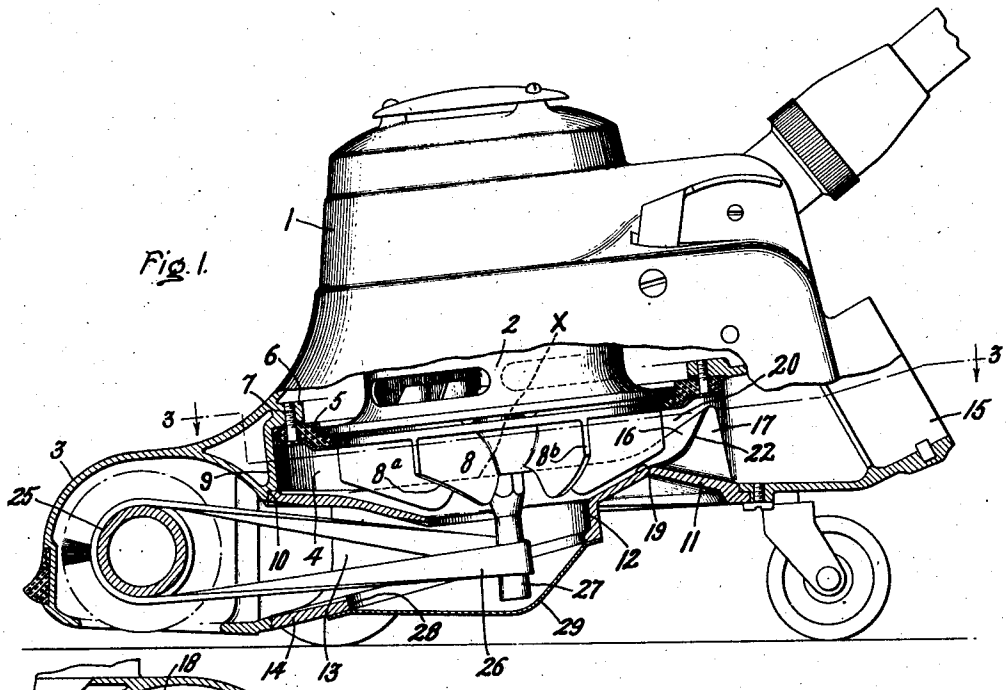
Dec. 31, 1935. N. H. WATTS 2,026,406

VACUUM CLEANER

Filed Oct. 18, 1933

Fig. 1.



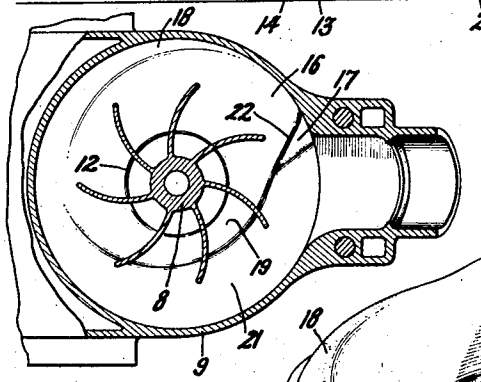




Fig. 3.

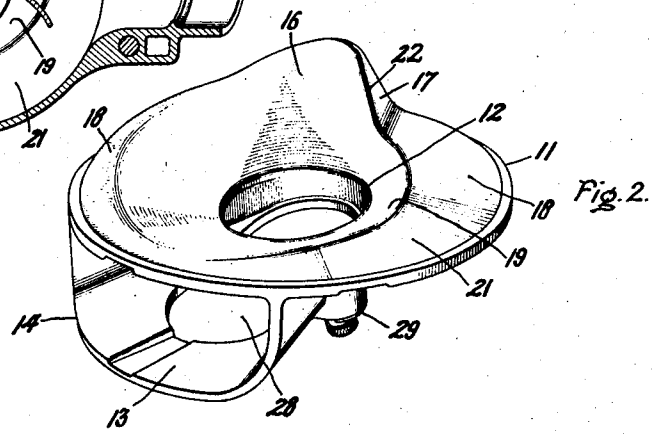



Fig. 2.

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## VACUUM CLEANER

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7 Claims. (Cl. 230—133)

The present invention relates to vacuum cleaners and especially to electric vacuum cleaners of the portable household type wherein the suction producing means comprises a centrifugal fan or impeller located in a fan chamber, air being drawn in at the central portion of the fan chamber and discharged at the periphery.

