Oct. 3, 1961 R. A. PAPSDORF 3,002,676

VENTILATING FAN CONSTRUCTION

Filed Jan. 12, 1959 2 Sheets-Sheet 1

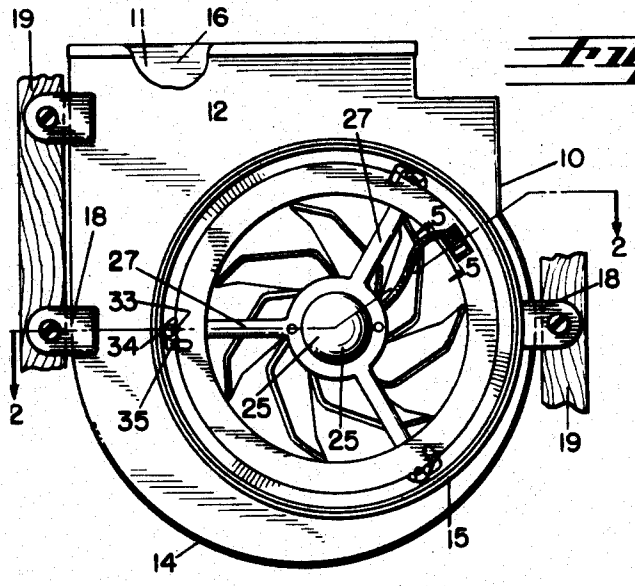


Fig. 1

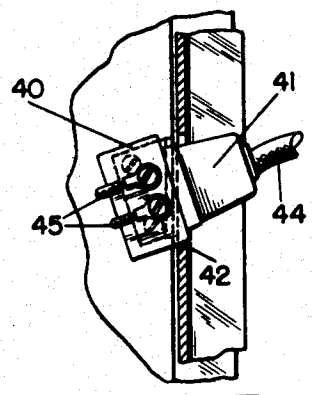


Fig. 5

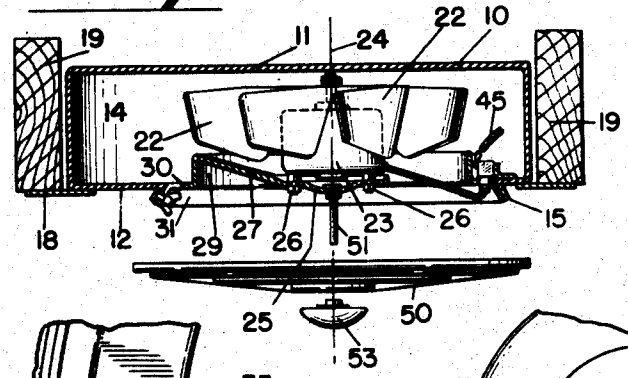


Fig. 2

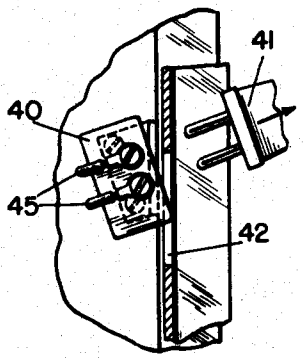


Fig. 6

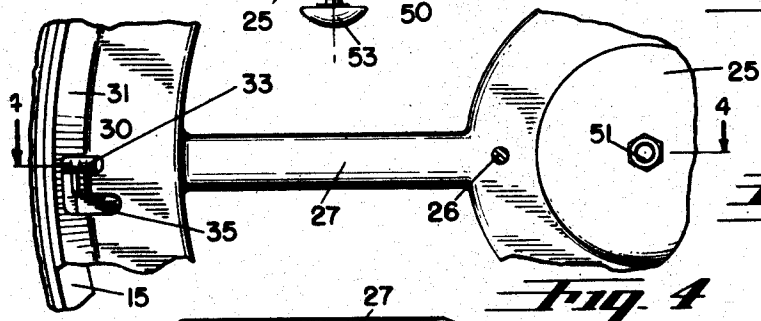
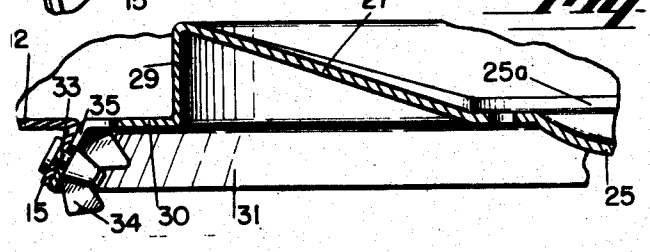


