# CLEANING SYSTEM AND METHOD

## Technical Field

The present invention relates to system and method for cleaning household appliances. In particular, the present invention relates to system and method for cleaning air conditioning systems.

## Background

Air conditioning systems are widely used in many commercial and residential buildings. To ensure the systems working under normal conditions, such systems require maintenances which typically involve cleaning services, which is to be carried out on-site, or at the cleaning service providers' professional service workshops. On-site cleaning provides convenience to system users due to shorter service time required and also low cost. However, in order to minimize interference to surrounding household appliances and furniture, on-site cleaning are typically carried out by using vacuum cleaners for dust removal only and using tap water for simple washing, therefore the cleaning result is usually unsatisfactory. On the other hand, workshop cleaning may achieve better results but it involves dismantle and reinstallation of the units, which causes inconveniences to the user during the service period and with high cost.

It is therefore desirable for a new cleaning system and method which not only provide the convenience of the on-site cleaning but also can achieve the workshop cleaning effect. Such a solution is currently not available.

## Brief description of drawings

Fig. 1 is a schematic side view showing a cleaning system according to one embodiment of the present invention.

Fig. 2 is a front view of the cleaning system shown in Fig. 1 together with a ladder.

Fig. 3 is a partial top view of Fig. 2 showing the collection tray at first and second positions.

Fig. 4 is a schematic side view of a cleaning system shown in Fig. 1 when the collection tray is at working position.

Fig. 5 is a schematic side view of Fig. 4 when the system is set up for cleaning operation.

Fig. 6 is a schematic side view of Fig. 5 when cleaning operation is carried out.

Fig. 7 is a partial cross sectional view showing the water gun according to embodiment of the present invention.

Fig. 8 is a schematic side view showing a cleaning system according to another embodiment of the present invention.

Fig. 9 is a partial cross sectional right side view of Fig. 8.

**Summary of the invention**

A system and method for cleaning household appliance such as air conditioning units which provides the convenience of on-site cleaning and can achieve workshop cleaning effect. The system has a water supply assembly and a water collection assembly supported by a housing. The water supply assembly provides high pressure water jet to clean the air conditioning units. The water collection assembly includes a collection tray and a flexible sheet attached to the collection tray. The flexible sheet is capable of at least partially wrapping around the air conditioning unit to form an enclosure to prevent leaking or splashing of the water during cleaning.

**Detailed Description of Preferred Embodiments**

As shown in Figs. 1 and 2, a cleaning system 100 according to one embodiment of the present invention has a base in the form of a housing 110 to which other parts of the system are installed and supported. Fixed inside housing 110 there is a water pump 130 which connects to a water inlet 132 via a control valve 131, and a water outlet 134. A water gun 140 is connected to outlet 134 by flexible hose 142. Water pump 130 is to receive tap water supplied via inlet 132, and upon starting, to supply high pressure water through outlet 134 which eventually jets out from water gun 140 through nozzle 144. High pressure water provided from nozzle 144 is sprayed onto air conditioning units to perform the main cleaning task. Water pump 130 may be the type with control means to regulate the water flow rate and water pressure which are adjustable to achieve proper cleaning effects based on the actual needs. Upon completion of the cleaning, or it is desirable to temporarily stop the high pressure water supply to water gun 140 during the cleaning process, water pump 130 will be shut off and meanwhile, control valve 131 is closed to prevent inlet water from entering into water pump 130.

A collection tray 170 is provided at upper part of cleaning system 100. Collection tray 170 is mounted to housing 110 via a discharge pipe 180. Discharge pipe 180 is connected to collection tray 170 at top end 180a, passes through housing 110 and is

connected at bottom end 180b to a collection tank 112 which is stacked below housing 110.

Discharge pipe 180 has a first segment 182, a second segment 184 and a third segment 186. First segment 182 and third segment 186 are both arranged vertically and are offset from each other with a distance linked by second segment 184. First segment 182 is mounted to housing 110, with bottom end 180b positioned facing collection tank 112. The top end of first segment 182 is connected to one end of second segment 184 by a first elbow 183. Another end of second segment 184 is connected to the bottom end of third segment 186 by a second elbow 185. The top end of third segment 186 is mounted to a discharge port 172 of collection tray 170. Connected in the above mentioned manner, it forms a fluid discharge passage which can direct water and/or other fluid used during the cleaning process from collection tray 170 to collection tank 112, through discharge pipe 180.