As is known, a centrifugal suction producing means of this type requires a discharge passage surrounding the fan of gradually increasing cross sectional area, the discharge passage being smallest just beyond the discharge opening as regards the direction of rotation of the fan and increasing in cross sectional area toward the discharge opening. To accomplish this result, it has been the practice to shape the casing so as to provide a volute or scroll surrounding the fan, the discharge conduit being located at one side of the casing and opening to the rear, it being required that it open to the rear to enable the bag connection to be made. This construction results in an unsymmetrical arrangement of the fan casing with the bag connection at one side and the casing not concentric with the fan.

The object of my present invention is to provide an improved construction and arrangement of fan and fan casing wherein the casing is symmetrical and wherein the discharge opening may be located centrally at the rear of the casing, and for a consideration of what I believe to be novel and my invention, attention is directed to the accompanying description and the claims appended thereto.

In the drawing, Fig. 1 is a side elevation, partly in section, of a vacuum cleaner having a fan and casing embodying my invention; Fig. 2 is a perspective view of a bottom plate for the fan casing; and Fig. 3 is a detail sectional view taken on line 3—3, Fig. 1.

Referring to the drawing, the cleaner structure comprises a dome 1 in which an electric motor 2 is supported in any suitable manner, a suction nozzle 3, and a fan chamber 4. In the present instance, the motor is shown as being supported at its lower end by a resilient ring 5 fastened to a flange 6 by screws 7. The motor shaft projects into the fan casing and carries a fan 8 of suitable construction having a radial discharge. The front edges of the fan blades slope rearwardly from their inner ends outwardly as is indicated at $8^a$. The ends are straight as is indicated at $8^b$.

The fan casing comprises a cylindrical or annular side wall 9 which depends from the underside of dome 1 and is concentric with the motor shaft. At its lower edge it is provided with a ledge 10 on which is fastened a bottom cover plate 11 which projects axially into the casing and forms one end wall of the fan chamber. The other end wall is formed by the end plate of the motor casing. In cover plate 11 is a central opening 12 which communicates through a passage 13 formed by walls 14 with the suction nozzle 3. At the rear of fan chamber 4 is a discharge conduit 15 which is centrally and symmetrically located with respect to the fan casing.

With the above described arrangement, it will be seen that the surrounding side wall of the fan casing is concentric with the fan and the motor shaft and to provide the desired variation in cross sectional area of the fan chamber space surrounding the fan, I provide bottom cover plate 11 with projecting means 16 which provides a substantially flat wall 17 just beyond discharge conduit 15 as regards the direction of rotation of the fan which forms in substance a dam or deflecting wall for directing air into conduit 15. Beyond wall 17 projecting means 16 slopes gradually downwardly and gradually widens providing a surface 18 which defines with the other end wall of the fan casing a passage of increasing cross sectional area surrounding the ends of the fan blades, which passage extends up to discharge conduit 15. As will be clear, this passage of increasing cross sectional area is obtained by increasing the distance between the end walls of the fan casing in an axial direction. Viewed from one aspect projecting member 16 is a conical member of greatest height directly adjacent surface 17 and gradually decreasing in height to the discharge opening which presents a surface sloping radially from the periphery of the fan toward the side walls 9 of the casing and which has an upper surface 18 of gradually increasing width extending from the side walls 9 of the casing toward the fan. The projecting member 16 ends opposite the discharge conduit 15 and at this point the surface 18 extends horizontally from the front edge of the fan toward the wall of the casing. This is indicated by the dotted line X in Fig. 1. Plate 11 has an annular surface 19 which conforms to the front edges $8^a$ of the fan blades to prevent leakage of air. This is shown particularly in Fig. 1.

Projection 16 does not conform closely to the end edges of the blades but is spaced somewhat therefrom to provide a triangular shaped diverging air passage 20. Passage 20 directly adjacent the blade ends is of a width equal approximately to that of the blade end and gradually narrows radially outwardly and upwardly. In other words, passage 20 is triangular in shape with one side of the triangle adjacent the blade ends. This permits some recirculation of air so that there is not an abrupt cut-off of the air at this point. This arrangement affects but little the efficiency of the fan and has the advantage that its lessons the noise.

Considering the discharge passage for the air, it will be seen that it is in the form of a helix

spiraling outwardly in an axial direction so that at its discharge end where its walls merge into discharge conduit 15, the passage is somewhat to one side of the ends of the fan blades. There is thus provided an outwardly sloping wall as is indicated at 21 having its high point along a sort of ridge 22 which merges into projection 16 which serves to direct the air away from the fan and into outlet conduit 15. This serves to minimize the flow of air toward triangular passage 20, the major portion of the air being directed away from such passage to the outlet conduit 15. As a result, the flow of air through passage 20 is not large. The wall 21 gradually increases in width from a point opposite the discharge conduit as indicated by the ridge 22 and at the discharge conduit extends within the periphery of the fan.

