928,048

# PATENT SPECIFICATION

DRAWINGS ATTACHED

928,048

Date of Application and filing Complete Specification Aug. 4, 1959.

No. 26630/59.

Application made in United States of America (No. 754035) on Aug. 8, 1958.

Complete Specification Published June 6, 1963.

Index at acceptance:—Class 138(1), H2.

International Classification:—A47l.

COMPLETE SPECIFICATION

## Improvements relating to Cleaning Apparatus

We, HOOVER LIMITED, a Company registered under the laws of Great Britain, of Perivale, Greenford, Middlesex, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

This invention relates to liquid pick-up suction appliances of the kind including a suction nozzle communicating with a suction system including a separator for sucking up dirty liquid from the air, and a storage chamber to receive the dirty liquid from the separator, the appliance having a working position in which the separator lies above the storage chamber and is connected to it through a passage so that liquid picked up will flow from the separator to the storage chamber, and also being capable of being laid down in four storage positions namely on its front or its back or on either side. The term front is used to refer to the part of the appliance facing away from the user in the normal working position.

According to the present invention the passage is so formed that in each of three of the said storage positions it includes a portion of which a horizontal section through the wall of the passage affords a closed figure which leads upwards from the storage chamber to the separator so as to form a liquid trap to prevent return flow of liquid from the storage chamber to the separator and to the suction system. In the fourth of the said storage positions the passage may open through the upper part of a partition separating the storage chamber from the separator so that in this position the partition forms a weir to prevent return flow of liquid from the storage chamber to the separator.

In one arrangement the suction nozzle, a motor-fan unit, a removable tank constituting the storage chamber, and the separator are arranged substantially in alignment in the order specified, with an elongated handle projecting beyond them. Thus the separator and storage chamber may be mounted end-to-end along a line sloping upwards and backwards and the passage opens into the back part of the bottom of the separator.

Preferably the separator communicates with the storage chamber through a port adjacent the back of the bottom wall of the separator, and the separator affords walls defining a trap pocket into which the port opens in the separator, the trap pocket being such that when the appliance is lying on its back liquid cannot flow out of the storage chamber into the separator without blocking the port. The trap pocket may communicate with the separator through a second port lying in a plane at right angles to the first port, the second port being so placed that when the appliance is lying on one side it lies above the first port so that liquid cannot flow out of the storage chamber into the separator without blocking the first port. Moreover the trap pocket may communicate with a second trap pocket through the second port, the second trap pocket communicating with the separator through a third port parallel to or coplanar with the second port but facing the opposite way, the second port being so placed that if the appliance is lying on its other side the third port is at or above the level of the second port so that liquid cannot flow out of the storage chamber into the separator without blocking the second port.

The storage chamber is conveniently formed in an open-ended tank detachably mounted on the framework of the appliance with its open end clamped in sealing engagement with the bottom of the separator casing, whilst the separator chamber may be formed of two separately moulded superposed vessels interlocked together in open communication with each other.

In one form of the invention the separator has in the rear wall of its upper part a wet

air inlet opening and a dry air outlet opening and a partition extending generally vertically between them to force the air to travel downwards into the lower part of the separator in passing from the inlet opening to the outlet opening. Preferably the separator includes a vertical baffle between the vertical partition and the inlet opening so as to collect moisture and allow it to drip into the bottom of the separator, thereby preventing that moisture from collecting along the bottom edge of the vertical partition with a danger of being swept into the outlet opening. Moreover the separator may include a platform, extending forward below the outlet opening, preferably sloping downwards away from it, to force air to flow into the forward part of the separator before it can reach the outlet opening, rather than passing vertically downwards and under the rear part of the partition.

The invention may be carried into practice in various ways but one specific embodiment will be described by way of example with reference to the accompanying drawings in which:—

Figure 1 is a side elevation on a small scale of a cleaning appliance embodying the invention,

Figure 2 is an exploded phantom perspective view of the separator, partly broken away,

Figure 3 is a longitudinal sectional elevation of the separator with the appliance lying on its back and the separator affording a liquid trap,

Figure 4 is a view looking at the bottom of the separator with the appliance lying on its left-hand side, and

Figure 5 is a view similar to Figure 4 but with the appliance lying on its right-hand side.

