Oct. 18, 1966 C. E. S. ANDERSSON-SASON ETAL 3,279,157

SUCTION CLEANER

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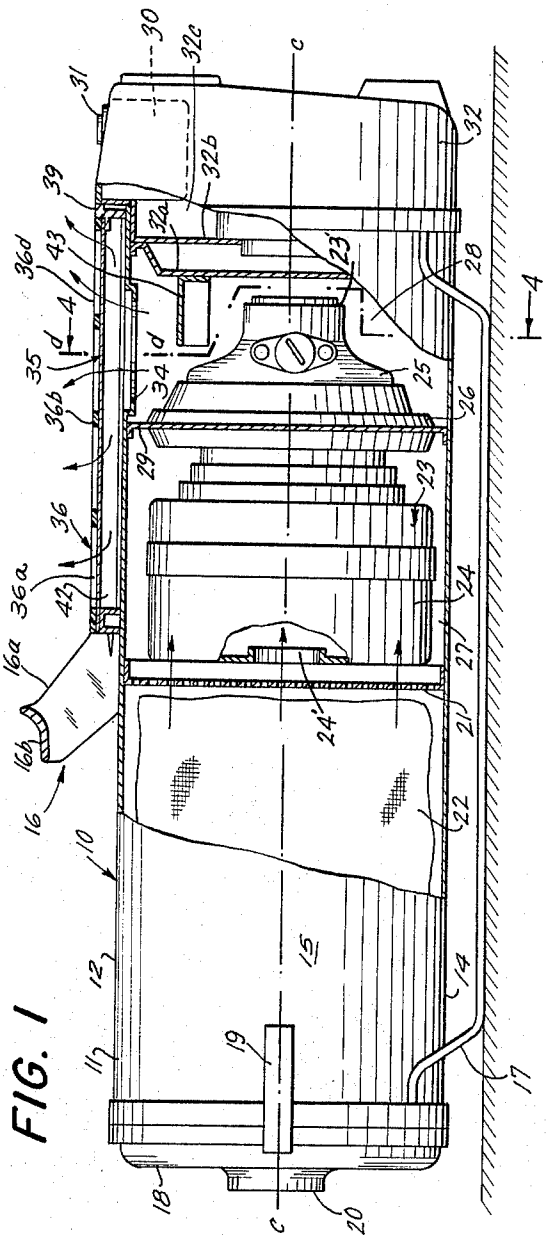