Fig. 3

Fig. 4



INVENTOR.
ROBERT A. PAPSDORF
BY
Knight & Rodgers
ATTORNEYS

Oct. 3, 1961 R. A. PAPSDORF 3,002,676

VENTILATING FAN CONSTRUCTION

Filed Jan. 12, 1959 2 Sheets-Sheet 2

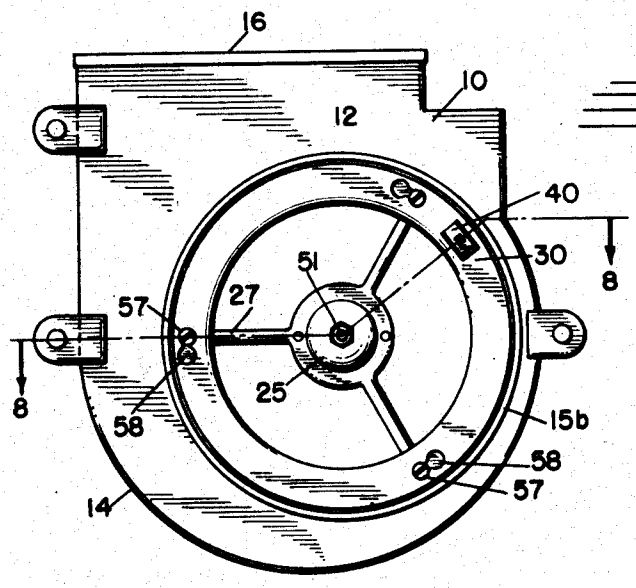


Fig. 7

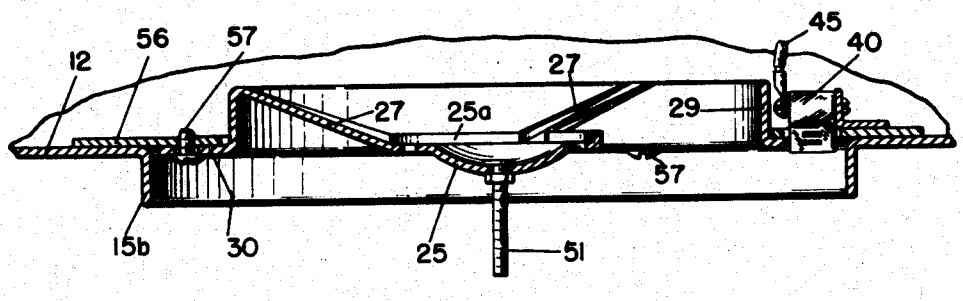


Fig. 8

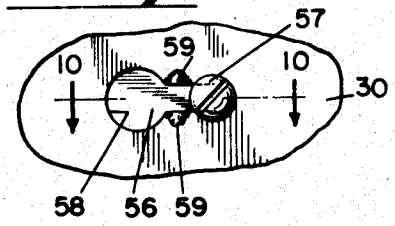


Fig. 9

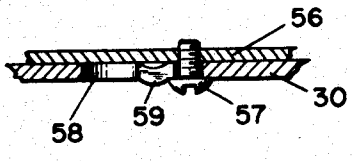


Fig. 10

INVENTOR.
ROBERT A. PAPSDORF
BY
Knight & Rodgers
ATTORNEYS

United States Patent Office 3,002,676 Patented Oct. 3, 1961

3,002,676

VENTILATING FAN CONSTRUCTION

Robert A. Papsdorf, Claremont, Calif., assignor to Emerson-Pryne Company, Pomona, Calif., a corporation of Delaware

