

- [54] **ROTARY ASSEMBLY FOR HUMIDIFIER**
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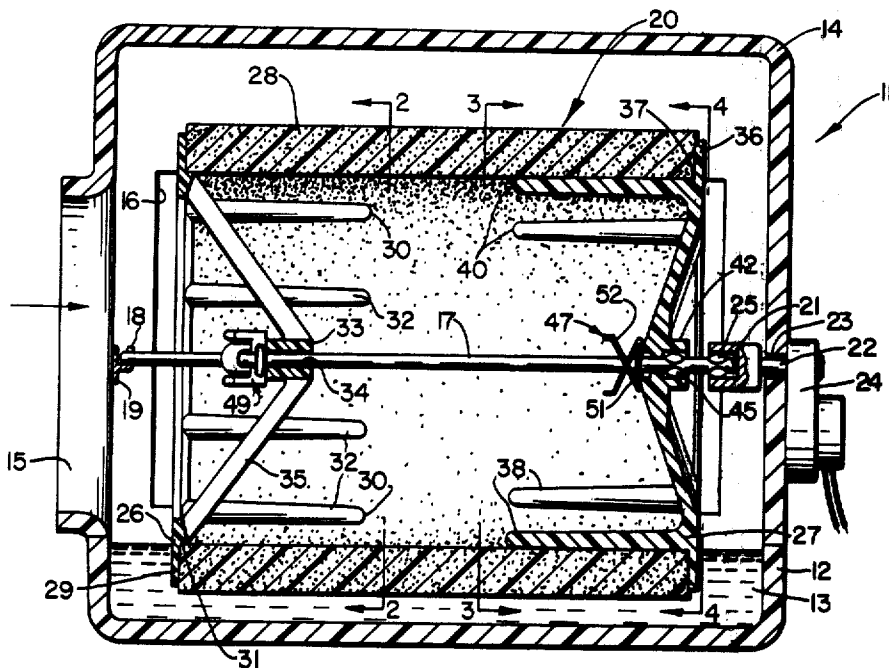
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- [51] **Int. Cl.**..... **B01f 3/04**
- [58] **Field of Search** 261/42; 210/402, 403, 232; 55/492, DIG. 31, 290, 408, 500, 510, 511

