Sept. 26, 1939. G. E. LOFGREN 2,174,444

VACUUM CLEANER

Filed Nov. 17, 1938 2 Sheets-Sheet 1

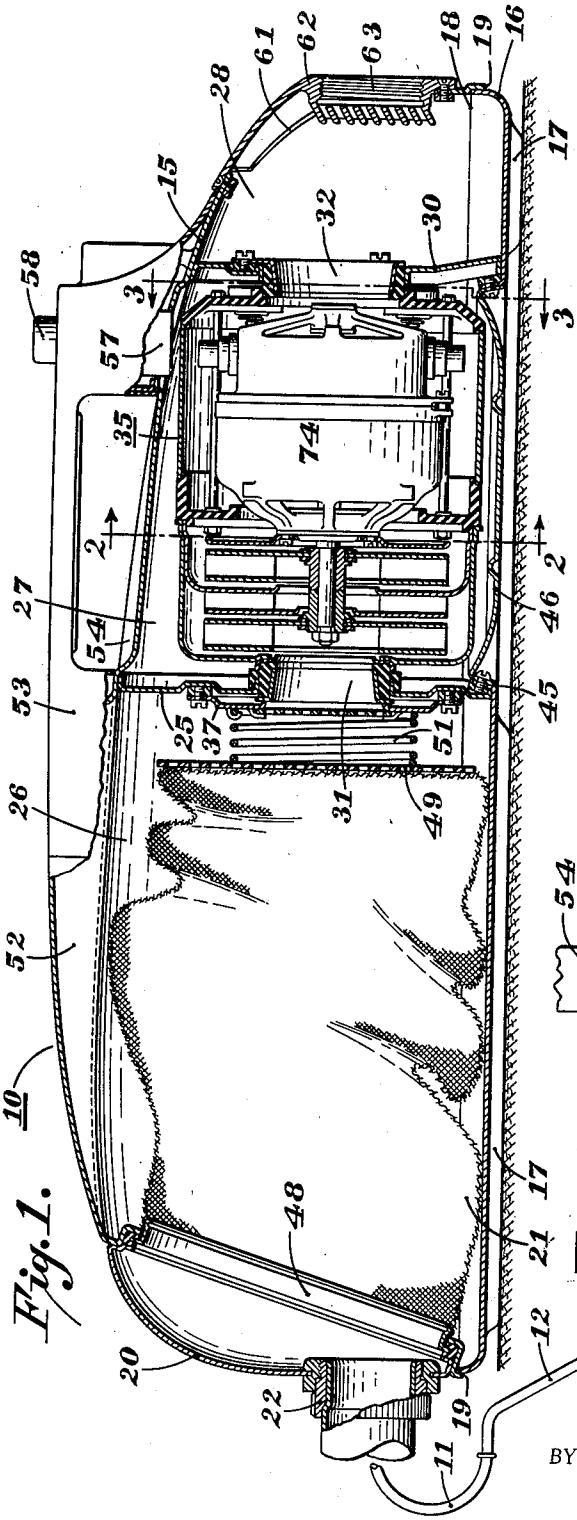


Fig. 1.

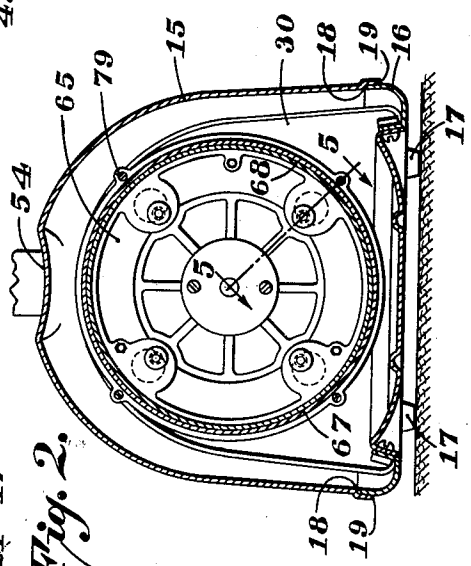


Fig. 2.

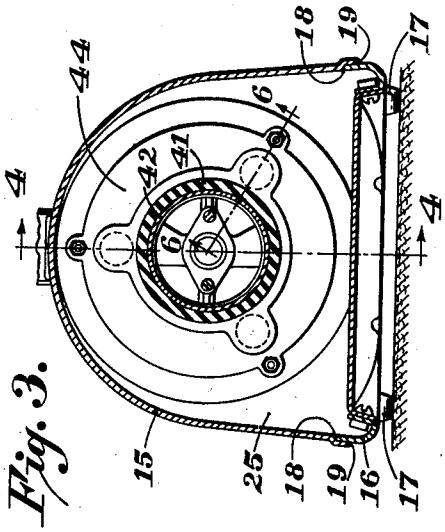


Fig. 3.