Filed Jan. 12, 1959, Ser. No. 786,160
7 Claims. (Cl. 230—117)

The present invention relates generally to the construction of a ventilating fan unit and more especially to means in such a unit for mounting a motor and impeller within the housing. In a ventilating unit of this character, the usual practice is for the motor and the fan or impeller to be assembled and then mounted as a unit inside the housing which forms a portion of the air duct. For this purpose there is provided a motor mount which supports the motor in the proper position and which is attached to the housing. The motor is mounted adjacent to an opening in the housing. At this opening in the housing is a venturi ring which defines the actual air inlet to the impeller and directs the air stream to the impeller. This venturi ring, and the motor mount have heretofore been separately fabricated members attached to the housing.

Thus it is a general object of my invention to design the motor mounting means and the venturi ring in the manner to achieve maximum efficiency in operation and likewise to obtain minimum manufacturing costs.

These advantages of my invention have been attained in a ventilating fan unit of the character described, in which a unitary venturi ring and motor mounting means comprises a central plate to support the motor, a plurality of arms integral with the plate extending outwardly therefrom, and a venturi ring of a diameter suitable for the impeller with which it is used, said venturi ring being integral with the outer ends of the arms. Also integrally formed with the venturi ring is an attachment flange joining the ring at a point axially spaced from the connection to the arms. This attachment flange is engageable with the wall of the housing around the opening therein properly to locate the motor and fan within the housing. The venturi ring is ordinarily a figure of revolution, typically being a cylindrical member which is concentric with the axis of revolution of the impeller.

In a preferred form of the invention, the housing has an outstanding flange around the inlet opening which provides a plaster ground. The attachment flange on the unitary ring and motor mount has a section which, when all parts are assembled, is parallel to and in engagement with this outstanding flange.

The complete unit includes fastening means for attaching the motor mounting means to the housing, this fastening means being of a character which is disengageable by rotation of the motor mount and ring relative to the housing. In order to lock the motor mount against rotation which would disengage the fastening means while the power supply is connected to the motor, an electrical receptacle adapted to receive a removable plug is mounted on the housing and accessible through an opening in the attachment flange. When the plug is inserted in the receptacle to complete the circuit to the motor, the plug is in a position to lock the motor mounting means against rotation in the direction to disengage the fastening means.

How the above objects and advantages of my invention, as well as others not particularly mentioned, are attained, will be more readily understood by reference to the following description and to the annexed drawing, in which:

FIG. 1 is a bottom plan view of a ventilating unit constructed according to my invention.

FIG. 2 is a partially exploded, vertical median section on line 2—2 of FIG. 1, showing the unit installed in a ceiling of a room.

FIG. 3 is an enlarged fragmentary bottom plan showing one of the arms extending between the motor mounting plate and the venturi ring, and means for fastening the combined motor mount to the housing.

FIG. 4 is an enlarged vertical section on line 4—4 of FIG. 3.

FIG. 5 is a fragmentary vertical section on line 5—5 of FIG. 1 showing a receptacle with a plug therein.

FIG. 6 is a view similar to FIG. 5 showing the attachment flange rotated from the position of FIG. 5 after the plug has been removed from the receptacle.

FIG. 7 is a bottom plan view similar to FIG. 1 showing a modified form of my invention, but without fan and motor.

FIG. 8 is a fragmentary vertical section on line 8—8 of FIG. 7.

FIG. 9 is an enlarged fragmentary inverted plan of the fastening means and anti-rotating device.

FIG. 10 is a vertical section on line 10—10 of FIG. 9.

Referring now to the drawing and particularly to FIGS. 1 and 2, there is shown a housing indicated generally at 10. Although the invention is not limited to any particular size or design of housing for the ventilating unit, the one illustrated in the drawing is widely used though perhaps at times with differences in details of design. Housing 10 has two flat spaced walls 11 and 12 which, when the ventilating unit is installed in the ceiling as in FIG. 2, become respectively the upper and lower walls of the housing. These two walls are joined by a side wall 14 which is curved for most of its length but includes straight terminal sections adjoining the air outlet 16 from the housing.

