



Method and Apparatus for Maintaining a Fluid Supply

Reference to Related Application

Reference is made to earlier international patent application PCT/SG2007/000021,
5 published as WO 2007/097714, and filed on 24 January 2007 for an invention titled
“Method and Apparatus for Supplying a Fluid” (the “earlier application”) the contents
of which are incorporated herein by reference as if in used herein in its entirety.

Technical Field

10 This invention relates to an apparatus for maintaining a fluid supply and a method for
maintaining the apparatus and refers particularly, though not exclusively to a spray
method and apparatus system that requires reduced maintenance for extracting
contaminants from a spray system.

15 Background

Spray systems require regular maintenance to keep the systems in efficient working
order. The spray system may comprise a plurality of fluid outlets. Deposits can
accumulate in one or more the plurality of fluid outlets preventing correct operation.

20 In spray systems used in such as, for example, kitchen exhaust or extractor systems, the
fluid spray is used to extract contaminants such as, for example, grease and food
particles from the exhaust flow. It is important that deposits of contaminants are
removed from the fluid outlets to maintain a consistent spray.

25 Specialized labour may be required to clean the fluid outlets. Such maintenance may be
costly, and may be a substantial expense to businesses, particularly if the number of
systems to be serviced is high.

Summary

30 In accordance with a first exemplary aspect, there is provided a self-cleaning spray
system comprising



a spray pipe having at least one nozzle in a wall of the spray pipe such that, during a spray operation, fluid is sprayed in a spray in a spray plane from the at least one nozzle;

5 a cleaning pipe spaced from the spray pipe and having at least one outlet to direct fluid towards the at least one nozzle and into the spray pipe for cleaning the at least one nozzle during a reverse flush operation, the at least one outlet being spaced from the spray plane.

The cleaning pipe may be parallel to the spray pipe. The at least one outlet may be
10 configured to direct a jet of fluid directly at the at least one nozzle. The at least one outlet may be laterally and angularly spaced from the spray plane. The angular spacing may be less than an included angle of the spray. The cleaning pipe may include at least one tube branching from the cleaning pipe. The at least one tube may terminate at the at least one outlet. The at least one tube may be attached to the spray tube proximate the at
15 least one nozzle. The system may further comprise at least one pump, a plurality of valves and a controller to energise the pump and open and close the valves to change between the spray operation and the reverse flush operation. The at least one nozzle may be an aperture through the wall of the spray pipe.

20 According to a second exemplary aspect there is provided a method for maintaining a fluid supply by removing contaminants from a spray system, the method comprising
in a spray operation, directing fluid from at least one nozzle in a spray pipe, in a spray that is in a spray plane; and
in a reverse flushing operation, directing fluid from at least one outlet of a
25 cleaning pipe at the at least one nozzle to clear contaminants therefrom,
the at least one outlet being spaced from the spray plane.

The reverse flushing operation may further comprise applying a negative pressure in the spray pipe and a positive pressure in the cleaning pipe. During the reverse flush
30 operation a jet of fluid may be directed at the at least one nozzle. The at least one outlet may be laterally and angularly spaced from the spray plane. The angular spacing may be less than an included angle of the spray. At least one pump and a plurality of valves

may be provided. A controller may be used to energise the pump and open and close the valves to change between the spray operation and the reverse flush operation. The at least one nozzle may be an aperture through the wall of the spray pipe. The self-cleaning spray system may be part of a self-cleaning kitchen exhaust system.

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Brief Description of the Drawings

In order that the present invention may be fully understood and readily put into practical effect, there shall now be described by way of non-limitative example only exemplary embodiments, the description being with reference to the accompanying illustrative
10 drawings.

In the drawings:

Figure 1 is a perspective view of a fluid supply apparatus according to the earlier application;

15 Figure 2 is a top view of the apparatus of Figure 1;

Figure 3 is a vertical cross section view along the lines and in the direction of arrows A-A on Figure 2;

Figure 4 is a side view of a kitchen exhaust system according to an exemplary embodiment;

20 Figure 5 is a schematic view of the kitchen exhaust system in Figure 4;

Figure 6 is a cross section view along the lines and in the direction of arrows B-B in Figure 5;

Figure 7 is (a) a schematic perspective view and (b) a vertical cross-sectional view of another exemplary embodiment;

25 Figure 8 is (a) a schematic perspective view and (b) a vertical cross-sectional view of a further exemplary embodiment;

Figure 9 is (a) a schematic perspective view and (b) a vertical cross-sectional view of yet another exemplary embodiment; and

Figure 10 is (a) a schematic perspective view and (b) a vertical cross-sectional view of a
30 final exemplary embodiment.

