Aug. 27, 1963 R. B. TATGE 3,101,889

RESILIENT MOUNTING FOR MOTOR AND FAN UNIT

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Fig. 1.

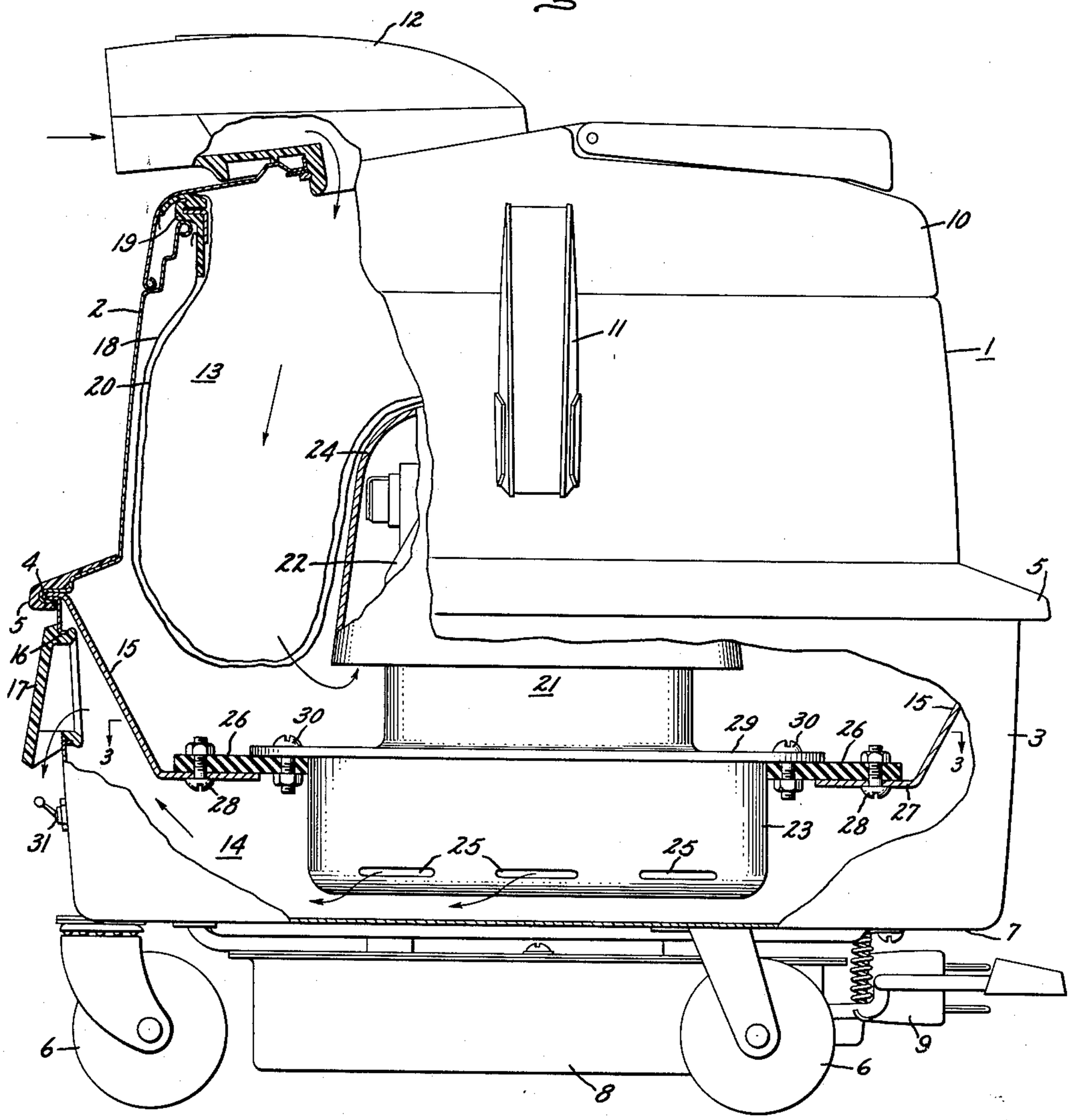

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Fig. 2.