INVENTOR.
Gustaf Einar Lofgren
Arthur G. Prangley
ATTORNEY.

BY

Sept. 26, 1939. G. E. LOFGREN 2,174,444

VACUUM CLEANER

Filed Nov. 17, 1938 2 Sheets-Sheet 2

Fig. 4.

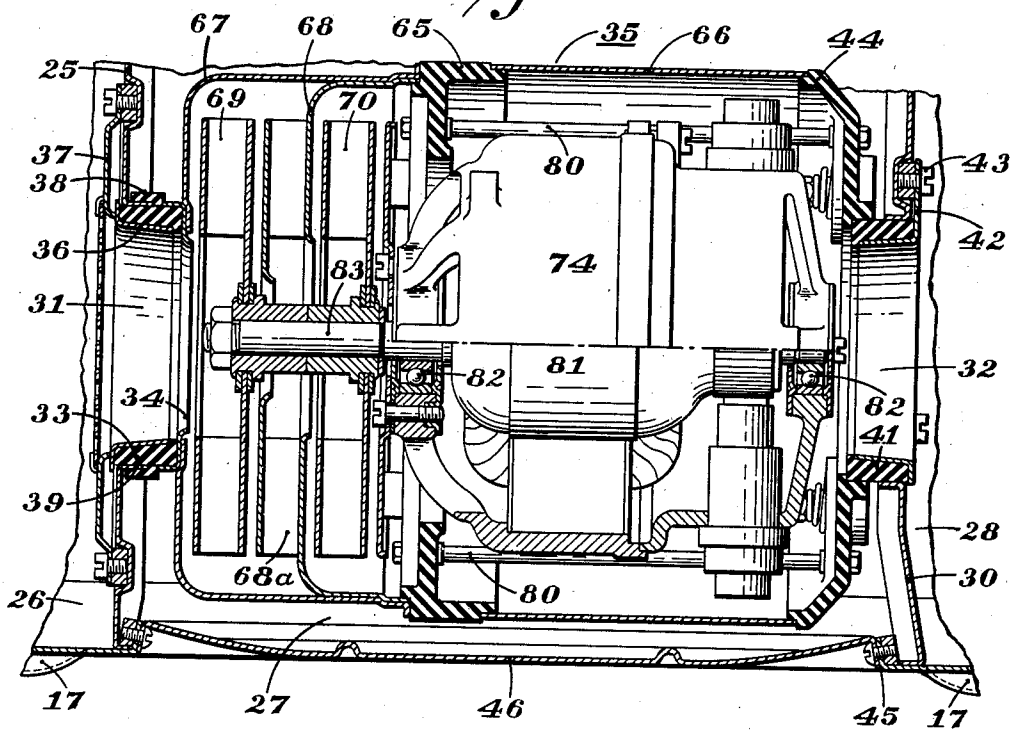


Fig. 5.

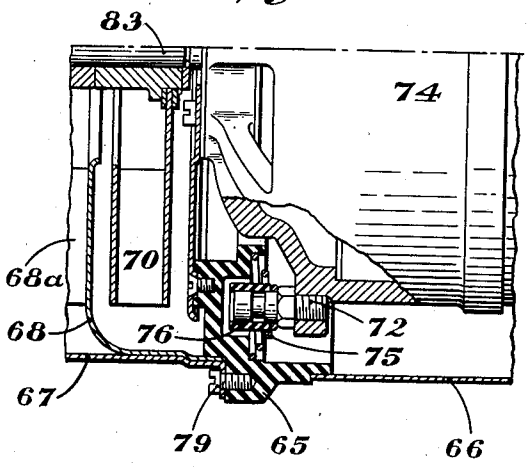
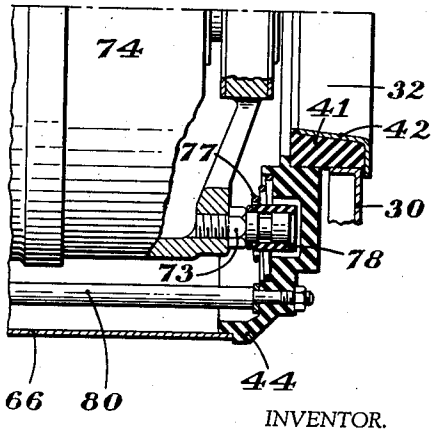


Fig. 6.