As shown in Figs. 2 and 3, an auxiliary pipe 190 is provided with one end mounted to housing 110 and another end mounted to collection tray 170 at a support point 174. Auxiliary pipe 190 may be made of the same material and with the same diameter as discharge pipe 180, with its first, second and third segments 192, 194 and 196 structured in the same manner as those of discharge pipe 180. Discharge pipe 180 and auxiliary pipe 190 can therefore provide necessary structural support to hold collection tray 170 above housing 110.

First segment 182 of discharge pipe 180 is rotatable relative to housing 110 about its longitudinal axis 182a. The top end of third segment 186 is mounted to discharge port 172 of collection tray 170 in a fixed manner, by adhesive for example, to prevent any fluid leakage. The bottom end of third segment 186 is inserted into second elbow 185 and is rotatable relative to second elbow 185 about its longitudinal axis 186a.

Likewise, first segment 192 of auxiliary pipe 190 is rotatable relative to housing 110 about its longitudinal axis 192a. The top end of third segment 196 is mounted to support point 174 of collection tray 170 in a fixed manner, by adhesive for example. The

bottom end of third segment 196 is inserted into a second elbow 195 and is rotatable relative to second elbow 195 about its longitudinal axis 196a.

By allowing rotation of first segment 182 of discharge pipe 180 relative to housing 110 and rotation of third segment 186 relative to second elbow 185, and rotation of first segment 192 of auxiliary pipe 190 relative to housing 110 and rotation of third segment 196 relative to second elbow 195, collection tray 170 becomes movable between a first position 170a shown in Figs. 1, 2 and 3, and a second position 170b as shown in Figs. 3 and 4. When at first position 170a, collection tray 170 is placed right above housing 110. This feature makes cleaning system 100 more compact in size, hence to provide convenience to cleaning system 100 for storage and during transportation. When at the second position 170b, collection tray 170 is placed at one side of housing 110, which extends the reaching range of the cleaning system beyond the side edge of housing 110, hence it is more convenient for water / fluid collection during cleaning operation.

Discharge pipe 180 and auxiliary pipe 190 may also be structured such that the height of collection tray 170 can be varied. In one embodiment, a first support sleeve 189 and a second support sleeve 199 are mounted to housing 110. First support sleeve 189 and second support sleeve 199 both have a bore diameter slightly greater than the external diameter of first segment 182 of discharge pipe 180 and first segment 192 of auxiliary pipe 190. First segment 182 of discharge pipe 180 is inserted into, and becomes slidable relative to, first support sleeve 189. Similarly, first segment 192 of auxiliary pipe 190 is inserted into, and becomes slidable relative to, second support sleeve 199. Depending on the actual location height of an air conditioning unit to be cleaned, the height of collection tray 170 can be changed accordingly by following the sliding movement of first segment 182 of discharge pipe 180 within first support sleeve 189, and first segment 192 of auxiliary pipe 190 within second support sleeve 199. To lock collection tray 170 at a desired height, first and second support sleeves 189 and 199 may each be provided with a locking clamp (not shown) which, when activated, tightly grips each support sleeve to the respective first segment 182 of discharge pipe 180 and first segment 192 of auxiliary pipe 190. To increase the locking effect, slits (not shown) may be formed on each support sleeves which are deformable by the locking clamp to grip the respective pipes.

Inside collection tray 170 there is provided a flexible, waterproof thin sheet, for instance a canvas 120. Canvas 120 can be folded inside collection tray 170, as shown in Fig. 1, when cleaning system 100 is not in use. When opened, canvas 120 can extend outside of collection tray 170 but the bottom side of canvas 120 remains attached to collection tray 170. The bottom side of canvas 120 has a hole 122 which is positioned above discharge port 172 of collection tray 170.

The upper and surrounding parts of canvas 120 are sized sufficiently to be able to at least partially wrap around an air conditioner unit to form an enclosurebefore a cleaning task is carried out. As shown in Figs. 5 and 6, in use, cleaning system 100 is firstly placed near a wall 12 to which an air conditioning unit 10 is mounted. Before the cleaning process, air conditioning unit 10 is partially unmounted from the wall, i.e. with its lower part moving slightly away from the wall with a space. Collection tray 170 can then be rotated from first position 170a to second position 170b, and placed hanging below air conditioning unit 10. Therefore, there is no need to move away any other existing household appliance or furniture originally located under or near air conditioning unit 10, such as TV 20 and / or cabinet 22, during the cleaning process. This provides additional convenience and cost savings to the house owners. When collection tray 170 is rotated to second position 170b, there is also left more space above housing 100 by which, a ladder 30 (Fig. 2) can be placed over housing 110 for easy operation during the cleaning process. Depending on the actual mounting height of air conditioning unit 10, if necessary, the height of collection tray 170 may be adjusted so that it is placed right underneath air conditioning unit 10. Thereafter, canvas 120 is opened and wrapped around air conditioning unit 10 to form an enclosure, as shown in Fig. 6. The top side of the enclosure may be left open for accessing air conditioning unit 10 during the cleaning process.

