United States Patent [19]

Carpenter et al.

[11] **3,830,595**

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[54] **MOTOR MOUNTING SUPPORT**

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[52] **U.S. Cl.** **417/363,** 248/15, 310/91

[51] **Int. Cl.** **F16f 15/00,** H02k 5/24

[58] **Field of Search** ..... 417/360, 363, 355, 353; 248/15 X, 18; 310/62, 63, 91 X

[56] **References Cited**

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Assistant Examiner—Richard Saer
Attorney, Agent, or Firm—Donnelly, Maky, Renner & Otto

[57] **ABSTRACT**

A centrifugal blower having a cantilever support structure for positioning the fan motor within the interior of the fan wheel. The support includes cantilever arms extending through the housing inlet opening to connections with a motor base plate located between the fan back plate and motor. Special tie rods are provided between the cantilever arms, whereby each arm cooperates with the others to resist tilt or wobble forces.

3 Claims, 3 Drawing Figures

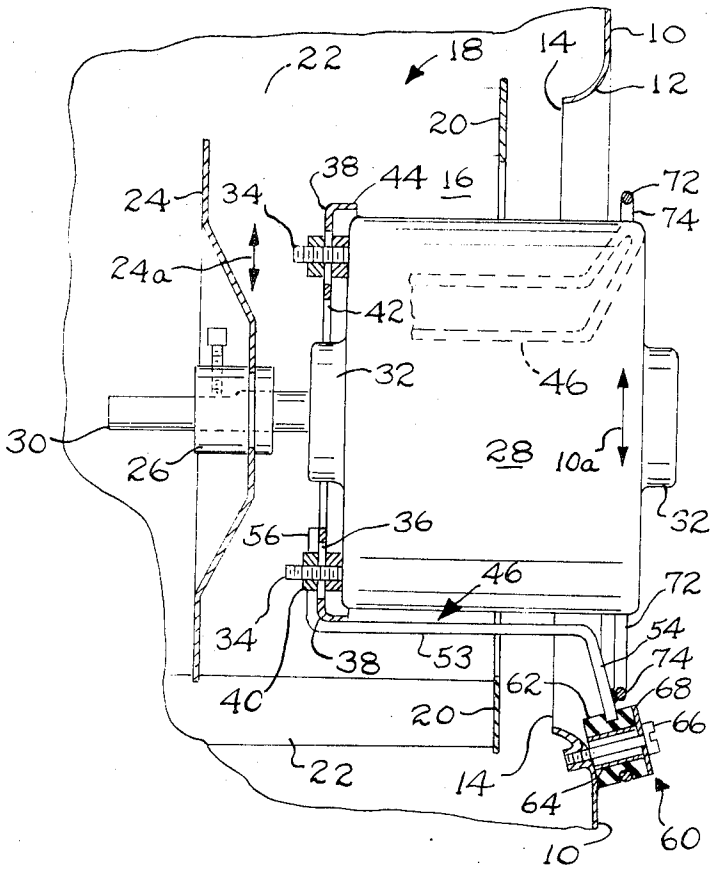


FIG. 1

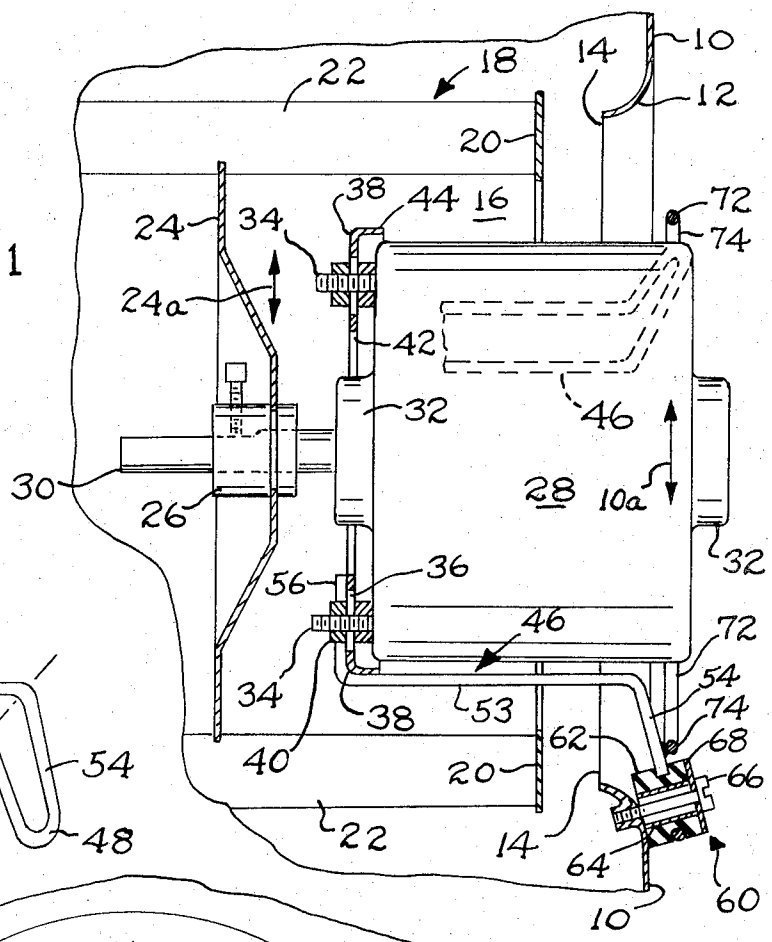
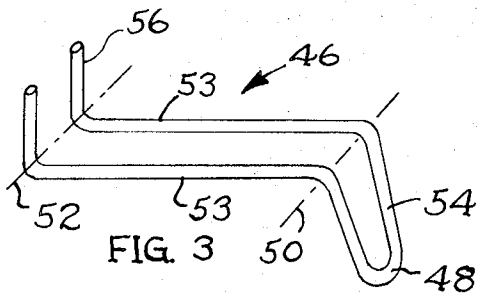


FIG. 3



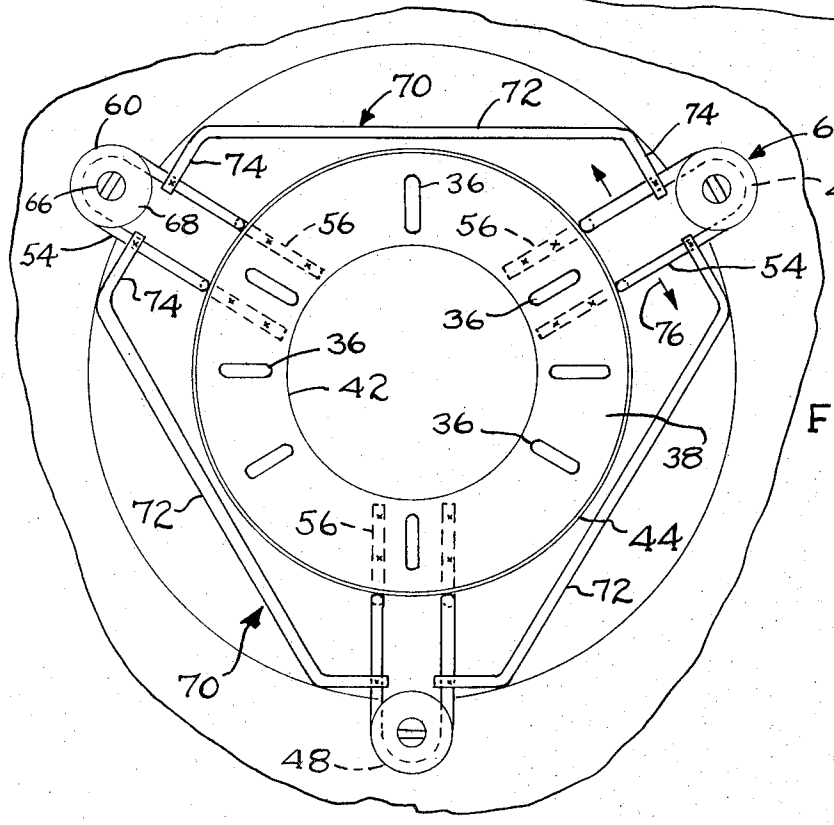


FIG. 2

MOTOR MOUNTING SUPPORT

THE DRAWINGS

FIG. 1 is a fragmentary sectional view through a blower utilizing the invention.

FIG. 2 is a right end view of the FIG. 1 structure with the fan motor removed.

FIG. 3 is a perspective view of a rod-formed strut or arm structure used in the FIG. 1 assembly.