As shown in Figure 1 of the drawings the appliance to which the present invention relates comprises a scrubbing and water pick-up nozzle 10 provided with brush bristles 11, a motor-fan unit within a casing 12, a tank 13 for detergent solution and dirty liquid, a separator 14, a handle 15, and wheels 16.

The nozzle 10 is connected to the interior of the separator by a wet suction tube 17 whilst the separator is connected to the suction side of the motor-fan unit by a dry suction tube 18.

As shown in Figure 3 the tank 13 includes an outer casing 19 for receiving clean detergent solution and an inner impervious flexible bag 20 for receiving the dirty liquid sucked up from the floor. The mouth of the bag 20 is secured to a ~~resilient~~ sealing and supporting ring 21 having an annular flange 22 which serves as a gasket to provide a seal between a shoulder 23, inside the mouth of the outer casing 19, and the bottom face of the separator 14 against which it is held by means of a clamp 24 engaging the bottom of the tank 13.

The dispensing of detergent solution from the tank 13 is controlled by a control lever 25 mounted on the handle as described in more detail in the present applicants British Patent Specification No. 26627/59 (Serial No. 928,045). The usual cable 26 is provided for supply of electricity to the motor-fan unit through a switch 27.

As shown in Figure 2 the separator is formed of upper and lower vessels 28 and 29 which are moulded separately and cemented together, and which together perform the two functions of separating the dirty water from the air stream employed to suck it up off the floor, and preventing the dirty liquid from flowing back from the dirty liquid bag 20 in the tank into the separator and suction tube if the appliance is laid on its back or on either of its sides.

The upper edge of the lower vessel 29 is formed with an annular recessed shoulder 30 to receive a rib 31 at the lower edge of the upper vessel 28 in order to locate the two vessels in relation to one another.

The rear part of the lower vessel 29 is provided with left and right hand sockets or bores 32 and 33 which receive the upper ends of the wet suction tube 17 and dry suction tube 18 respectively. The bores 32 and 33 are continued in passages 34 and 35 respectively in the lower vessel which register with passages 36 and 37 in the upper vessel. The passages 36 and 37 are closed at their upper ends and open into the interior chamber 38 of the upper vessel 28 through left and right hand openings or windows 39 and 40 of generally rectangular shape. The wall of the passage 36 is partially formed by an extension 41 moulded integrally with the lower vessel 29 and having its edges fitting into channels 42 formed in the upper vessel 28.

The lower vessel 29 is formed with a through passage 43 in line with a through passage 44 in the upper vessel 28 to receive the handle 15.

Accordingly wet air will be drawn into the separator from the wet suction tube 17 through the left hand opening or window 39 and will leave the separator through the right hand window or opening 40 to be delivered to the dry suction tube 18. In passing from the left hand window 39 to the right hand window 40 the air is forced to travel in a tortuous path being deflected down into the lower vessel and then caused to rise up into the upper part of the upper vessel before reaching the right hand window 40.

For this purpose the upper vessel has in it certain partitions.

A central vertical partition 57 divides the interior 38 of the upper vessel 28 into left and right hand chambers 55 and 56. This partition extends down to the lower edge of the vessel 28 so as to compel the air passing from the left hand chamber to the

right hand chamber to flow down into the lower vessel. In addition an inclined vertical baffle 58 is provided in the left hand chamber extending from adjacent the fore-and-aft mid point of the central vertical partition 57 to the front periphery of the chamber 55 so that at their forward ends the baffle 58 and partition 57 are spaced apart. The baffle 58 also extends down to the bottom edge of the upper vessel 28, so as to prevent the accumulation of drops of water along the bottom edge of the central vertical partition 57, whence they might be carried out through the righthand window 40.

Immediately below the right hand window 40, the right hand chamber 56 is provided with a sloping platform 59 which extends forward about half way to the front of the chamber 56. This prevents the air from passing from the left hand window to the right hand window by a short path under the rear part of the central vertical partition 57. The sloping platform slopes down towards the front of the vessel so that water droplets formed on it will tend to flow down and fall off from its forward end.

The interior of the lower vessel 29 is ribbed as shown at 60 to aid in the separation of water from the moving air by minimising swirling.

Openings 61 are formed in the top of the upper vessel 28 to vent the separator to atmosphere when the appliance is not being used for drying the floor. These openings can be closed by a lid 62 shown in Figure 1 when dirty water is to be drawn up from the floor by the suction produced by the motor-fan unit.

