Aug. 31, 1937. K. J. WAHLBORG 2,091,537

VACUUM CLEANER

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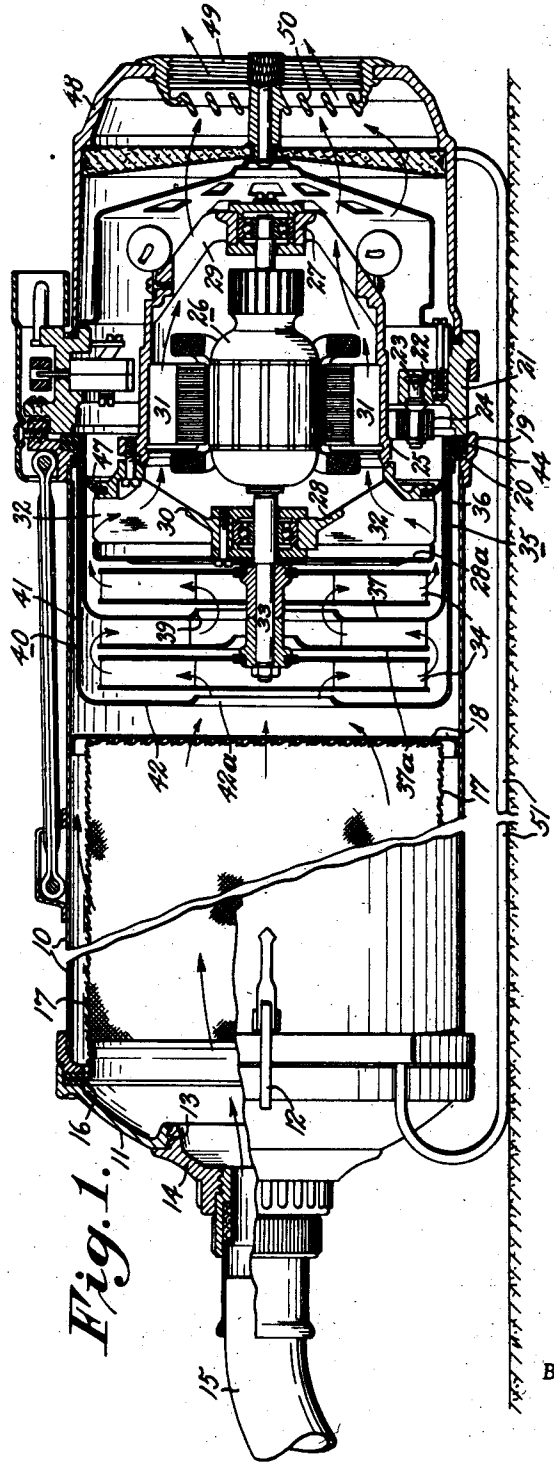

Fig. 1.

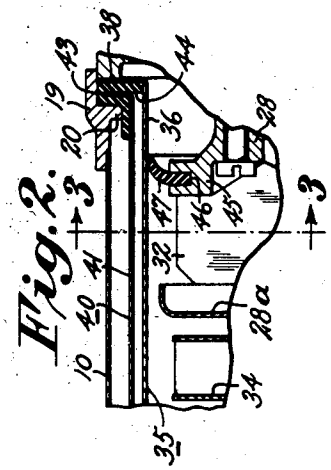

Fig. 2.

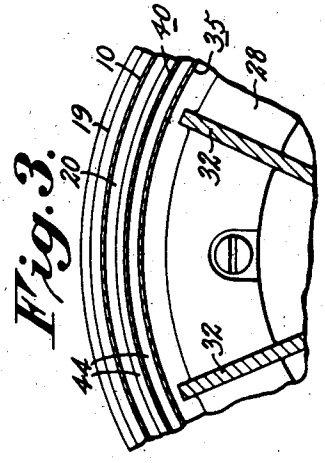

Fig. 3.

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# UNITED STATES PATENT OFFICE

2,091,537

## VACUUM CLEANER

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Application December 4, 1934, Serial No. 755,870
In Germany December 13, 1933

8 Claims. (Cl. 230—117)

My invention relates to vacuum cleaners and particularly to means for arranging the electric driving motor in the casing of a vacuum cleaner so as to obtain the maximum amount of cooling of the motor by the air circulated.

In order to maintain the noise produced by the operation of the vacuum cleaner at a minimum, it is desirable to resiliently mount the electric motor in the cleaner casing. This type of mounting absorbs the vibrations produced by the operation of the motor to a great extent and thus reduces the noise which would otherwise result from these vibrations. In order to obtain the maximum cooling effect from the air circulated through the cleaner, it is desirable to cause all of this air to pass through the electric motor, which is provided with air passages for this purpose. However, in order to assure that all of the air does pass through the motor, it is necessary to provide a seal between the motor housing and the casing in order that none of the air shall pass around the outside of the motor. The aforementioned resilient mounting of the motor necessarily permits some movement of the motor with respect to the cleaner casing. Therefore, the seal between the motor and casing cannot be a rigid one.

