Aug. 10, 1965 M. A. LOWELL 3,199,774

IN-DUCT FAN

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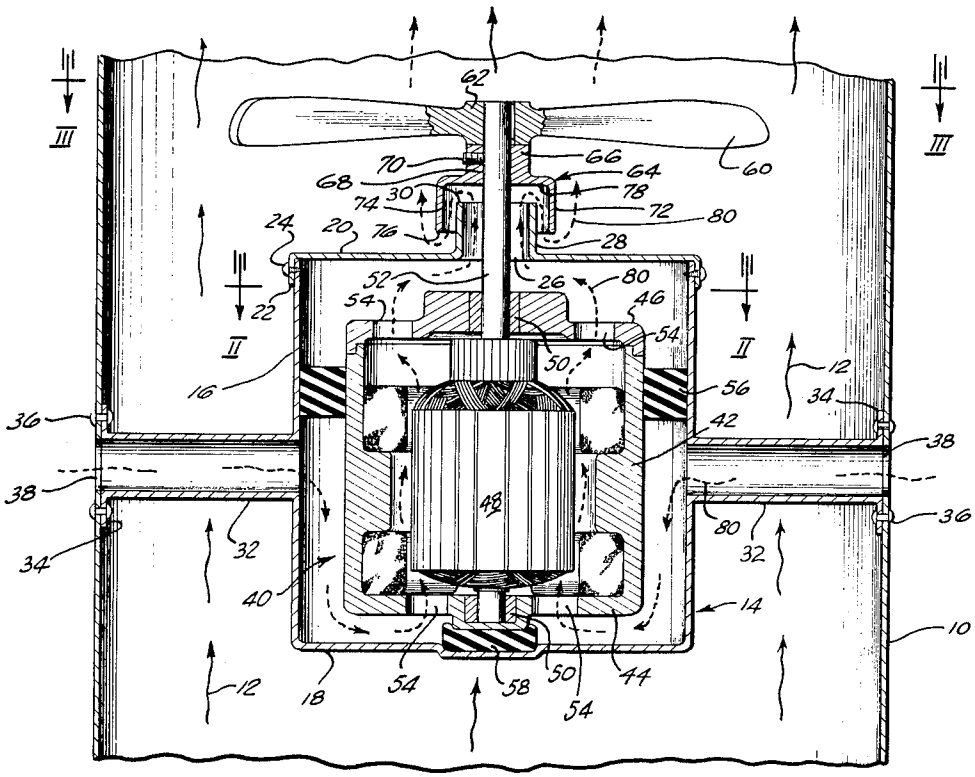

FIG. 1

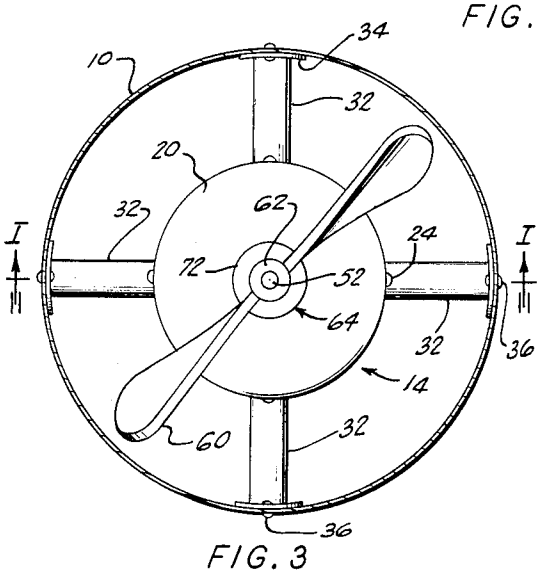

FIG. 3

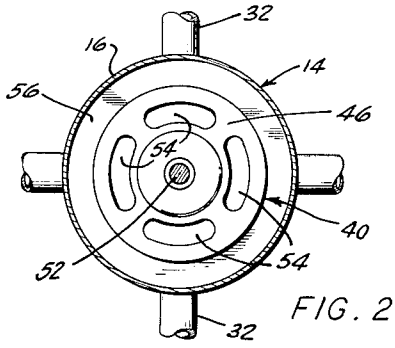

FIG. 2

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IN-DUCT FAN

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The invention pertains to a fan arrangement within a duct to produce forced flow therein, and particularly pertains to a fan assembly for installation entirely within a duct.