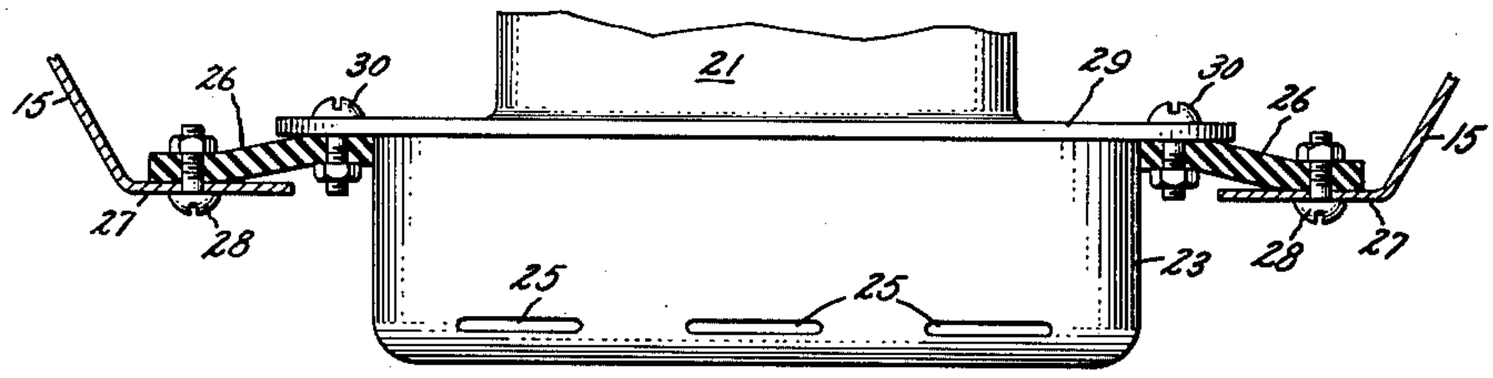
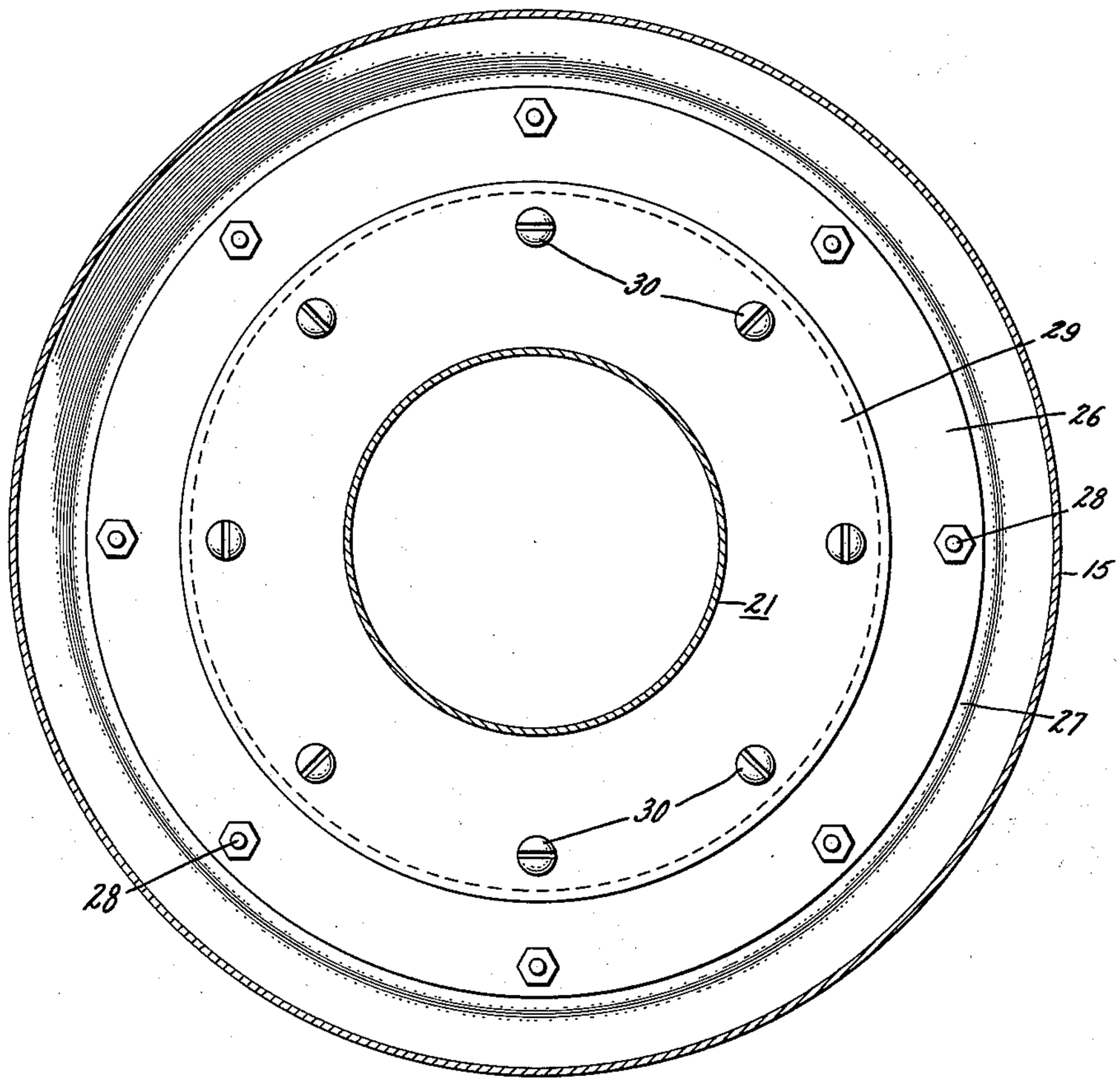