One of the objects of my invention is to provide a seal which will be air-tight while still permitting relative movement between the motor and the cleaner casing.

Another object of my invention is to reduce turbulence of the air discharged from the fan rotor before it enters the motor. Turbulence results in a loss and hence it is desirable to eliminate it in the interest of efficiency.

Further objects and advantages of my invention will be apparent from the following description considered in connection with the accompanying drawing of which:

Fig. 1 is a cross-sectional view of a preferred embodiment of my invention;

Fig. 2 is a view on an enlarged scale of part of the apparatus shown in Fig. 1; and

Fig. 3 is a cross-sectional view taken on the line 3—3 of Fig. 2.

Referring to the drawing, reference character 10 designates a preferably cylindrical casing. A cap member 11 may be secured to one end of casing 10 by means of releasable fasteners 12. Cap member 11 is provided with a threaded central aperture 13 into which may be screwed a coupling member 14. Coupling 14 is likewise provided with a central aperture adapted to receive one end of a flexible hose 15. Secured between cap member 11 and the end of casing 10 is a flanged member 16 to which is secured the open end of a dust bag 17. A perforated plate 18 may be secured within casing 10 in such a position as to support the closed end of dust bag 17.

The other end of casing 10 is provided with a ring 19 formed with an inner inwardly extending annular portion 20. Secured to ring 19 is a motor supporting ring 21 which may be formed with a plurality of inwardly extending lugs 22. Lugs 22 carry bolts 23. Each bolt supports one end of the spiral springs 24, the other end of which is secured to the motor housing 25. This type of resilient motor support is not new per se and is shown more in detail in the co-pending application of Erik O. H. Hansson, Serial No. 687,839, filed Sept. 1, 1933.

The motor, designated generally by reference character 26, includes housing 25 and bearing shields 27 and 28. These shields are formed with air passages 29 and 30, respectively. Air ducts 31 are formed through the stator of the motor and provide for the passage of air therethrough. The front bearing shield 28 may also be provided with radially extending guide vanes 32, shown more particularly in Fig. 3. A transverse wall 28*a* is carried by bearing shield 28 and, with vanes 32, defines radial channels leading to openings 30.

Secured to the shaft 33 of the motor is a centrifugal fan including one or more rotors 34. In the present instance two rotors are shown. An inner fan housing 35 encloses one of the rotors and includes a cylindrical portion 36 and an end wall 37. Carried by and spaced from end wall 37 is a transverse wall 37*a*. The open end of cylindrical portion 36 is formed with an outwardly extending flange 38 and the end wall 37 is formed with a central aperture 39. An outer fan housing 40 is formed with a cylindrical portion 41 and an end wall 42 having a central opening 42*a*. The open end of cylindrical portion 41 is formed with an outwardly extending flange 43. A packing ring 44 is located within ring 19 and between the shoulder 20 thereon and motor supporting ring 21. Flange 38 extends between packing ring 44 and ring 21. Flange 43 extends into an annular recess formed in the packing ring. Thus, when ring 21 is drawn toward shoulder 20 and ring 19, it securely clamps the flanges on fan housings 35 and 40 and thus holds the fan housings in place.

Forward bearing shield 28 of the motor is provided with an outwardly extending annular flange 45 which is formed with a groove 46 therein. A

sealing ring 47, preferably made of rubber or like flexible material, is retained in groove 46. The outer diameter of ring 47 is greater than the inner diameter of the cylindrical portion 36 of inner fan housing 35 and therefore contacts this cylindrical portion. Preferably, the thickness of ring 47 at the outer periphery thereof is less than at its inner periphery, as is clearly shown in Fig. 2. This tapering form of the ring increases its flexibility.

A cap member 48 is secured to motor supporting ring 21 in any suitable manner and encloses the rear end of the motor. Cap 48 is formed with a threaded aperture 49 which is adapted to receive coupling 14 when the cleaner is used for blowing purposes. Inclined vanes 50 may be placed across aperture 49 in order to direct the air discharged therethrough in an upward direction away from the floor. A pair of runners 51 are provided for movably supporting the cleaner on a floor or other surface.