Forced flow duct arrangements, wherein a fan and motor are located within the duct, have the disadvantage of subjecting the fan motor to the gas flowing through the duct unless protective measures are taken. Accordingly, in those installations wherein it is desired to locate the fan motor within the duct, and protect the motor from the gas flowing through the duct, it is common to use a fan motor shield or housing in which the motor components are located. It is also known to circulate air exteriorly of the duct through the fan motor for cooling purposes. The present invention pertains to an in-duct fan assembly wherein the assembly results in a minimum restriction to gas flow through the duct, and wherein fan motor cooling air is drawn through the fan motor from the atmosphere exteriorly of the duct and uniformly circulated through the motor.

Another object of the invention is to provide an in-duct fan assembly wherein a fan motor is supported within a casing, and the fan motor may be of a conventional, readily available construction.

Yet another object of the invention is to provide an in-duct fan assembly using a conventional fan motor supported with a housing, wherein the support structure for the housing serves as a duct to permit cooling air to be drawn from the exterior of the duct and through the motor.

An additional object of the invention is to provide an in-duct fan assembly wherein a fan motor is located within a housing and has a shaft extending through an opening in the housing, baffle means being employed adjacent said housing opening preventing the entrance of undesirable foreign matter into the housing.

Another object of the invention is to provide an in-duct fan assembly wherein a fan motor is located within a housing having a shaft extending therefrom through a housing opening wherein a baffle is supported on the shaft and associating with the housing opening so that improved cooling air flow through the housing and fan motor is obtained.

These and other objects of the invention arising from the details and relationships of the components of an embodiment thereof will be apparent from the following description and accompanying drawing wherein:

FIG. 1 is a diametrical, sectional view of a fan assembly in accord with the invention, as installed in a vertical duct, as taken along section I—I of FIG. 3, the fan being only partially sectioned,

FIG. 2 is a plan, sectional, detail view taken through the fan motor housing along section II—II of FIG. 1, and

FIG. 3 is a reduced scale, plan, sectional view taken through the duct, along section III—III of FIG. 1.

FIG. 1 illustrates a typical application of the invention wherein the fan assembly is located within a vertical duct 10 of an air conditioner cooling tower system wherein the flow of moist air is in the direction of the arrows 12. The duct 10 is illustrated as being cylindrical. However, it will be appreciated that the fan assembly of the invention may be employed with a duct of any cross-sectional configuration.

The fan assembly includes a housing 14 of sheet metal

or similar material, having a cylindrical wall 16, an upstream facing wall 18, and a downstream facing wall 20. The downstream facing wall 20 is preferably in the form of a cover having an overlapping flange 22, whereby the wall 20 may be attached to the cylindrical wall 16 by removable fastening means 24, such as sheet metal screws. The downstream facing wall 20 is provided with a centrally located opening 26 defined by the tubular neck 28 formed on the wall. The neck 28 communicates with the interior of the housing 14 at its inner end and is provided with an outer edge 30 spaced from wall 20, as will be apparent from FIG. 1.

The housing 14 is supported within the duct 10 by a plurality of radially extending, tubular support arms 32 of equal length. The arms 32 form a spider mounting for the housing 14, whereby the housing may be centrally located within the duct. The arms 32 are affixed at their inner ends to the wall 16 and communicate with the housing interior. The outer ends of the arms 32 may be flanged as at 34 to permit the arms to be fastened to the inner surface of the duct 10. Rivets or other commercial fastening means 36 may be used to attach the flanges 34 to the duct. The duct 10 is provided with openings 38 aligned with the support arms 32, whereby the atmosphere outside of the duct communicates through the support arms with the interior of the housing 14.

The housing 14 receives a conventional fan motor 40. The fan motor 40 includes a casing 42 having end walls 44 and 46. The armature 48 is rotatably supported within the casing on bearings 50, and the armature drive shaft 52 extends through the opening 26, and is of sufficient length to extend through the neck 28, as will be apparent from FIG. 1. It is a feature of the invention that the fan motor 40 may be of a conventional form readily available on the commercial market. Thus, the casing 42 will be of a cylindrical configuration provided with openings 54 in the end walls 44 and 46 for cooling purposes.

The fan motor 40 is mounted within the housing 14 by means of an annular sealing ring 56 of a resilient material such as rubber or the like. The annular ring 56 circumscribes the motor casing 42, FIG. 2, and may be bonded to the casing and housing, or may be located in place by compression forces. Also, a resilient pad 58 is interposed between the housing wall 18 and the lower casing end wall 44 to support the weight of the fan motor.