FIG. 1

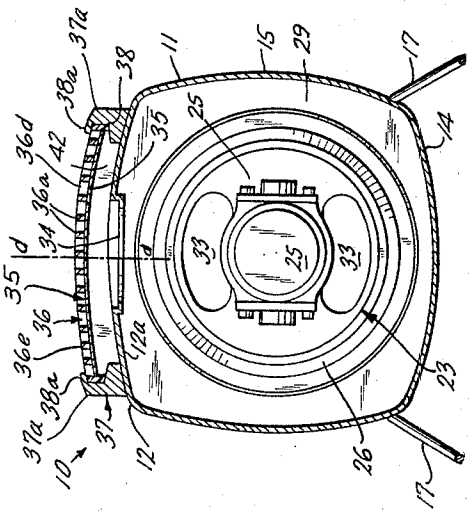


FIG. 4

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SUCTION CLEANER

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FIG. 2

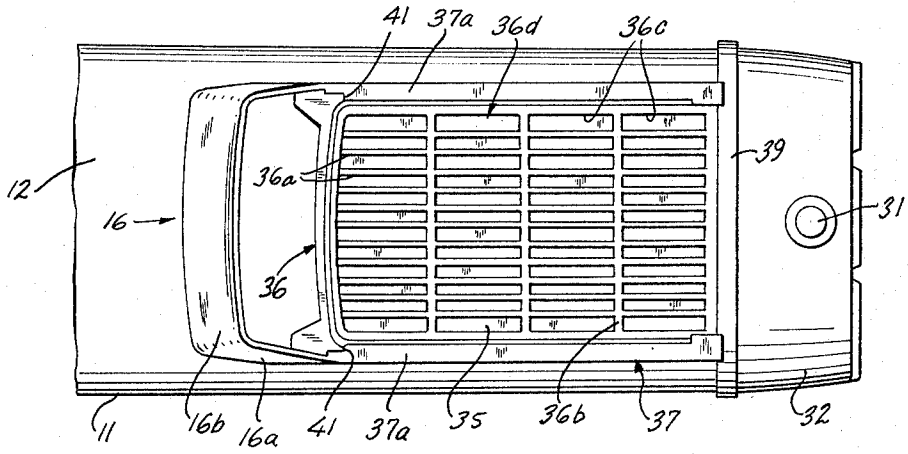
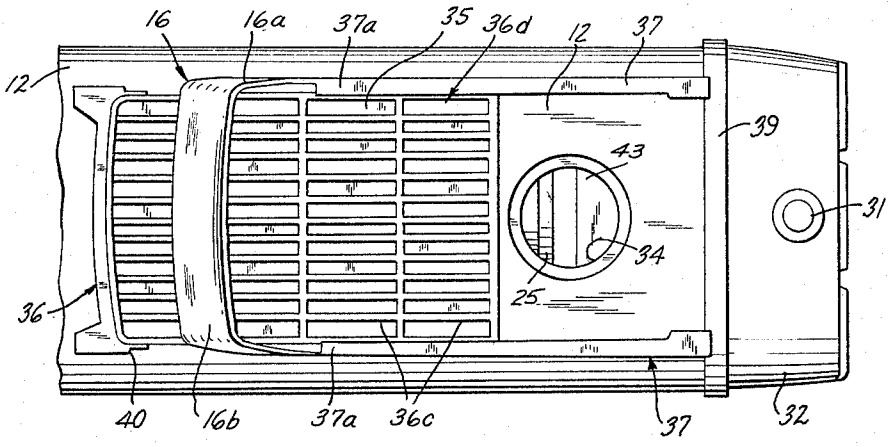


FIG. 3



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SUCTION CLEANER

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6 Claims. (Cl. 55—357)

Our invention relates to suction cleaners.

Suction cleaners comprise a casing having an air inlet and outlet and a motor-fan unit for moving air in a path of flow therethrough. A removable dust bag is located in the casing adjacent the air inlet for separating entrained dust from the air flowing through the casing. A fine filter often is provided adjacent the air outlet of the casing to insure removal of any fine dust particles which may have passed through the dust bag before the air is discharged into the room. Also, a suction cleaner accessory is often detachably connected to the air outlet or blowing outlet end of the casing. The accessory may be a hose, or a spraying device which is connected to one end of a hose, the opposite end of which is connected to the cleaner outlet.

The object of our invention is to provide an improved suction cleaner of the type indicated in which apertured structure defining an air discharge opening or blowing outlet end, which is formed to detachably receive an end of the hose, is concealed from view by a fine air filter during normal operation of the cleaner for suction purpose and can readily be made available for use when desired. We accomplish this by providing a suction cleaner casing having a longitudinally extending exterior wall section which is movable lengthwise of the casing to and from a first position over the air discharge opening or blowing outlet end and a fine filter comprising a layer of air-permeable material which has a cross-sectional area greater than the air discharge opening or blowing outlet end, and, when the motor-fan unit is employed to induce flow of air by suction effect into the dust bag to collect dust therein and the longitudinally movable exterior wall section is in its first position, the fine air filter is adjacent to the inner surface of the movable exterior wall section and disposed in the path of air flow between the air discharge opening or blowing outlet end and the outer surface of the exterior wall section, whereby air discharged from the air discharge opening or blowing outlet end will flow through the fine filter to the exterior of the casing past the longitudinally movable exterior wall section which, when it is in its first position, defines the air outlet of the suction cleaner.

Further objects and advantages of the invention will become apparent as the following description proceeds, and the features of novelty which characterize the invention will be pointed out with particularity in the claims annexed to and forming a part of this specification.