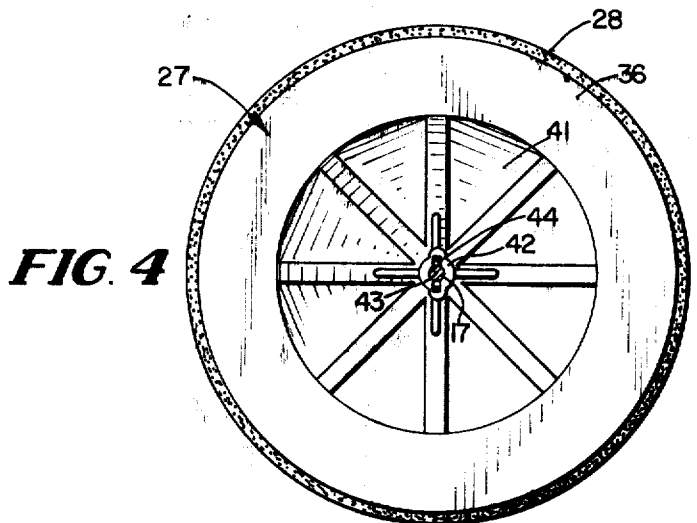
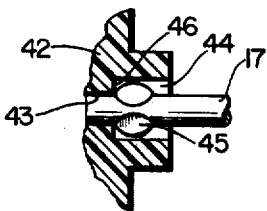
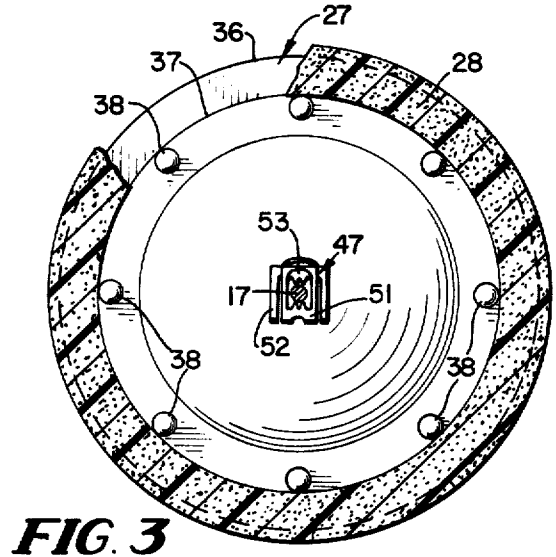
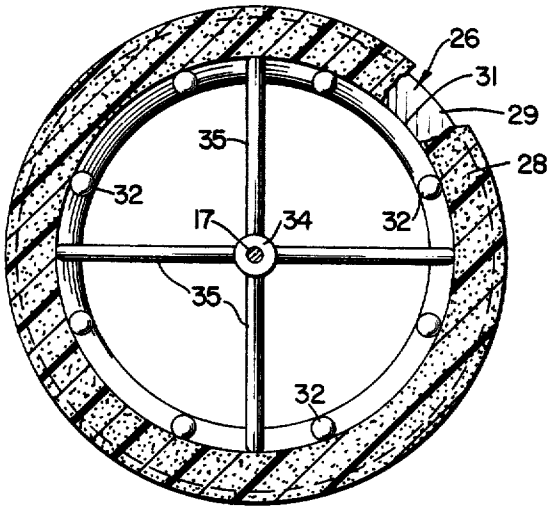
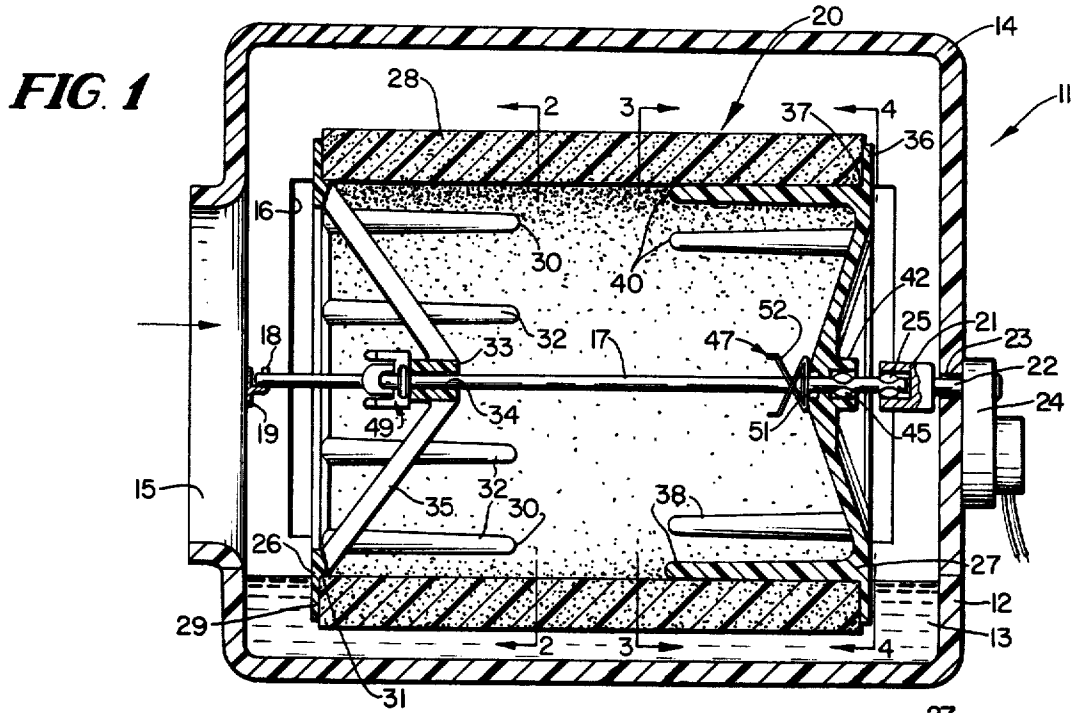
[57] **ABSTRACT**

A rotor assembly for a rotary drum type humidifier wherein two separate end members integrally formed of synthetic plastic material are mounted on a common shaft and each has a projecting circular row of fingers frictionally receiving the opposite ends of a resilient water pick-up annulus extending between the end members. The annulus may be removed from the assembly simply by removing a single spring metal fastener holding one of the end members on the shaft.

