A suction sweeping machine includes a filter arrangement for collecting debris from a fluid stream. The filter arrangement comprises an outlet leading into the filter arrangement, a container, preferably in the form of a plastic bag (32), for collecting debris and having an open upper end, and a porous tube (132) which extends downwardly into the bag. The arrangement is such that a debris carrying fluid stream flowing from the outlet diffuses through the porous tube (132) and out of the open end of the bag (32), while the debris remains within the bag. Preferably, the porous tube is flexible and the plastic bag is located in a compartment with an access door (124) in a lateral sidewall thereof, and a plurality of candle filters (152) provide a secondary filter. Preferably, a shaker mechanism operative when the door (124) is shut is provided to shake dust off the candle filters (152). The candle filters are mounted on a frame which is removable from the machine for wash down and servicing, either vertically or horizontally. The machine has a hose (201) for removing debris from confined areas, which is carried by a pivoted support frame (203).
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SUCTION SWEEPING MACHINE

This invention relates to a suction sweeping machine which is designed for picking up debris from streets and other areas, and can be operated by a person walking or riding behind the machine.

Such a machine is the subject of our U.K. Patent No. 2287418B. Such machines include rotary brushes and a suction inlet at ground level, through which debris is drawn and then collected in a large capacity refuse bag or sack. The machine is provided with a filter arrangement which allows the air drawn into the machine to be returned to the atmosphere, after any dust and other solids have been filtered from it and deposited in the bag or sack. While such machines work very satisfactorily, they suffer from one disadvantage, which is that in due course, the filter arrangement begins to become clogged with fine dust particles.

It is among the objects of the present invention to provide a suction sweeping machine with a filter arrangement and debris collection arrangement which is more convenient to use than known suction sweeping machines.

The present invention provides a suction sweeping machine including a motor, a fan driven by the motor, a suction head connected by an inlet duct to the fan, whereby debris may be collected from the ground in a fluid stream generated by the fan, and be forced by the fan into an outlet duct extending from the fan to a container, wherein the outlet duct terminates in an outlet communicating with the container, there being a porous filter member extending from the outlet into the container through an opening in an upper portion thereof, whereby debris from the fluid stream in the outlet duct is collected within the porous member whereas the fluid in the fluid stream flowing from the outlet may diffuse through the porous member and out of the opening, and wherein an access opening is provided in a lateral side wall of the container, through which debris
within the porous member may be removed.

The fluid stream flowing from the outlet may carry the remains of papers, drinks cans, cigarette ends and the like. This debris, which is chopped as it passes through the fan, will collect in the container which may be periodically emptied or removed for disposal. Also, when used in a machine provided with water mist dust suppression, the "wet" dust and dirt will remain in the container and may thus be easily and cleanly removed from the machine. Similarly, when the suction sweeping machine passes over a puddle, the water drawn into the machine will be retained in the container and will not result in the machine leaving a trail of dirty water behind it as occurs with conventional machines. A special container is used in wet weather.

The container may be a rigid or semi-rigid box but is preferably in the form of a sack or bag. In the majority of applications a simple plastic "bin bag" or "plastics bin liner sack" will suffice, such that filled bags or sacks may be readily removed, sealed and disposed of, and a supply of replacement bags may be carried on the machine. The ability to use such bags also reduces the running costs of the machine; these bags are relatively inexpensive and available from a wide variety of sources. The bag may be located within a compartment which provides protection for the bag and improves the appearance of the machine.

Preferably the porous member is a flexible tube, the lower end of which is located within the bottom of the container, and the upper end of which is in communication with said outlet. Preferably said flexible tube is supported at its upper end on a rigid support which is removably located within said container through said access opening in the side wall thereof, the rigid support being shaped to match the shape of said outlet.

Preferably the rigid support and the outlet are located relative to the opening in the container centrally towards the front thereof, so that spaces are left between the walls of the container and porous member over the whole areas of two side faces of the container for the passage of air from
said fluid stream.

In the preferred embodiment the container comprises a generally rectangular compartment at the rear of the machine, and towards one side thereof, said compartment being defined by generally rigid mesh screens on the side thereof opposite said one side and to the rear thereof, by a generally impervious front wall, and by a generally impervious floor and roof walls, and by a door providing said access opening. One or more trays for collecting liquid and/or dust may be located in the bottom of the compartment. Preferably, also the sides of the compartment defined by said mesh screens are further defined by filter means which may comprise fine screens of textile material.