For a better understanding of the invention, reference may be had to the following description taken in connection with the accompanying drawings, in which:

FIG. 1 is a side elevational view, partly broken away and in section, of a suction cleaner embodying the invention;

FIG. 2 is a fragmentary top plan view of the cleaner shown in FIG. 1;

FIG. 3 is a view similar to FIG. 2 illustrating the manner in which access is gained to the blowing outlet end of the cleaner; and

FIG. 4 is a sectional view taken at line 4—4 of FIG. 1.

Referring to the drawing, the invention has been shown in connection with a horizontal tank-type suction cleaner

10 having a casing 11 including a top 12, bottom 14 and vertically extending side walls 15. The casing 11 is provided with a handle 16 and spaced members 17 which extend lengthwise of the casing along the bottom 14 and serve as skids to facilitate movement of the cleaner on a surface.

A front end cover 18 is removably secured at 19 to the casing 11 in any suitable manner and formed with an inlet opening 20 to which a suction hose (not shown) is adapted to be removably connected. Suitable cleaning appliances may be connected to the outer free end of the suction hose and through which air flows into the casing. Within the casing 11 is provided a perforated partition 21, at one side of which is disposed a removable dust collector or dust bag 22 which acts to separate dust from air as it flows therethrough.

Flow of air through casing 11 is effected by a motor-fan unit 23 which includes a centrifugal fan 24 carried at one end of an electric motor 25. The motor-fan unit 23 is suspended in casing 11 by structure 26 which provides a resilient mounting for the motor-fan unit and a seal between spaces 27 and 28 in the casing, the inner and outer peripheries of the suspension structure being respectively fixed to the motor-fan unit 23 and an inwardly extending flange 29 of the casing. A switch 30 is located at the top of a rear hood or end cover 32 which is removably secured in any suitable manner (not shown) to the casing 11. The switch 30 is provided with an actuating button 31 which extends upward through an opening in the end cover 32 and is accessible at the exterior of the casing 11. The switch 30 forms part of an electrical circuit (not shown) for respectively connecting and disconnecting the motor 25 to and from a source of electrical energy in any manner well known in the art.

When the suction cleaner 10 is being operated and the fan 24 driven by the motor 25, dust-laden air is drawn through the suction hose into the interior of the casing 11. Dust collects in the bag 22, and air from which dust has been removed passes through the dust bag and perforated partition 21 into the space 27. Air in the space 27 flows into the inlet 24' of the fan 24 from which it is discharged and flows through the shell of the motor 25 to effect cooling thereof, such air passing from the motor at 33 into the space 28 defined in part by the suspension structure 26 which bridges the gap between the motor-fan unit 23 and the flange 29. In this way the passage formed between the casing 11 and the motor-fan unit 23 is closed by the suspension structure 26 and all of the air discharged from the fan 24 passes through the motor 25 into the space 28.

The space 28 is also defined in part by a partition 32*a* which is transverse to the axis *c*—*c* of the casing 11 and is impervious to air and fixed to the casing 11 in any suitable manner to form a seat at the end thereof in which a part 32*b* of the rear end cover 32 nests when it is mounted on the casing. The end cover 32, which is cup-shaped, and transverse partition 32*a* form a compartment 32*c* in which the switch 30 is located. When the rear end cover 32, which is removed axially of the casing 11 from an air outlet 36*d*, is removed from the casing 11 to repair the switch 30 or provide a new one for the cleaner 10, for example, the transverse partition 32*a* remains in its mounted position on the casing 11 so that contact with the motor 25 is prevented. In its mounted position all points of the periphery of the wall 32*a* contact the inner surface of the casing 11 and are in sealing engagement therewith. Hence, the switch 30 can be inspected without disturbing the motor 25 by removing the exterior wall part or end cover 32 of the casing 11.

