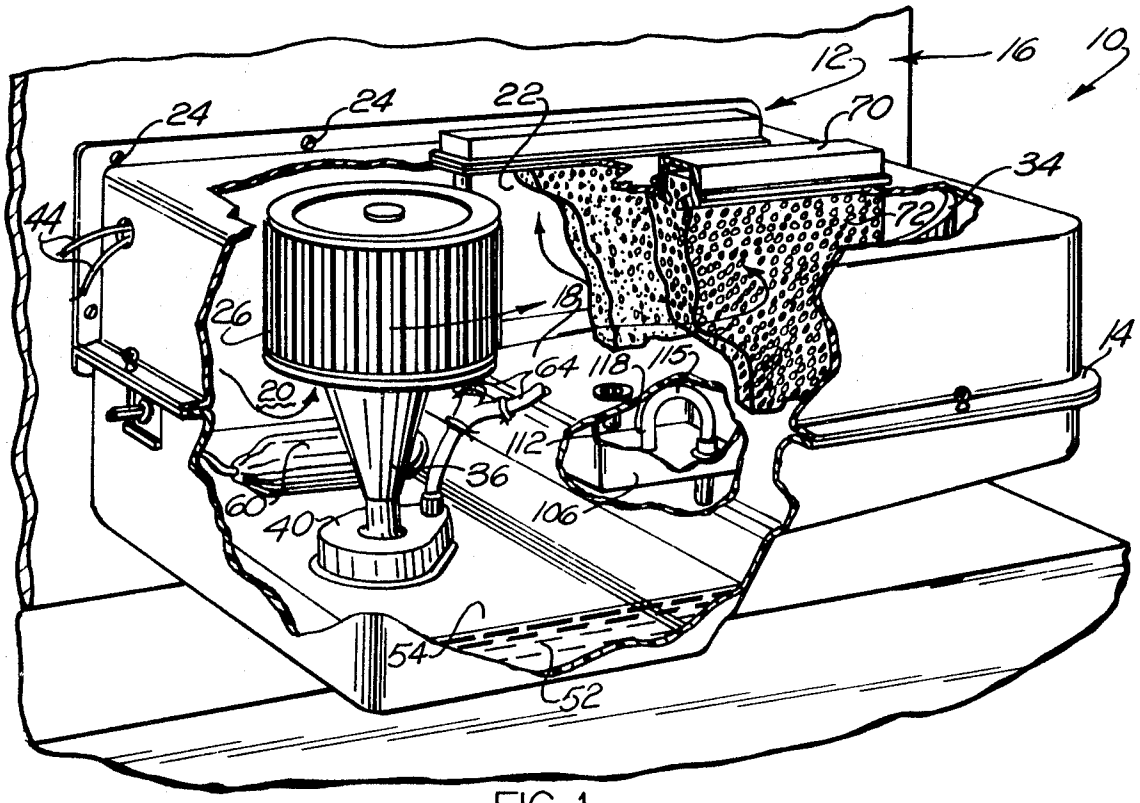


FIG. 1

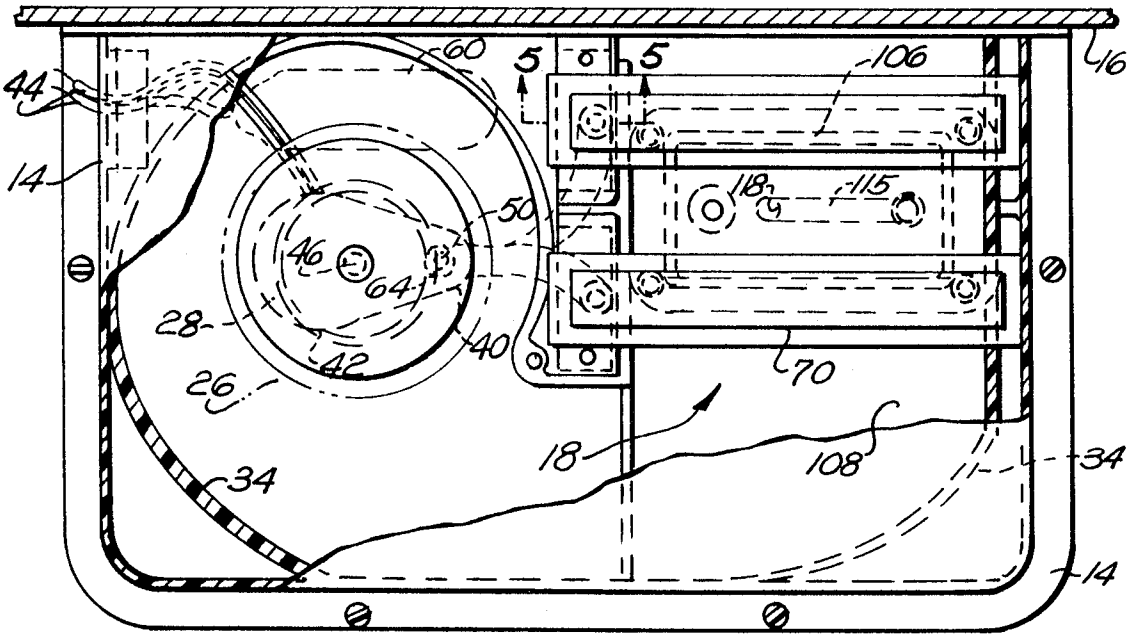


FIG. 2

