

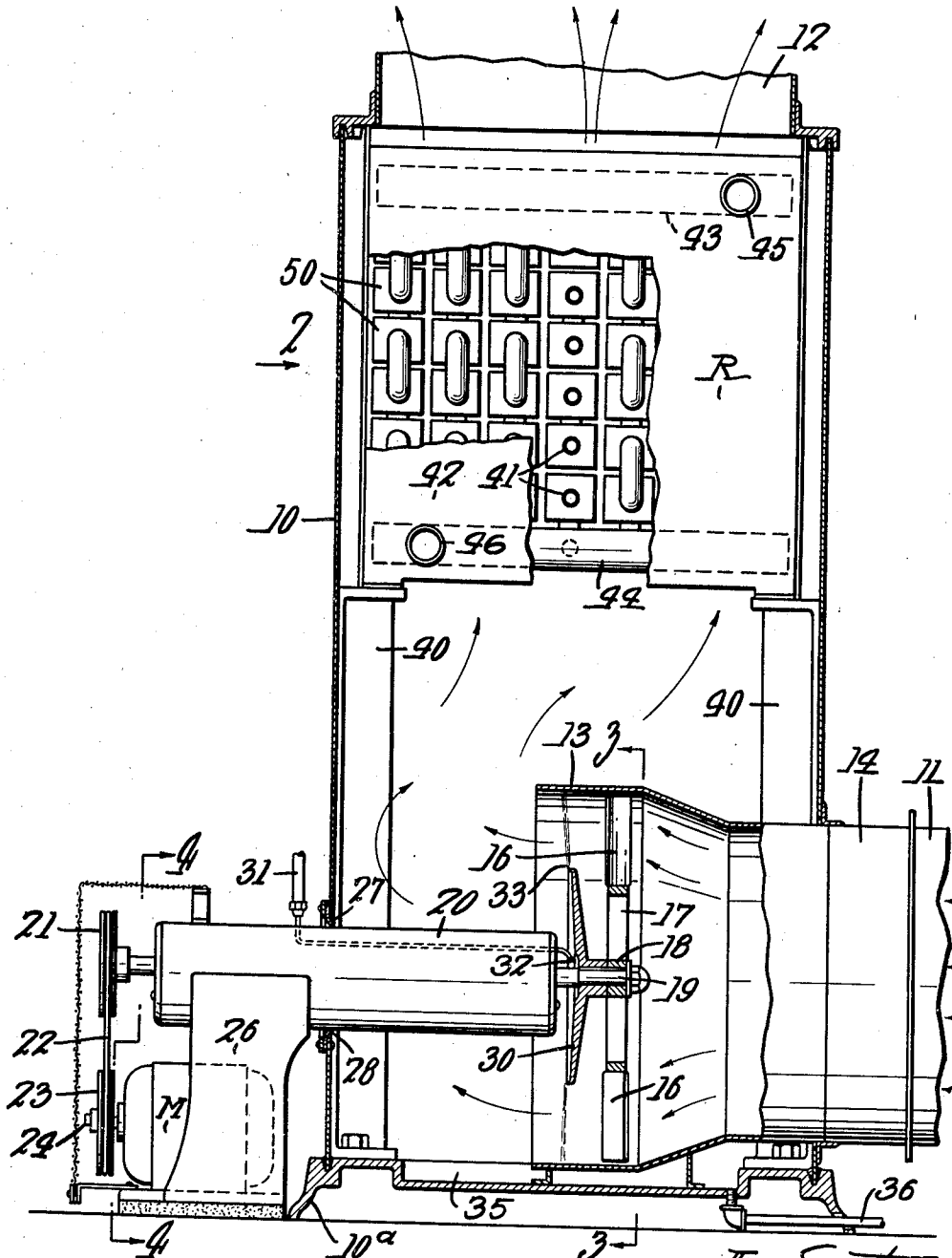
Oct. 19, 1937.