Housing 10 has an air inlet opening in wall 12, this inlet being surrounded and defined by outstanding flange 15 which is integral with side wall 12. Air leaves the housing through outlet 16 between walls 11 and 12, which is preferably rectangular in shape for easy connection to a suitable duct for discharging air.

Wall 12 of the housing has mounted on it a plurality of nailing tabs 18 by which the housing may be attached to studs or ceiling joists 19 of the building in which the ventilating unit is installed. Flange 15 then serves as a plaster ground, as shown in FIGS. 2 and 4, allowing the housing to be plastered over except for the opening to admit air.

Air is moved from the inlet to outlet 16 of the housing by a fan or impeller 22 consisting of a plurality of blades of any suitable design. The impeller is mounted upon the drive shaft of an electric motor 23 to be rotated by the motor about vertically extending axis 24 of the shaft. The drive shaft extends beyond the upper end of the motor for direct mounting of the blade assembly on the shaft. The blades of the impeller extend outwardly beyond and downwardly around the motor to reduce overall dimensions and move cooling air past the motor. The impeller and electric motor are assembled together and are handled as a unit.

This assembly consisting of the impeller and motor is mounted within the housing by means of the combined venturi ring and motor mount of unitary construction which is mounted in the opening in housing wall 12. This motor mounting means is shown in greater detail in FIGS. 3 and 4, and comprises a central plate 25 upon which the motor is supported, being attached by screws 26 which pass upwardly through the plate. A plurality of arms 27 are integral at one end with a central plate 25, these arms extending radially outward from the plate. In the design illustrated there are three arms 27; but it will be realized that this number may be changed if desired. As may be seen in FIG. 4, arms 27 may be

slightly curved in transverse cross section in order to give them greater stiffness, as will be understood. If this is done, central plate **25** may conveniently be provided with an upstanding peripheral rim **25***a*.

At their outer ends, arms **27** are integral with venturi ring **29**, which is preferably a cylindrical member with its axis concentric with the axis of revolution **24** of impeller **22**. The venturi ring has a diameter slightly smaller than the maximum diameter of impeller **22**, and it extends inwardly to a point closely adjacent the blades of impeller **22** in order to direct entering air to the impeller. Ring **29** circumscribes and defines the actual air inlet to the impeller. Venturi ring **29** is not necessarily limited to being a cylinder since, generally speaking, it can be any figure of revolution, for example a conical surface, about the same axis.

Integral with the outermost or lower edge of venturi ring **29**, is an attachment flange which extends around the full circumference of the ring. This attachment flange, while made in a single integral piece, has two more or less well defined sections **30** and **31** angularly disposed relative to each other. The first section **30** lies in a plane substantially perpendicular to the central axis and preferably is coincident with or parallel to the plane of wall **12** while the second section **31** of the flange is inclined downwardly and outwardly relative to the first section. Inclination of this second section is such that it may be brought parallel to and in engagement with flange **15** of housing wall **12** in order to locate the combined venturi ring and motor mounting means properly with respect to the housing. It will be noted that arms **27** are joined to the venturi ring at the innermost end of the ring closest to the fan, and thus are connected to the ring at a position spaced axially from the attachment flange which is at opposite or outer ends of the ring. However, in order to minimize the overall dimensions of the housing, it is preferable that central plate **25** be located at or near the plane of housing wall **12**. For this reason arms **27** are inclined inwardly of the housing or upwardly, as viewed in FIG. 4, from the central plate.