The operation of the device is as follows:

When the fan rotors 34 are rotated by electric motor 26 they serve to draw air through hose 15, coupling 14 and the central opening in cap 11 into the dust bag 17. Entrained dust is separated from the air stream and is retained in the dust bag while the air passes therethrough and is drawn into central opening 42a in transverse wall 42 of fan housing 40. The forward rotor throws this air outwardly and it passes between stationary wall 37a and transverse wall 37 of fan housing 35. From here the air passes through opening 39 and is acted upon by the second fan rotor which throws it outwardly against the cylindrical portion 36 of inner fan housing 35. Due to the action of the fan rotors this air is travelling in a circular path and is forced to flow radially inwardly between the forward bearing shield 28 of the motor and stationary wall 28a. Radial guide vanes 32 tend to stop the circular motion of this air and tend to constrain it to flow in a radial direction, thus reducing turbulence. Sealing member 47 prevents the passage of any of this air around the outside of the motor. Consequently all of the air passes through openings 30 in forward bearing shield 28, through passages 31 in the stator and through openings 29 in the rear bearing shield 27. Of course, some of the air will pass between the stator and the rotor. The air finally will be discharged through the opening 29 in cap 48. The air thus comes in intimate contact with the motor windings and serves to cool them efficiently.

The rotation of the motor causes vibrations to be set up therein which are absorbed by the supporting springs 24. These springs permit the motor to move somewhat with respect to casing 10 and consequently with respect to the fan housings. However, resilient packing member 47 between the motor and the inner fan housing maintains an air-tight seal therebetween while permitting such movement to take place. Obviously, if the fan housings terminate forward of bearing shield 28, sealing member 47 may be of sufficient diameter to contact the interior of casing 10 and thus establish an air-tight seal between the motor and the casing.

While I have described one more or less specific embodiment of my invention this has been done for purposes of illustration only and the scope of my invention is not to be limited thereby, but only by the appended claims viewed in the light of the prior art.

What I claim is:

1. In a vacuum cleaner, a motor having a housing and a shaft, a fan rotor carried by said shaft, a casing around said rotor, said casing and said motor housing being resiliently mounted with respect to each other, said motor being formed with air passages therethrough, and flexible packing means between said motor and said casing for restraining all of the air circulated by said fan rotor to flow through said air passages, said packing means being separate from the resilient mounting.

2. In a vacuum cleaner, a motor having a housing and a shaft, a fan rotor carried by said shaft, a casing around said rotor, said casing and said motor housing being resiliently mounted with respect to each other, said motor being formed with air passages therethrough, guide vanes disposed in substantially axial planes between said motor and said rotor and located adjacent to the inlet ends of said passages, and flexible packing means between said motor and said casing for restraining all of the air circulated by said fan rotor to flow through said air passages, said packing means being separate from the resilient mounting.

3. In a vaccuum cleaner, a casing, a motor having a shaft, said motor being resiliently mounted in said casing, a fan rotor carried by said shaft, a fan housing around said fan and supported in said casing resiliently with respect to said motor, said motor being formed with air passages therethrough, and flexible packing means between said motor and said fan housing for restraining all of the air circulated by said fan rotor to flow through said air passages.

4. In a vacuum cleaner, a casing, a motor having a shaft resiliently mounted in said casing, a fan rotor carried by said shaft, a fan housing around said fan and supported in said casing resiliently with respect to said motor, said motor being formed with air passages therethrough, axially and radially extending guide vanes located in said fan housing between said fan rotor and said motor adjacent to the inlet ends of said passages, and flexible packing means between said motor and said fan housing for restraining all of the air circulated by said fan rotor to flow through said air passages.

5. In a vacuum cleaner, a motor having a housing and a shaft, a fan rotor carried by said shaft, a casing around said rotor, springs for resiliently mounting said motor housing with respect to said casing, said motor being formed with air passages therethrough, and an annular flexible packing member carried by said motor housing and contacting said casing for restraining all of the air circulated by said fan rotor to flow through said air passages.

6. In a vacuum cleaner, a motor having a housing and a shaft, a fan rotor carried by said shaft, a casing around said rotor, coil springs for resiliently mounting said motor housing with respect to said casing, said motor being formed with air passages therethrough, guide vanes disposed in substantially axial planes carried by said motor between said motor and said fan rotor and located adjacent to the inlet ends of said passages, and flexible packing means between said motor housing and said casing for restraining all of the air circulated by said fan rotor to flow through said air passages.

7. In a vacuum cleaner, a casing, a motor having a shaft resiliently mounted in said casing, a fan rotor carried by said shaft, a fan housing

around said fan and supported in said casing resiliently with respect to said motor, said motor being formed with air passages therethrough, an outwardly extending radial flange carried by said motor and located within said fan housing, and an annular flexible packing member carried by said flange and contacting said fan housing for restraining all of the air circulated by said fan rotor to flow through said air passages.

8. In a vacuum cleaner, a casing, a motor having a shaft resiliently mounted in said casing, a fan rotor carried by said shaft, a fan housing around said fan and supported in said casing resiliently with respect to said motor, said motor being formed with air passages therethrough, and a flexible annular packing ring carried by said motor within said fan housing, the thickness of said ring being less at the outer periphery than at the inner periphery thereof and the outer diameter of said ring being greater than the inner diameter of said fan housing whereby said ring contacts said housing to restrain all of the air circulated by said fan rotor to pass through said air passages.

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