- [56] **References Cited**
- UNITED STATES PATENTS**
- 2,909,046 10/1959 Wheeler..... 261/92 X
- 3,266,481 8/1966 Wentling et al. 261/92 X
- 3,640,515 2/1972 Stiles..... 261/92

15 Claims, 5 Drawing Figures





ROTARY ASSEMBLY FOR HUMIDIFIER

This invention relates to rotary drum type humidifiers and particularly to improved rotor assembly structures therefor.

Humidifiers of this type wherein a resilient annulus of open pore polyurethane or like porous water pick-up material is mounted in a rotor assembly have been in practical use especially in hot air heating systems for some time. In such humidifiers the annulus is slowly rotated with its lower sector passing through a constantly maintained water body and picks up water to be entrained in air flowing through the wall of the annulus. Examples of such humidifiers are disclosed in the patents to Stiles U.S. Pat. Nos. 3,408,880 and 3,640,515; Wentling et al. U.S. Pat. Nos. 3,149,626 and 3,266,481; Herr U.S. Pat. No. 3,599,942; Martin U.S. Pat. No. 3,274,993 and Lobb U.S. Pat. No. 3,481,588.

All humidifiers of this type have a common problem. The water to be picked up by the annulus is usually metered into the reservoir through which the lower sector of the annulus passes from the municipal or other local water source which contains solids and precipitates that are effectively filtered out of the water during passage through the porous annulus. Also dust and particles in the air stream are similarly filtered. These filtered solids gradually accumulate and eventually clog the pores of the annulus, thus reducing its ability to pick up water so that efficiency of the humidifier gradually lessens.

It has therefore become customary, and even necessary in some waters, to remove the annulus for cleaning the pores, or more usually replacement with a fresh annulus. This introduces the problem of ease of gaining access to the rotor assembly and removal and replacement of the annulus. In many of these prior humidifier assemblies it is difficult to remove the rotor assembly from its drive in the humidifier, and in most the annulus is supported on a structure including a full length skeleton wire or sheet metal frame that presents difficulties in removing the annulus from the frame.

It is the major object of the present invention to provide a novel rotor assembly that is readily removable from the humidifier and easily disassembled for removal of the porous annulus.

Another object of the invention is to provide a novel humidifier or like rotor assembly wherein a porous water pick-up annulus is mounted on spaced separate end members, which are preferably hard smooth synthetic plastic elements. Further to this object each end member has a circular row of annulus mounting fingers projecting into the associated end of the annulus.

A further object of the invention is to provide a novel humidifier rotor assembly wherein spaced end members mounting opposite ends of a porous water pick-up annulus are slidably supported on a motor driven shaft, with means being provided on the shaft for axial location of the end members in the assembly.

Further objects of the invention will appear as the description proceeds in connection with the annexed claims and the appended drawings.

BRIEF DESCRIPTION OF DRAWINGS

FIG. 1 is a side elevation in section showing the invention according to a preferred embodiment;

FIG. 2 is an end view in section substantially on line 2—2 of FIG. 1;

FIG. 3 is an end view in section substantially on line 3—3 of FIG. 1;

FIG. 4 is an end view partly in section substantially on line 4—4 of FIG. 1; and

FIG. 5 is an enlarged fragmentary section showing connection of one of the rotor end members to the shaft.

PREFERRED EMBODIMENTS

FIG. 1 shows a humidifier housing 11 at the lower part of which is provided a detachable pan-like closure 12 which contains a body of water 13 maintained at a predetermined level as by a float controlled water inlet valve (not shown). The upper part 14 of the housing 11 fits on lower part 12 to form an enclosure, and an end wall opening 15 is provided for connection to a hot air or cool air return duct. A generally rectangular opening indicated at 16 is provided in a side wall of the housing for connection to a plenum or another duct in accord with conventional practice.