In order to hold the unitary ring and motor mounting means in position, suitable fastening means is supplied. A preferred form of fastening means is illustrated in FIGS. 3 and 4, and comprises a threaded bolt **33** attached to housing flange **15** and upon which wing nut **34** can be screwed. An L-shaped slot **35** is placed in the attachment flange to receive bolt **33**. It will be understood that, when the motor mounting means with the motor on it is inserted into the housing and moved along the central axis, bolt **33** passes through the radial leg of slot **35** to reach the apex of the slot, after which the motor mounting means may be rotated about the central axis to move the bolt along the circumferential leg of the slot. In this position, a wing nut **34** may be applied to the bolt and screwed down to hold the attachment flange against rotation relative to the housing. The number of such bolts in the fastening means may be changed if desired, but it is convenient to provide three as shown in FIG. 1.

This fastening means is disengageable by reversing the steps just outlined, including the direction of rotation of the motor mounting means relative to the housing, to remove the motor and impeller from the housing for servicing. According to my invention I provide means associated with the power supply to the motor to hold the motor mounting means against such reverse rotation as long as the electrical conductors to the motor are physically connected to supply electric power to the motor. This means includes receptacle **40** rigidly attached to housing **10** with the side of the receptacle which is adapted to receive the prongs of plug **41** accessible through opening **42** in section **30** of the attachment flange on the motor mounting means. When this motor mount has been rotated to the extreme position with the fastening means fully engaged, opening **42** is directly above receptacle **40** and the prongs on plug **41** can then be inserted in the appropriate openings in receptacle **40** as in FIG. 5. Plug **41** is attached to the end of conductor **44** which is also connected to motor **23**. Receptacle **40** is connected to a power supply circuit by other conductors **45**, and in this way the electrical circuit to the motor is completed. It will be seen from FIG. 5 that in operating position plug **41** may be engaged by one side of opening **42** by a small amount of rotation of the motor mount in a reverse direction, i.e., the direction to disengage bolts **33** from slots **35**. This engagement of the plug by the mount prevents rotation of the motor mount for a sufficient distance and in the direction to disengage it from fastening means **33**. Rotation of the motor mount to remove it from the housing can only be accomplished when plug **41** is disengaged from receptacle **40**, as shown in FIG. 6. Although not necessary, it is preferred that receptacle **40** be tilted slightly with respect to the plane of rotation of flange section **30** in order to reduce the possibility of accidental contact of the flange with one of the prongs of plug **41** should the plug not be fully seated.

When installed in the ceiling or the like it is desirable to cover the air inlet of the housing by means of an ornamental grill **50** shown in FIG. 2 in position occupied just prior to mounting over the air inlet. In order to hold this grill in place, the central portion of plate **25** is slightly dished in order to receive the head of bolt **51** between the plate and motor **22**. Grill **50** has a central hole through which bolt **51** is passed. When grill **50** is in position over the air inlet its rim rests against the plaster (not shown in FIG. 2) around the air inlet, and it is held in place by means of a threaded nut in the ornamental knob **53** which is screwed onto bolt **51**.

A modified form of my invention is shown in FIGS. 7 and 8. In this form of the invention the ventilating unit is constructed and installed in the same manner as previously described, except as to those features which are pointed out below. The principal differences lie in the construction and arrangement of the mutually engaging portions of the housing and the combined venturi ring and motor mount. As will be seen by reference to FIG. 8, the outstanding flange **15***b* around the air opening in the housing wall is approximately perpendicular to housing wall **12** instead of being disposed at an acute angle thereto as is flange **15** in FIG. 4. At the base of this flange and inside housing **10** there is attached flat annular plate **56** which projects radially inwardly from flange **15***b*. This provides a ledge or shoulder which engages the radial portion **30** of the attachment flange on the combined venturi ring and motor mount. The outstanding flange section **31** may be omitted.

The fastening means comprises screws **57** screwed into threaded holes in plate **56** and passing through key-hole slots **58** in flange **30**.

It is preferred to provide anti-rotational means in the form of protrusions **59**. These are struck from inner face of the metal at the junction of the wide and narrow parts of key-hole slots **58**. When screws **57** are in the end of the narrow part, as in FIG. 9, and are tightened, protrusions **59** hold ring **30** against rotation in a direction to disengage it from screws **57**. Since this unit is normally ceiling mounted, the weight of the motor and mount presses ring **30** down against the heads of screws **57** even if they are not tight, and the anti-rotating effect of the protrusions is still exerted.

