

APPARATUS FOR CLEANING BY SUCTION

The present invention relates to apparatus for cleaning by suction, especially apparatus suitable for internal cleaning of public transportation vehicles such as buses, trains, ships and aeroplanes or large premises such as schools, offices and hotels.

It is known to use central suction systems for creating a suction effect at a number of working locations for connecting suction tools, but these have not been sufficient in view of the difficult contamination to which public transportation means and public premises are subjected. A special problem has been the removal of dirt which has got stuck by drying or has been trampled into mats and cannot be removed by suction only.

An object of the invention is to improve a suction device of this type by a combination of steps for dissolving the dirt and increasing the suction force.

According to the present invention there is provided a n apparatus for cleaning by suction comprising:

- a vacuum pump for creating low pressure;
- a suction head for collecting by suction liquid and solid dirt and debris from a surface being cleaned;
- a conduit system connecting said suction head to said vacuum pump for application of low pressure to said suction head to cause suction cleaning and thus a flow of air from said suction head to said pump, the liquid and solid dirt and debris collected at said suction head being entrained in the air flow along said conduit system;

- means for applying a liquid at the surface being cleaned by said suction head;

a liquid collection tank having an inlet and an outlet and arranged in said conduit system with said inlet connected to said suction head and said outlet connected to said pump, said tank in use containing a body of liquid with said inlet located below a surface of said body of liquid whereby the liquid, dirt and debris entrained in the air flow is collected in said body of liquid in the tank, and said outlet located above the body of liquid; and

a separator arranged in said conduit system downstream in the air flow direction from said liquid collection tank and adapted to separate from the air flow any liquid, dirt and debris entrained in the air flowing from the liquid collection tank, so as to prevent liquid, dirt and debris from reaching the pump.

Preferably the pump is capable of providing a low pressure of at least 50% vacuum, i.e. a pressure of half atmospheric pressure or less.

In the following an embodiment of the invention is described by way of example with reference to the accompanying drawings, in which:-

Fig. 1 is a view of a suction apparatus embodying the invention

Fig. 2 is a detail view on a larger scale of a suction head of the embodiment of Fig. 1 seen from below.

Figs. 3 - 5 show details of the suction head of Fig. 2 seen along the lines 3-3, 4-4 and 5-5 in Fig. 2.

The apparatus shown in Fig. 1 comprises a suction system in which the low pressure is generated by a vacuum pump 10, to which an inlet pipe 11 and an outlet pipe 12 are connected. The inlet pipe 11 is connected at its other end to a tank 13 via a separator 14 which prevents water and dirt from following with the air flow from the tank to the vacuum pump. The direction of the air flow is shown by the arrows 15 and 16.

Both the separator 14 and the tank 13 are provided with not illustrated level controls. The supply pipe to the tank extends below the surface of the water 19 present in the tank. At the bottom of the tank dirt 20 gathers which has been brought along by the suction air. The water which also has been conveyed by the suction air mixes with the water in the tank. In this way the water which is added at the suction spot is prevented from reaching the vacuum pump 10. The tank 13 and the separator 14 cooperating therewith thus perform a separating function which is necessary for the use of a vacuum pump.

The pipe 18 is provided with an arbitrary number of connection studs 21, of which one is shown in Fig. 1, each stud leading via a valve device 22 to a joining duct 23 to a connection for a hose 24, which leads to a suction tool 25 having a suction head 32. The arrow 26 shows the direction of the air current.

For the supply of water to the suction spot there is provided a pipe 27 which suitably can be connected to an existing water supply system. It is suitable to use hot water. The water flows along the arrow 28 and continues in the pipe 29 via the valve device 22 parallel with the hose 23, 24 to the suction head 32, where the water is sprinkled out through one or more spray nozzles. There can also be a not illustrated dosing pump for a cleaning agent.