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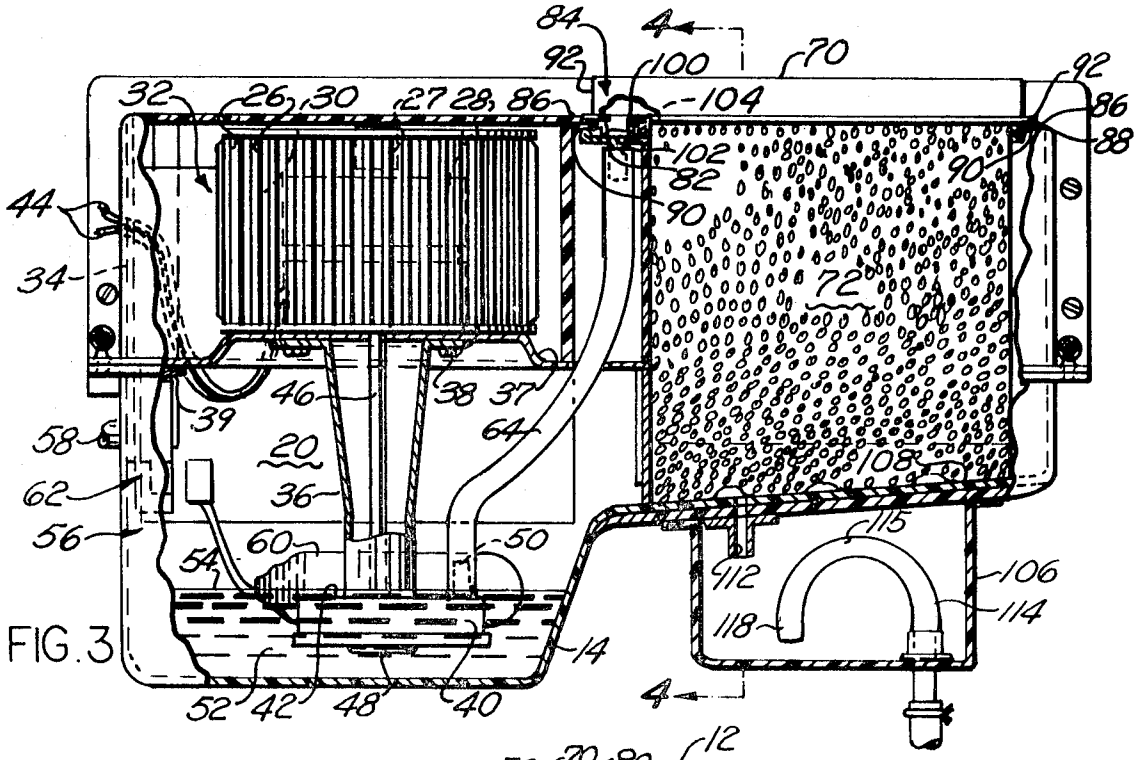