GENERAL ARRANGEMENT

FIG. 1 shows a double inlet centrifugal blower having a scroll housing which includes a housing side sheet **10,** said sheet being inwardly curved at **12** to define an inlet opening **14** for air going into the interior space **16** within a centrifugal fan wheel **18.**

Fan wheel **18** comprises two end plates or rings, one of which is shown at **20.** Interconnecting the end plates are the usual fan blades **22.** The fan wheel is completed by a centerplate **24** and hub **26.** In operation, an electric motor **28** is energized to rotate wheel **18** around the axis of motor shaft **30,** whereby the blades draw air through inlet opening **14** and another similar inlet opening (not shown) in the non-illustrated housing side sheet. The air is exhausted through an outlet opening in the housing, not shown. The arrangement is generally similar to that shown in U.S. Pat. No. 3,127,092, issued Mar. 31, 1964 to R. E. Schenberger or U.S. Pat. No. 2,936,947, issued May 17, 1960 to J. H. Staak.

MOTOR-BASE ARRANGEMENT

Motor **28** includes bearings for shaft **30** contained within end caps **32.** The inner of left end of the motor carries four axially spaced mounting screws, two of which are shown at **34** in FIG. **1.** These mounting screws project through slots **36** in a sheet metal base plate **38.** Nuts **40** are threaded onto the ends of the screws to lock the motor onto the base plate.

Base plate **38** is of circular outline as seen in FIG. **2,** and is provided with an enlarged central opening **42** to accommodate the left end cap **32.** An endless reinforcing flange **44** extends axially from the peripheral edge of the plate; additional reinforcement could be provided by forming the plate with embossed areas, as is common in many sheet metal structures.

As shown in FIG. **2,** plate **38** is formed with eight radial slots **36.** In the usual situation only four of the slots would accommodate mounting screws **34;** the extra slots are provided for adapting the plate to different motors, varying in horsepower, mounting screw location frame size, etc. Preferably slots are used instead of round holes to permit radial adjustment of the fan wheel, as may be necessary for best alignment with inlet opening **14** and the housing cut off (not shown).

CANTILEVER ARM STRUCTURES

Motor base plate **38** is supported and positioned within the fan interior by means of three identical cantilever arms or struts **46** evenly spaced around the motor periphery. As shown best in FIG. **3,** each arm **46** is formed by a single circular cross section rod bent or curved at **48** into a hairpin shape. The hairpin element is further bent at **50** and **52** to form a central straight section **53,** an outwardly radiating end section **54,** and an inwardly radiating end section **56.** Each of these sections comprises two generally parallel rod elements.

Each arm or strut **46** has its inwardly radiating rod section **56** welded to the left face of plate **38.** The outwardly radiating end section **54** of each arm **46** is located adjacent the outer surface of the housing side sheet **10** for connection thereto by means of the semi-resilient anchors **60.** Each anchor comprises an elastomeric sound-absorbing grommet **62** encircling a metal sleeve **64** that in turn surrounds a screw **66** that threads into a taped opening in the housing side sheet. One or more washers **68** distribute axial thrust forces from screw **66** onto the elastomeric grommet.

Each grommet is provided with an external groove which enables the grommet to fit onto the U-bend area **48** of the rod section **54.** After the three grommets have thus been inserted onto the respective rod section **54,** the entire assembly can be positioned within the inlet opening **14** of the housing for thread-in of the screws **66.**

TIE RODS

The three arms **46** are preferably rigidified and interconnected by means of three circular cross-sectioned tie rods **70** oriented as chords with respect to the motor axis. Each tie rod comprises an elongated straight central section **72** and short turned end sections **74.** Sections **74** are welded to the rod sections **54** of the arms **46** to provide a stress-transmitting ring structure. As seen in FIG. **2,** the endless ring is of generally triangular cross section wherein the central sections **72** of the tie rods form the sides of the triangle and the U-bend portions **48** of the arms **46** form the apex portions of the triangle. The space circumscribed by the triangle is large enough to permit passage of motor **28** therethrough, as when the motor is being affixed to base plate **38.**

INSTALLATION PROCEDURE

Initially fan motor **28** is connected to base plate **38** while outside the blower housing. With fan wheel **18** loosely positioned inside the blower housing, the motor **28** — support structure assembly is moved through the inlet opening of the housing to permit shaft **30** to be inserted into hub **26.** Screws **66** are then threaded into the housing side sheet **10** to complete the assembly operation. Disassembly of the components is accomplished by reversing the procedure.