S. L. LORD ET AL

2,096,286

AIR CONDITIONING APPARATUS

Original Filed March 8, 1934 3 Sheets-Sheet 1



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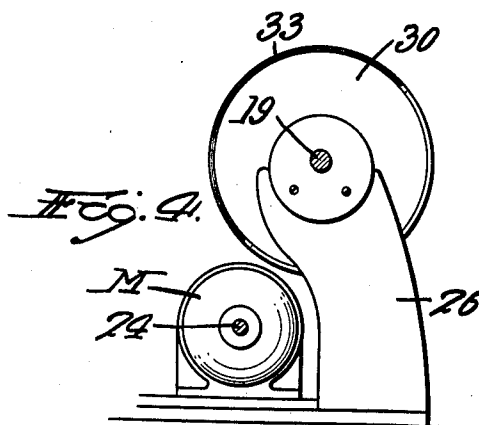
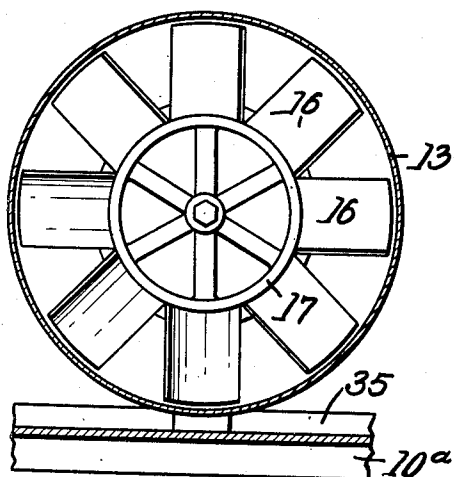
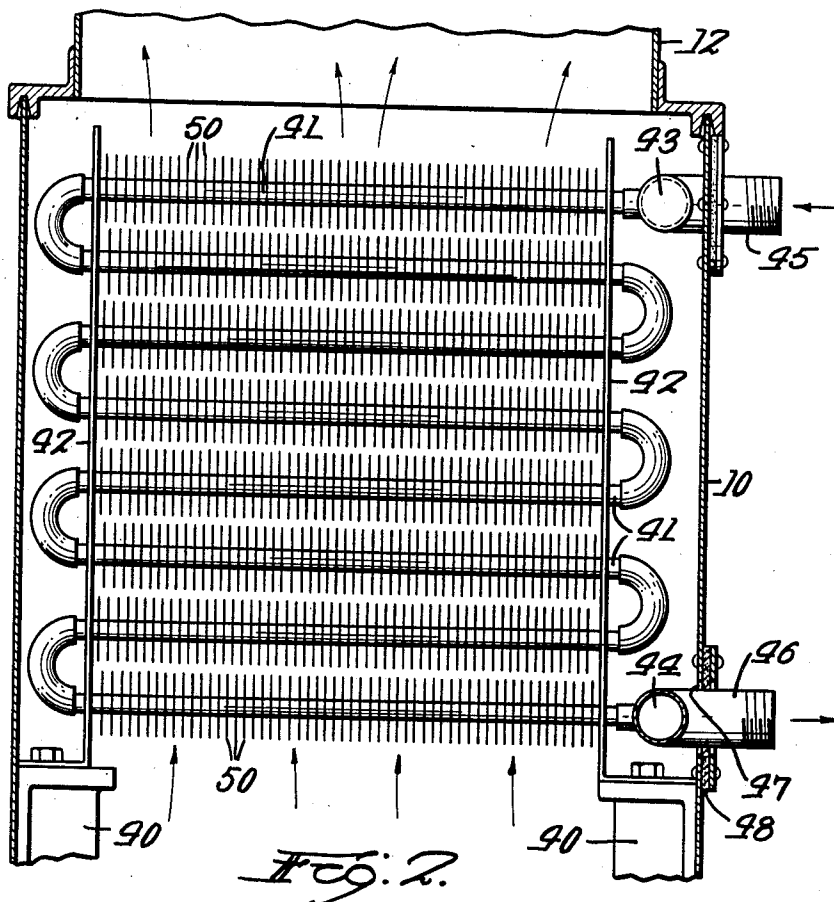
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AIR CONDITIONING APPARATUS

