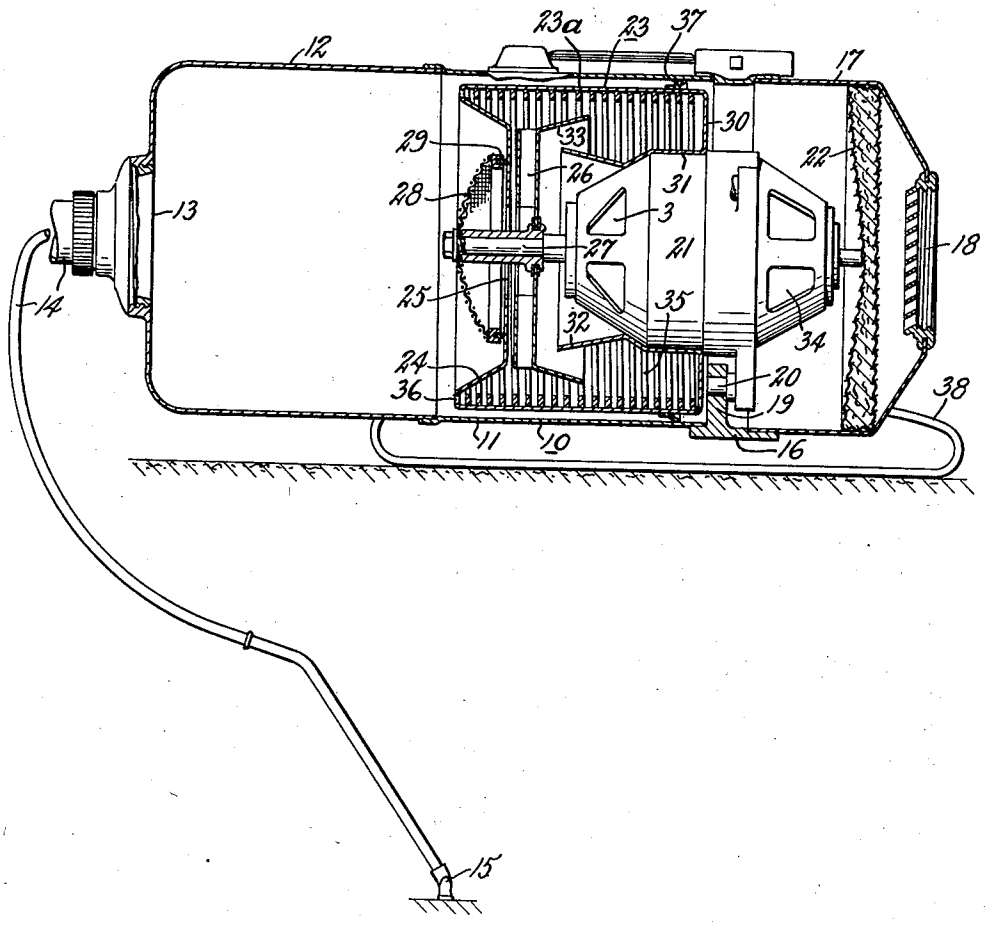
Sept. 14, 1937. J. F. R. KARLSTROM 2,093,082

VACUUM CLEANER

Filed Nov. 5, 1936



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Patented Sept. 14, 1937

2,093,082

UNITED STATES PATENT OFFICE

2,093,082

VACUUM CLEANER

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Application November 5, 1936, Serial No. 109,242
In Germany November 8, 1935

12 Claims. (Cl. 183—35)

My invention relates to vacuum cleaners and more particularly to a vacuum cleaner employing the effect of centrifugal force for separating the entrained dust and other solid particles from the air.

One of the objects of my invention is to provide an improved centrifugal separator. Another object is to incorporate an improved centrifugal separator in a vacuum cleaner. Further objects and advantages of my invention will be apparent from the following description considered in connection with the accompanying drawing which forms a part of this specification and on which the single figure is a cross-sectional view of a preferred embodiment of my invention.

Referring to the drawing reference character 10 designates a casing, preferably of cylindrical shape. Casing 10 includes a barrel portion 11 to one end of which is removably secured a cap-like member 12 forming a dust receptacle. Member 12 is formed with an inlet opening 13 to which may be connected a flexible hose or the like 14 leading to a suction nozzle 15. Rigidly secured to the other end of barrel portion 11 is a ring 16 and removably secured to the ring is an end-cap 17 formed with an exhaust opening 18.