The housing details are more or less conventional and may be for example similar to those disclosed in Stiles U.S. Pat. No. 3,640,515 or 3,408,880. The float controlled valve arrangement may be that disclosed in Powers U.S. Pat. No. 3,099,286.

A rotor shaft 17 extends from a bearing support 18 carried by a narrow strap 19 fixed diametrically across opening 15 to an axially engaged coupling 21 connecting it with a motor output shaft 22 mounted in a bearing 23 in the opposite end wall. An electric motor unit 24 containing a gear reduction whereby the shaft 17 is driven only slowly at about four revolutions per minute is secured to the housing side wall and its output shaft extends through that wall. Shaft 17 is usually horizontal and centered with circular opening 15.

The motor drive and coupling arrangement may include a slip clutch as disclosed in Stiles U.S. Pat. No. 3,408,880, or in some instances the coupling 21 may be a direct fixed connection between the motor output shaft and the rotor shaft. In any event shaft 17 is formed with a non-circular axially slidably inserted end section 25 for drive attachment to coupling 21.

Shaft 17 is part of a rotor assembly 20 that comprises spaced separate opposite end members 26 and 27 mounted on the shaft and an annular water pick-up sleeve or annulus 28 of flexible porous synthetic plastic material extending between the end members. As shown in FIG. 1 the lower sector of annulus 28 passes through the water reservoir 13 during rotation of the rotor assembly.

End member 26 which is mounted on shaft 17 adjacent housing opening 15 is an integral hard synthetic plastics element having a flat annular plate or wall 29 formed with a relatively shallow internal shoulder 31. A plurality of identical equally circumferentially spaced circular cross-section smooth surfaced fingers 32 of the same length arranged in a circular row extend at right angles from wall 29 parallel to each other toward the interior of the rotor assembly, and these fingers 32 are preferably located radially inwardly of shoulder 31. Fingers 32 have their bases in a circular area concentric with wall 29 and preferably they are of slightly reducing taper from wall 29 toward their rounded ends 30. The radially outer surfaces of the row of fingers 32 lie in the circular plane of shoulder 31.

End member 26 has a reduced diameter hub 33 formed with a smooth bore 34 slidably rotatably sur-

rounding shaft 17. Hub 33 is connected to annular wall 29 by a series of stiff thin radial arms 35 that are inclined inwardly in the assembly to longitudinally locate the hub about midway of the length of arms 32.

The other end member 27 is a mainly imperforate disc-like integral hard synthetic plastics element having a flat annular plate or wall 36 formed with a relatively shallow internal annular shoulder 37 of the same diameter as shoulder 31, and a plurality of identical equally circumferentially spaced smooth surfaced fingers 38 of the same length extend at right angles from wall 36 parallel to each other toward the interior of the rotor assembly. Fingers 38 are preferably of the same size and shape as fingers 32 and in the assembly extend in a circular row in substantial longitudinal alignment with fingers 32. The radially outer surfaces of fingers 38 lie in the circular plane of shoulder 37. The fingers 38 are tapered similarly to fingers 32 and terminate in rounded ends 40.

The central imperforate wall portion 41 of end member 27 surrounded by wall 36 is dished inwardly in the assembly and centrally formed with a hub 42 having a smooth bore 43 (FIG. 5) surrounding shaft 17. As shown in FIGS. 4 and 5 the outer end of bore 43 is diametrically formed to provide a key slot 44 adapted to receive an enlarged non-circular fixed section 45 on shaft 17 to connect end member 27 nonrotatably to shaft 17 in the assembly as will appear. The axial face 46 at the bottom of key slot 44 provides a stop limiting axial displacement of shaft 17 inwardly, or to the left in FIG. 1, in the assembly.

