June 17, 1941. W. LEATHERS 2,245,989

SUCTION DEVICE FOR VACUUM CLEANERS

Filed July 27, 1939

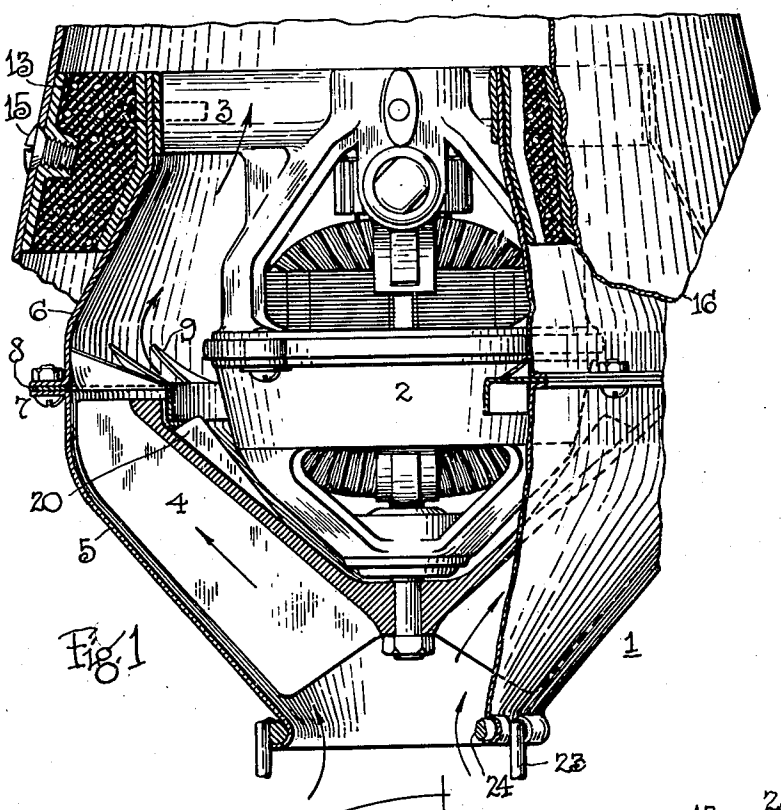


Fig. 1

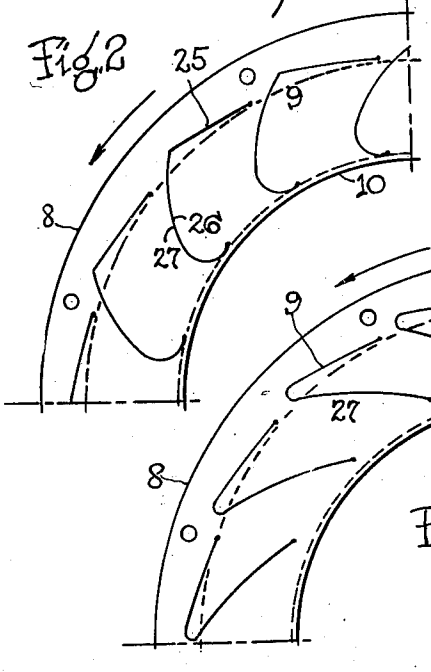


Fig. 2

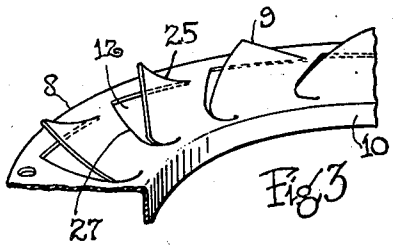


Fig. 3

Fig. 4

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Patented June 17, 1941

2,245,989

UNITED STATES PATENT OFFICE

2,245,989

SUCTION DEVICE FOR VACUUM CLEANERS

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Application July 27, 1939, Serial No. 286,832

4 Claims. (Cl. 230—117)

This invention relates to improvements in vacuum cleaners, but more particularly to the canister-type machine wherein all the cleaning is done through a cleaning hose. It has a special application to the vertical-axis canister-type cleaner wherein the motor-suction-unit may be suspended, as herein described, in a flexible, pendant manner for the purpose of reducing vibration and hence the noises due thereto.

An object of the invention is to produce a higher suction for cleaning purposes than is obtainable with the single-stage centrifugal fan common to bag-type vacuum cleaners, and to impel a much larger volume of air for cleaning purposes than is possible with the multiple-stage centrifugal compressor common to canister-type cleaners.

A further object of the invention is to obtain the substantial equivalent of a double-stage centrifugal compressor in a manner free from "siren-sounds."

A still further object of the invention is to reduce noise by suspending the motor-suction-unit flexibly and pendantly in the vertical-axis-type canister vacuum cleaner.

An additional object is to obtain the highest suction-volume ratio whereby when the cleaning nozzle is used in a highly restrictive manner, such as when deeply imbedded in napped surfaces, the suction will be relatively high, and when the nozzle is used in a more open manner, the volume will be relatively high. This combination is particularly desirable in machines for domestic use wherein motive powers and motor weights must be much more restricted than with machines for industrial cleaning purposes. However, a conical fan together with auxiliary reaction blades, as shown herein, yields enormously increased air-flow over the multiple-stage centrifugal unit of similar power when applied to portable industrial cleaners.

Other objects and advantages will be more particularly pointed out hereinafter or will become apparent as the description proceeds.

In the accompanying drawing in which like reference numerals designate similar parts throughout there is illustrated a suitable, mechanical embodiment of what is now considered to be a desirable form of the invention. The drawing is, however, for the purpose of illustration only and not to be taken as limiting the invention, the scope of which is to be measured by the scope of the appended claims.