INVENTOR.

BY Gustaf Einar Lofgren

Arthur J. Prangley

ATTORNEY.

Patented Sept. 26, 1939 2,174,444

UNITED STATES PATENT OFFICE

2,174,444

VACUUM CLEANER

Gustaf Einar Lofgren, Riverside, Conn., assignor to Electrolux Corporation, New York, N. Y., a corporation of Delaware

Application November 17, 1938, Serial No. 240,894

6 Claims. (Cl. 230—117)

This is a continuation in part of my co-pending application, Serial No. 52,027, filed November 29, 1935, entitled "Vacuum cleaners."

My invention relates to vacuum cleaners and more particularly to vacuum cleaners of the so-called inside bag type having a dust separator and a motor-fan unit located in a cleaner housing.

In the operation of vacuum cleaners some noise is produced by the flow of air through the cleaner and additional noise is caused by vibration of the motor-fan unit in its operation. Vibration of the motor-fan unit may be transmitted to other parts of the vacuum cleaner increasing any noise produced thereby and possibly loosening parts of the cleaner.

In accordance with this invention an improved motor-fan unit mounting is provided for reducing the noise and vibration produced by the operation of the motor-fan unit.

My invention also contemplates resiliently mounting a motor and fan in a motor-fan unit housing and then resiliently mounting the motor-fan unit housing in the vacuum cleaner housing. The motor-fan unit is so constructed that it may be readily removed and replaced in the vacuum cleaner casing.

What I consider to be novel and my invention may be better understood by reference to the following specification and appended claims when considered in connection with the accompanying drawings, in which

Fig. 1 is a longitudinal sectional view of a vacuum cleaner embodying my invention;

Fig. 2 is a transverse sectional view taken along the line 2—2 of Fig. 1;

Fig. 3 is a transverse sectional view taken along the line 3—3 of Fig. 1;

Fig. 4 is an enlarged sectional view taken on the line 4—4 of Fig. 3;

Fig. 5 is an enlarged detailed sectional view taken on the line 5—5 of Fig. 2; and

Fig. 6 is an enlarged detailed sectional view taken on the line 6—6 of Fig. 3.

The vacuum cleaner includes a cleaner unit 10 to which is connected a flexible hose 11, by which the cleaner unit may be pulled by the operator, and a hollow wand 12 to which is connected the nozzle 13. This general type of cleaner and its mode of use are known. The cleaner unit to which the present invention is directed, rests on the floor. The operator generally holds the wand 12 with the flexible hose loose between the cleaner unit and the wand.

The cleaner unit 10 includes a housing made essentially of an upper shell 15 and a lower shell 16. Preferably the shells are made from flat sheet metal stock by die forming in a punch press. The lower shell is shallow and is formed with ridges 17 on the under sides to act as runners when pulling the cleaner unit on the carpet or floor. The lower shell has a continuous or endless top edge at 18, which, when the cleaner unit is resting normally, is in a horizontal plane. The upper shell 15 is a deep drawn shell which is a sort of inverted dish and which also has a continuous or endless edge 19. When the cleaner unit is resting normally, the edge 19 is likewise in a horizontal plane. The edges 18 and 19 are joined as by welding. Both the upper and lower shells preferably widen from the centerline to the jointure so that the plane of joining is at the horizontal cross-section of maximum area. The plane of joining is close to the floor.

At the forward end of the cleaner unit is a cover 20 which controls access to the dust bag 21 and to which the hose 11 is connected by a suitable coupling member 22.

The housing of the cleaner unit is sub-divided by two partitions or bulkheads 25 and 30. Bulkhead 25 may be termed the forward bulkhead and bulkhead 30 the rear bulkhead. Each of the bulkheads is flanged around its periphery and welded to the shell all the way around to form an air-tight joint. The bulkheads divide the housing into three distinct compartments, namely, a dust compartment 26, a motor-fan compartment 27, and a filter compartment 28. The bulkheads are imperforate except for center openings 31 and 32.

Positioned in opening 31 is a motor-fan unit suspension ring 33, preferably made of rubber. Ring 33 also extends within a metal ring 34 secured to a case 35 for the motor-fan unit. A cap ring 36 is placed over ring 33 and held in place by a member 37 fastened to the bulkhead as by a screw, as shown. A spacer ring 38 may be used between ring 34 and the center flange 39 of bulkhead 25.