In making the rotor assembly, end member 27 is introduced onto the left end of shaft 17 (FIG. 1) and slidably displaced along the shaft until key slot 44 of the hub interfits with the key 45 of the shaft. This limits axial displacement of end member 27 along the shaft in that direction and at the same time locks the end member and shaft for rotation together. A resilient sheet metal grip type fastener 47 of known type is now mounted on the shaft and pushed therealong to abut end member 27, as shown in FIG. 1, and this locks end member 27 against axial displacement on shaft 17.

The water pick-up sleeve 28 is now mounted on end member 27. As shown it is a generally cylindrical resilient annulus of open pore polyurethane having an internal diameter enabling it to fit snugly frictionally upon the relatively slippery smooth outer surfaces of fingers 38. The slight taper of the fingers and the rounded ends simplify this operation. It may even be preferable to have the internal diameter of sleeve 28 slightly less than the circle containing the outer surfaces of fingers 38 whereby the inherent resiliency of the sleeve will enable it to expand and fit tightly over the fingers. As shown in FIG. 1, the adjacent end of sleeve 28 abuts wall 36 of end member 27 with the edge of the inner periphery of the sleeve resting on shoulder 37. Sleeve 28 may be composed of the open pore polyurethane foam disclosed in the patent to Voltz U.S. Pat. No. 3,171,820.

The relatively open end member 26 is now slidably mounted on shaft 17 and pushed on until fingers 32 enter the inner periphery of sleeve 28 and the end of the sleeve rests on shoulder 31 in end abutment with wall 29. Now another resilient sheet metal grip type fastener 49 is pushed over the shaft end into abutment with the hub of end member 26 so that wall 29 is thereby pressed tightly against the end of sleeve 28.

The rotor assembly is now complete, and to install it in the humidifier it is necessary only to slidably insert the enlarged shaft end 25 into coupling 21 and drop the other end of the shaft into the U-shaped support bearing at 18.

It will be noted in the rotor assembly that a circular row of fingers, eight are shown but any suitable number may be used, project into supporting relation within the sleeve 28 at opposite ends for about one-third length of the sleeve. Sleeve 28 has sufficient stiffness not to sag between the finger ends. Due to the above described mode of assembly, different length sleeves can be mounted in the assembly using the same size end member units. This reduces inventory and no special accuracy need be taken in sleeve length determination because adjustment of end member 26 along the shaft will compensate.

The key and slot drive connection between end member 27 and the shaft 17 insures that the rotor assembly will be driven by the motor, and the resilient frictional mounting of the sleeve on the end members insures that the sleeve will be relatively non-rotatable with respect to the end members during normal operation. The resiliency of the sleeve material permits end member 26 to be pushed against the sleeve end sufficiently to slightly axially compress the sleeve, thus providing a tight compact rotor assembly.

In order to replace or clean sleeve 28 it is necessary only to tip the left end of the shaft up out of bearing 18 and pull it axially out of coupling 21, whereby it will be free to remove from the housing. Then, upon removal of fastener 49, end member 26 may be quickly slidably removed from the shaft and separated from sleeve 28. The sleeve may now be pulled axially off the fingers 38.

As shown the fasteners 47 and 49 may be of the type wherein a sheet metal body 51 has integral spring legs 52 which urge teeth 53 into gripping contact with the shaft surface. When legs 52 are pressed toward each other teeth 53 are separated and the fastener becomes freely slidably along the shaft.

Since the fingers of the end members are hard and smooth and not corroded by water, they readily permit installation and assembly of the sleeve 28. There is no rust or corrosion of the end members which last the life of the humidifier. By making the end members separate, the removal operation is simplified greatly. It is necessary only to remove two fasteners, neither requiring the use of tools such as screw drivers or wrenches, to completely dismantle the rotor assembly; and reassembly is correspondingly easy and can be accomplished by even the most unskilled.

In operation with air to be humidified entering at opening 15 the air will pass through the water containing pores of the annulus wall and exit through opening 16. As compared to prior rotor assemblies where skeleton supports extended the entire length of the sleeve, the present invention provides a large central region of the sleeve that is not impeded by such supports and therefore the air passage is increased in volume at a given pressure and the general humidification action is improved.