The lower vessel 29 has in its bottom a part-segmental opening or port 48 for the flow of liquid into the tank 13, but this opening is masked from the interior of the lower vessel by partitions providing a liquid trap to prevent liquid from flowing from the tank back into the separator if the appliance is placed on its back or side. Thus at the right side of the vessel 29 as viewed in Figure 2 a vertical partition 45 cuts off a segmental pocket 47 lying over the part segmental opening 48. The pocket 47 is closed at the top and is therefore separated from the interior 46 of the lower vessel. At the left hand side of the vessel 29 an inclined partition 49 extends forwardly and downwardly from the rear wall of the vessel to form a triangular prism shaped pocket 51 which is closed both at its top and bottom but opens (to the right as viewed in Figure 2) into the interior 46 of the lower vessel 29 by way of a triangular opening or port 52, as well as being open to the segment shaped pocket 47 by way of an opening or port 53.

The two ports 52 and 53 are separated by the vertical edge 54 at the left hand end of the vertical partition 45, and it is the edge 54 which determines the water level in the pockets whether the appliance is laid on its back or either of its sides. Thus water which collects in the chamber 46 can flow to the left across the bottom 50 and through the triangular port 52 into the pocket 51 and then to the right through the port 53 so as to be discharged into the dirty liquid bag 20 through the part segmental port 48.

## Operation

The motor-fan unit may be left switched on throughout the operation of the device. For detergent dispensing and scrubbing the lid 62 is left open, but when the dirty liquid is to be picked up the lid is closed so that the suction will suck up dirty liquid from the floor through the wet suction tube 17 and deliver it into the separator. The air enters the separator through the left hand window 39 and flows forwardly in the chamber 55, down under the baffle 58 and central vertical partition 57, then up in the forward part of the right hand chamber 56 so as to rise above the sloping platform 59 in the forward part of the chamber whence it travels back and out through the right hand window 40.

Dirty liquid will tend to be separated from the air and drip from the lower edge of the baffle 58 on to the bottom 50 of the lower vessel 29. The fact that the lower edge of the baffle 58 is spaced from the lower edge of the central vertical partition 57 tends to prevent water droplets from forming on the lower edge of the latter and being carried away in the dry air stream. The wet air will also impinge upon the ribbed interior of the lower vessel and further dirty liquid will thereby be separated from it.

The dirty liquid which collects in the bottom 50 of the lower vessel 29 will flow to the left through the triangular port 52 into the pocket 51 then rearwardly and back to the right through the port 53 and down through the part segmental port 48 into the dirty liquid bag.

If the user should place the appliance on its back as shown in Figure 3 the water in the dirty liquid bag cannot flood the separator 14. The liquid will fill the pocket 47 as shown in Figure 3, and the lower part of the pocket 51, but will not rise above the edge 54 of the wall 45. The operation is similar to that of well known drinking vessels for poultry in which different levels are maintained in the storage tank and trough due to an air-lock. In effect the only passage between the separator and the tank is closed by the water so that air cannot enter the tank from the separator and hence the vacuum in the tank and the atmospheric pressure in the separator prevent any flow from the tank into the separator.

Figures 4 and 5 are views looking from the tank at the bottom of the vessel 29. If the appliance is placed on its left side as

shown in Figure 4 the dirty liquid can pour through the opening 53 into the triangular pocket 51 but as soon as the latter is full and the water surface rises to the edge 54 no further air can escape from the separator into the tank, and hence no further water will pour out of the tank. Similarly if the appliance is placed on its right side as shown in Figure 5 the water level cannot rise into the pocket 51 since as soon as it reaches the edge 54 it prevents any air from escaping into the tank.

Thus in each case it is the edge 54 of the wall 45 which determines the height to which the water will rise in the pocket 47 or 51 and which prevents the dirty water from flowing into the interior of the separator. Should the appliance accidentally be placed on its front, flooding of the water separator vessel will not take place because the part segmental port 48 is near the top of the tank and the liquid level cannot rise high enough to reach it, the bottom 50 of the lower vessel 29 acting as a weir.

It will therefore be appreciated that the invention provides an efficient liquid separator for a liquid pick-up appliance in which the dirty liquid is stored in a receptacle immediately below the separator but in which it is impossible to flood the separator by water from the storage receptacle whether the appliance is laid on its back or on either of its sides, even though the level of water in the storage receptacle is then above the lower part of the separator.