Ring 16 is formed with a plurality of inwardly extending lugs 19 from which extend pins 20. An electric motor 21 is suitably supported by pins 20 preferably, by resilient means such as are shown in Patent No. 2,035,882, granted March 31, 1936 to E. O. H. Hansson. A filter 22 may be disposed within cap 17 between the motor and exhaust opening 18. Rigidly secured to the housing of motor 21 is a hollow member 23. Member 23 includes a cylindrical wall 23a and an inwardly dished end wall 24 facing the dust receptacle 12. Wall 24 is formed with a central opening 25 which serves as an inlet for a centrifugal impeller 26 which is mounted adjacent to the end wall on the shaft 27 of motor 21. Opening 25 is protected by a coarse screen 28 which may also be mounted for rotation with the motor shaft. The periphery of screen 28 may carry a packing ring 29 which bears against the front of wall 24.

Hollow member 23 also includes an annular end wall 30 which extends from the cylindrical portion 23a to the housing of the motor. Integral with end wall 30 is an inner cylindrical wall 31 which embraces closely the exterior of the motor housing for some distance and then is flared outwardly to form a conical member 32. The housing of motor 21 is formed with air passages 3 opening to the interior of hollow member 23 within conical member 32. The opposite end of the motor housing is formed with air passages 34 opening into the space within end cap 17. A conical member 33 is carried by impeller 26 and encloses the open end of conical member 32.

The inner surface of the cylindrical portion 23a of member 23 is provided with a spiral rib 35 defining, between successive terms of the rib, a spiral groove. If a particle travels through this spiral groove in the same direction of rotation as that of impeller 26, the particle will move axially toward the dished end wall 24. This end wall is formed with openings 36 which establish communication between the end of the spiral groove and the dust receptacle 12.

In order to prevent flow of air between the outer surface of member 23 and the inner surface of the casing 10, a flexible packing 37 is provided. This packing should be flexible because the member 23 may move slightly with respect to the casing due to the fact that the member is supported on the motor, which is resiliently mounted within the casing. The casing is supported on a horizontal surface by means of runners or the like 38.

The operation of the above described device is as follows:—

Rotation of impellers 26 by means of motor 21 causes air to be drawn in through nozzle 15, hose 14 and inlet 13 to within dust receptacle 12, from where it passes through screen 28 and opening 25 to the impeller. As the nozzle is passed over a surface to be cleaned, dust and other solid particles will be picked up by the air stream and carried into dust receptacle 12. A certain percentage of the dust and solid particles will be deposited within the dust receptacle due to the reduction in velocity of the air stream therein, and large particles such as matches, pins and threads, will be prevented from reaching the impeller by the screen 28. Due to the fact that this screen rotates, it will eliminate from the air flowing therethrough a certain percentage of the solid particles which would be small enough to pass through the openings in the screen if the screen were stationary.

The air and solid particles which pass through the screen 28 and opening 25 to the impeller are acted upon by the impeller and discharged from its periphery and given a high angular velocity. Inasmuch as the end wall 24 prevents the escape in this direction of all but a small percentage of the air, the openings 26 being restricted in size,

the air and entrained particles are forced to flow in a spiral path around the interior of cylindrical wall 23a, the pitch of this spiral path being such that rotating air advances axially toward the annular end wall 30. When the rotating air reaches the end wall it is forced inwardly toward cylindrical wall 31 and its axial direction is reversed and it is forced to advance spirally along the outer surface of wall 31 and conical member 23 to within conical member 33. During the spiral passage from left to right, as viewed in the figure, the solid particles, having a much greater mass than the air molecules, are hence more strongly acted on by centrifugal force and are thrown outwardly into the spiral groove formed by the successive terms of rib 35. However, inasmuch as the pitch of this spiral rib is opposite to that of the spiral path taken by the air under the influence of the impeller, the rotating particles are forced to advance within the groove toward the openings 36 formed in wall 24. The particles along with a small proportion of the air pass through openings 36 and are deposited within dust receptacle 12. The aforesaid small proportion of the air joins the air entering through inlet 15 and is again acted upon by the impeller. The lighter particles which may not have been forced to travel in the spiral groove as they passed with the air along the interior of cylindrical wall 23a, are thrown outwardly by centrifugal force when the air is forced by end wall 30 to take a spiral path of less diameter.

The air practically freed from dust when it enters conical member 23, is forced to again reverse its axial direction and pass within conical member 32 and through the motor housing to the space within end cap 17. In passing from within conical member 33 to within conical member 32, the diameter of the circular path of the air is again reduced and the lightest particles of dust will be thrown outwardly by centrifugal force. The fact that conical member 33 rotates tends to maintain the angular velocity of the air at its original, or a higher value.

The clean air discharged through the motor housing into end cap 17 then passes through filter 22 and exhaust opening 18 to the atmosphere. The filter may be impregnated with a disinfectant for the purpose of removing bacteria, which are so light that they would not be separated from the air by centrifugal force.

When it is desired to empty the accumulated dirt, the dust receptacle 12 may be removed from the barrel portion 11 and the dirt disposed of in any convenient place.