A fan blade 60 having a central hub 62 is keyed, or otherwise attached, to the fan motor shaft 52 axially spaced from the neck edge 30. An annular, cup-like collar 64, including a portion 66, is mounted on the shaft 52 by means of a bore 68 centrally defined in the portion 66, and a set screw 70 threadedly supported within the portion 66 bears on the shaft to fix the collar therein. The collar 64 includes a cylindrical bell wall portion 72 defining a chamber 74. The lower end of the collar wall portion 72 is defined by the wall edge 76. The radial dimension of the wall 72 is substantially larger than the radial dimension of the neck 28, whereby radial spacing is provided between the neck and collar wall. Also, the collar 64 is so located on the shaft 52 that substantial clearance is provided between the neck edge 30 and the chamber bottom wall 78, whereby air may flow through the neck 28 and into the chamber 74. As will be appreciated from FIG. 1, the collar wall edge 76 is located nearer the housing wall 20 than is the neck edge 30. Thus, the air passing through the neck 28 into the chamber 74 and out under the collar edge 76 passes through the zigzag path indicated by the arrows 80. The collar thereby prevents direct acess to the interior of the housing 14 through the neck 28 and forms a baffle, whereby foreign matter, moisture and such are prevented from entering the housing and adversely affecting the fan motor.

As the opening 26, neck 28, and collar 64 are located on the low pressure side of the fan blade 60 energizing the fan motor 40 to rotate the fan blade will cause fan motor cooling air to enter the support arms 32 through the duct openings 38 and flow through the openings 54 within casing end wall 44, over the motor armature and windings, and through the openings 54 within casing wall 46 into the neck 28 and around the neck and collar wall 72 into the duct 10. Simultaneously, the fan blade will be moving the air within the duct in a vertical, upward direction. As the sealing ring 56 is located between the motor casing end walls 44 and 46, the air entering the housing 14 through the support arms 32 cannot directly flow to the opening 26 but must first pass through the openings 54 within the casing lower end wall 44 and, thus, through the motor, thereby providing optimum ventilation and cooling of the fan motor and preventing the mositure-laden air within the duct 10 from entering the motor housing.

In addition to preventing the entrance of undesirable foreign matter into the opening 26, the collar wall 72 is of sufficient radial dimension as to locate the flow of air around the collar edge 76 outwardly with respect to shaft 52 to extend beyond the radial dimension of the hub 62 and into the effective region of the fan blade. For this reason the diameter of wall portion 72 is greater than the diameter of hub 62. Thus, the collar 64 aids in insuring a sufficient ventilating air flow through the housing 14.

As the housing 14 is of a symmetrical and uniform shape and is centrally supported within the duct 10, and as the support arms 32 are symmetrically related to the duct, the presence of the fan assembly within the duct causes a minimum of turbulence through the duct, and produces a minimum of restriction therein. The fan assembly, in accord with the invention, may be employed in ducts conveying hot or corrosive gases or any type of gas which would be harmful to a fan motor. As the openings 38 are the only duct modifications required for the fan assembly installation, it will be appreciated that the fan assembly may be mounted at any desired location within a duct, and does not require special duct work or sections. By the use of the housing 14 and the sealing ring 56 and by locating the support arms between the sealing ring and the casing wall 44, the fan motor may be of the conventional open-type internally ventilated construction and, thus, a most economical in-duct fan assembly is provided.

It is appreciated that various modifications to the described embodiment may be apparent to those skilled in the art, and it is intended that the invention be defined only by the scope of the following claims.

I claim:

1. A fan assembly adapted to be mounted within a duct comprising, in combination,

(a) a motor housing having upstream and downstream facing walls with respect to the gas flow in the duct,

(b) a plurality of support arms extending from said housing adapted to support said housing within the duct,

(c) at least one of said support arms being tubular having an inner end communicating with the interior of said housing and an outer end adapted to communicate with the atmosphere surrounding the duct in which said housing is mounted,

(d) an electric motor within said housing including a casing having a first end wall disposed adjacent said housing upstream wall and a second end wall disposed adjacent said housing downstream wall, and a drive shaft extending through said second end wall and said housing downsream wall,

(e) an opening defined within each of said casing end walls,

(f) sealing means interposed between said motor casing and housing intermediate said casing end walls, said tubular support arms communicating with said housing intermediate said sealing means and said upstream wall,

(g) a tubular open-end-neck centrally defined on said housing downstream wall extending away from said housing and communicating with the interior thereof, said motor drive shaft extending through said neck,

(h) a fan blade attached to said shaft located exteriorly of said housing and adjacent said neck, the lower pressure created by said fan blade adjacent said neck causing gas flow through said tubular arm, motor casing and neck, and

(i) an annular cup-shaped collar supported relative to said housing having an open end extending over said neck and radially spaced therefrom, preventing direct access to the interior of said housing through said neck.