The other or exhaust end of the motor-fan unit is similarly supported by means of a rubber cushioning ring 41 mounted in the central opening 32 of bulkhead 30. A seating ring 42 holds ring 41 in place. This ring is fastened to bulkhead 30 by screws 43. Ring 41 seats in a fiber or bakelite end cap 44 forming part of the case 35.

The bottom shell 16 is provided with an opening 45 covered by means of a removable cap 46 whereby the case 35 can be inserted and removed from the motor-fan compartment. In inserting the

motor-fan unit, the case 35 is held in alignment with openings 31 and 32, and rubber rings 33 and 41 are then inserted by pushing them toward the case 35 from within compartments 26 and 28 respectively, after which the caps 36 and 42 are applied. The case 35 and the connections between the same and the bulkheads are air-tight wherefore, due to the air-tight connection of the bulkhead 25 with the shell, the only one of the compartments which is subjected to suction is compartment 26. Thus substantially one-half of the shell is relieved of stress due to preponderance of external pressure. It will be understood that the bulkheads greatly strengthen the shell.

The dust bag 21 is provided with a ring 48 which is held between cover 20 and a flange on the upper shell. Suitable mechanism may be employed to clamp cover 20 onto the housing with the dust bag ring therebetween. Clips may be used as shown in United States Patent No. 1,757,239 of May 6, 1930. The dust bag is preferably large so as to wrinkle within chamber 26 and distention of the dust bag is resisted by a plate 49 and a spring 51 attached thereto and to member 37. Member 49 may be utilized to operate a signal as disclosed in United States Patent No. 2,022,250 of November 26, 1935.

Upper shell 15 is formed with a ridge 52 at the top which is a continuation of a handle part and provides space which may be used for dust indicating mechanism. Ridge 52 etxends longitudinally and is preferably initially stamped into the upper shell. The handle is formed as a separate piece 53 which overlaps and is secured to ridge 52. The shell may be recessed at 54 and the part 53 is cut away for grasping by the hand. The handle is above the motor-fan compartment which is at the center of gravity of the cleaner unit.

A step switch 57 is incorporated in part 53 and includes a step button 58. The step switch is connected to the motor through an opening in the shell.

A hole 61 is provided for access to compartment 28. This hole is normally closed by means of cover 62 which may be made as a die casting and which includes a discharge opening 63 into which the hose 11 may be secured for blowing purposes. Compartment 28 may have a special filter pad therein or may be loosely filled with filtering material.

Referring more particularly to the motor-fan assembly, the motor and fan are resiliently supported in case 35 on two rings 44 and 65 made of a phenolic condensation product or fiber or other suitable electrical insulating material. A sheet metal cylinder 66 extends between rings 44 and 65. Mounted on ring 65 are two fan housings 67 and 68. Housing 68 extends between fans 69 and 70. Intermediate directing vanes 68*a* are mounted on housing 68. The case 35 has a substantially cylindrical exterior and may be supported in any radial position desired.

Motor casing 74 is provided with a plurality of axially extending pins 72 and 73. Four pins 72 are provided and cooperating conical springs 75. The apices of springs 75 are secured to pins 72 by caps 76. The enlarged ends of springs 75 are seated in recesses in ring 65. Three pins 73 are spaced uniformly around the motor casing 74 with cooperating conical springs 77. Springs 77 are seated in recesses provided in ring 44 with their apices secured to pins 73 by caps 78.

Fan housings 67 and 68 are secured to ring 65 by screws 79. Rings 44 and 65 and cylinder 66 are clamped together by rods 80. This assembly forms the case 35.

Within case 35 motor casing 74 is resiliently supported by springs 75 and 77. In motor casing 74 an armature 81 is mounted on ball bearings 82. Armature shaft 83 carries the fans 69 and 70.

By this arrangement the motor and fans are resiliently mounted in the case 35 permitting relatively free axial or radial vibrations. Thus when the motor and fans change in speed of rotation due to a change in loading of the cleaner the resultant vibrations are not transmitted directly to the case 35 but are absorbed in part by the interposed resilient means.

The case 35 is resiliently supported on the bulkheads 25 and 30 by the rubber rings 33 and 41. Thus any vibrations produced in the case 35 as by fluctuations in the air flow therethrough or by vibrations which may not be completely absorbed by the springs 75 and 77 are not transmitted directly to the housing of cleaner unit 10 because of the interposed resilient means.