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

What I claim is:—

1. In a vacuum cleaner, a hollow cylindrical member, a centrifugal impeller disposed within, and adjacent to one end of said member for causing flow of air and entrained solid particles within said member in a spiral path advancing toward the opposite end of the member, and means forming a spiral groove on the inner surface of said cylindrical members, said spiral groove advancing toward said one end of said cylindrical member, said cylindrical member being formed with a passageway at said one end communicating with said groove.

2. In a vacuum cleaner, a hollow cylindrical member formed with an inwardly dished end wall, a centrifugal impeller disposed within said member adjacent to said wall for causing flow of air and entrained solid particles within said member in a spiral path advancing toward the opposite end of the member, said wall being formed with an inlet opening for said impeller, and means forming a spiral groove on the inner surface of said cylindrical member, said spiral groove advancing toward said end wall, the end wall being formed with a passage communicating with said groove.

3. In a vacuum cleaner, a hollow cylindrical member formed with an inwardly dished end wall, a centrifugal impeller disposed within said member adjacent to said wall for causing flow of air and entrained solid particles within said member in a spiral path advancing toward the opposite end of the member, said wall being formed with an inlet opening for said impeller, an electric motor for operating said impeller disposed within said member and including a housing formed with an air opening adjacent to said impeller, an annular end wall joining said opposite end with said motor housing, a partition of less diameter than said cylindrical member disposed between said impeller and the adjacent end of said housing, the other end of said motor housing being located outside of said cylindrical member and formed with an air opening, and means forming a spiral groove on the inner surface of said cylindrical member, said spiral groove advancing toward said dished wall, the dished wall being formed with a passage communicating with said groove.

4. A vacuum cleaner as claimed in claim 3 in which said partition is mounted for rotation with said impeller.

5. A vacuum cleaner as claimed in claim 3 in which said partition is formed with a conical flange increasing in diameter toward said annular end wall.

6. A vacuum cleaner as claimed in claim 3 in which said partition is mounted for rotation with said impeller and is formed with a conical flange increasing in diameter toward said annular end wall.

7. A vacuum cleaner as claimed in claim 3 in which said partition is formed with a conical flange increasing in diameter toward said annular end wall, and including a conical member around the air opening in the end of said housing adjacent to said impeller and having its larger end disposed within said conical flange.

8. In a vacuum cleaner, a casing including a removable portion forming a dust receptacle and provided with an inlet opening, a cylindrical member within said casing and formed with an end wall facing said dust receptacle, a centrifugal impeller within said cylindrical member adjacent to said end wall, the end wall being formed with an inlet opening for the impeller, said impeller causing flow of air and entrained solid particles within said cylindrical member in a spiral path advancing away from said end wall, means forming a spiral groove on the inner surface of said cylindrical member, the pitch of said spiral groove being opposite to that of said spiral path, said end wall being formed with a passage adjacent to its periphery connecting said groove with said dust receptacle, and means establishing communication between the interior of said cylindrical member and the atmosphere.

9. In a vacuum cleaner, a casing including a

removable portion forming a dust receptacle and provided with an inlet opening, an electric motor mounted within said casing, a cylindrical member supported by said motor and enclosing one end of said motor, said member having an end wall facing said dust receptacle and formed with a central opening, a centrifugal impeller rotatable by said motor within said member adjacent to the opening in said end wall, said motor being formed with an air passage leading from within said member to atmosphere, said impeller causing flow of air and entrained solid particles within said cylindrical member in a spiral path advancing away from said end wall, and means forming a spiral groove on the inner surface of said cylindrical member, the pitch of said spiral groove being opposite to that of said spiral path, said end wall being formed with passages adjacent to its periphery connecting said groove with said dust receptacle.

10. In a vacuum cleaner, a casing including a removable portion forming a dust receptacle and provided with an inlet opening, an electric motor resiliently mounted within said casing, a cylindrical member supported by said motor and enclosing one end of said motor and having an end wall facing said dust receptacle formed with a central opening, flexible packing means disposed between said cylindrical member and said casing for preventing passage of air therebetween, a centrifugal impeller rotatable by said motor within said member adjacent to the opening in said end wall, said motor being formed with an air passage connecting the interior of said cylindrical member with a space in said casing separated from said dust receptacle by said member and said packing, said impeller causing flow of air and entrained solid particles within said cylindrical member in a spiral path advancing away from said end wall, and means forming a spiral groove on the inner surface of said cylindrical member, the pitch of said spiral groove being opposite to that of said spiral path, said end wall being formed with passages adjacent to its periphery connecting said groove with said dust receptacle.

11. A vacuum cleaner as claimed in claim 9 including a coarse screen disposed in the path of air flowing through the inlet opening in said end wall.

12. A vacuum cleaner as claimed in claim 9 including a coarse screen disposed in the path of air flowing through the inlet opening in said end wall, said screen being mounted for rotation with said impeller.

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