Detailed Description of the Exemplary Embodiments

Figures 1 to 3 show an apparatus 100 for supplying a fluid in an enclosure according to the earlier application. The fluid may be, for example, a fluid that is in normal circumstances considered as being an incompressible fluid. The apparatus 100 comprises a pipe 110 having a plurality of nozzles 112 that as shown are in the form of apertures 112 through a wall 113 of the pipe 110. However, other suitable forms of nozzle may be used. Each of the plurality of apertures 112 has a first portion 114 extending from an inner surface 115 of the wall 113, and a second portion 116 extending from the outer surface 117 of the wall 113, the first portion 114 and the second portion 116 intersecting to form an opening 118.

The pipe 110 may be of a shape selected from a group consisting of: polygon, ellipse and circle. Each of the plurality apertures 112 may be equidistantly spaced to provide an even distribution of fluid.

The opening 118 will be somewhat rectangular and will thus have a spray 125 that is fan shaped, generally in a longitudinally oriented spray plane 132.

Figures 4 to 6 illustrate the exemplary embodiment in operation. The pipe 110 with the plurality of apertures 112 formed as described above is integrated into, for example, a self-cleaning kitchen exhaust system 140. It may be incorporated in any other spray system such as, for example, agricultural sprays, road sprays, irrigation sprays, spray cooling systems, and so forth.

The pipe 110 is at the top of an enclosure 146 and during spray operation directs the fluid spray 125 of a fan shape in a spray plane 132 between a set of baffles 148 and a filter module 156 towards a fluid tray 162. The kitchen exhaust flow is drawn through inlet 142 and flows through the baffles 148. The baffles 148 include three overlapping louvers 150, 152, 154 which prevent any of the spray from leaking. The kitchen exhaust flow then flows horizontally through the spray plane 132. The kitchen exhaust flow then flows horizontally through the replaceable filter cartridge 158 in filter module 156 and out outlet 144. The flow rate of kitchen exhaust flow may be controlled by a fan (not shown) integrated with the outlet 144.

A cleaning pipe 170 of any suitable size, shape and form, has a plurality of outlets 172 that are directed at the apertures 112 but which are spaced laterally and angularly from the fluid spray 125 and spray plane 132 so as not to interfere with the fluid spray 125 during spray operation. The lateral spacing of outlets 172 prevents the interference with the fluid spray 125 during spray operation. The angular spacing of outlets 172 enables the outlets 172 to be directed at the apertures 112. Preferably, the angular spacing is less than half the spray angle 126, being the included angle of the spray 125. If any of the apertures 112 become blocked they will be blocked from within pipe 110 due to contaminants from within pipe 110. Therefore, there is a reverse flush operation that supplies fluid through pipe 170 into outlets 172. The outlets 172 are directed at apertures 112 and supply a jet 174 of cleaning solution directly at the apertures 112. The jet 174 of cleaning solution therefore intersects the spray plane 132 at the apertures 112. The jet 174 of cleaning solution is forced through the apertures 112 to clear any blockage due to the pressure of jet 174. This may be assisted by having a positive pressure in pipe 120 and a negative pressure in pipe 110. The negative pressure in pipe 110 may assist by drawing the jet 174 through apertures 112, as well as providing a suction pressure (negative pressure) on any obstruction in an aperture 112.

There may be one outlet 172 in pipe 170 for each aperture 112 in pipe 110. However, there may be one outlet 172 for two or more apertures 112, or more than one outlet 172 for each aperture 112. Cleaning pipe 170 is spaced from pipe 110, and may be parallel to pipe 110.

The fluid flow through pipe 110 and pipe 170 is controlled by a controller (not shown), which energises a series of valves and at least one pump 176; in either the spray operation or the reverse flush operation. Alternatively, the pipe 110 and/or pipe 170 may be connected to a pressurised water supply system such as, for example, the public water supply, in which case there may not be a pump 176. Further alternatively, compressed air may be used to pressurise the fluid in pipes 110 and/or 170. The switch between spray operation and the reverse flush operation, or the initiation of the reverse flush operation from an off condition, may be automatic based on sensors detecting a blockage, at scheduled times or may be manually initiated.