Also in the preferred embodiment, the fine screens preferably comprise a plurality of vertically extending candle filters, the candle filters comprising felt like socks each supported on a skeletal frame, and open at its upper end, the open upper end communicating with an overall machine casing which directs filtered air forwardly and downwardly. Preferably, the skeletal frame can lifted or slid out of the compartment. Preferably, in order to prevent clogging of the candle filters, a shaker mechanism is provided for shaking fines collected by the candle filters off the candle filters, for subsequent removal from within the housing, the shaker mechanism being controlled by switch means associated with the door for closing the access opening.

A flexible plastic sack is preferably located within said container, which is preferably supported at its upper end on a rectangular frame, the dimensions of which correspond generally with the cross sectional shape of the container. It is preferred that the frame is slidable relative to a framework connected to a chassis supporting the outlet, between a position of use generally surrounding the outlet, and a sack replacement position achievable only when said access opening is open. Preferably clamping means is provided for clamping said frame in its position of use, in which upper end portions of the sack will also be held in
engagement with the frame.

Preferably, the rigid support and frame are provided with co-operating support means whereby the rigid support may be removably supported in a predetermined location on said frame, so that when said frame is in its position of use, the porous member is in fluid communication with said outlet.

Preferably also, the filter arrangement includes a second filter member, through which the fluid stream flows after exiting the container, to remove fines from the fluid stream which do not remain in the container. In the majority of applications most of the finer dirt and dust will still tend to collect in the container such that replacement or cleaning of the filter arrangement, e.g. filter tube will only be required relatively infrequently. Alternatively or additionally, the filter arrangement may form a wall of an enclosure in which the container is located or an end wall of a conduit, and may be adapted for periodic replacement or cleaning. Most preferably, the container is replaceable without disturbing the filter arrangement.

Preferably also, the tubular porous member extends to the base of the container. Most preferably, the porous member and the container are arranged such that a gap is maintained therebetween, to facilitate airflow through a large area of the porous member. Most preferably, the porous member is frusto-conical or flared, and widens from the outlet towards the base of the container.

The porous member is preferably formed of flexible material, for example woven polypropylene, but it may be rigid, and formed for example of a metal mesh. A single porous member may be provided. Alternatively, two or more porous members, of successively finer pore size, may be provided such that larger debris is retained in the container by the first porous member, while finer particles are retained by the succeeding members. In a suction sweeping machine, such an arrangement may obviate the need for an outer bag or a second filter member.
Preferably each skeletal frame comprises a spring-like
device depending from a cylindrical tube, with the socks
being located on the tubes by suitable ties, and being held
open along the spring-like device, over which the socks are
stretched. According to another aspect of the present
invention, we flare the upper ends of the tubes, so that the
upper end of each tube is trumpet shaped. This improves the
performance of the candle filters by increasing the air flow
through the tubes, by up to about 15%.

Preferably, a shaker mechanism is mounted on the
filter support frame, and may comprise an electric motor
which drives an offset weight. The shaker mechanism may
shake just the candle filters, or all the filters defining
the walls of the compartment, thus causing dust thereon to
be shaken off and deposited in said one or more trays in the
bottom of the compartment for subsequent removal.

Preferably, the switch means associated with the
door is such that the electric motor will only be activated
to operate the shaker mechanism when the door is closed.
This can be achieved in known manner, e.g. by having a
control device associated with the switch. There may be a
time delay device to ensure that once the electric motor
operates, it is automatically switched off after a
preselected time.

While the shaker could be operated from the machine
controls if the motor is off and the door is closed, it is
preferred that there be a proximity detector fitted to the
door which has to be activated, as well as a timer
monostable which must also not be off, before the shaker
motor operates. It is preferred that the shaker motor be
timed to operate for about one minute. Obviously, the
machine must not be in operation when the shaker is in
operation, otherwise dust on the filter socks would be held
on the socks.