Fig. 3.



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RESILIENT MOUNTING FOR MOTOR AND FAN UNIT

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This invention relates to vacuum cleaners, and more particularly to a vacuum cleaner motor and fan unit mounting arrangement.

The general object of the invention is to provide an improved vacuum cleaner motor and fan unit mounting structure having improved noise and vibration isolation characteristics.

Briefly stated, in accordance with one aspect of my invention I provide a resilient flexible annular supporting wall member for the motor and fan unit of a canister type vacuum cleaner, and utilize the air pressure created in the exhaust chamber of the cleaner when it is operating to support the motor and fan unit in "floating" relation to the cleaner casing. Other structural elements are provided for positively supporting the motor and fan unit at a position below its floating position when it is not energized.

In vacuum cleaners of the type in which this invention is particularly useful the exhaust chamber is located underneath the suction chamber and the motor and fan unit extends through an opening therebetween so as to withdraw air from the suction chamber and discharge it into the exhaust chamber. Thus during operation of the cleaner the air pressure in the suction chamber is below atmospheric pressure and the air pressure in the exhaust chamber is above atmospheric pressure. Under these circumstances the pressure on the lower end of the motor and fan unit and the lower surface of its supporting wall member substantially exceeds the pressure on the upper portions of these parts.

In practicing my invention the sizes of the air inlet of the suction chamber and the air outlet of the exhaust chamber, and the weight and air moving capacity of the motor and fan unit are so proportioned that the difference in pressure in the two chambers is sufficient to support the motor and fan unit in its floating position. Under these conditions the high compliance of the supporting wall member minimizes the transmission of vibrations from the motor and fan unit to the casing and none of the vibrations can be transmitted to the cleaner casing through metal-to-metal contact.

The subject matter which I regard as my invention is particularly pointed out and distinctly claimed in the concluding portion of this specification. My invention, however, both as to organization and method of operation, together with further objects and advantages thereof, may be best understood by reference to the following description taken in connection with the accompanying drawings in which:

FIG. 1 is a side elevation view of a vacuum cleaner embodying my invention, some of the parts being broken away to show details of construction;

FIG. 2 is a fragmentary side elevation view of certain of the parts shown in FIG. 1, and

FIG. 3 is a cross-sectional view taken along the line 3—3 in FIG. 1.

Referring to the drawings, the canister type cleaner illustrated in FIG. 1 includes a generally cylindrical casing 1 formed in two sections, i.e., a tubular upper section 2 and a cup-shaped lower section 3 joined in stacked air-tight relation. Casing sections 2 and 3 may be conveniently formed from sheet metal and joined together by a rolled flange joint 4 covered by a resilient annular bumper 5. Suitable wheels 6 are secured to the bottom wall 7 of casing 1, to which is also secured a cord reel housing 8 enclosing a coiled electric power cord 9 which may be withdrawn and connected to a conventional electric wall socket. The upper section of casing 1 is closed by a circular lid 10 releasably secured to the casing by a pair of suitable clamps 11, only one of which is visible in FIG. 1. Mounted on lid 10 in swivelling relation is an air inlet fitting 12 adapted to be connected to a suitable cleaning tool by means of a conventional flexible hose, neither of which are shown.