During spray operation, valves MV1, between the pump 176 and the pipe 110, and MV2, between a reservoir 180 and the pump 176, are open. The end of pipe 110 is blocked by valve SV3 which is closed to maintain the desired pressure in pipe 110. Pump 176 is operating. Fluid is drawn from the reservoir 180 by the pump 176 and
 5 supplied by pipe 110 through valves MV2 and MV1. The return pipe 184 returns the waste fluid from the fluid tray 162 and returns it to the reservoir 180. If the fluid level in reservoir 180 becomes low, valve MV4 is opened to add fluid to reservoir from a fluid supply.

10 At the end of spray operation, pump 176 is switched off, and valve MV5 is opened to drain all unwanted contaminants from reservoir 180 to a grease trap (not shown). Valve MV5 is then closed. Valve MV4 is then opened to supply fluid from fluid supply to the reservoir 180 to fill reservoir 180 to the required level. Valve SV3, between the pipe 110 and the reservoir 180, is then opened and pump 176 operated to clear pipe 110 by
 15 flushing. The pump 176 is then switched off and valve SV3 closed.

To clean any aperture 112 that may be blocked (completely or partially), valve MV1 is closed. Valves SV1, between the pump 176 and the reverse flush pipe 170, and SV2, which may be connected between an optional Venturi opening in the valve MV2 and the
 20 pipe 110, are opened. By valve SV1 being opened, fluid from reservoir 180 and/or directly from the fluid supply is supplied to pipe 170 to create jets 174 from each of the outlets 172. The pump 176 is switched on. Fluid jets 174 from outlets 172 pass through apertures 112 into pipe 110. As pipe 110 is connected to the Venturi opening in the valve MV2 the fluid flow through valve MV2 causes a negative pressure or suction in
 25 pipe 110 that will suck the fluid jets 174 into pipe 110 through the apertures 112 to clear the apertures 112 by reverse flush. The negative pressure will also act directly on any contaminant in apertures 112 as a blockage. If required or desired, other forms of assistance may be used to generate the negative pressure. This may include, for example, a second pump (not shown). This may be in addition to or in place of the
 30 Venturi opening. As the first portion 114 is normally larger than the second portion 116, any blockage will most likely be at the opening 118 and will thus be easily drawn into the first portion 114 and thus into pipe 110, where it can be eliminated. Any

contaminants in an aperture 112 will have a positive pressure applied to them by jet 174, on one side of the contaminant, and a negative pressure applied to them from pipe 110 on a side opposite the jet 174. The two pressures therefore compliment each other to dislodge the contaminant and draw it into pipe 110.

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The pipe 170 may include tubes 178 branching at an angle relative thereto such as, for example, a right angle, terminating in the openings 172. The tube 178 may be affixed to the pipe 110 to minimise any relative movement due to thermal expansion and contraction, fluid pressure changes, and the like.

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As shown in Figure 7 the tubes 178 may be somewhat hook shaped and be partially around pipe 110 with outlets 172 directed at apertures 112. Tubes 178 may be securely or releasably attached to pipe 110. In Figure 8 there are no tubes 178 and the outlets 172 are formed directly through the wall of pipe 170 and are aimed to form the jet spray 174 directly at the apertures 112. In Figure 9 the tubes 178 are relatively short, generally straight tubes extending outwardly from pipe 170 in a non-radial manner with outlets 172 directed at apertures 112. A bracket 179 is used to maintain pipes 110, 170 in the correct relationship so outlets 172 are always directed at apertures 112, and tubes 178, are spaced from the spray plane 132 both laterally and angularly. For Figure 10, the tubes 178 pass through the wall of pipe 110 opposite apertures 112 with outlets 172 directed at apertures 112.

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Once the apertures 112 are unblocked the valves SV1 and SV2 are closed, valves MV1 and SV3 opened, and pump 176 switched on to flush the contaminants in the pipe 110 into the reservoir 180.