Another preferred feature of this invention is the
provision of a skeletal frame for supporting a suction hose
fitted to the machine for removing debris and rubbish from
awkward areas. Preferably, the hose is carried on the frame
by one or more support stirrups and/or straps and the frame is pivotally supported on the chassis of the machine about a vertical axis adjacent a front end of the machine. Preferably also, at its end remote from its pivotal connection to the chassis, the hose frame carries an over dead centre latch of known construction, for securing the frame to the side of the machine. Preferably, the door in this lateral side wall of the machine does not have a latch, but is held closed by the latch of the hose frame, which engages a catch on the machine chassis, there being suitable pressure members on the hose frame to bear against the outside of the door to keep it shut when the latch is engaged with the catch.

This and other aspects of the present invention will now be described, by way of example, with reference to the accompanying drawings, in which:

Figure 1 is a perspective view, from one side and to the rear, of a suction sweeping machine of the present invention, with part of the overall machine casing removed, and with a side access door open, with various parts from within the machine removed to show the interior thereof;

Figure 2 is a perspective view from above of a flexible porous member for location within the interior of the machine of Figure 1;

Figure 3 is a perspective view of the interior of part of the machine, showing an outlet for a fluid stream containing debris, and a rectangular frame and supporting slideway therefor, the frame being in a sack replacement position, but without a porous member or sack in position;

Figure 4 is another perspective view, similar to Figure 3, but with the frame in a position of use;

Figure 5 is a view similar to Figure 3, but with the porous member and sack fitted;

Figure 6 is another perspective view, similar to Figure 4, but with the porous member and sack fitted.

Figure 7 is a partly schematic, perspective view of a modified constructions of machine showing a pivoting hose frame, with the hose in a stowed position;
Figure 8 is a view similar to Figure 7, with the hose in a position of use; and

Figure 9 is a block diagram showing a circuit arrangement for a filter shaker mechanism.

Reference is first made to Figure 1 of the drawings which illustrates a suction sweeping machine which is wheel mounted and is operable by a person walking behind the machine and directing the machine by means of handles 14. Power for the machine is provided by a small IC engine which also drives a pair of side brushes 18 to direct dirt, dust and debris into a vacuum intake between and to the rear of the brushes 18. A conduit leads from the intake to an impeller or fan driven by the engine which, in addition to drawing the air through the intake, breaks up any larger debris carried into the machine. From the impeller, the debris-carrying airstream is directed through an upwardly, then rearwardly and then downwardly extending conduit 26, the outlet 28 of which leads into a filter arrangement. There is a smooth transition of the conduit where it changes from a horizontal to a generally downwardly extending orientation immediately upstream of the outlet 28, so that at the outlet 28, there is a generally rectilinear non helical flow of the airstream.

The duct outlet 28 is oriented so as to direct the fluid stream containing debris downwardly into a container, provided by a plastic bag or refuse sack 32. The outlet 28 is rectangular as shown in Figures 3 and 4, and terminates in the top of a compartment for the container, which is generally rectangular, and defined by an impervious front wall 120, a side wall and a rear wall (not shown) each defined by a rigid mesh filter 122, a side door 124, a generally waterproof floor 126 in the form of a rectangular tray to the upstanding rim of which the three side walls are connected, and a roof 128.

The outlet 28 is supported by a rectangular framework 130 of the same general dimension as the compartment, the framework 130 being supported by the machine chassis, with the outlet being located generally centrally of the front
wall 120 (see Figure 4). The container is located laterally offset on the machine, to the side defined by the door 124.

The filter arrangement for the fluid stream containing debris exiting from the outlet 28 includes a flexible porous tube or sleeve 132, which is supported at one end on a rigid rectangular support 134 (see Figs. 2 and 5) of the same dimension as the outlet 28. The sleeve 132 tapers and is larger at its base than where it is connected to the support 134, and its length is such that, in use, it will, with its support 134, extend from the outlet 28 almost to the floor 126.

Prior to using the sweeping machine, a plastic sack 32 is located within the compartment by wrapping its upper edge region over a rectangular frame 136 which is slidably supported on two inclined slideways 138 supported from the framework 130, as shown in Figures 3, 4 by stirrups 140. Figure 3 shows the frame slid out of the open side doorway of the machine, ready to receive a sack 32 whereas Figure 4 shows the frame in a position of use (but without a sack fitted thereto), and held in that position by a latch 142.