Air is discharged from space 28 of the cleaner 10 through an opening 34 formed in a wall part 12*a* of the top wall 12 of the casing 11 along a zone which extends

axially of the casing **11** and is disposed above the openings **33** from which air emerges from the motor shell and overlies one end of the motor-fan unit at which it is journaled at **23'**. It will now be seen that the casing **11** forms a single housing for the dust bag **22** and motor-fan unit **23** which are disposed alongside one another and have a common longitudinal axis *c—c* extending lengthwise of the cleaner **10**. The vertical axis *d—d* of the air discharge opening **34** is substantially perpendicular to the longitudinal axis *c—c* of the dust bag **22** and motor-fan unit **23** so that all of the air emerging from the openings **33** of the motor shell into the space **28** will flow therefrom to the top part **12***a* of the casing **11** and be discharged upward therefrom through the opening **34**. However, the compartment **32***c* formed by the end cover **32** and transverse wall **32***a* is axially removed from and outside of that part of the casing **11** providing the path of flow for air between the inlet **20** and outlet **36***d*.

A suction cleaner accessory is often detachably connected to the air discharge opening **34** of the cleaner. The accessory may be a hose, or a spraying device which is connected to one end of the hose, the opposite end of which is connected to the air discharge opening **34**. Such accessories are usually provided with fittings which are of a kind well known in the art and enable them to be detachably connected to the opening **34**.

In accordance with this invention, a very fine filter **35** is provided at the top wall **12** of the casing **11** which overlies the air discharge opening **34** and is movable axially over the outer surface of the casing **11** to permit a suction cleaner accessory to be detachably connected to the air discharge opening. The filter **35** may comprise a single sheet of material, such as cloth, paper or the like, for example, which is formed of fibrous material which is permeable to air and impregnated or bonded with a plastic like polyacrylonitrile butadiene-styrene, for example. The filter **35** is mounted at the underside of an apertured filter frame or member **36** having a reticulated grill defined by spaced axially extending ribs **36***a* and transverse ribs **36***b*.

As seen in FIG. 4, the filter **35** and frame **36** upon which it is mounted are slightly arched and conform to the shape of the top wall **12** of the casing **11**. However, the filter **35** is essentially flat and closely adjacent to the top **12** of the casing **11**. The filter frame **36** also may be formed of a plastic like polyacrylonitrile butadiene-styrene, for example. When a plastic of this type is employed to provide the member or frame **36**, it may be formed by compression molding in suitable dies in which the filter **35** is positioned, whereby the filter and frame **36** become an integral structure with the filter and frame bonded to one another. In FIG. 4 it will be seen that the filter **35** is fixed to the underside or bottom of the frame **36** and the ribs **36***a* and **36***b* project vertically upward therefrom. The intersecting spaced ribs **36***a* and **36***b* provide openings **36***c* which collectively define the air outlet **36***d*.

The filter frame **36** is received and held at the top **12** of the casing **11** by means **37**, the frame **36** being movable lengthwise or axially of the casing **11** by the means **37** which comprise spaced guides or tracks **37***a* fixed to the top **12** of the casing in any suitable manner. The tracks **37***a* are formed with U-shaped channels **38**, the open ends of which face one another and receive the outermost axially extending ribs **36***a* of the frame **36**. The top parts of the tracks **37***a*, which form the upper arms **38***a* of the channels **38**, overlie the top edges of the outermost axially extending ribs **36***a* and form grooves in which the filter frame **36** is movable lengthwise of the casing **11**.

As best shown in FIGS. 2 and 3, the handle **16** and spaced tracks **37***a* may comprise an integral part formed of a suitable plastic. The handle **16** includes a pair of spaced sides **16***a* each of which extends vertically upward from a different one of the tracks **37***a*. The handle **16** further includes a crossbar **16***b* which is connected to the

upper ends of the sides **16***a*, the crossbar **16***b* being spaced from the top **12** of the casing **11** and substantially perpendicular to the axis *c—c* of the casing **11**. In its closed position the filter frame **36** abuts an end ring **39** of the casing **11**, as shown in FIG. 2. When it is desired to connect a suction cleaner accessory to the air discharge opening **34** of the cleaner, the filter frame **36** is moved lengthwise of the casing **11** beneath the handle **16** so that the air discharge opening **34** will be accessible, as shown in FIG. 3. In FIG. 3 it will be seen that the left-hand end of the filter frame **36** is notched at **40**. When the filter frame **36** is moved to its normal closed position seen in FIG. 2, the notched ends **40** of the filter frame move against shoulders **41** on the tracks which frictionally grip the left-hand end of the frame **36** and serve as stops to limit axial movement of the frame.