The hoses 24 and 29 are hung in a balance block 42 which holds the hoses weightlessly hung up in a curved loop, so that they can be pulled apart or pushed together, so that the hand tool 25 can be moved. At the upper end of the hand tool there is an operating lever 30 for opening or closing the air flow and another operating lever 31 for controlling the water flow. These levers act via the valve aggregate 22.

Fig. 2 is a view from below of a suction head 32. This consists of a frame 33 with an elongated hole 34 for the suction air connected to the tubular hand tool 25 by a funnel 36 (Figs. 3 - 5). Along each long side of the frame 33 a

rubber strip 44 and 45 respectively is attached, which is formed with vertical ribs and is held by a clamping iron 46 and 47 respectively which is fastened to the frame 33 with screws 48. In order to prevent the rubber strips 44 and 45 from being compressed by the suction effect there are two sliding pins 52 arranged, which have a rounded lower end surface in order to slide more easily on the floor. The rounded surface lies somewhat higher than the lower edge of the rubber strips 44 and 45. In order to prevent the head from getting stuck by the suction the strips 44 and 45 are separated from each other at their ends by openings 49.

The water is sprayed by a pipe 50 which is coupled to the hose 29 which is attached along the suction tool 25. The pipe 50 is mounted on the suction head along one long side thereof and is provided with two spray nozzles 51, which sprinkle the water on the floor for instance in the form of a thin fan-shaped curtain from each nozzle.

The pump 10 shall be of a type which gives a substantial low pressure, for instance a vacuum pump which gives 80 % vacuum. A prerequisite for the use of such a pump is that the suction air is cleaned both from dirt and from water, and this is achieved by means of the sludge tank 13 which is supported by the separator 14. Also other pumps giving a substantial low pressure are possible, for instance a turbine which gives about 60 % vacuum. The low pressure (vacuum) delivered by the pump should preferably be of the size 50 % vacuum or more.

The sprinkling of water does not only serve the purpose of dissolving the dirt, so that the dirt easier follows with the suction air. The water sprinkling in connection with the sludge tank has the advantage that burning cigarette stubs are effectively extinguished and can be sucked into the system without danger of fire. This is not possible with dry suction systems where the risk of fire has been found so serious that the ash trays have to be emptied separately. Moreover the water serves to bind the dust.

CLAIMS

1. An apparatus for cleaning by suction comprising:
a vacuum pump for creating low pressure;
a suction head for collecting by suction
liquid and solid dirt and debris from a surface being
cleaned;

a conduit system connecting said suction
head to said vacuum pump for application of low pressure
to said suction head to cause suction cleaning and
thus a flow of air from said suction head to said pump,
the liquid and solid dirt and debris collected at said
suction head being entrained in the air flow along
said conduit system;

means for applying a liquid at the surface
being cleaned by said suction head;

a liquid collection tank having an inlet
and an outlet and arranged in said conduit system with
said inlet connected to said suction head and said
outlet connected to said pump, said tank in use containing
a body of liquid with said inlet located below a surface
of said body of liquid whereby the liquid, dirt and
debris entrained in the air flow is collected in said
body of liquid in the tank, and said outlet located
above the body of liquid; and

a separator arranged in said conduit system
downstream in the air flow direction from said liquid
collection tank and adapted to separate from the air
flow any liquid, dirt and debris entrained in the air
flowing from the liquid collection tank, so as to prevent
liquid, dirt and debris from reaching the pump.

2. An apparatus according to claim 1 wherein
said liquid is water.

3. An apparatus according to claim 1 or claim
2 wherein said pump is capable of providing a low pressure
of at least 50% vacuum.



4. An apparatus according to any one of claims 1 to 3 wherein said suction head has at least one curtain-forming rubber strip projecting downwardly to contact the surface being cleaned and openings in said strip to prevent sticking of said head to the surface being cleaned by suction, and said suction head further having at least one abutment which projects downwardly to contact the surface being cleaned so as to prevent collapse of said curtain-forming rubber strip due to the low pressure.

5. An apparatus substantially as described and exemplified herein with reference to the drawings.