Figures 5 and 6 show a sack 32 supported on the frame 136; the support 134 of the sleeve 132 is provided with a U-shaped support bracket 144 at its rear, and with two support hooks 146 at its front, the former being designed to rest on a support ledge 148 formed on the frame 136, at its 'rear' and the latter to hook over a 'front' member of the frame 136. As can be seen from Figure 5, the presence of the support 134 on the frame 136 is designed to hold an upper edge region of the sack 32 in position on the frame 136. When the latter has been slid back into its position of use, and latched in that position by the latch 142, as seen in Figure 6, the whole of the upper edge region of the sack 32 will be clamped to the frame 136, and the sleeve support 134 will be held up in communication with the outlet 28.

Once the door 124 has been closed, the sweeping machine is ready to use. In use, the debris laden fluid stream will exit into the porous sleeve 132, and the air therefrom will
diffuse through the porous sleeve 132, leaving the majority of the debris in the sack. This air will move upwardly in the two gaps between the side and rear walls of the sack and sleeve respectively; these gaps are readily apparent in Figure 5. This air, which may contain light and/or fine debris, will then pass through the spaces between the outlet 28 and framework 130 (see Figure 4), into the general area of the compartment defined exteriorly by the mesh screens 122 and the door 124, and interiorly by the sack 32. To keep the sack spaced from the door, a U-shaped plate 150 is secured to the inner face of the door. This air is then filtered again by rows of candle filters 152 located to the rear of the compartment and on the side thereof remote from the door 124.

Candle filters are known per se, and comprise slim tubular socks made of felt or the like, supported on skeletal frames, such as helically coiled wire 'springs'. The candle filters 152 are open at their upper ends as shown in Figure 1, and are supported at their upper ends in an apertured plate, and the air under pressure in the compartment is forced by the fan 24 through the felt, which screens out fine debris, dust and other particles, and then escapes through the open top of the candle filters.

There is an overall casing (not shown) for the sweeping machine, into the interior of which this filtered air escapes. This casing is designed to direct the air forwardly and downwardly for discharge into the surrounding atmosphere.

Beneath each of the rows of candle filters 152 there is a removable tray 154, 156 for collecting dust collected on the exterior of the filters 152. This dust can periodically be shaken off the felt material with the aid of a shaker mechanism (for example, an electric motor and counterweight acting on a subframe for the filters, the subframe being spring mounted (not shown) on the chassis of the machine). A suitable resiliently deformable diaphragm seal is provided between the machine and subframe for the filters.
A typical shaker motor circuit block diagram is shown in Figure 8 of the accompanying drawings.

If the filters are shaken before the door is opened, this will result in the compartment being filled with airborne dust which would make emptying the container a most unpleasant task. Hence, by shaking the filters after the door has been closed, it means that when the door is next opened to empty or replace the container, the dust in the compartment will have settled into the said one or more trays, and these can be emptied when the container is emptied or replaced. Accordingly a proximity detector is fitted to the door 124, and the act of closing the door will activate the detector, to bring into operation a timer device and to activate the shaker motor. After a predetermined period of time, e.g. 1 minute, the timer device will cause the shaker motor to be switched off, by which time the dust on the candle filters should have been shaken off. During the period that the shaker motor is in operation it is preferred that the machine itself is rendered inoperative, for the reason mentioned above.

A further tray (not shown) is located in the floor of the compartment for collecting liquids sucked up by the machine. This may be provided with a drain plug.

In the event of the machine being used in wet weather, the plastic sack has one or more drain holes formed therein to allow water continuously to drain out of the machine as it sweeps along. However, in fine weather, if there is little water on the surface being swept, water would be collected in a normal plastic sack and be absorbed by the debris therein. When it is raining, instead of using a plastic sack with holes therein, it is preferred to use a porous plastic bag which will allow the water to drain out of the bag and through the drain hole in the tray beneath it. When the machine is operated in wet weather it can soak up to about 5 litres of water per minute quite easily. There is also a water door or sludge door (not shown) in the fan housing which should be opened in wet weather, but even when this is open the machine will still push water into the
plastic bag or sack. If there are no holes in the sack or bag it can quickly fill up with water and is then almost completely impossible to handle. Accordingly, in wet weather a bag or sack from which water can drain must be used as the container and the water must also be allowed to exit through the tray in the compartment for the bag or sack. Of course, when it is raining it does not matter that water picked up by the machine is allowed to drain out through the bottom thereof since the trail of water is not visible.