OPERATING FEATURES

The fan motor **28** is ultimately supported or suspended in the general plane **10*a*** near housing sheet **10;** i.e., in the plane of the three anchors **60.** The weight of the fan wheel and the centrifugal flywheel-like loading forces are transmitted to the motor in the plane **24*a*** of the fan center plate (or back plate if the blower is of the single inlet type). Thus, the motor support must be of sufficient stiffness and character to adequately counteract the product of the load forces and the moment arm existing between the two planes **10*a*** and **24*a*.**

Radial load forces in plane **24*a*** tend to momentarily or continuously deflect one or more of the arms **46** around their points of connection with anchors **60.** The deflecting force is resisted by the other two arms **46** and the three tie rods **70.** Assuming the lowermost arm **46** is subjected to a radial (downward) deflecting force, the other two uppermost arms **46** will be put in tension so that their elastomeric grommets will be compressed to resist the force. The uppermost (horizontal) tie rod

70 interconnect the two uppermost screws 66 so that each screw-grommet unit is better able to absorb a proportionate share of the load. Circumferential load forces in plane 24*a* tend to twist the arms 46 about their anchors 60; the twisting action is generally along directional line 76 (FIG. 2). Tie rods 72 interconnect the various arms 46 so that the arms are not able to independently twist; instead the three arms must twist together more or less as a unit. Each arm reinforces its fellow arms so that each is required to absorb or counteract only a portion of the twisting force. Preferably each tie rod is straight, as opposed to being curved, whereby to prevent bending of the rod in response to load forces.

Each arm 46 includes two parallel rod elements. These elements individually are relatively flexible and hence unstable. However, after the arms have been welded to base plate 38 the parallel rod elements acquire increased flex resistance; they then act somewhat in the nature of solid plates (in which the space between the rod elements is filled in). When the respective arms 46 are further interconnected by the tie rods 70 the resultant assembly becomes a fairly rigid, nonflexible unit.

It will be noted that the motor mounting screws 34 are shown near the outer periphery of the motor. This outermost disposition of the screws is preferred since there is then a lessened tendency for the motor to wobble or work loose from plate 38. In structure where the motor is mounted near its axis, as by means of a ring clamped onto end cap 32, there is a possibility for transverse wobble of the motor about its mounting connection. When widely spaced mounting screws are employed there is a lessened tendency for wobble between the motor and its mounting structure.

For utmost rigidity the motor support structure should be of heavy gauge material. Prior art devices have sometimes employed heavy gauge channels and plates. However, such structures act as air obstructions to reduce the effective size of the air inlet opening and thus unduly limit the volumetric flow and/or pressure capability of the blower. The illustrated use of rod-formed elements achieves what is believed to be a satisfactory combination of good support structure rigidity and good air flow.

This invention was conceived primarily for use in blowers employed in hot air furnaces. Such blowers have wheel diameters on the order of ten inches, wheel speeds in the vicinity of 1,000 r.p.m., volumetric deliveries on the order of 1,500 c.f.m., and motor sizes up to about one half horsepower. With such blowers we have constructed motor support structure using steel rods with diameters of about 0.2 inch and steel plate (for plate 38) of about 0.05 inch thickness. We have found that the motor support structures thus formed were relatively quiet as compared to other structures tested. Probably the quietness is related in some way to the rigidity of the structure (lack of vibration) and lessened air turbulence.

We claim:

1. In a blower having a housing side sheet formed to provide an air inlet for a fan located inside the housing, support means for supporting a fan motor in a generally horizontal position at least partially inserted into said air inlet, said support means comprising a plurality of circumferentially-spaced rod struts, each said strut comprising a single rod member bent into a generally U-shaped configuration including an interconnecting neck portion and an inner end portion, said neck portion and inner end portion of each said strut being respectively bent generally radially outward and inward, a plurality of circumferentially-spaced resilient anchors secured to the outer surface of said side sheet and having said neck portions extending partially therearound for connecting said struts to said side sheet, said motor being mounted to a base plate at its inserted end within said inlet, said inner end portions of said struts being attached to said base plate, tie means interconnecting all of said rod struts at said neck portions thereof inwardly of said resilient anchors and lying in a plane closely adjacent the plane of said housing side sheet, and said struts extending freely in unconnected relationship to one another between said tie means and said inner end portions thereof.

2. The device of claim 1 wherein said tie means comprises a plurality of individual tie rods spanning adjacent ones of said rod struts.

3. The device of claim 2 wherein each of said tie rods has inwardly bent end portions and is longitudinally straight between said end portions.

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