WHAT WE CLAIM IS:—

1. A liquid pick-up suction appliance including a suction nozzle communicating with a suction system including a separator for sucking up dirty liquid from a floor in a current of air and separating the liquid from the air, and a storage chamber to receive the dirty liquid from the separator, the appliance having a working position in which the separator lies above the storage chamber and is connected to it through a passage so that liquid picked up will flow from the separator to the storage chamber, and also being capable of being laid down in four storage positions namely on its front or its back or on either side, characterised in that the passage is so formed that in each of three of the said storage positions it includes a portion of which a horizontal section through the wall of the passage affords a closed figure and which leads upwards from the storage chamber to the separator so as to form a liquid trap to prevent return flow of liquid from the storage chamber to the separator and to the suction system.

2. An appliance as claimed in Claim 1 in which in the fourth of the said storage positions the passage opens through the upper part of a partition separating the storage chamber from the separator so that in this position the partition forms a weir to prevent return flow of liquid from the storage chamber to the separator.

3. An appliance as claimed in Claim 1 or Claim 2 in which the suction nozzle, a motor-fan unit, a removable tank constituting the storage chamber, and the separator are arranged substantially in alignment in the order specified, with elongated handle projecting beyond them.

4. An appliance as claimed in any one of the preceding claims in which the separator and storage chamber are mounted end-to-end along a line sloping upwards and backwards and the passage opens into the back part of the bottom of the separator.

5. An appliance as claimed in any one of the preceding claims in which the separator communicates with the storage chamber through a port adjacent the back of the bottom wall of the separator, and the separator affords walls defining a trap pocket in to which the port opens in the separator, the trap pocket being such that when the appliance is lying on its back liquid cannot flow out of the storage chamber into the separator without blocking the port.

6. An appliance as claimed in Claim 5 in which the trap pocket communicates with the separator through a second port lying in a plane at right angles to the first port, the second port being so placed that when the appliance is lying on one side it lies above the first port so that liquid cannot flow out of the storage chamber into the separator without blocking the first port.

7. An appliance as claimed in Claim 6 in which the trap pocket communicates with a second trap pocket through the second port, and the second trap pocket communicates with the separator through a third port parallel to or coplanar with the second port but facing the opposite way, the second port being so placed that if the appliance is lying on its other side the ~~liquid~~ third port is at or above the level of the second port so that liquid cannot flow out of the storage chamber into the separator without blocking the second port.

8. An appliance as claimed in any one of the preceding claims in which the storage chamber is formed in an open-ended tank detachably mounted on the framework of the appliance with its open end clamped in sealing engagement with the bottom of the separator casing.

9. An appliance as claimed in any one of the preceding claims in which the separator chamber is formed of two separately moulded superposed vessels interlocked together in open communication with each other.

10. An appliance as claimed in any one of the preceding claims in which the separator has in the rear wall of its upper part a wet air inlet opening and a dry air outlet opening and a partition extending generally verti-

shown in Figure 4 the dirty liquid can pour through the opening 53 into the triangular pocket 51 but as soon as the latter is full and the water surface rises to the edge 54 no further air can escape from the separator into the tank, and hence no further water will pour out of the tank. Similarly if the appliance is placed on its right side as shown in Figure 5 the water level cannot rise into the pocket 51 since as soon as it reaches the edge 54 it prevents any air from escaping into the tank.

Thus in each case it is the edge 54 of the wall 45 which determines the height to which the water will rise in the pocket 47 or 51 and which prevents the dirty water from flowing into the interior of the separator. Should the appliance accidentally be placed on its front, flooding of the water separator vessel will not take place because the part segmental port 48 is near the top of the tank and the liquid level cannot rise high enough to reach it, the bottom 50 of the lower vessel 29 acting as a weir.

It will therefore be appreciated that the invention provides an efficient liquid separator for a liquid pick-up appliance in which the dirty liquid is stored in a receptacle immediately below the separator but in which it is impossible to flood the separator by water from the storage receptacle whether the appliance is laid on its back or on either of its sides, even though the level of water in the storage receptacle is then above the lower part of the separator.