It is preferred that the subframe for the filters is removable from the overall casing of the machine. This may be achieved by lifting the candle filters and the subframe upwards through a suitable opening in the top of the machine, but it is preferred that this is achieved by sliding the filters and subframe sideways out of the casing, for example through a side door immediately to the rear of the door 124, or through a side door on the side of the machine opposite the door 124. Removal of the filters from the machine assists with servicing of the machine and the filters, but more importantly, allows the filters to be hosed down, e.g. after they have clogged up after use in wet weather.

It is preferred that the sweeping machine is provided with a water operated dust suppression system, and a water tank for this purpose is preferably located in a side door of an engine compartment of the machine, or as a "saddle" tank over an internal suction casing.

Preferably, the machine is fitted with a towing device, so that a wheeled seat can be drawn behind it for use by the operator. This seat may be collapsible and stowable beneath the rear of the machine when not required and could be of the type disclosed in our pending U.K. Patent Application No. 9510701.5 dated 26.5.95. Accordingly, the rear of the machine is designed to accommodate the collapsed wheeled seat. Part of the rear most portion of this machine may be supported on a horizontal pivot axis for this purpose.

In the modified embodiment of machine shown in Figure
7, a hose 201 which is used for sucking up rubbish from confined spaces is supported, when not in use, on a support frame 203, which is of generally U-shaped construction, and pivotally supported on the machine chassis at the ends of the arms of the U, about a generally vertical pivot axis 205, there being suitable stirrups 207 on the opposite curved end of the frame to receive the hose. When not in use, the frame 203 is secured to the side of the machine casing by a latch 209, which engages with a catch on the casing. The curved end of the frame 203 overlies the door 124, and has a plurality of fingers or soft pressure pads on its inner face, which bear against the outer face of the door when the latch 209 is closed, so as to hold the door in a closed position, and in sealing engagement with a suitable seal formed between the door 124 and the machine casing. The frame 203 is merely to support the hose when this is not in use, but a hose support arm 211 is associated with the frame 213, and is also pivoted to the machine chassis about the axis 205. This arm 211 carries a support strap 213 for holding the hose 201 off the ground when it is in use. The position of use of the hose is shown in Figure 8.

All the controls for the machine are located on and/or between or in the vicinity of a pair of rearwardly extending handlebars 14. By providing a side access door for changing the sack 32, as distinct from a rear door, there is no need to articulate the handle bars before opening the door. To replace a sack, the machine is stopped, the door 124 is opened, and the frame 136 for the sack 32 is unlatched from the framework 130, so that the frame 136, together with the sack 32 and the support 134 carrying the flexible porous sleeve 132 can be slid to the Figure 11 position. The support 134 and attached sleeve 132 are then lifted off the frame 136 and out of the sack 32, allowing all the debris in the sack to fall to the bottom thereof. This filled sack 32 can then be lifted out of its frame 136, disposed of, and be replaced with a fresh empty sack 32.

It will be apparent to those of skill in the art that the above-described embodiments of the present invention
obviate the need for a porous internal bag and also allow replacement of the internal bag or sack without disturbing the filter member.

It will also be apparent to those of skill in the art that the above-described embodiments are merely exemplary of the present invention and that various modifications and improvements may be made thereto without departing from the scope of the invention; for example, various component parts of a particular embodiment of sweeping machine described above can be used in one of the other described embodiments of machine, in place of, or in conjunction with, component part(s) thereof, as appropriate.
CLAIMS

1. A suction sweeping machine including a motor, a fan driven by the motor (not shown), a suction head (not shown) connected by an inlet duct to the fan (not shown), whereby debris may be collected from the ground in a fluid stream generated by the fan, and be forced by the fan into an outlet duct (128) extending from the fan to a container (32), wherein the outlet duct (128) terminates in an outlet (28) communicating with the container (32), there being a porous filter member (132) extending from the outlet (28) into the container through an opening in an upper portion thereof, whereby debris from the fluid stream in the outlet duct (128) is collected within the porous member (132), whereas the fluid in the fluid stream flowing from the outlet may diffuse through the porous member (132) and out of the opening, and wherein an access opening (124) is provided in a lateral side wall of the container, through which debris within the porous member (132) may be removed.