Between the motor and fans on the one hand and the housing of cleaner 10 on the other, two resilient means are interposed in series. These resilient means in series are the conical springs 75 and 77 located between the case 35 and the motor 74 and fans 69 and 70 and the rubber rings 33 and 41 located between the housing of cleaner 10 and case 35.

In the operation of the vacuum cleaner the motor and fans are rotated and produce a flow of air from left to right in cleaner unit 10, as shown in Fig. 1. As a result, a suction is produced at the cleaning tool 13. When the cleaning tool 13 is in contact with a rug, a certain amount of air and dirt will be drawn into the cleaner unit 10. If the cleaning tool 13 is lifted from the rug a greater quantity of air will flow through the cleaner unit which will increase the load on the motor and fans and so result in a reduction of speed of rotation. If the cleaning tool 13 is sealed tightly against an impervious surface there may be substantially no flow of air through the cleaner unit 10 so the load on the motor and fans will be reduced and result in an increase in speed of rotation. The motor being of the series wound type produces a torque in the armature 81 which increases as the load increases and causes a decrease in the speed of rotation of the armature. To every force there is an equal and opposite reaction. Thus the motor field carried by motor casing 74 tends to rotate in a direction opposite to armature 81 with a torque equal and opposite in direction to the torque produced in the rotation of armature 81. This reactive torque is absorbed by the motor mounting. The springs 75 and 77 and the rubber rings 33 and 41 permit the motor casing 74 and the case 35 to rotate through a small arc to absorb the reactive torque. As the cleaning tool 13 traverses various surfaces being cleaned the quantity of air flowing therethrough may vary over a wide range. The resultant variation in the reactive torque is absorbed by the springs 75 and 77 and rubber rings 33 and 41 without producing a sympathetic vibration in one part or another of the cleaner unit 10. The rubber rings 33 and 41 being located at a relatively small radius from the axis of the motor will better absorb these radial vibrations because the peripheral amplitude of the vibrators is less at a smaller radius.

The variation in the quantity of air flow through the motor and fans also produces a variation in the reactive axial component of force.

The variation in the axial component of force is readily absorbed by the springs 75 and 77.

The combination of the springs 75 and 77 mounting the motor and fans in case 35 and the rubber rings 33 and 41 mounting the case 35 in the cleaner unit 10 prevents the transmission of vibrations due to the change in the load on the motor, and in the quantity of air flow which in turn reduces the noise of operation of the vacuum cleaner.

What I claim is:

1. A vacuum cleaner including a housing, transverse bulkheads spaced apart within said housing and having central openings, a cylindrical case having a central opening at each end, means resiliently mounting said case for absorbing vibration with the openings of the case registering with the openings of the bulkheads, a motor-fan unit located in said case, and means between the ends of the motor and the case resiliently mounting said motor in said case.

2. A vacuum cleaner including a housing, two bulkheads separating the interior of said housing into three compartments, a case located in one of said compartments, a ring of resilient material secured to each end of said case and to each of said bulkheads, a motor-fan unit located in said case, and means between the ends of the motor and the case resiliently mounting said motor in said case.

3. A vacuum cleaner including a housing, a case located in said housing, a motor-fan unit located in said case, a plurality of springs spaced apart and interposed between said case and each end of said motor, and supporting means of resilient material for said case located adjacent the axis of said motor-fan unit at each end and secured to said housing.

4. A vacuum cleaner including a housing, transverse bulkheads spaced apart within said housing, a motor-fan unit located within said housing between said bulkheads, a ring of non-metallic material secured to one of said bulkheads, a second ring of non-metallic material secured to said first ring, resilient means for mounting said motor-fan unit to said first and second rings, a fan housing secured to said second ring, and means securing said fan housing to the other of said bulkheads.

5. A vacuum cleaner including a housing, two transverse bulkheads spaced apart within said housing and having central openings, rings of resilient material secured in the openings of said bulkheads, a motor-fan unit located between said bulkheads, a case mounted on said rings of resilient material between said bulkheads, and resilient means between the ends of the motor and the case for mounting said motor-fan unit within said case.

6. A vacuum cleaner comprising a housing, a case in said housing, a motor fan unit in said case, spaced resilient means between each end of the motor and the case for resiliently supporting the motor fan unit in the case, and means adjacent each end of the axis of the motor fan unit for resiliently supporting said case from the housing.

GUSTAF EINAR LOFGREN.