FIG. 3

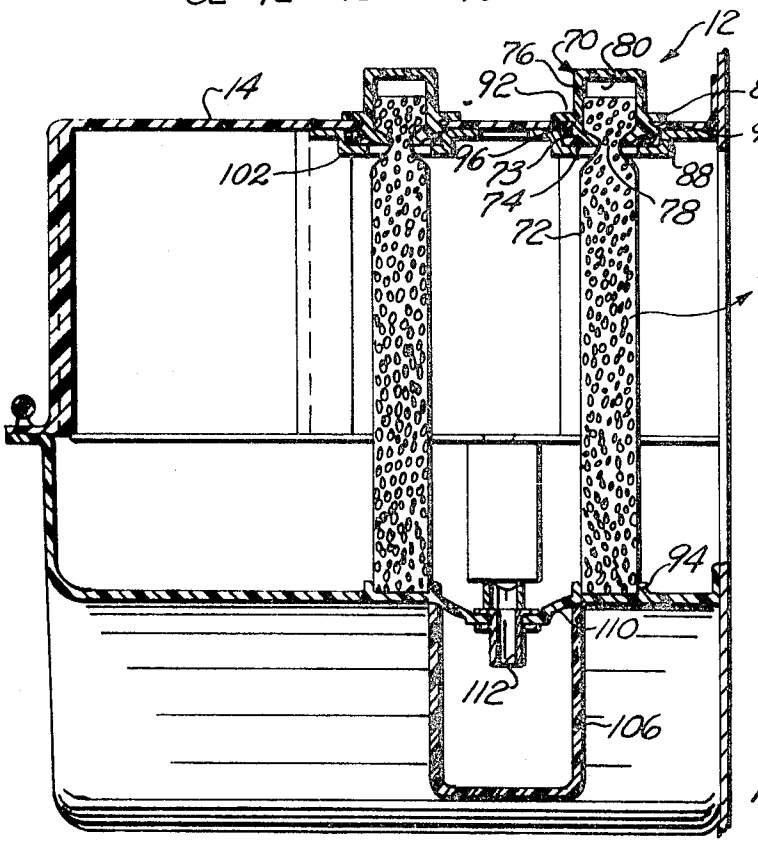


FIG. 4

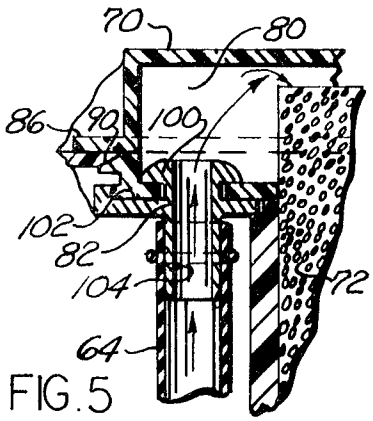


FIG. 5

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FURNACE HUMIDIFIER

The present invention relates to a humidifier having a vaporizer means removably mounted in a housing member, and more particularly relates to a humidifier having a vaporizer means which is readily removable from the humidifier housing member without disassembly of the humidifier or use of any tools whatsoever.

Humidifiers for increasing the moisture content of air are known. The humidifiers of the prior art expose an airstream to a liquid such as water in order to increase the moisture content of the air. Generally, the liquid is supplied to a vaporizer means which exposes the liquid to the airstream to effect evaporation of the liquid.

In this type of humidifier, the liquid, usually water, supplied to the vaporizer means contains some mineral impurities. When the liquid is evaporated from the vaporizer means, these impurities remain in the vaporizer means and decrease its efficiency. Since these mineral deposits must be removed from the vaporizer means, it is desirable that such an operation be performed with a minimum of effort.

In order to remove these mineral deposits the vaporizer means must be removed from the humidifier. Once the vaporizer means is removed from the humidifier, cleaning liquid may be forced through the vaporizer means to rinse the mineral deposits therefrom. Once these mineral deposits have been removed, the humidifier must be reassembled with the cleaned vaporizer means positioned therein. The prior art humidifiers require complicated disassembling processes to accomplish cleaning of the vaporizer. The humidifiers of the prior art require an excessive amount of time for disassembly and reassembly after cleaning the vaporizer means.

The configuration of a humidifier having a housing member and a vaporizer means removably received by the housing member has been further complicated by certain considerations which are important from both a commercial and operational standpoint. When building a vaporizer means such that it is easily removable with respect to the housing, the configuration must be such that the vaporizer means is sealed with respect to the housing member to allow air to flow through the vaporizer means without substantial leaking out of the mounting area.

Another problem is the metering of the liquid to be vaporized. By controlling the amount of liquid to be evaporated, a uniform distribution of liquid will be presented to the airflow through the humidifier, thus maximizing the efficiency of the humidifier. For example, when the vaporizer means includes a sheet of porous material, the thicker the sheet, the more liquid must be supplied thereto. One such metering device, as shown in Gushue U.S. Pat. application Ser. No. 748,268, filed July 29, 1968, now abandoned, discloses the use of a manifold to grip a porous material. The metering device shown by Gushue is a standing-type room humidifier and is not used in conjunction with any other air supply system, such as a furnace.