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3 Sheets-Sheet 2



The Invention of
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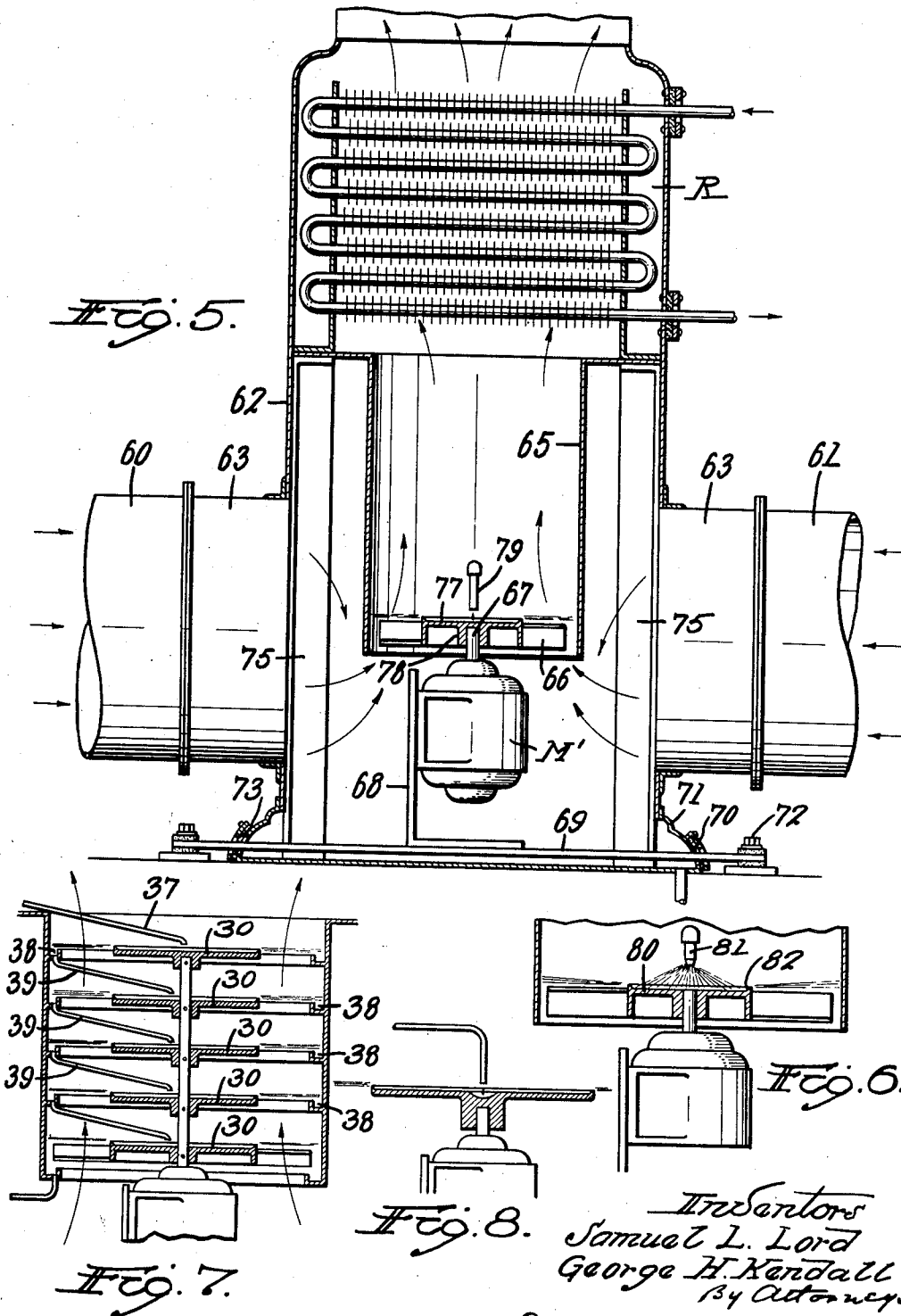
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AIR CONDITIONING APPARATUS

Original Filed March 8, 1934

3 Sheets-Sheet 3



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UNITED STATES PATENT OFFICE

2,096,286

AIR CONDITIONING APPARATUS

Samuel L. Lord, Dedham, and George H. Kendall,
Weston, Mass., assignors, by direct and mesne
assignments, of one-half to John M. B.
Churchill, Philadelphia, Pa., and one-half to
Henry R. Hayes, New York, N. Y.