2. A suction sweeping machine according to claim 1, wherein the porous member (132) is a flexible tube, the lower end of which is located within the bottom of the container (32), and the upper end of which is in communication with said outlet (28).

3. A suction sweeping machine according to claim 2, wherein said flexible tube (132) is supported at its upper end on a rigid support (134) which is removably located within said container (32) through said access opening (124) in the side wall thereof, the rigid support (134) being shaped to match the shape of said outlet (28).

4. A suction sweeping machine according to claim 1, 2 or 3, wherein the rigid support (134) and the outlet (28) are located relative to the opening in the container (32) centrally adjacent a front thereof, so that spaces are left between the walls of the container and porous member over the whole areas of two side faces of the container for the
passage of air from said fluid stream.

5. A suction sweeping machine according to claim 1, 2, 3 or 4, wherein the container (32) is located in a generally rectangular compartment (120, 122, 124, 126) at the rear of the machine, and towards one side thereof, said compartment being defined by generally rigid mesh screens (122) on the side thereof opposite said one side and to the rear thereof, by a generally impervious front wall (120), and generally impervious top and bottom walls (126), and by a door (124) providing said access opening (124).

6. A suction sweeping machine according to claim 5, wherein one or more trays (154, 156) is located in the bottom of the compartment.

7. A suction sweeping machine according to claim 6, wherein the sides of the compartment defined by said mesh screen (122) are further defined by filter means (152).

8. A suction sweeping machine according to claim 7, wherein said filter means (152) comprise fine screens of textile material.

9. A suction sweeping machine according to claim 7, wherein said filter means (152) comprise a plurality of vertically extending candle filters, each said candle filter comprising a felt-like sock supported on a skeletal frame, and opening at its upper end (see Figure 1), the open upper end communicating with an overall machine casing (26) which directs filtered air forwardly and downwardly.

10. A suction sweeping machine according to claim 9 wherein the skeletal frame can lifted out of the compartment.

11. A suction sweeping machine according to claim 9 wherein the skeletal frame can be slid laterally out of the compartment.
12. A suction sweeping machine according to claims 9, 10 or 11 wherein in order to prevent clogging of the candle filters, a shaker mechanism is provided for shaking fines collected by the candle filters off the candle filters, for subsequent removal from within the housing, the shaker mechanism being controlled by switch means associated with the door for closing the access opening.

13. A suction sweeping machine according to any one of claims 1-9, wherein a flexible plastic sack (32) is located within said container.

14. A suction sweeping machine according to claim 13, wherein the sack is supported at its upper end on a rigid rectangular frame, the dimensions of which correspond generally with the cross sectional shape of the container.

15. A suction sweeping machine according to claim 14, wherein the frame (134) is slidable relative to a framework (136, 138, 140) supporting the outlet (28), between a position of use generally surrounding the outlet (28), and a sack replacement position achievable only when said access opening (124) is open (see Figure 5).

16. A suction sweeping machine according to claim 15, including clamping means (142) for clamping said frame in its position of use, in which upper end portions of the sack (32) will also be held in engagement with the frame (134).

17. A suction sweeping machine according to claim 14, 15 or 16, wherein said rigid support and said frame are provided with co-operating support means (138, 140) whereby the rigid support (136) may be removably supported in a predetermined location on said frame (34), so that when said frame is in its position of use, the porous member (132) is in fluid communication with said outlet (28).
18. A suction sweeping machine according to any one of the preceding claims, including a second filter member (122), through which the fluid stream flows after exiting the container (32).

19. A suction sweeping machine according to claim 18, wherein the second filter member (122) forms a wall of an enclosure in which the container (32) is located.

20. A suction sweeping machine according to claim 19, wherein the container (32) is replaceable without disturbing the second filter member (122).

21. A suction sweeping machine according to any one of claims 1-20, wherein the porous member (132) is open at the end spaced from the outlet (28).