Receptacle **40** is mounted on the housing as before to prevent accidental disengagement of the motor mount and fastening means.

From the above description it will be seen that various changes in design and arrangement of parts, other than described, may be made without departing from the spirit and scope of my invention. Accordingly it is to be understood that the foregoing is considered to be illustrative of, rather than limitative upon, the invention as defined by the appended claims.

I claim:

1. In a ventilating fan construction including a housing with an air inlet and an air outlet, and an impeller and drive motor therefor within the housing, motor mounting means comprising: a central plate to support the motor; a plurality of arms integral with the plate and extending outwardly therefrom; a venturi ring conforming in diameter with the impeller and integral with the arms; an attachment flange joined to one edge of the venturi ring and engageable with a wall of the housing around the inlet therein to locate the motor-mounting means relative to the housing;

fastening means for attaching the motor mounting means to the housing, said fastening means being disengageable by rotation of the motor mounting means relative to the housing; and an electrical receptacle in the power supply to the motor mounted on the housing and adapted to receive a plug, the receptacle being accessible through an opening in the attachment flange whereby the plug when inserted in the receptacle holds the motor mounting means against rotation in a direction to disengage the fastening means.

2. In a ventilating fan construction including a housing wall having an air inlet opening therein, the combination comprising:

a removable impeller and motor mount adapted to support an impeller at the opening;

fastening means for attaching the impeller and motor mount to the housing, said fastening means disengageable by rotation of the mount relative to the housing;

and a stationary electrical receptacle in the power supply to the motor on the mount adapted to receive a plug to complete the power supply circuit, said receptacle being attached to the housing wall and being accessible to the plug through an opening in the mount whereby the plug when inserted in the receptacle holds the mount against rotation in a direction to disengage the fastening means.

3. In a ventilating unit construction, the combination of:

a housing having a wall with an opening therein surrounded by a flange extending away from one side of the wall to provide a plaster ground around the opening;

a removable fan and motor mount of one-piece construction comprising a central plate to support a motor and fan, a plurality of integral arms extending outwardly from said plate, a venturi ring joined to the arms at their outer ends, and an attaching flange integral with the venturi ring, said venturi ring being of smaller diameter than the flange on the housing wall and extending away from the plane of said housing wall at the other side thereof;

and fastening means for securing the fan and motor mount to the housing, said fastening means being releasable to free the fan and motor mount for removal from the housing.

4. The combination as claimed in claim 3 in which the flange on the housing wall is frusto-conical in shape and the attaching flange has a complementary frusto-conical section engaging the housing flange.

5. The combination as claimed in claim 4 in which the fastening means comprises a fixed bolt mounted on the housing flange and a slot of substantially right angular conformation in the attaching flange to receive the bolt.

6. The combination as claimed in claim 3 in which the fastening means comprises a keyhole slot in the attaching flange to receive at its small end the shank of a screw, and a protrusion in the attaching flange at the junction of the wide and narrow portions of the keyhole slot to engage the head of the screw when in the narrow portion of the slot.

7. The combination as claimed in claim 3 in which the fastening means includes a plurality of projecting members mounted on the housing and a plurality of apertures in the fan and motor mount each to receive one projecting member, the mount being secured in place on the housing by motion of the mount toward the housing to pass the projecting members through the apertures and subsequent rotational movement of the mount relative to the housing.

References Cited in the file of this patent

UNITED STATES PATENTS

1,889,117	Adamcikas et al.	Nov. 29, 1932
2,025,216	Opitz	Dec. 24, 1935
2,557,223	Hans	June 19, 1951
2,558,421	Danihhirsch	June 26, 1951
2,780,981	Miller	Feb. 12, 1957
2,800,272	McKee	July 23, 1957
2,828,682	Marker	Apr. 1, 1958