Application March 8, 1934, Serial No. 714,671
Renewed April 10, 1937

4 Claims. (Cl. 261—90)

This invention relates to apparatus for conditioning air for use in dwelling houses and other inhabitable structures.

It is the general object of our invention to provide an improved apparatus for scrubbing and cleaning, humidifying, heating and circulating a continuous supply of air for the purpose above indicated, or for dehumidifying and cooking the air.

10 With this general object in view, important features of our invention relate to the provision of improved air-circulating and moisture-distributing mechanism, to an improved mounting for such mechanism by which all moving parts
15 are supported entirely independent of the fan housing or air ducts, and to improved means for heating the air, including a novel radiator construction.

Our invention further relates to arrangements
20 and combinations of parts which will be hereinafter described and more particularly pointed out in the appended claims.

Preferred forms of our invention are shown in the drawings, in which

25 Fig. 1 is a sectional front elevation of one form of our improved conditioning apparatus;

Fig. 2 is an enlarged side elevation of the air-heating radiator construction, looking in the direction of the arrow 2 in Fig. 1;

30 Figs. 3 and 4 are detail sectional elevations, taken along the lines 3—3 and 4—4 in Fig. 1;

Fig. 5 is a view similar to Fig. 1 but showing a modified construction;

Fig. 6 is a detail sectional front elevation
35 showing a slight further modification, and

Figs. 7 and 8 are detail views of additional modifications.

Referring to Figs. 1 to 4, we have shown conditioning apparatus comprising an enclosing casing 10 having an air intake connection 11 and an air outlet connection 12. The intake connection 11 is connected to a fan housing 13, and an air filter 14 of any usual or commercial form may be introduced between the air intake 11
45 and the fan housing 13.

Fan blades 16 (Fig. 3) are mounted on a frame member 17 having a hub 18 secured to the end of a fan shaft 19. The shaft 19 is rotatable in bearings in an elongated bearing sleeve 20, and the shaft 19 is provided at its outer end with a pulley 21 connected by a belt 22 to a pulley 23 on the armature shaft 24 of a driving motor M.

The bearing sleeve 20 is secured in a support or stand 26, fastened to a suitable foundation in
55 any usual manner but at a point entirely outside

of the casing 10 of the conditioning apparatus and the base 10^a thereof. The motor M is also mounted entirely outside of the casing 10 and base 10^a, and is mounted in such position that it has no contact therewith.

The sleeve 20 (Fig. 1) extends freely through a relatively large opening 27 in the side of the casing 10, and is sealed therein by felt ring packing 28. This packing is of a soft and yielding nature, as it resists only very slight outward air pressure, and this packing is entirely incapable of transmitting any vibration from the sleeve 20 to the casing 10.

This matter of supporting the motor and fan entirely outside of the air casing or any part structurally connected thereto is of very great importance and constitutes one of the outstanding features of our invention. It has been found by experiment that if any moving part or the support thereof directly engages the casing of air-conditioning apparatus, or any of the air ducts, the vibration and the noise occasioned thereby will be transmitted throughout the house with extremely unpleasant results.

With our improved apparatus, however, the driving motor and all moving parts are supported entirely outside of the casing 10 and they have no metallic or other direct contact therewith. Extremely quiet operation of the apparatus is thus achieved.

For the purpose of washing or scrubbing the incoming air and for humidifying the same, we provide a disc 30 mounted on the fan shaft 19 and rotatable at high speed therewith. Water is delivered through a pipe 31 to a discharge point 32 adjacent the center of the disc 30, and the disc 30 is provided with an offset edge or rim 33 by which the water is thrown off of the rapidly revolving disc in the form of a fine mist. The particles of mist, however, travel directly outward through the incoming stream of air, and more or less in the plane of the disc.