WHAT WE CLAIM IS:—

1. A liquid pick-up suction appliance including a suction nozzle communicating with a suction system including a separator for sucking up dirty liquid from a floor in a current of air and separating the liquid from the air, and a storage chamber to receive the dirty liquid from the separator, the appliance having a working position in which the separator lies above the storage chamber and is connected to it through a passage so that liquid picked up will flow from the separator to the storage chamber, and also being capable of being laid down in four storage positions namely on its front or its back or on either side, characterised in that the passage is so formed that in each of three of the said storage positions it includes a portion of which a horizontal section through the wall of the passage affords a closed figure and which leads upwards from the storage chamber to the separator so as to form a liquid trap to prevent return flow of liquid from the storage chamber to the separator and to the suction system.

2. An appliance as claimed in Claim 1 in which in the fourth of the said storage positions the passage opens through the upper part of a partition separating the storage chamber from the separator so that in this position the partition forms a weir to prevent return flow of liquid from the storage chamber to the separator.

3. An appliance as claimed in Claim 1 or Claim 2 in which the suction nozzle, a motor-fan unit, a removable tank constituting the storage chamber, and the separator are arranged substantially in alignment in the order specified, with an elongated handle projecting beyond them.

4. An appliance as claimed in any one of the preceding claims in which the separator and storage chamber are mounted end-to-end along a line sloping upwards and backwards and the passage opens into the back part of the bottom of the separator.

5. An appliance as claimed in any one of the preceding claims in which the separator communicates with the storage chamber through a port adjacent the back of the bottom wall of the separator, and the separator affords walls defining a trap pocket in to which the port opens in the separator, the trap pocket being such that when the appliance is lying on its back liquid cannot flow out of the storage chamber into the separator without blocking the port.

6. An appliance as claimed in Claim 5 in which the trap pocket communicates with the separator through a second port lying in a plane at right angles to the first port, the second port being so placed that when the appliance is lying on one side it lies above the first port so that liquid cannot flow out of the storage chamber into the separator without blocking the first port.

7. An appliance as claimed in Claim 6 in which the trap pocket communicates with a second trap pocket through the second port, and the second trap pocket communicates with the separator through a third port parallel to or coplanar with the second port but facing the opposite way, the second port being so placed that if the appliance is lying on its other side the ~~liquid~~ port is at or above the level of the second port so that liquid cannot flow out of the storage chamber into the separator without blocking the second port.

8. An appliance as claimed in any one of the preceding claims in which the storage chamber is formed in an open-ended tank detachably mounted on the framework of the appliance with its open end clamped in sealing engagement with the bottom of the separator casing.

9. An appliance as claimed in any one of the preceding claims in which the separator chamber is formed of two separately moulded superposed vessels interlocked together in open communication with each other.

10. An appliance as claimed in any one of the preceding claims in which the separator has in the rear wall of its upper part a wet air inlet opening and a dry air outlet opening and a partition extending generally verti-

cally between them to force the air to travel downwards into the lower part of the separator in passing from the inlet opening to the outlet opening.

11. An appliance as claimed in Claim 10 in which the separator includes a vertical baffle between the vertical partition and the inlet opening so as to collect moisture and allow it to drip into the bottom of the separator, thereby preventing that moisture from collecting along the bottom edge of the vertical partition with a danger of being swept into the outlet opening.

12. An appliance as claimed in Claim 10 or Claim 11 in which the separator includes a platform extending forward below the outlet opening to force air to flow into the forward part of the separator before it can reach the outlet opening rather than passing vertically downwards and under the rear part of the partition.

13. An appliance as claimed in Claim 12 in which the platform slopes downwards away from the outlet opening so that liquid deposited on it will tend to creep down it and drip from its lower edge.

14. An appliance as claimed in any one of the preceding claims in which the separator has a bore extending through it to receive a handle for the appliance.

15. An appliance as claimed in Claim 14 in which the bore of the handle lies between a pair of sockets, one for a wet suction pipe communicating with the nozzle for drawing-up air carrying dirty liquid, and the other for a dry suction pipe leading to the motor-fan unit.

16. An appliance as claimed in any one of the preceding claims in which the separator is provided with a top opening and a lid for rendering the suction ineffective at will.

17. A cleaning appliance as specifically described herein with reference to the accompanying drawings.

KILBURN & STRODE,
Agents for the Applicants.

Leamington Spa: Printed for Her Majesty's Stationery Office by the Courier Press.—1963.
Published at The Patent Office, 25, Southampton Buildings, London, W.C.2, from which copies may be obtained.

* C L M S *