The interior of casing 1 is divided into an upper suction chamber 13 and a lower exhaust chamber 14 by a frusto-conical partition 15 which is secured at its periphery to the portions of the casing forming joint 4. Exhaust chamber 14 is provided with an exhaust outlet 16 having a removable air deflector plug 17 therein. Plug 17 is arranged to deflect air flow downwardly toward the floor and may be removed when it is desired to connect the vacuum cleaner hose to outlet 16 for blowing operations.

It will be understood that during operation of the cleaner dirt is collected in suction chamber 13 and hence a suitable air filter bag 18 is mounted therein. The upper edge of filter bag 18 is secured to a resilient gasket 19 adapted to rest on the upper edge of casing 1 so as to support the bag in the position shown. If desired a disposable paper filter bag 20 may also be utilized and if this is done the upper edge of the bag 20 is disposed over gasket 19 so as to be held in place by cover 10 when it is placed in the position shown in FIG. 1.

Suction is created in suction chamber 13 by a motor and fan unit 21 centrally mounted within casing 1 so as to withdraw air from the suction chamber and exhaust it into the exhaust chamber 14. Motor fan unit 21 may be conventional in design and includes an electric motor 22, a fan (not shown) housed within fan chamber 23 and connected to motor 22 so as to be driven thereby, and a filter bag supporting shell 24. The path of air flow created by motor fan unit 21 is indicated by arrows in FIG. 1 and progresses through air inlet fitting 12, suction chamber 13, under shell 24 and through motor 22, through the fan and finally through exhaust openings 25 in fan chamber 23 before being exhausted into exhaust chamber 14 and out through exhaust outlet 16.

In accordance with my invention motor and fan unit 21 is mounted within the casing 1 by mounting structure so arranged that during operation the motor and fan unit is supported in floating relation with respect to the casing structure by air pressure within exhaust chamber 14. As shown in FIG. 1, a resilient flexible annular supporting wall member 26 is secured in air tight relation along its outer periphery to flange portion 27 of partition 15 and is secured in air tight relation along its inner edge to motor and fan unit 21. Annular wall member 26 may be made of rubber or other suitable flexible material possess-

ing good vibration isolating characteristics and high compliance. It is secured to flange 27 by a plurality of nuts and bolts at spaced intervals along its periphery or by other suitable fastening means. Motor and fan unit 21 is provided with an annular mounting flange 29 which is similarly secured to the inner edge of flexible wall member 26. Thus, as shown in FIG. 2, motor and fan unit 21 is mounted so as to permit limited vertical movement thereof with respect to partition 15, and it is important that the radial distance between the circles along which fasteners 28 and 30 are spaced be sufficient to permit such movement. It is also important that suitable stop means for limiting downward movement of the motor fan unit to a predetermined lowermost position be provided, and in the present embodiment annular mounting flange 29 on the motor and fan unit extends in overlapping relation with respect to flange portion 27 of partition 15 so that positive support for the parts is provided when the motor and fan unit is not energized.

It will be understood that electric power cord 9 is connected to motor 22 in a circuit which includes control switch 31, and that operation of the cleaner is effected by plugging power cord 9 into an electrical outlet and actuating switch 31 to its "on" position.

During operation of the vacuum cleaner shown in FIG. 1 the air pressure in suction chamber 13 is below atmospheric pressure and the air pressure in the exhaust chamber 14 is above atmospheric pressure. Thus, under these circumstances the pressure on the lower end of the motor and fan unit and the lower surface of resilient supporting wall member 26 substantially exceeds the pressure on the upper portions of these parts. It will be understood that the pressure in chambers 13 and 14 depend upon the size of the air inlet opening provided by inlet opening fitting 12 and the size of exhaust outlet 16. Hence, the sizes of these openings are so proportioned in relation to the air moving capacity and the weight of the motor and fan unit 21 that the difference in pressure in the two chambers is sufficient to support the motor and fan unit in the floating position shown in FIG. 2. Under these conditions the high compliance of the resilient supporting wall member minimizes the transmission of vibrations from the motor and fan unit to partition 15 and casing 1, and of course none of the vibrations can be transmitted to the cleaner casing through metal-to-metal contact.