The humidifier of the present invention provides a vaporizer means which is readily removable from the housing of the humidifier, thus the humidifier efficiency may be returned to its original level by replacing the old vaporizer media with new or by rinsing the vaporizer media to remove the deposits before replacing it. A reservoir may also be provided in conjunction with the humidifier of the present invention to collect any excess liquid supplied to the vaporizer means. The excess liquid may carry away a portion of the minerals remaining upon evaporation of a portion of the liquid supplied thereto.

The humidifier of the present invention further solves these problems by providing a vaporizer means comprising a porous material and a manifold means. The manifold means grips the porous material with lips which restrict the porous material. Thus, the flow of the liquid into the porous material will be metered thereby and the amount of liquid carried in the porous material is controlled. In addition, the liquid to be evaporated is uniformly distributed across the airflow of the humidifier of the present invention.

Accordingly, it is an object of the present invention to provide a new and improved humidifier having a vaporizer means which is removably mounted in a housing of the vaporizer in a manner which provides for easy removal thereof for cleaning or replacement purposes.

It is yet another object of the present invention to provide a humidifier having a vaporizer means removably mounted in a housing member and adapted to meter the flow of liquid to be evaporated therefrom.

A further object of the present invention is the provision of a new and improved humidifier having a vaporizer which includes a porous material and a liquid manifold connected therewith and wherein the manifold has portions which releasably engage a housing of the humidifier so that the manifold and porous material can be readily removed therefrom or replaced thereon.

Yet another object of the present invention is to provide a humidifier having a vaporizer means removably mounted in a housing member which is adapted to be supplied with an excess of liquid thereto for flushing the impurities remaining from the liquid which has been evaporated wherein the excess liquid will carry the impurities therefrom.

Yet another object of the present invention is to provide a humidifier having a vaporizer means removably mounted in a housing member which includes a reservoir for collecting the excess liquid flowing from the vaporizer means and means to periodically remove the excess liquid from the reservoir.

Further objects and advantage of the present invention will be apparent to those skilled in the art to which it relates from the following detailed description thereof made with reference to the accompanying drawings forming a part of this specification and in which:

FIG. 1 shows a perspective view of a humidifier embodying the present invention showing a portion thereof cut away;

FIG. 2 is a top view of the humidifier shown in FIG. 1;

FIG. 3 is a side elevational view of the humidifier shown in FIG. 1 with a portion cut away;

FIG. 4 is a sectional view of the humidifier shown in FIG. 1 taken along lines 4—4 thereof; and

FIG. 5 is an enlarged sectional view taken along the lines 5—5 of FIG. 2.

The present invention provides a new and improved humidifier having a vaporizer means which is removably mounted in a humidifier housing member. The improved humidifier of the immediate invention is adapted to meter the liquid to be evaporated into the air flowing therethrough. The humidifier of the present invention is designed such that liquid under pressure may be readily connected and disconnected to the vaporizer means to maintain water pressure in a portion of the vaporizer means. Such a design ensures a uniform distribution of liquid presented to the area through which the air to be humidified is flowing. The present invention may be applied to humidifiers of a wide variety of constructions and designs, and for purposes of illustration, is described and illustrated in the drawings as applied to a humidifier **10** shown in FIG. 1.

The humidifier **10** includes a vaporizer means **12** removably mounted with respect to a housing **14**. The humidifier **10** is adapted to allow air to pass through a portion of the vaporizer means **12** to evaporate the liquid supplied to the vaporizer means **12**. In such a manner, the humidity of the air passing through the humidifier is increased.

In order to receive air to be humidified the humidifier **10** is mounted on an air duct **16**, such as a plenum leading from a furnace. The housing **14** is mounted on the air duct **16** by any conventional means such as fasteners **24**. The humidifier **10** has passage means, generally indicated at **18**, for providing for flow of air through the humidifier **10**. The passage means **18** includes an inlet **20** for receiving air from the air duct **16** and an outlet **22** for returning humidified air back to the air duct **16**. It should be clearly understood that the passage means **18** may be defined by the air duct **16** and that the vaporizer means **12** may be directly mounted in the airflow through the air duct **16**.