We have found by experiment that moisture thus applied to the incoming air acts very effectively to wash or scrub the air stream and to remove dust, pollen, smoke and odors therefrom. At the same time, a desired portion of the moisture in the form of mist is taken up by the air stream, thus humidifying the air to the desired extent. Excess moisture, if any, collects in a recess 35 of the base 10^a and may be removed through a drain pipe 36. The edge or rim 33 is preferably provided with a thin sharp edge, which is particularly effective in providing

a satisfactory mist with a small consumption of water.

This scrubbing of the incoming air is a very valuable part of our process of air conditioning. The application of moisture by forcibly throwing a very fine fog or mist in the form of a sheet directly across an air stream which is moving substantially perpendicular thereto is believed to be novel and has been proved to be remarkably economical and efficient. While water is more commonly used in this connection, other liquids may be substituted to effect special results.

We may use the water or other liquid at either high or low temperatures, for either heating or cooling of the air stream.

We may also use a plurality of discs 30, as indicated in Fig. 7, this arrangement being particularly applicable to the vertical type of machine shown in Figs. 5 and 6. When such a plurality of discs is used, the water or other liquid is preferably supplied to the upper disc 30 through a pipe 37 (Fig. 7) and the moisture thrown outward by the disc is collected in an annular channel 38 and is conducted to the next lower disc 30 through a feed pipe 39. A separate channel 38 and feed pipe 39 are provided for each succeeding lower disc 30, so that the same liquid may be utilized for several successive scrubbing and heating or cooling operations.

This arrangement of successive discs is particularly desirable under certain special conditions, such as when cooling extremely hot air or gases or when warming extremely cold air or gases. In either case it will be noted that the direction of flow of the liquid is directly opposite to the direction of flow of the air or gas, so that the cooler portion of the air is engaged by the cooler portion of the liquid, either in a heating or a cooling operation, and thus the most efficient conditions for heat transfer to or from the current of air are provided, as will be hereinafter more fully explained.

The washed and humidified air then passes upward, as indicated by the arrows, to a heating device or radiator R mounted on posts 40, which in turn are supported on the base 10^a. The air stream passes upward through the radiator R to the air outlet connection 12 and is heated to a desired temperature during such upward passage.

A preferred construction of the radiator is shown in Fig. 2 and comprises heating coils 41 mounted in reverse bends in end plates 42 and connected to headers 43 and 44. A steam inlet pipe 45 is connected to the upper header 43 and an outlet pipe 46 is connected to the lower header 44. These pipes extend out through openings 47 in the casing 10 and are preferably provided with felt sealing rings 48.

The coils 41 are preferably each provided with a large number of thin metal discs 50 by which the radiating surface is greatly increased, and these discs are preferably staggered in vertical arrangement as clearly shown in Fig. 2, so that the air passing upward must travel a tortuous course.

It will be understood that hot water or other heated liquids may be substituted for steam in the heating coils.

The counter-flow arrangement of the coils, with the steam or hot water flowing downward and the incoming air flowing upward, is of very great importance. With this arrangement the cool air first encounters the relatively cool lower

coils 41, and as the temperature of the air increases in its upward passage, the air encounters heating coils at progressively high temperatures. Accordingly, the heat differential between the air and the heating coil is relatively small at every point, and heat is easily and economically transferred from the coil to the air stream.

This form of radiator is also particularly adapted for cooling the air and will operate with water at ordinary water-main temperature to produce as low an air temperature as is necessary for satisfactory use in summer weather. When the radiator is operated as a cooling device, the cool water becomes heated as it flows downward, so that the warm air first encounters the warmer coils at the bottom of the radiator, and the cooler air encounters the cooler coils toward the top of the radiator. The device thus operates on the counter-flow principle, whether in use for heating or cooling.

The range of heat interchange may be extended as far as desired. When steam or gases possessing available latent heat are used, the steam or gases may be condensed in the lower coils of the radiator and the condensed liquid may be further cooled by the removal of additional heat therefrom. In such cases it may be desirable to maintain a liquid level in the lower coils of the radiator.