The fine filter **35** serves to remove fine dust particles from air emerging from the opening **34**. The air-permeable filter **35** preferably is microporous in character and also serves as a diffuser. For this reason the fine filter **35** normally is positioned at the vicinity of the top **12** of casing **11** at a level which is above the air discharge opening **34** to provide a diffusing chamber **42** at the underside of the filter. During normal operation of the cleaner **10** air flows through the opening **34** at a relatively high velocity. The filter **35** has an overall cross-sectional area that is materially greater than that of the air discharge opening **34**, whereby the air is subdivided into a multiplicity of tiny air streams which are discharged from the outer surface of the filter **35** over its entire area which is sufficient to reduce the velocity of the air discharged from the cleaner so that settled dust in the vicinity of the cleaner will not be disturbed.

As seen in FIG. 1, a plate **43** is fixed to the imperforate transverse wall **32***a* and extends axially of the casing **11** at a zone between the motor **25** and air discharge opening **34**. Air passing from space **28** to the opening **34** flows around the plate **43** which serves as a protective shield to prevent current-carrying parts of the motor circuit from being contacted when the filter frame **36** is moved to its open position shown in FIG. 3 and the air discharge opening **34** of the cleaner is exposed.

In view of the foregoing, it will now be understood that the frame **36** and filter layer **35** mounted on the inner side thereof form an exterior wall section of the casing **11**. During normal operation of the cleaner for cleaning purpose, the filter layer **35** is mounted over the opening **34** in a plane which is substantially perpendicular to the vertical axis *d—d* of the opening and in the path of air flow between the opening **34** and the outer surface of the apertured movable exterior wall section **36** which defines the air outlet of the suction cleaner when positioned over the opening **34**. With this construction air discharged vertically upward from the opening **34** will flow through the filter layer **35** and past the exterior wall section **36** to the exterior of the casing **11** at which region the air outlet **36***d* is located.

It will now be understood that the fine air filter **35** is disposed between the motor-fan unit **23**, which is horizontally disposed in the casing **11**, and the air outlet **36***d* of the cleaner which is defined by the apertured member **36** when the latter, which serves as an exterior wall section of the casing **11**, is in its first or closed position over the air discharge opening **34**, as shown in FIG. 1.

The portion of the path of flow of air between the motor-fan unit **23** and the fine air filter **35** includes the opening **34** formed in the top wall portion **12***a* of the casing **11**. Essentially, the opening **34** formed in the casing part **12***a* defines passage means having the vertical axis *d—d* from which air emerges in its path of flow toward the fine air filter **35**. The air discharge opening **34** in the wall part **12***a* constitutes structure which is operable to produce an air stream which is directed substantially perpendicularly toward the fine air filter **35**. As shown in FIG. 1, the fine air filter **35** is positioned between the

opening 34 and the outer surface of the exterior wall section 36 for air discharged from the opening 34 to flow through the fine air filter 35, which is in intimate physical contact with the inner surface of the exterior wall section 36 during operation of the cleaner, and past the exterior wall section to the exterior of the casing 11.

While a particular embodiment of the invention has been shown and described, such variations and modifications are contemplated as fall within the true spirit and scope of the invention, as pointed out in the following claims.

We claim:

1. In a tank-type suction cleaner (10) having, in combination,

(a) an elongated casing (11) which normally is horizontally disposed and provided with an air inlet (20) and an outlet (36*d*) and having a path of flow for air therebetween (20 and 36*d*), the air outlet (36*d*) being at the top (12) of said casing (11), the air inlet (20) and outlet (36*d*) being located at opposite ends of said elongated casing (11) and removed from one another axially (*c*—*c*) of said casing (11),

(b) said casing (11) including an imperforate wall (32*a*) which is transverse to the axis (*c*—*c*) of said casing (11), said wall (32*a*) having all points of the periphery thereof contacting the interior surface of said casing (11) in sealing engagement therewith and defining a part of the path of flow for air between the inlet (20) and the outlet (36*d*) which is at the top (12) of the casing (11),