2. A fan assembly adapted to be mounted within a duct comprising, in combination,

(a) a motor housing having upstream and downstream facing walls with respect to the gas flow in the duct,

(b) a plurality of support arms extending from said housing adapted to support said housing within the duct,

(c) at least one of said support arms being tubular having an inner end communicating with the interior of said housing and an outer end adapted to communicate with the atmosphere surrounding the duct in which said housing is mounted,

(d) an electric motor within said housing including a casing having a first end wall disposed adjacent said housing upstream wall and a second end wall disposed adjacent said housing downstream wall, and a drive shaft extending through said second end wall and said housing downstream wall,

(e) an opening defined within each of said causing end walls,

(f) sealing means interposed between said motor casing and housing intermediate said casing end walls, said tubular support arms communicating with said housing intermediate said sealing means and said upstream wall,

(g) a tubular axially extending neck centrally defined on said housing downstream wall having an outer edge axially spaced from said downstream wall and an inner end communicating with the interior of said housing, said motor shaft extending through said neck,

(h) a fan blade attached to said shaft located exteriorly of said housing and axially spaced from said neck outer edge, and

(i) a cup-shaped collar mounted on said shaft between said fan blade and neck outer edge, said collar having an open end extending over said neck outer edge and radially spaced therefrom located nearer said housing downstream wall than said neck outer edge, whereby said collar prevents direct access to the interior of said housing througs said neck.

3. In a fan assembly as in claim 2, wherein

(a) said fan blade includes a hub portion disposed adjacent said motor shaft, and

(b) said collar open end is of a greater radial dimension with respect to the axis of said shaft than said fan blade hub portion.

4. A fan assembly adapted to be mounted within a duct comprising, in combination,

(a) a motor housing having upstream and downstream facing walls with respect to the gas flow in the duct,

(b) a plurality of tubular support arms equally spaced about the circumference of said housing and radially extending therefrom each having an inner end communicating with the interior of said housing and an outer end adapted to communicate with the atmos-

phere surrounding the duct in which said housing is mounted,

(c) an electric motor within said housing including a casing having a first end wall disposed adjacent said housing upstream wall and a second end wall disposed adjacent said housing downstream wall, and a drive shaft extending through said second end wall and said housing downstream wall,

(d) an opening defined within each of said casing end walls,

(e) an annular resilient sealing ring surrounding said casing sealingly associated with and interposed between said casing and housing, said ring engaging said casing intermediate said casing end walls, said tubular support arms communicating with said housing intermediate said sealing ring and said upstream wall,

(f) an opening defined in said housing downstream wall, and

(g) a fan blade attached to said shaft located exteriorly of said housing and adjacent said housing opening, the lower pressure created by said fan blade adjacent said housing opening causing gas flow through said tubular arms, motor casing and housing opening.

5. A fan assembly adapted to be mounted within a duct comprising, in combination,

(a) a motor housing having upstream and downstream facing walls with respect to the gas flow in the duct,

(b) a plurality of tubular support arms radially extending from said housing each having an inner end communicating with the interior of said housing and an outer end adapted to communicate with the atmosphere surrounding the duct in which said housing is mounted,

(c) an electric motor within said housing including a casing having a first end wall disposed adjacent said housing upstream wall and a second end wall disposed adjacent said housing downstream wall, and

a drive shaft extending through said second end wall and said housing downstream wall,

(d) an opening defined within each of said casing end walls,

(e) an annular resilient sealing ring surrounding said casing sealingly associated with and interposed between said casing and housing, said ring engaging said casing intermediate said casing end walls, said tubular support arms communicating with said housing intermediate said sealing ring and said upstream wall,

(f) a tubular axially extending neck centrally defined on said housing downstream wall having an outer edge axially spaced from said downstream wall and an inner end communicating with the interior of said housing, said motor shaft extending through said neck,

(g) a fan blade attached to said shaft located exteriorly of said housing and axially spaced from said neck outer edge, and

(h) a cup-shaped collar mounted on said shaft between said fan blade and neck outer edge, said collar having an open end extending over said neck outer edge and radially spaced therefrom located nearer said housing downstream wall than said neck outer edge, whereby said collar prevents direct access to the interior of said housing through said neck.

References Cited by the Examiner

UNITED STATES PATENTS

1,244,334	10/17	Ilg	230—117 X
1,431,907	10/22	Cramer	230—117
2,494,772	1/50	McElroy	230—117

FOREIGN PATENTS

377,132	6/23	Germany.

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