22. A suction sweeping machine according to any one of claims 1-21, wherein the porous member (132) extends to the base of the container (32).

23. A suction sweeping machine according to any one of the preceding claims, wherein the porous member (132) and the container are arranged such that a gap is maintained therebetween (see Figure 5), to facilitate airflow through a large area of the member.

24. A suction sweeping machine according to any one of the preceding claims, wherein the porous member (132) is flared (see Figure 2), and widens from the outlet towards the base of the container (32).

25. A suction sweeping machine according to any one of the preceding claims, wherein the porous member is spaced from the wall of the container (32) so that air may diffuse through the wall of the porous member (132) and pass upwardly through the space or spaces between the porous member (132) and container (32), which space or spaces
extend over a substantial part of the height of the porous member (132).

26. A suction sweeping machine according to any one of the preceding claims, wherein at least one gap is maintained between the porous member (132) and the container (32) to facilitate air flow through a major portion of the porous member, said gap extending at least into a lower part of the container (32) when there is little or no debris in the container (32).

27. A suction sweeping machine according to any one of the preceding claims, wherein there is a gap for the passage of air filtering through the porous member (132), between the porous member (132) and container (32), said gap extending into the container over a major part of the depth of the container side wall.

28. A suction sweeping machine according to any one of the preceding claims, wherein the fluid stream, where it exits from the outlet (28), is substantially rectilinear and non-helical, and flows generally towards the base of the container (32).

29. A suction sweeping machine according to any one of the preceding claims, wherein the outlet duct (128) has a rearwardly extending generally horizontal portion and downstream thereof a generally vertical portion terminating in the outlet (28) which faces downwardly, there being a smooth transition from the generally horizontal to the generally vertical portion.

30. A suction sweeping machine according to claim 9 or any one of claims 10-29 when dependent on claim 29 wherein the upper ends of each tube (152) is flared, so that the upper end of each tube is trumpet shaped.

31. A suction sweeping machine according to claim 12 or any
one of claims 13-30 when dependent on claim 12 wherein the shaker mechanism is mounted on the skeletal frame, and comprises an electric motor which drives an offset weight.

32. A suction sweeping machine according to claim 31 wherein the switch means associated with the door is such that the electric motor will only be activated to operate the shaker mechanism when the door is closed.

33. A suction sweeping machine according to claim 32 wherein a control device is associated with the switch and a time delay device is provided to ensure that once the electric motor operates, it is automatically switched off after a preselected time.

34. A suction sweeping machine according to any one of the preceding claims wherein a further skeletal frame (203) is provided for supporting a suction hose (201) fitted to the machine for removing debris and rubbish from awkward areas.

35. A suction sweeping machine according to claim 34 wherein the hose (201) is carried on the frame (203) by one or more support stirrups (207) and/or straps (213) and the frame is pivotally supported on the chassis of the machine about a vertical axis (205) adjacent a front end of the machine.

36. A suction sweeping machine according to claim 34 or 35 wherein at its end remote from its pivotal connection to the chassis, the hose frame (203) carries an over dead centre latch (209) for securing the frame to the side of the machine.

37. A suction sweeping machine according to claims 34, 35 or 36 wherein the door (124) in the lateral side wall of the machine does not have a latch, but is held closed by the latch (209) of the hose frame (203), which engages a catch on the machine chassis, there being suitable pressure members on the hose frame (203) to bear against the outside
of the door (124), to keep it shut when the latch (209) is engaged with the catch.

38. A suction sweeping machine substantially as hereinbefore described with reference to Figures 1-6 of the accompanying drawings.

39. A suction sweeping machine substantially as hereinbefore described with reference to Figures 7 and 8 of the accompanying drawings.

40. A suction sweeping machine substantially as hereinbefore described with reference to Figure 9 of the accompanying drawings.
## INTERNATIONAL SEARCH REPORT

### A. CLASSIFICATION and SUBJECT MATTER

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According to International Patent Classification (IPC) or to both national classification and IPC.

### B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

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Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

### C. DOCUMENTS CONSIDERED TO BE RELEVANT

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Further documents are listed in the continuation of box C. Patent family members are listed in annex.

### Date of the actual completion of the international search

8 January 1997

### Date of mailing of the international search report

23. 01. 97

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Vanmol, M

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