The embodiments of the invention in which an exclusive property or privilege is claimed are defined as follows:

1. A rotor assembly for a humidifier comprising a housing, a shaft provided at one end with means for axially separable connection to power means for rotating

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said shaft, bearing means readily releasably supporting said shaft at its other end, separate end members disposed in longitudinally spaced relation along said shaft, each of said end members comprising an annular row of relatively fixed fingers and an annular axially facing flange peripherally outwardly of said fingers, means connecting at least one of said end members non-rotatably to said shaft, means slidably connecting at least one of said end members in axially detachable relation upon said shaft, a water pick-up annulus of flexible porous synthetic plastic material extending between said end members with its opposite ends in substantial abutment with said flanges, said fingers projecting longitudinally part way into the interior of said annulus and terminating in ends therein, there being no connection between said fingers and said shaft at said ends whereby said annulus is independently interiorly supported by said fingers, the outer periphery of each of said rows of fingers having the same effective diameter and defining smooth surface means axially slidably receiving the ends of said annulus and one of said members being apertured for the entrance of air to be humidified by passage through said annulus.

2. The rotor assembly defined in claim 1, wherein the non-rotatably connected one of said end members is longitudinally fixed on said shaft, the other end member is longitudinally displaceable along said shaft, and means is provided for releasably fixing said other end member on said shaft in any adjusted position of said other end member.

3. The rotor assembly defined in claim 2, wherein said other member is provided with a hub by which it is slidably mounted on said shaft, and said fixing means is a removable fastener mounted to be displaced along said shaft in axial holding relation with said hub.

4. The rotor assembly defined in claim 3, wherein said one end member is provided with a hub by which it is slidably mounted on said shaft, and there are cooperating means provided on said shaft and said hub for longitudinally fixing said one end member on said shaft and for connecting said one end member non-rotatably to said shaft.

5. The rotor assembly defined in claim 4, wherein said means longitudinally fixing said one end member on said shaft comprises a rigid projection on said shaft in axial abutment with a surface adjacent one end of the hub of said one end member and a removable fastener axially displaceably mounted on said shaft in abutment with the other end of said hub.

6. The rotor assembly defined in claim 4, wherein said shaft is a uniform diameter shaft having at the end

where said one end member is mounted longitudinally spaced non-circular formations for connecting said shaft to said one end member and a motor driven coupling member respectively.

7. The rotor assembly defined in claim 2, wherein each of said end members is an integral hard synthetic plastic element having a row of circumferentially spaced rigid smooth surfaced fingers projecting within the adjacent open end of said annulus, said annulus having its opposite internal peripheral regions resiliently frictionally surrounding the respective rows of fingers.

8. The rotor assembly defined in claim 7, wherein said one end member is substantially imperforate and said other end member is open to passage of air longitudinally of said annulus.

9. The rotor assembly defined in claim 7, wherein said one end member is a substantially imperforate plate having said row of fingers projecting at right angles therefrom adjacent its outer periphery, and being formed centrally with a hub for sliding displacement along said shaft.

10. The rotor assembly defined in claim 9, wherein said hub is formed with a key slot for slidably interlock with a key formation on said shaft means.

11. The rotor assembly defined in claim 7, wherein said other end member comprises an annular plate from which said row of fingers project substantially at right angles, and is provided centrally with a hub slidably along said shaft and connected to said plate by a plurality of rigid but thin webs.

12. The rotor assembly defined in claim 1, wherein said fingers are substantially conical with a slight decreasing diameter toward the interior of the rotor.

13. The rotor assembly defined in claim 1, wherein said end members are relatively rigid integral synthetic plastic members having annular rows of circumferentially spaced smooth surfaced fingers projecting snugly within the adjacent end of said annulus.

14. The rotor assembly defined in claim 13, wherein the axially inner side of each end member is formed at the flange with an annular shoulder adjacent the row of fingers, the outer surfaces of said row of fingers lying substantially in the projected plane of said shoulder.

15. The rotor assembly defined in claim 13, wherein said fingers on each end member are solid projections of substantially the same length having transversely curved smooth surfaces at least on their outer annulus contacting regions.

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