To start the cleaning operation, water gun 140 is brought closer to air conditioning unit 10, with nozzle 144 placed inside the wrapped canvas 120 and facing the parts-to-be-cleaned. Pump 130 can then be turned on to supply high pressure water jet towards air conditioning unit 10 through water gun 140.

As canvas 120 is wrapped around air conditioning unit 10, during the cleaning process, any water splashed from air conditioning unit 10 is blocked by canvas 120, collected in collection tray 170 and directed to collection tank 112 through discharge pipe 180. Therefore, by supplying high pressure water jet to air conditioning unit 10 and with the air conditioning unit protected by canvas 120, the present invention is able to achieve the cleaning effect the same as that carried out in a professional cleaning workshop, but without the need to dismantle the air conditioning unit and ship it to the workshop. Household appliances and / or furniture near the air conditioning unit can be protected from being affected by canvas 120. Another words, embodiments of the present invention can provide the workshop level cleaning effect and with on-site cleaning convenience.

Referring back to Fig. 1, to enhance the cleaning effect, cleaning system 100 may also include a container 150 for storing and supplying chemical solutions. Container 150 is provided with chemical solution 151 and compressed air 153 therein, and may be placed on top of housing 110. A flexible hose 152 is connected to container 150 and to water gun 140 via a valve 154 and a T-joint 156. When it is desired to carry out the cleaning operation by using high pressure water jet only, valve 154 is closed such that no chemical solution is supplied from container 150. When cleaning by chemical solution is needed, water pump 130 is turned off such that no high-pressure water is supplied to water gun 140. Valve 154 is then opened so that chemical solution 151 stored in container 150 can be supplied to water gun and sprayed onto the air conditioning unit for cleaning.

Container 150 is a hermetically sealed tank or bottle, with chemical solution 151 and compressed air 153 stored inside. Compressed air 153 may be prepared by an air pump (not shown). According to one aspect, the present invention provides solutions to generate compressed air in container 150 without the need of using an air pump. This is achieved by firstly supplying condensed chemical solution in container 150, and closing the cap 158 of container 150 and valve 154. Air 153 and condensed chemical solution 151 in container 150 are therefore under a hermetically-sealed environment, but without the air being compressed. Thereafter, water pump 130 is turned-on, which supplies high-pressure water to water gun 140 through T-joint 156 and in the meantime, valve 154 is opened.

Since the pressure of the water supplied by water pump 130 is higher than that in container 150, high pressure water enters container 150 via T-joint 156, valve 154 and hose 152. Firstly, this high pressure water has an effect to dilute condensed chemical solution in container 150. Secondly, with more water being supplied into container 150, more diluted chemical solution is generated which, progressively occupies more and more spaces in container 150. As a result, air 153 is forced to become compressed, and the pressure of air 153 is built up to a level higher than the pressure of the external environment.

When the chemical solution is diluted to a level suitable for cleaning purpose, valve 154 is closed and water pump 130 is turned off. Container 150 is now with compressed air 153 prepared therein and in a state ready to supply suitably diluted chemical 151.

To further improve the cleaning effect, productivity and ease of operation, in particular for some types of air conditioning units having a very compact design and limited space available for carrying out the cleaning service, the present invention provides a water gun which is capable of accessing different parts of an air conditioning unit within limited space.

As shown in Fig. 7, water gun 140 has an inlet fitting 143, connected to T-joint 156 for instance, which may also serve as a handle. Inlet fitting 143 is connected to nozzle 144 through a flexible conduit 145 in a water-sealed manner, hence high pressure water can be supplied from hose 142 to nozzle 144 via conduit 145 without leaking. Due to the connection by conduit 145, inlet fitting 143 and nozzle 144 are fixed together. This structure restricts nozzle 144 from twisting relative to inlet fitting 143.

Water gun 140 further includes a sleeve 146 through which conduit 145 passes. Sleeve 146 may be made of non-elastic material such as a PVC pipe. A first end 146a of sleeve 146 is connected to inlet fitting 143. An opposite, second end 146b is connected to nozzle 144. Sleeve 146 is bent at a predetermined angle T at a portion between first and second ends 146a and 146b. The bore diameter of first and second ends 146a and 146b are suitably dimensioned to match the external diameter of inlet fitting 143 and nozzle 144,

respectively, such that relative rotation between sleeve 146 and inlet fitting 143 and between sleeve 146 and nozzle 144 is allowable.

