

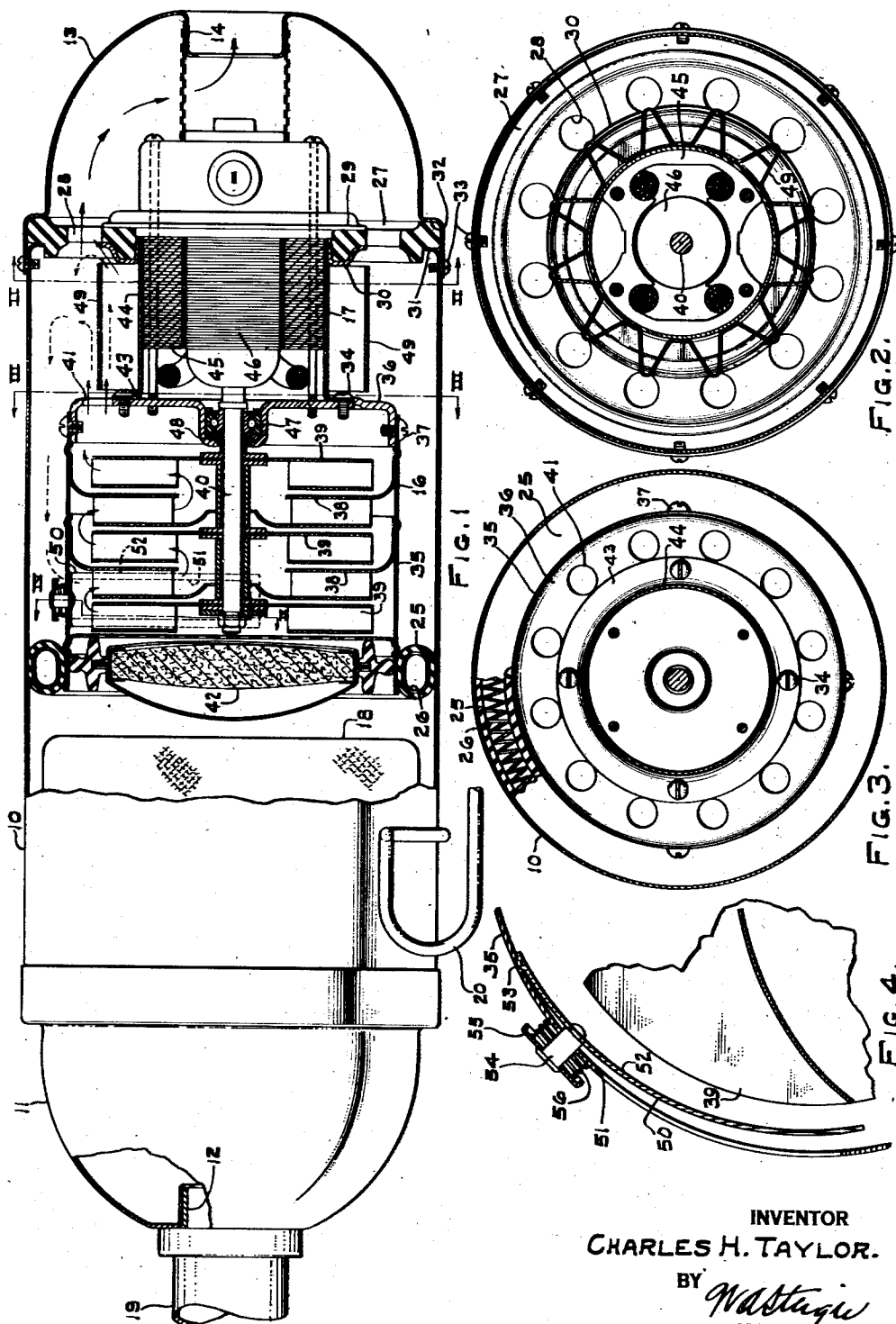
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SUCTION CLEANING APPARATUS

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## SUCTION CLEANING APPARATUS

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This invention relates to suction cleaning apparatus and more especially to suction cleaning apparatus of the tank type, and it has for an object to provide improved apparatus of this type.

Another object is to provide an improved motor unit for a tank type cleaner.

A still further object is to provide an improved arrangement for dissipating the heat generated incident to the operation of the motor.

A further object is to provide an improved resilient support for the fan and motor.

These and other objects are effected by the invention as will be apparent from the following description and claims taken in connection with the accompanying drawing forming a part of this application, in which:

Fig. 1 is a longitudinal view of a cleaner embodying this invention, with parts broken away;

Fig. 2 is a section taken on line II—II of Fig. 1;

Fig. 3 is a section taken on the line III—III of Fig. 1, with parts broken away; and,

Fig. 4 is a partial section taken on line IV—IV of Fig. 1 showing the valve for permitting closed circuit flow of the air in open position.