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If the fluid contains a degreaser, detergent or soap, or is warm or hot, either during the spraying operation or the reverse flushing operation, it will assist in reducing blockages and/or enhance the clearing by reverse flushing. A pressure sensor (not shown) may be placed in pipe 110 and connected to the controller. The pressure in pipe 110 may be used to determine whether there may be a blockage in one or more of the apertures 112 and/or whether a preventative, reverse flushing operation may be desirable. The

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controller may be programmed for automatic operation of the reverse flushing operation. This may be periodic such as, for example, daily, weekly, monthly, at the end of each operational cycle, and so forth.

- 5 The embodiment of Figures 3 to 9 may also be used with conventional spray outlets. The cleaning pipe 170 may also be retrofitted to existing spray systems. The cleaning pipe 170 may be able to be moved to a suitable non-operating position when not required and may be able to be moved to the operating position described above when required. The jet would be provided only when in the operating position.

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Whilst there has been described in the foregoing description preferred embodiments of the present invention, it will be understood by those skilled in the technology concerned that many variations or modifications in details of design or construction may be made without departing from the present invention.

THE CLAIMS

1. A self-cleaning spray system comprising
a spray pipe having at least one nozzle in a wall of the spray pipe such
that, during a spray operation, fluid is sprayed in a spray in a spray plane from
5 the at least one nozzle;
a cleaning pipe spaced from the spray pipe and having at least one outlet to
direct fluid towards the at least one nozzle and into the spray pipe for cleaning the at
least one nozzle during a reverse flush operation, the at least one outlet being spaced
from the spray plane.
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2. A self-cleaning spray system as claimed in claim 1, wherein the cleaning pipe is
parallel to the spray pipe.
3. A self-cleaning spray system as claimed in claim 1 or claim 2, wherein the at
15 least one outlet is configured to direct a jet of fluid directly at the at least one nozzle.
4. A self-cleaning spray system as claimed in any one of claims 1 to 3, wherein
the at least one outlet is laterally and angularly spaced from the spray plane.
- 20 5. A self-cleaning spray system as claimed in claim 4, wherein the angular spacing
is less than an included angle of the spray.
6. A self-cleaning spray system as claimed in any one of claims 1 to 5, wherein the
cleaning pipe includes at least one tube branching from the cleaning pipe wherein the at
25 least one tube terminates at the at least one outlet.
7. A self-cleaning spray system as claimed in claim 6, wherein the at least one tube
is attached to the spray tube proximate the at least one nozzle.
- 30 8. A self-cleaning spray system as claimed in any one of claims 1 to 7, wherein the
system further comprises at least one pump, a plurality of valves, and a controller to

energise the pump and open and close the valves to change between the spray operation and the reverse flush operation.

9. A self-cleaning spray system as claimed in any one of claims 1 to 8, wherein the
5 at least one nozzle comprises at least one aperture through the wall of the spray pipe.

10. A self-cleaning spray system as claimed in any one of claims 1 to 9, wherein the self-cleaning spray system is part of a self-cleaning kitchen exhaust system.

10 11. A method for maintaining a fluid supply by removing contaminants from a spray system, the method comprising
in a spray operation, directing fluid from at least one nozzle in a spray pipe, in a spray that is in a spray plane; and
in a reverse flushing operation, directing fluid from at least one outlet of a
15 cleaning pipe at the at least one nozzle to clear contaminants therefrom, the at least one outlet being spaced from the spray plane.

12. A method as claimed in claim 11, wherein the reverse flushing operation further comprises applying a negative pressure in the spray pipe and a positive pressure in the
20 cleaning pipe.

13. A method as claimed in claim 11 or claim 12, wherein during the reverse flush operation a jet of fluid is directed at the at least one nozzle.

25 14. A method as claimed in any one of claims 11 to 13, wherein the at least one outlet is laterally and angularly spaced from the spray plane.

15. A method as claimed in claim 14, wherein the angular spacing is less than an included angle of the spray.

16. A method as claimed in any one of claims 11 to 15, wherein a controller is used to energise at least one pump and open and close a plurality of valves to change between the spray operation and the reverse flush operation.
- 5 17. A method as claimed in any one of claims 11 to 16, wherein the at least one nozzle comprises at least one aperture through the wall of the spray pipe.
18. A method as claimed in any one of claims 11 to 17, wherein the self-cleaning spray system is part of a self-cleaning kitchen exhaust system.