By the foregoing arrangement, I provide a symmetrical fan chamber having the discharge opening centrally located at the rear of the cleaner casing but which at the same time provides the desired contour for the discharge passage for the air and directs the air evenly and smoothly to the discharge conduit. As a result of this and the provision of passage 20 which prevents abrupt cut-off of the air flow at the fan blade ends, the fan is quiet and efficient in operation.

In the present instance, the cleaner is provided with a brush 25 in its nozzle driven by a belt 26 from a pulley 27 formed on the extended end of the motor shaft and to give access to the belt, walls 14 are provided with an opening 28 over which is fastened a removable cover plate 29.

In accordance with the provision of the patent statutes, I have described the principle of operation of my invention, together with the apparatus which I now consider to represent the best embodiment thereof, but I desire to have it understood that the apparatus shown is only illustrative and that the invention may be carried out by other means.

What I claim as new and desire to secure by Letters Patent of the United States, is:

1. In a fan structure, a shaft, a fan on the shaft having a radial discharge, a casing concentric with said shaft and fan having an inlet at its central portion and an outlet at its periphery, a wall adjacent the fan providing a dam beyond the outlet as regards the direction of rotation of the fan, a wall adjacent the fan at one end of the casing sloping radially from the periphery of the fan toward the side wall of the casing and providing a diverging passage between the ends of the fan blades and said dam, and a passage of gradually increasing axial width from said dam around the fan to said outlet.

2. In a fan structure, a shaft, a fan on the shaft having a radial discharge, a casing concentric with said shaft and fan having an inlet at its central portion and an outlet at its periphery, a wall adjacent the fan providing a dam beyond the outlet as regards the direction of rotation of the fan and a passage of gradually increasing axial width from said dam around the fan to said outlet, said passage having a wall adjacent the fan at one end of the casing extending from the casing toward the fan having a surface gradually increasing toward said outlet and extending within the periphery of the fan at said outlet.

3. In a fan structure, a shaft, a fan on the shaft having a radial discharge, a casing concentric with the shaft and fan having an inlet at its central portion and an outlet at its periphery, an axially extending wall adjacent the fan providing a dam for directing air to the said outlet, and a passage of gradually increasing axial width from said dam around the fan to said outlet, said passage having a wall adjacent the fan at one end of the casing sloping radially from the periphery of the fan toward the side wall of the casing providing a diverging passage between the ends of the fan blades and the dam and a wall extending from the side wall of the casing toward the fan having a surface gradually increasing toward the outlet and merging with said dam and said radially sloping wall.

4. In a fan structure, a shaft, a fan on the shaft having a radial discharge, a casing concentric with the shaft and a fan having an inlet at its central portion and an outlet at its periphery, an axially extending wall adjacent the fan providing a dam for directing air to said outlet, and a passage of gradually increasing axial width from said dam around the fan to said outlet, said passage having a wall adjacent the fan at one end of the casing sloping radially from the periphery of the fan toward the side wall of the casing providing a diverging passage between the ends of the fan blades and the dam and a wall extending from the side wall of the casing toward the fan, merging with said radially sloping wall, and having a surface gradually increasing toward the outlet and extending within the periphery of the fan at the outlet.

5. In a vacuum cleaner, a shaft, a fan on the shaft having a radial discharge, a casing concentric with the shaft and fan comprising an annular side wall and a plate at one end of said wall, said casing having an inlet opening at its central portion, and a discharge conduit at its periphery, and a member on the plate which projects axially from the plate within the annular side wall of the casing in the space radially beyond and surrounding the fan and provides an axially extending wall beyond the discharge conduit as regards the direction of rotation of the fan for directing air to the discharge conduit, said member sloping toward said plate from said axially extending wall beyond said wall as regards the direction of rotation of the fan whereby the axial width and cross sectional area of the space surrounding the fan is gradually increased.

6. In a fan structure, a shaft, a fan on the shaft having a radial discharge, a casing concentric with said shaft and fan having an inlet at its central portion and an outlet at its periphery, said casing having an annular side wall concentric with said shaft and a plate connected to the side wall at one end having its joint with the side wall in a single plane, and walls projecting axially from said plate within the space between the side wall of the casing and the fan, said walls sloping axially toward said plane from beyond the discharge conduit as regards the direction of rotation of the fan whereby the axial width and cross sectional area of the space surrounding the fan is gradually decreased.

7. In a fan structure, a fan, a scroll casing surrounding said fan having an outlet at its periphery and a circumferential passage adjacent the fan of gradually increasing area leading to the outlet, and an axially extending wall beyond the discharge conduit as regards the direction of rotation of the fan for directing the air to the outlet, said wall causing said circumferential passage to be diverging at said wall.

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