Referring to the drawing in detail, the suction cleaner includes a longitudinal cylindrical casing 10 having an end cap 11 which has an inlet opening 12 therein and an end cap 13 which has an outlet opening 14 therein. This casing encloses a fan unit 16 for drawing air into the casing through the inlet opening and forcing it out through the outlet opening, a motor unit 17 for driving the fan unit, and a dust bag 18 for filtering dirt out of the air passed through the casing. A hose 19 may be connected to the inlet opening 12 when the cleaner is used for cleaning by suction or it may be attached to the outlet opening 14 when the cleaner is used for blowing. A pair of runners 20 are provided for supporting the cleaner horizontally above a surface.

The fan unit 16 and the motor unit 17 are assembled as a unit outside of the casing 10 and are inserted therein as a sub-assembly. Means are provided for resiliently supporting the sub-assembly spaced centrally from the walls of the casing 10 so that vibrations set up incident to the operation of the sub-assembly will be absorbed by the supporting means instead of being transmitted to the casing 10. This supporting means includes an annular rubber tube 25, having an annular coil spring 26 therein, which is positioned on the fan unit 16 and a rubber ring or disc 27 which is attached to the motor unit 17. The ring 27 has a plurality of holes 28 therein to increase its flexibility and increase its ability

to absorb vibrations. The cleaning air discharged from the fan housing also passes through these openings in order to exit from the casing 10. These holes are located approximately midway between the inner and the outer edges of the ring 27 and are equally spaced circumferentially. The ring 28 is held at its inner edge between flanges 29 and 30 which are attached to the motor unit by any suitable means. The outer edge of the ring 27 is clamped between a flange 31 on the casing 10 and a shoulder 32 on the end cap 13. When assembling the cleaner, the end cap 13 is forced down onto the ring 27 with enough force to compress the edge of the ring so that an airtight joint between the flange 31 and the shoulder 32 is provided. The cap 13 is held in position by screws 33 that engage screw-threaded holes in the casing 10. The rubber tube 25 encircles the forward end of the fan unit 16. This tube is positioned on the end of the fan unit before the sub-assembly is positioned in the casing 10, and it may be collapsed by hand to insert it in the casing 10 past the flange 31. After the sub-assembly is positioned in the casing 10, the coil spring 26 holds the tube 25 expanded in airtight relation against the inner side of the wall of the casing 10 and against the outer side of the wall of the fan unit 16.

The fan unit 16 includes a cylindrical housing member 35 which encloses a fan. This housing member is attached to an end wall member 36 by screws 37 or some other suitable means. The fan includes stationary blade elements 38 which are carried by the housing member 35 and rotary blade elements 39 which are mounted on an extension of a motor shaft 40. The member 36 has a plurality of holes 41 therein through which air drawn into the fan housing 35 by the fan is discharged. These holes are located near the periphery of the member 36 and they are equally spaced circumferentially. A final filter element 42 is positioned in the forward end of the housing 35. This element removes some of the fine dirt or dust that might pass through the dust bag 18.

The motor unit 17 includes a cup-shaped airtight casing 44 in which is mounted a universal type electric motor having a stator 45 and a rotor 46. In the embodiment shown, the motor casing is stamped out of a single piece. However, it will be understood that it may be formed of several pieces so long as it is airtight. The open end of the cup-shaped motor casing is fastened to the member 36 by some means that provides an airtight connection. In the em-

bodiment shown this connection is provided by a flange 43 on the motor casing 44 and screws 34 which extend through holes in the flange 43 and engage screw threaded holes in the member 36. The motor shaft 40 on which the rotor 46 is mounted projects through the member 36 into the fan housing 35 and is supported by a bearing 47 which is carried by the member 36. A washer 48 of felt or some other suitable material is provided adjacent the bearing 47 to provide an air and dirt-tight seal to prevent dirt from entering the motor housing through the motor shaft opening. It is desirable to keep the cleaning air out of the motor casing because it usually contains some remaining dust particles which cause the commutator of the motor to unnecessarily wear and also damage the winding of the motor and in time may clog up the air gap between the stator and the rotor. A tubular heat transfer device or fin 49 for rapidly dissipating the heat generated incident to the operation of the motor is attached to the motor casing 44 by welding or some other suitable means. This fin extends into the path of the air discharged from the openings 41 in the end wall member 36. The discharged air passes over both sides of the fin 49 (for a substantial length of the motor casing 44) at a high velocity and picks up heat from the fin and conveys it to the outside of the cleaner.

When the cleaner is used for cleaning by suction the cleaning air passes through the casing 10 approximately along the path indicated by the solid arrows in Fig. 1.