A fan 26 is provided adjacent to the inlet passage 20 to draw air from the air duct. A motor 28 as best seen in FIG. 3 is mounted to rotate the fan and is actuated by means of the electrical leads 44 which are connected to a humidistat for actuation of the motor 28. The motor 28 is connected to the fan 26 by means of a coupling 27 which also serves to support the fan 26. The fan 26 draws the air into the inlet 20 and up through the center 30 of the fan and expels the air from the outer surface 32 of the fan 26 to force the air through the vaporizer means 12. A wall 34 is provided to direct the air from the fan 26 through the vaporizer means 12.

The motor 28 is mounted to the housing 14 by means of a support member 37 which is attached to the housing 14 by means of fasteners, generally indicated at 39. The motor 28 retains a second support member 36 by threaded fastener means 38. The second support member 36 has a lower end 40 which houses a pump 42.

The motor 28 is drivingly connected to the pump 42 by the shaft 46 such that when the motor 28 is actuated by the humidistat the pump 42 is also actuated.

The pump 42 supplies the vaporizer means 12 with liquid through a conduit means 64. The pump 42 may be of any conventional design and is adapted to receive liquid therein through the inlet 48 and expel the liquid through the outlet 50 under pressure.

The pump 42 is immersed in a reservoir 52 containing liquid therein. Means 56 are provided to maintain the liquid contained therein at a level 54 such that when the level of the liquid drops below the level 54, additional liquid will be supplied thereto through the opening 58. The means 56 for maintaining the level 54 includes a float 60 which floats in the liquid and is adapted to actuate a valve 62 when the level of the liquid drops below the level 54. When the valve 62 is actuated, the inlet 58 to the reservoir is opened to supply additional liquid to the reservoir 52 from a conventional liquid supply (not shown).

In operation, when the humidistat senses that the humidity in an area should be increased, the motor 28 is actuated through the electrical leads 44 and air is drawn in from the air duct 16 into the humidifier 10 through the inlet 20. The air moves up through the inside of the fan 26, is expelled from the outer surface 32 thereof and is directed through the vaporizer means 12. Consequently, the humidified air returns to the air duct 16 through the outlet 22 of the humidifier 10 to be circulated to the space to be supplied with humidified air.

Actuation of the motor 28 also actuates the pump 42 to draw liquid through the inlet 48 and expel the liquid through the outlet 50 under pressure. The liquid under pressure flows through the conduit 64 to the vaporizer means 12. When the pump draws sufficient liquid from the liquid reservoir 52 such that the level of the liquid is below the liquid level 54, the means 56 operates to replenish the supply of liquid.

The vaporizer means 12 includes two vaporizer assemblies, each of which have a manifold 70 and a porous material 72. It should be understood that the vaporizer means 12 may include any number of vaporizer assemblies, but for ease of description, one representative vaporizer assembly will be described hereinbelow.

The manifold 70 includes a first portion 74 for gripping the porous material 72 and a second portion 76 projecting outwardly of the housing member 14 so as to be gripped for removal of the vaporizer means 12 from the housing 14. The portion 74 for retaining the porous member 72 may be defined by lips which compress the porous material 72 into an area, generally indicated at 78. When a porous material is so compressed, the area 78 which is compressed decreases in porosity and thus provides resistance to flow of liquid therethrough. The lips 74 extend around the periphery of the porous material 72 such that each edge of porous material 72 is compressed in the areas generally indicated 78 as best seen in FIGS. 3 and 4.

The manifold 70 includes a chamber 80 extending along the length of the porous material 72. The chamber 80 is supplied with liquid under pressure from the conduit means 64 through the connection 82. When liquid under pressure is supplied to the manifold chamber 80, the liquid has a substantially uniform pressure along the entire length of the manifold 70. Thus, the liquid passing through the area 78 provides a uniform supply of liquid to the porous material 72 to allow for a uniform distribution of the liquid in the porous material 72 over the area through which the air is flowing.

The porous material may be comprised of any foraminous material well known to those skilled in the art such as reticulated polyurethane. It should also be understood that generally the porous member 72 is supplied in a sheet having a certain thickness. If the thickness is varied, it is important to vary the size of the lips 74 and consequently the area 78 through which the liquid flows. For example, if a thicker sheet of material were used and more air forced therethrough, it would be important to increase the size of the area 78 to provide a greater amount of liquid to the porous material 72. It should also be understood that when thicker material is used, if the size of the area 78 is held constant, the flow rate therethrough will decrease since the resistance to flow of the porous material compressed thereby increases.