When inlet fitting 143 is held stationary, rotation 148 of sleeve 146 about its longitudinal axis 147 has the effect of varying the water jet direction spraying out from nozzle 144. Shown in Fig. 7 as an example, T is set at an angle of 150-degree. A 180-degree rotation of sleeve 146 about its longitudinal axis 147 will result in a change of nozzle output direction from position 140a to position 140b, with a changed angle of 60-degree under the formula of (180-T) x 2. Embodiments of the present invention achieve nozzle angle adjustment without the need of complicated components used in conventional multi-angle water gun, e.g. a ball-valve or the like. The angle-adjustment structure enables easy access of many parts in an air conditioning unit and further improves the cleaning efficiency and productivity.

According to another embodiment, a cleaning system 200 further includes an air blower assembly which may be used in the cleaning process for drying the parts after cleaning. In the present embodiment as shown in Figs. 8 and 9, the air blower assembly includes an air pump 220 fixed inside housing 210. An auxiliary pipe 290 used to provide structural support to collection tray 270, is also utilized to form part of the air-supply path of the air blower assembly. This is achieved by having the bottom portion 290a of auxiliary pipe 290 connected to the outlet of air pump 220. The air blower assembly further includes a link pipe 260 connecting discharge pipe 280 and auxiliary pipe 290, by a first T-joint 268 and a second T-joint 269, respectively. First segment 282 of discharge pipe 280 is divided into a first section 2822 and a second section 2824. The lower portion of first section 2822 is slidably received by sleeve 289. The top end of first section 2822 is fixedly attached to first T-joint 268 in a water-tight manner by, adhesive for instance. The top end of second section 2824 is fixedly attached to a first elbow 283 in a water-tight manner by, adhesive for instance. The lower portion of second section 2824 is inserted into T-joint 268. Although not shown in Fig. 9, as being blocked by discharge pipe 280, support pipe 290 is structured in a manner similar to discharge pipe 280. By arranging discharge pipe 280 and support pipe 290 in the above-mentioned structure, rotation between second section 2824 of discharge pipe 280 and first T-joint 268, and rotation

between second section 2924 of support pipe 290 and second T-joint 269, become both possible. This structure allows collection tray 270 to raise or lower its height position relative to housing 210 the same way as the previous embodiment. Meanwhile, first section 2822 of discharge pipe 280 and first section 2922 of support pipe 290 are slidable relative to first and second sleeves 289, 299. This allows collection tray 270 together with link pipe 260 as well as relevant parts of discharge pipe 280 and support pipe 290 to be moved along vertical direction to vary the height of collection tray 270.

The bore of one end of link pipe 260 connecting discharge pipe 280 is blocked by a plug 262 to prevent any water leaking from discharge pipe 280 into link pipe 260. An air outlet 264 may be provided on link pipe 260 to which an air nozzle (not shown) may be connected to supply compressed air for the drying purpose. Utilizing auxiliary pipe 290 as part of the compressed air supply path and with the additional support provided by link pipe 260 makes cleaning system 200 more robust and compact, easy for maintenance, storage and transportation.

CLAIMS

1. A cleaning system comprising:

a housing;

a supply assembly connected to the housing for providing

a cleaning liquid to an object;

a collection assembly supported by the housing for receiving the

cleaning liquid from the object;

wherein the collection assembly includes a flexible sheet

for at least partially wrapping around the object to

collect the cleaning liquid.

2. The system of claim 1, wherein the collection assembly further comprising:

a tank attached to the housing;

a tray to which the flexible sheet is attached, wherein the flexible sheet is

foldable into the tray and expandable from the tray, and;

a discharge pipe connected between the tank and the tray, wherein the discharge

pipe is to support the tray to the housing and to direct the cleaning liquid

collected by the flexible sheet to the tank.

3. The apparatus of claim 0, wherein the discharge pipe comprising:

a vertically arranged first discharge pipe segment;

a horizontally arranged second discharge pipe segment; and

a vertically arranged third discharge pipe segment,

wherein the first discharge pipe segment has one end connected to the tank and

another end connected to the second discharge pipe segment;

the third discharge pipe segment has one end connected to the tray at a first

fixing portion, and another end connected to the second discharge pipe segment

such that the third discharge pipe segment is offset from the first discharge pipe

segment.