(c) means extending axially (*c*—*c*) in said casing (11) and including a motor-fan unit (23) for circulating air in the path of flow from the inlet (20) to the outlet (36*d*), said unit (23) including an electric motor (25) and a fan (24) driven thereby, said motor (25) and said fan (24) being disposed within said path of flow,

(d) means including structure (26, 29) to provide sealing means (26, 29) between said casing (11) and said motor-fan unit (23) for constraining all air passing through said path of flow to flow through said motor-fan unit (23),

(e) said casing (11) having a compartment (32*c*) which is outside the path of flow for air between said inlet (20) and the outlet (36*d*), switch means (30) in said compartment (32*c*) for controlling said motor (25), said switch means (30) having a control member (31) which extends to the exterior of said casing (11) and is accessible at the top (12) thereof, said compartment (32*c*) being defined in part by an exterior wall part (32) of said casing (11) which is removable therefrom for inspecting said switch means (30) without disturbing said motor (25) in said path of flow for air between said inlet (20) and outlet (36*d*),

(f) wall means including a part (12*a*) at the top (12) of said casing (11) and said transverse wall (32*a*) and said sealing means (26, 29) defining a space (28) which forms a part of said path of flow for air between the inlet (20) and outlet (36*d*) and into which all of the air flows through said motor-fan unit (23),

(g) said part (12*a*) at the top (12) of said casing (11) being formed with an opening (34) having a vertical axis (*d*—*d*), said opening (34) being below and vertically spaced from the outlet (36*d*) and through which air from said space (28) in its path of flow from the inlet (20) to the outlet (36*d*) is discharged vertically upward toward the outlet (36*d*),

(h) an air filter comprising a layer (35) of air-permeable material having a cross-sectional area greater than that of the air discharge opening (34),

(i) the top (12) of said casing (11) including an exterior wall section (36) which is apertured (36*c*) and movable to and from a position over the opening (34),

(j) the outlet (36*d*) of the cleaner (10) being defined by said exterior wall section (36) when positioned over the opening (34),

(k) the opening (34) being formed to receive an end of a hose and being accessible when said exterior wall section (36) is moved from its position over the opening (34),

(l) means (37) which functions to receive and hold said exterior wall section (36) over the opening (34), said last-mentioned means (37) functioning to enable said exterior wall section (36) to be moved to and from its position over the opening (34),

(m) and said layer (35) of air-permeable material during operation of the cleaner being maintained over the opening (34) and in a horizontally extending plane which is substantially perpendicular to the vertically extending axis (*d*—*d*) of the opening (34) and between the opening (34) and the outer surface (36*e*) of said exterior wall section (36) for air discharged upward from the opening (34) to flow through said layer (35) of air-permeable material and past said exterior wall section (36) to the exterior of said casing (11).

2. In a tank-type suction cleaner (10) as set forth in claim 1 in which said means (37) to receive and hold said exterior wall section (36) over the opening (34) comprises spaced tracks (37*a*) extending axially (*c*—*c*) of said casing (11) at the top (12) thereof, said tracks (37*a*) being U-shaped (38) in transverse section and having their open ends facing one another, and said exterior wall section (36) being slidable axially (*c*—*c*) of said casing (11) along said tracks (37*a*).

3. In a tank-type suction cleaner (10) as set forth in claim 2 which includes a handle (16) having a pair of spaced sides (16*a*) each of which extends vertically upward from a different one of said tracks (37*a*) and a crossbar (16*b*) connected to the upper ends of said sides (16*a*), said crossbar (16*b*) being spaced from the top (12) of said casing (11) and substantially perpendicular to the axis (*c*—*c*) of said casing (11), and said exterior wall section (36) being slidable axially (*c*—*c*) of said casing (11) along said tracks (37*a*) from a first position over said opening (34) to a second position removed from said opening (34) in which at least a part of said exterior wall section (36) is beneath the crossbar (16*b*) of said handle (16).

4. In a tank-type suction cleaner (10) as set forth in claim 1 in which said exterior wall section (36) comprises an apertured frame (36*a* and 36*b*) and said layer (35) of air-permeable material.