In order to provide a vaporizer means 12 which is removable with respect to the housing 14, portions of the manifold 70 are provided to removably engage the housing 14. The portions include an upper protrusion 86 and a lower protrusion 88 which define a groove 90. The protrusions 86, 88 and groove 90 extend about the outer peripheral surface, generally indicated at 92, of the manifold means 70.

The groove 90 receives the housing member 14 such that the upper protrusion 86 prohibits downward movement of the vaporizer means 12 and the lower protrusion 88 resists removal of the vaporizer means 12. Since the porous material 72 of the vaporizer means 12 is in contact with the lower portion of the housing 14, as best seen in FIG. 4, downward movement of the manifold means is further prohibited. Lateral movement of the vaporizer means 12 due to flow of air therethrough is prohibited by extensions 94 of the humidifier housing 14.

A chamber 96 is provided about the area in which the manifold 70 is received by the housing 14 to facilitate removal of the manifold means 70. The chamber 96 allows the lower protrusion 88 to yield and flex when the vaporizer means 12 is removed from the housing 14. It should further be understood that the manifold 70 is formed from a flexible material such as rubber or plastic, to facilitate removal of the vaporizer means 12 from the housing 14.

In order to further facilitate simplified removal of the vaporizer means 12 with respect to the housing 14, a simplified fluid connection 82 is provided to eliminate any complicated disconnection problems. The manifold 70 is provided with a lower flange 100 which is adapted to be seated against a member 102 having a connecting tube 104 mounted thereon. The tube 104 receives liquid under pressure from the conduit 64 and supplies the liquid under pressure to the manifold 70. The lower flange 100 seals the connection 82 such that the pressurized liquid is contained in the chamber 80 of the manifold 70 to supply the porous material 72 with the liquid under a uniform pressure across its entire length.

Thus, when the vaporizer means 12 is to be removed from the housing 14, the second portion 76 of the manifold means 70 may be gripped and an upward force exerted such that the lower protrusion 88 will buckle and yield to allow removal of the vaporizer means 12. On the other hand, when the vaporizer means 12 is received by the housing 14, the groove 90 provides a uniform seal about the outer peripheral surface 92 of the manifold such that the vaporizer means 12 is retained in the housing means 14.

It should be understood that the communication of the flange 100 with the member 102 provides for a fluid connection 82 which does not require any complicated connections to be made when the vaporizer means 12 is assembled with the housing 14. When the vaporizer means 12 is so removed it

may be rinsed out and the particles remaining from the liquid that has evaporated may be removed therefrom.

An additional feature which may be used in conjunction with the humidifier **10** of the present invention includes a drain off reservoir **106**. When an excess amount of liquid is allowed to flow through the porous material **72**, liquid will flow from the bottom **108** of the vaporizer means **12**. The housing **14** is shaped in a trough configuration in the area generally indicated at **110** as best seen in FIG. **4** to allow the excess liquid to flow down a central portion of the housing **14**. A drain orifice **112** is provided in the trough **110** to supply the drain off reservoir **106** with the excess liquid.

As the humidifier **10** continues to operate the excess liquid continues to flow into the reservoir **106**. A gravity siphon **114** positioned in the drain off reservoir **106** operates to remove the excess liquid contained in the drain off reservoir **106** when it reaches a predetermined level.

As the liquid level in the drain off reservoir **106** increases the liquid inside the gravity siphon **114** continues to rise until it reaches the upper portion **115** of the gravity siphon **114**. When the liquid level reaches this point, the gravity siphon **114** begins to remove the excess liquid from the drain off reservoir **106** until the level defined by the entrance **118** of the gravity siphon **114** is reached. Thus, a portion of the particles contained in the porous member **72** is removed from the humidifier **10**.

It should be apparent from the above that applicant has provided a highly improved humidifier **10** having a vaporizer means **12** removably mounted in a housing member **14**. The vaporizer means **12** is connected to a pump assembly **42** by conduit means **64** for supplying liquid to the vaporizer means **12**. The vaporizer means includes a manifold means **70** and a porous material **72**. The vaporizer means **12** is removably received by the housing **14** and includes means **73** for gripping the porous material **72** such that a portion of the porous material **72** is restricted thereby to uniformly distribute the liquid supplied to the porous material **72**.