Preferably the design factors which determine the resonant frequency of vibration of motor and fan unit 21 and wall member 26 are so chosen that this vibration frequency is encountered at relatively low speed, when the motor and fan unit is firmly supported in its lowermost position. In other words, during the period when the motor is started and comes up to full speed or is slowing down after being turned off, the motor speed at which high amplitude vibrations resulting from the condition of resonance occur should be below the speed required to lift the motor and fan unit to its floating position. In this way full advantage may be taken of the desirable characteristics of a high compliance vibration isolating system during full speed operation, and at the same time a relatively low compliance system is provided for resonant frequency conditions.

While I have illustrated and described a specific embodiment of my invention, I do not desire the invention to be limited to the particular construction disclosed, and I intend by the appended claims to cover all modifications within the true spirit and scope of my invention.

What I claim is:

1. A vacuum cleaner comprising an outer casing adapted to be supported on a horizontal surface; a partition within said casing including a laterally extending flange; said casing having an upper suction chamber and an exhaust chamber below said suction chamber separated by said partition; an air inlet communicating with said suction chamber; an air outlet communicating with said exhaust chamber; a motor and fan unit positioned within said casing and extending through an opening defined by said partition flange so as to withdraw air from said suction chamber and discharge it into said exhaust chamber; means for mounting said motor and fan unit in said opening including a flexible resilient generally annular relatively thin supporting wall member; said motor and fan unit including a laterally extending portion positioned above said resilient wall member and overlapping said partition flange so that said flange positively supports said unit in a lowermost position when said unit is deenergized; the sizes of said air inlet and said air outlet and the air moving capacity of said motor and fan unit being so proportioned that during operation said unit is supported above said lowermost position by air pressure; said laterally extending portion of said motor and fan unit having a diameter slightly greater than the diameter of said opening so that a small annular portion of said wall member is under a compressive force perpendicular to the plane of said partition flange when said unit is deenergized; first fastening means securing the radial inner portion of said resilient wall member to said laterally extending portion of said motor and fan unit in air tight relation; and second fastening means securing the radial outer portion of said wall member to said partition flange in air tight relation; said first and second fastening means being radially spaced from one another a distance greater than the thickness of said wall member so that the portion of said resilient wall member located radially inwardly from said second fastening means flexes and moves upwardly above the surface of said partition flange to place said wall member in tension and to position said wall member at an acute angle with respect to said partition flange when said unit is energized.

2. A vacuum cleaner comprising an outer casing adapted to be supported by a horizontal surface; a partition within said casing including a laterally extending flange; said casing having an upper suction chamber and an exhaust chamber below said suction chamber separated by said partition; an air inlet communicating with said suction chamber; an air outlet communicating with said exhaust chamber; a motor and fan unit positioned within said casing and extending through an opening defined by said partition flange so as to withdraw air from said suction chamber and discharge it into said exhaust chamber; means for mounting said motor and fan unit in said opening including a flexible resilient generally annular supporting wall member; said motor and fan unit including a laterally extending portion positioned above said wall member and overlapping said partition flange; said partition flange being vertically spaced from the bottom of said casing a greater distance than the vertical dimension of said motor and fan unit as measured from said laterally extending portion thereof to the bottom of said motor and fan unit so that said overlapping relation of said portion with said partition flange provides positive support for said motor and fan unit, in a lowermost position, above the the bottom of said casing, when said unit is not energized; the size of said air inlet and said air outlet and the air moving capacity of said motor and fan unit being so proportioned that during operation said motor and fan unit is moved to a floating position above said lowermost position by air pressure; said laterally extending portion of said motor and fan unit having a diameter slightly greater than the diameter of said opening so that a small annular portion of said wall member is under a compressive force perpendicular to the plane of said partition flange when said unit is deenergized; first fastening means securing the radial inner portion of said wall member to said laterally extending portion of said motor and fan unit in air tight relation; and second fastening means securing the radial outer portion of said wall member to said partition flange in air tight relation; said first and second fastening means being radially spaced from one another a distance greater than the thickness of said wall member so that the portion of said resilient wall member

located radially inwardly from said second fastening means flexes and moves upwardly above the surface of said partition flange to place said wall member in tension and to position said wall member at an acute angle with respect to said partition flange when said unit is energized; the speed of said motor and fan unit being so related to the weight of said unit, that the speed, at which high amplitude vibrations, resulting from the condition of resonance occur, is below the speed required to lift the motor and fan unit to its floating position.

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