I have in this specification set forth my invention, and for its complete understanding have appended drawing of which Fig. 1 is a partially-sectioned elevation of a motor-blower-unit incorporating the principles of my invention.

Fig. 2 is a diagrammatic plan-view of the reaction blade ring.

Fig. 3 is a partial perspective of same.

Fig. 4 is the same as Fig. 3 slightly modified.

A motor-suction-unit, being generally designated as 1, comprises a motor 2, supported by a plurality of arms 3, adapted to drive a conical centrifugal fan 4 in a clock-wise direction (seen from the hub). A lower fan case 5 surrounding fan 4 is joined to an upper case 6 at a peripheral juncture 7. Ring-member 8 comprising a full circuit of fixed reaction blades 9 is shown clamped between the two case members at the juncture 7. Ring member 8 has an inner flange 10 for holding it stiffly in shape although it is much lanced or perforated for turning integral blades 9 therefrom. The ring 8 is disposed immediately above the tips of the blades of the fan 4 and the reaction blades 9 are so bent that they will deflect air leaving the fan 4 at high rotary speed in an axial direction. Air thrown from the tips of fan 4 attains its kinetic energy from the high speed rotation of the fan and after passing through the slots 12 finds itself so trapped that it can not readily return to the fan chamber. In this manner recirculation of air, so prevalent with the type of single-stage rotary fan common to vacuum cleaners, is enormously reduced without in any way choking or impeding the relatively high volume pertaining to this type of compressor.

It should be noted that the centrifugal fan in conical form enables the turning of the air at fan tip speed through 90° to its centrifugal throw. This type fan turns the air in this manner with little or no loss in efficiency and while it is being so turned it is passed through a ring of reaction blades somewhat analogous to the blades of a turbine wherein a motive-fluid moves axially instead of radially, spirally or helically.

Support arms 3 of the motor-unit 2 are joined to the upper case 6 and there through to a flexible mounting structure 13 which consists of an inner and outer metal portion between which sponge-rubber has been vulcanized in such a manner that the vulcanized rubber adheres to the metal; a process depending primarily upon absolutely clean metal, brass-plated. The mounting structure 13 is again joined as by screws 15 to the outer case 16 of the vacuum cleaner. This top support providing a center of gravity much below the point of support, pro-

duces a slightly pendulous effect. It permits slight unbalances at high rotary speeds to lose their vibratory characteristics in gyrating action, the speed of which is a multiple inherent in the device. This gyration together with the soft mountings just described tends toward extreme silence.

An internal blade 20 on the fan 4 produces internal circulation of air for motor cooling.

The vertical-axis canister-type machine shown in Fig. 2 shows a highly suitable installation of the unit shown in Fig. 1. Nevertheless, the conical fan and reaction-turbine-blade-ring of Figures 1, 2, 3 and 4 may be mounted and operated successfully on a horizontal axis.

In a form preferred for its simplicity of construction the blades 9 are made integral with the ring member 8. This ring of blades may be formed by lancing from the metal sheet of which the entire part is composed. Suitable schematic form for a pattern is shown in Fig. 2, and a perspective of a portion of the ring made from that pattern is shown in Fig. 3 with the blades lanced and turned to final form. The blades 9 are so shaped that when turned to the most efficient form for air-deflecting purposes (as suggested in Fig. 3), the outside edge 25 of the blade fits snugly against the side wall of the upper fan-casing 6. The other side wall leaves its corresponding edge 27 in a horizontal plane but diagonal to the direction of motion of the tip of the blades of blower-fan 4. The object of this diagonal "slicing" of the high-speed compressed-air at the point of contact with the edge 27 is to lessen "siren-sounds" caused by too sharp interruption of the air where the cutting edge 27 is radial to blower-fan 4. It should be noted that the air delivered by the blower-fan is very dense against the inner wall of the case members 5 and 6 at their point of juncture which is adjacent the tip of the blades of the blower-fan. The blades 9, therefore, do their major air deflecting at their outer tips and hence their greater deflection is at their greatest radius.

A modification of the ring-member 8, shown in Fig. 4 consists of disposing the slicing edge 27 diagonally to the air stream, as in Fig. 2, but diagonally in the opposite direction to the air stream.

I claim:

1. In a vacuum-cleaner, a motor-suction-unit comprising a cone-shaped centrifugal fan adapted to be rotated by a co-axial motor, a cone-shaped casing surrounding said fan and means of deflecting air away from the tips of the blades of said fan in an axial direction for purposes of decreasing recirculation, said means comprising a plurality of fixed deflector blades disposed adjacent said tips, in a ring surrounding the said motor and co-axial therewith, with the entering edge of said fixed blades substantially in a plane at right-angles to the motor-axis and having their entering edges disposed diagonally to the wind stream.

2. The device described in claim 1, further characterized by having the said ring joined to the said cone-shaped casing at a point approximating its greatest diameter.

3. The device described in claim 1, further characterized by having an opening between the said ring and the motor permitting communication from a chamber above the said blades to a space back of the cone of the said cone-shaped fan for purposes of ventilating the said motor.

4. In a vacuum-cleaner, a motor-suction-unit comprising a cone-shaped centrifugal fan adapted to be rotated by a co-axial motor, a cone-shaped casing surrounding said fan and means of deflecting air away from the tips of the blades of said fan in an axial direction for purposes of decreasing recirculation, said means comprising a plurality of fixed deflector blades disposed adjacent said tips, in a ring surrounding the said motor and co-axial therewith, and with the entering edge of said fixed blades substantially in a plane at right-angles to the motor-axis.

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