Having described my invention, I claim:

1. A humidifier for mounting on an air duct leading from a furnace, said humidifier comprising a housing having passage means providing for flow of air therethrough from the air duct and flow of air therefrom into the air duct, means supported by said housing for drawing air thereinto from the air duct through said passage means and for creating a flow of air through the housing and back into the air duct through said passage means, vaporizer means located in the airflow through said housing for promoting vaporization of liquid, and a pump assembly connected by conduit means to said vaporizer means for supplying the liquid to said vaporizer means, said vaporizer means including a resilient pressurizable liquid manifold means and porous material associated with said manifold means, said manifold means having portions resiliently gripping said porous material such that a portion of said porous material is restricted thereby to meter the flow of the liquid into said porous material.

2. A humidifier as defined in claim **1** wherein said manifold means includes a chamber and said gripping portions of said resilient manifold means include lips for resiliently compressing said porous material and maintaining a substantially uniform pressure of the liquid in said chamber to provide substantially uniform wetting of said porous material.

3. A humidifier as defined in claim **1** wherein said manifold means includes portions which releasably engage said housing to enable said manifold means and said porous material to be removed therefrom as a unit.

4. A humidifier comprising a housing, means for providing for flow of air through said housing, vaporizer means located in the airflow for promoting vaporization of liquid into the airflow, a pump assembly supported by said housing, conduit means communicating said pump assembly and said vaporizer means for supplying the liquid to said vaporizer means, said vaporizer means having first portions which cooperate with said housing to support said vaporizer means in said airflow and a second portion which projects outwardly of said housing to be gripped to enable removal of said vaporizer means from said housing, said first portions being releasable from said housing to enable said vaporizer means to be removed therefrom.

5. A humidifier as defined in claim **4** wherein said vaporizer means comprises a liquid manifold means and porous material associated therewith to receive liquid therefrom, said first portions comprising first and second protrusions of said manifold means which engage opposite sides of said housing and which are made of yieldable material.

6. A humidifier as defined in claim **5** wherein said first and second protrusions comprise upper and lower protrusions, said upper protrusion being positioned outside of said housing, said lower protrusion being positioned inside of said housing.

7. A humidifier as defined in claim **4** wherein said manifold means defines a liquid-receiving chamber which is in liquid communication with said conduit means when said manifold means is received by said housing.

8. A humidifier comprising a housing, vaporizer means supported by said housing for promoting vaporization of a liquid into an airflow through said housing, a pump assembly, conduit means communicating said pump assembly and said vaporizer means for supplying the liquid to said vaporizer means, said vaporizer means comprising manifold means and porous material associated therewith, said vaporizer means being removably received by said housing, said manifold means being in fluid communication with said conduit means when said vaporizer means is received by said housing, said manifold means gripping said porous material such that a portion of said porous material is restricted thereby, said manifold supplying liquid under pressure to said porous material during operation of said pump assembly.

9. A humidifier as defined in claim **8** wherein a portion of said manifold means grips said porous material, said gripping portion including lips for compressing said porous material.

10. A humidifier as defined in claim **8** wherein said housing has an opening therein through which said vaporizer means extends, said manifold means including first and second protrusions thereon which engage opposite sides of said housing adjacent said opening, said protrusions being releasable to enable removal of said vaporizer means from said housing through the opening therein.

11. A humidifier as defined in claim **8** further including a drain-off reservoir for receiving excess liquid from said porous material.

12. A humidifier as defined in claim **11** which includes a gravity siphon to periodically remove a portion of the liquid contained in the reservoir.

13. A humidifier structure adapted to be located in an airflow through a member, said humidifier structure comprising a liquid manifold for receiving liquid and a porous member connected with said liquid manifold to receive liquid therefrom, said porous member being positionable in the airflow through the member, said liquid manifold having first portions cooperable with the member to support the porous member in said airflow and a second portion which projects outwardly of the member so as to be gripped for removal of said porous member from the member, said first portions of said manifold being releasable from the member to enable said porous member to be removed therefrom.

14. A humidifier structure as defined in claim **13** wherein said portions of said liquid manifold supporting said porous member control the flow of liquid from said liquid manifold to said porous member.

15. A humidifier structure as defined in claim **13** wherein said releasable first portions of said liquid manifold include protrusions which cooperate with the member and engage opposite sides of the member and which protrusions are made of a flexible material.

16. A humidifier as defined in claim **13** wherein said liquid manifold is connected to a pump for supplying said manifold with liquid under pressure.