When the cleaner is used for blowing, the outlet opening 14 might become obstructed so as to permit only a small quantity of air to be discharged. If this should happen the motor would probably heat up beyond the desired operating temperature due to the fact that there would be very little air moving past the fin 49 to take heat away from the motor. To prevent the motor from overheating in such a case a valve indicated generally by the reference character 50 is provided in the fan housing member 35 which automatically opens when the pressure on the outside of the fan housing reaches a predetermined value to permit the air discharged from the fan housing to flow in a closed circuit. The path of this circuit is substantially as indicated by the dotted arrows in Fig. 1, that is, through the holes 41 in the end wall member 36, adjacent the fin 49, against the inner surface of the wall of the casing 10 through the valve 50 into the fan housing 35 where the fan again forces it through the same path. When the air flows in this path, it takes heat from the motor unit and carries it to the wall of the casing 10, which is colder than the motor casing 14, where it can be radiated and converted to the ambient atmosphere. This arrangement is also effective to dissipate the heat generated by the compression of the air.

The valve 50 includes a port 51 in the fan housing 35 and a flap 52 for opening and closing the port. The flap 52 is positioned on the inside of the fan housing member 35 and is pivoted thereto at 53. A pin 54 is attached to the flap 52 and extends through the fan housing member. This pin has a pressure plate 55 thereon and a coiled compression spring 56 surrounds the pin 54 and is positioned between the pressure plate 55 and the outside of the fan housing wall.

When the cleaner is operating under normal conditions, that is, with the outlet opening 14

unobstructed, the pressure differential between the intake side and the exhaust side of the fan will be insufficient to overcome the force of the spring 56 which will hold the flap 52 closed against the port 50. In this instance, the air discharged from the fan will be forced out of the casing 10 through the outlet opening 14. When the cleaner is operating with the outlet opening 14 obstructed, such as might happen when blowing, the pressure on the discharge side of the fan will build up until the pressure differential between the intake side and the discharge side of the fan becomes sufficient to overcome the force of the spring 56 and move the flap 52 to open the valve 50 and permit closed-circuit flow of the air as described above. In a like manner, if the inlet of the hose 19 became clogged during cleaning by suction, the valve 50 will open to permit closed-circuit flow of the air inside the casing 10. The pressure at which the valve 50 will open to permit closed-circuit flow of the air may be regulated by selecting a spring 56 that has the desired strength.

From the foregoing description taken in connection with the drawing, it is seen that this invention provides a tank-type suction cleaner having an improved motor and an improved arrangement for dissipating the heat generated incident to the operation of the motor. It also provides an improved resilient mounting for the fan and motor unit.

While I have shown the invention in but one form, it will be obvious to those skilled in the art that it is not so limited, but is susceptible of various changes and modifications without departing from the spirit thereof, and I desire, therefore, that only such limitations shall be placed thereupon as are specifically set forth in the appended claims.

What I claim is:

1. In a suction cleaner, a casing having an inlet opening and an outlet opening, a fan unit in said casing, said fan unit including a fan and a housing enclosing the same, a motor unit in said casing, a valve in said fan housing that automatically opens when the flow of air through said outlet opening becomes obstructed, said valve permitting the air to flow in a closed circuit, said circuit being adjacent the motor unit and against the inner surface of the wall of said casing and through said valve and back into the fan housing, said closed circuit flow of the air serving to transmit the heat generated incident to the operation of the motor to the walls of the casing where it is radiated and conducted to the ambient atmosphere.

2. In a suction cleaner, a casing having an inlet opening and an outlet opening, a fan unit in said casing, said fan unit including a fan and a housing enclosing the same, a motor unit in said casing, a valve including a port in said fan housing and a closure movable relative to said fan housing, said valve being operated by the pressure differential between the inside and the outside of said fan housing, said valve permitting air to flow in a closed circuit, said circuit being adjacent the motor unit and against the inner surface of the wall of said casing and through said valve and back into said fan housing, said closed circuit flow of the air serving to transmit the heat generated incident to the operation of the motor and the compression of the air to the walls of the casing where it is radiated and conducted to the ambient atmosphere.

3. A suction cleaner comprising an air filter,

a fan for effecting flow of a stream of air, a motor for driving said fan, means providing a path for said air stream extending through said fan, said filter and in contact with said motor to cool the same, and valve means opened in response to a condition caused by obstruction to flow of air through said path to provide a second path for flow of air through said fan and in contact with said motor to cool the same.

4. The structure recited in claim 3 in which said valve means includes a normally closed pressure-responsive member adapted to be opened by air pressure.

5. A suction cleaner as recited in claim 3 in which said fan and said motor are enclosed in an outer casing, and in which the flow of air

through said second path is in contact with the exterior of said fan and said motor and with the interior of said casing, to dissipate heat through the wall of said casing.

6. A suction cleaner as recited in claim 3 in which said fan is enclosed in a housing having an outlet discharging in the vicinity of the exterior of said motor, in which said motor and said fan housing are both enclosed within an outer casing, and in which the flow of air through said second path is in contact with the exterior of said motor, the exterior of said fan housing and the interior of said outer casing, to dissipate the heat of said motor through the wall of said outer casing.

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