We may also use combustion gases for heating purposes, but in this case it is usually desirable to provide sufficient excess air to substantially lower the temperature of the combustion gases to a point where heat may be satisfactorily interchanged without excess drying or so-called "burning" of the air to be circulated through the dwelling.

In Fig. 5 we have shown a slightly modified construction in which two air inlets 60 and 61 are connected to opposite sides of a casing 62, preferably through filters 63, and in which the air is delivered to the radiator R through an air uptake tube 65.

A fan 66 is mounted direct on the armature shaft 67 of a motor M' which is supported on a bracket 68 secured to a cross frame or support 69. This cross frame extends outward through openings 70 in the base 71 of the casing 62, and is secured to a suitable foundation by clamping bolts 72. The frame 69 may be sealed in the openings 70 by felt packing 73 as previously described.

The motor M' and fan 66 are thus supported entirely out of engagement with the casing 62 or with any part mechanically connected therewith. Posts 75 support the weight of the radiator R but these posts are spaced apart and are out of contact with the cross frame 69.

In Fig. 5, we have shown the water-distributing disc 77 as formed integral with the hub 78 and central frame member of the fan 66, water being introduced in drops or in desired small quantities through a pipe 79. The operation and advantages of this form of our invention are as previously described.

In Fig. 6 we have shown a slight additional modification in which water is supplied to the moisture-distributing disc 80 through a spray nozzle 81 which delivers the water closely adjacent the raised outer edge or rim 82 of the disc. A plurality of concentric rings or rims may be provided on the disc 30, 77 or 80, if desired.

In Fig. 8 we have shown a disc having a hollow cup at the center, into which water drops. In

this form of disc, the water flows outward very evenly in all directions.

Each one of the constructions shown in Figs. 1 and 5 to 8 is effective in providing a satisfactory mist for washing or scrubbing the incoming air stream, and they may be used interchangeably in the different casings.

The order in which the described operations are performed is also of great importance and possesses important advantages. It is particularly important that the air be humidified when in its cooler condition as moisture absorbed by the air when in cool condition will not ordinarily be deposited until the air again reaches the temperature at which humidification took place. Consequently the moisture carried into the dwelling or other structure by the air stream will be fixed in the air by the heating thereof and will not condense on particles of furniture or other surfaces where the air is used.

Having thus described our invention and the advantages thereof, we do not wish to be limited to the details herein disclosed, otherwise than as set forth in the claims, but what we claim is:—

1. Air conditioning apparatus comprising an air-conducting casing having air inlet and outlet connections, a supporting structure for said casing, a fan to circulate air through said casing, means to drive said fan, a bearing sleeve for said fan, and means to support said bearing sleeve entirely outside of said casing, said sleeve freely extending through an opening in the side of said casing but out of contact with said casing.

2. Air-conditioning apparatus comprising an air-conducting casing having air inlet and outlet connections, a supporting structure for said casing, a fan to circulate air through said casing,

means to drive said fan, a bearing sleeve for said fan, and means to support said bearing sleeve entirely outside of said casing, said sleeve extending through a relatively large opening in said casing and being sealed against light air pressure by a soft yielding packing between said sleeve and casing.

3. Air conditioning apparatus comprising an air-conducting casing having air inlet and outlet connections, a supporting structure for said casing, a fan to circulate air through said casing, a motor for said fan, said motor being separately mounted on said supporting structure entirely outside of and independent of said casing, said fan having bearings and a bearing sleeve, and said bearing sleeve extending through an opening in the side of said casing and being sealed in said opening by relatively soft material substantially incapable of transmitting vibrations.

4. In an air conditioning apparatus, an air humidifying and circulating device comprising a fan having blades extending outward from an enlarged hub portion and having one face of said hub portion effective as a humidifying disc and comprising a substantially flat circular area with an abruptly and axially offset outer portion having a sharp thin edge, said outer portion constituting a cylindrical annular flange at the outer edge of said hub portion and extending axially therefrom, and a spray nozzle substantially aligned with the axis of said fan and delivering a spreading cone-shaped spray direct to said disc at the periphery thereof and adjacent said flange.

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