5. In a tank-type suction cleaner (10) as set forth in claim 4 in which said layer (35) of air-permeable material is in intimate physical contact with the inner surface of said exterior wall section (36).

6. In a tank-type suction cleaner (10) having, in combination,

(a) an elongated casing (11) which normally is horizontally disposed and provided with an air inlet (20) and an outlet (36*d*) and having a path of flow for air therebetween (20 and 36*d*), the air outlet (36*d*) being at the top (12) of said casing (11), the air inlet (20) and outlet (36*d*) being located at opposite ends of said elongated casing (11) and removed from one another axially (*c*—*c*) of said casing (11),

(b) said casing (11) including a hollow cup-shaped removable end cover (32) at the air outlet (36*d*) end thereof, said end cover (32) being removed axially (*c*—*c*) of said casing (11) from the air outlet (36*d*),

(c) said casing (11) including an imperforate wall (32*a*) which is transverse to the axis (*c*—*c*) of said casing (11), said wall (32*a*) having all points of the periphery thereof contacting the interior surface of said casing (11) in sealing engagement therewith and

defining a part of the path of flow for air between the inlet (**20**) and the outlet (**36***d*),

(d) said end cover (**32**) extending axially (*c*—*c*) of said casing (**11**) from said transverse wall (**32***a*), and, together with said transverse wall (**32***a*), forming a compartment (**32***c*) of said casing (**11**) which is axially removed from and outside of that part of said casing (**11**) providing the path of flow for air between the inlet (**20**) and outlet (**36***d*),

(e) means extending axially (*c*—*c*) in said casing (**11**) and including a motor-fan unit (**23**) for circulating air in the path of flow from the inlet (**20**) to the outlet (**36***d*), said unit (**23**) including an electric motor (**25**) and a fan (**24**) driven thereby, said motor (**25**) and said fan (**24**) being disposed within said path of flow,

(f) switch means (**30**) disposed in said compartment (**32***c*) within said end cover (**32**) for controlling said motor (**25**),

(g) means including structure (**26, 29**) to provide sealing means (**26, 29**) between said casing (**11**) and said motor-fan unit (**23**) for constraining all air passing through said path of flow to flow through said motor-fan unit (**23**),

(h) wall means including a part (**12***a*) at the top (**12**) of said casing (**11**) and said transverse wall (**32***a*) and said sealing means (**26, 29**) defining a space (**28**) which forms a part of said path of flow for air between the inlet (**20**) and outlet (**36***d*) and into which all of the air flows through said motor-fan unit (**23**),

(i) said part (**12***a*) at the top (**12**) of said casing (**11**) being formed with an opening (**34**) having a vertical axis (*d*—*d*), said opening (**34**) being below and vertically spaced from the outlet (**36***d*) and through which air from said space (**28**) in its path of flow from the inlet (**20**) to the outlet (**36***d*) is discharged vertically upward toward the outlet (**36***d*), the air discharge opening (**34**) being formed to detachably receive an end of a hose,

(j) said casing (**11**) including an exterior wall section (**36**) at the top (**12**) thereof which is movable to and from a position over the air discharge opening (**34**), said exterior wall section being apertured (**36***c*) and defining the air outlet (**36***d*) of the cleaner (**10**) when positioned over the discharge opening (**34**),

(k) an air filter comprising a layer (**35**) of air-permeable material having a cross-sectional area greater than that of the air discharge opening (**34**),

(l) and said air filter and exterior wall section (**36**) being so constructed and formed that said layer (**35**) of air-permeable material defining said air filter, during normal operation of the cleaner (**10**) for cleaning purpose, is maintained over the air discharge opening (**34**) in a plane which is substantially perpendicular to the vertical axis (*d*—*d*) of the air discharge opening (**34**) and between the opening (**34**) and the outer surface (**36***e*) of said exterior wall section (**36**) and air discharged from the opening (**34**) will flow through said layer (**35**) of air-permeable material defining said air filter and past said aperture (**36***c*) exterior wall section (**36**) to the exterior of said casing (**11**).

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