4. The apparatus of claim 3, wherein the second discharge pipe segment is rotatable relative to the housing about the first discharge pipe segment and the tray is rotatable relative to the second discharge pipe segment about the third discharge pipe segment by which, the tray is movable relative to the housing between a first position at which the tray is positioned above the housing and a second position at which the tray is at least partially positioned beyond a side surface of the housing.

5. The apparatus of claim 3, further comprising a first support sleeve attached to the housing, wherein the first discharge pipe segment is telescopically arranged in the first support sleeve by which the first discharge pipe segment is slidable relative to the first support sleeve to vary the height of the tray.

6. The system of claim 0, wherein the collection assembly further comprising an auxiliary pipe connected between the housing and the tray to support the tray to the housing. and a link pipe joining the discharge pipe and the auxiliary pipe, wherein the link pipe and the auxiliary pipe are fluidically connected to each other, and the link pipe and the discharge pipe are fluidically isolated from each other.

7. The system of claim 6, further comprising an air pump disposed in the housing, wherein the auxiliary pipe has an air-inlet connected to the air pump, the link pipe has an air-outlet in fluid communication with the air-inlet to allow compress air supply from the air-inlet to the air-outlet.

8. The system of claim 6,
wherein the discharge pipe comprising:
a vertically arranged first discharge pipe segment;
a horizontally arranged second discharge pipe segment; and
a vertically arranged third discharge pipe segment,
wherein the first discharge pipe segment has one end connected to the tank and another end connected to the second discharge pipe segment;
the third discharge pipe segment has one end connected to the tray at a first fixing portion, and another end connected to the second discharge pipe

segment such that the third discharge pipe segment is offset from the first discharge pipe segment.
wherein the auxiliary pipe comprising:
a vertically arranged first auxiliary pipe segment;
a horizontally arranged second auxiliary pipe segment; and
a vertically arranged third auxiliary pipe segment,
wherein the first auxiliary pipe segment has one end connected to the housing and another end connected to the second auxiliary pipe segment;
the third auxiliary pipe segment has one end connected to the tray at a second fixing portion, and another end connected to the second auxiliary pipe segment such that the third auxiliary pipe segment is offset from the first auxiliary pipe segment.

9. The apparatus of claim 8, wherein the second discharge pipe segment and the second auxiliary pipe segment are each rotatable relative to the housing and the tray is rotatable relative to each of the second discharge pipe segment and the second auxiliary pipe segment by which, the tray is movable relative to the housing between a first position at which the tray is positioned above the housing and a second position at which the tray is positioned beyond a side surface of the housing.

10. The apparatus of claim 9, wherein the first and second fixing portions are located at one side of the tray such that when the tray is at the second position an opposite side of the tray is positioned beyond a side surface of the housing.

11. The apparatus of claim 8, further comprising a first support sleeve and a second support sleeve attached to the housing, wherein the first discharge pipe segment is telescopically arranged in the first support sleeve by which the first discharge pipe segment is slidable relative to the first support sleeve, and wherein the first auxiliary pipe segment is telescopically arranged in the second support sleeve by which the first auxiliary pipe segment is slidable relative to the second support sleeve to vary the height of the tray.

12. The system of claim 1, wherein the supply assembly further comprising a fluid pump disposed in the housing and a jet gun connected to the fluid pump through a flexible hose to supply pressured liquid to the jet gun.

13. The system of claim 12, wherein the jet gun comprising:

an inlet fitting;

a nozzle;

a flexible conduit connected to the inlet fitting and the nozzle by which twisting

of the nozzle relative to the inlet fitting is restricted, and

an angled rigid sleeve through which the flexible conduit passes, wherein a first end of the rigid sleeve is rotatably connected to the inlet fitting and a second end of the rigid sleeve is rotatably connected to the nozzle.

14. The system of claim 12, further comprising a hermetically sealed container to store a cleaning agent therein, wherein the hermetically sealed container is connected to the flexible hose through a control valve and a T-joint, wherein the control valve is operable between a close position at which supply of the cleaning agent from the container is blocked and an open position at which supply of pressured water from the fluid pump to the container and supply of the cleaning agent from the container to the jet gun is allowed.

15. A jet gun comprising:

an inlet fitting;

a nozzle;

a flexible conduit connected to the inlet fitting and the nozzle by which twisting

of the nozzle relative to the inlet fitting is restricted, and

an angled rigid sleeve through which the flexible conduit passes, wherein a first end of the rigid sleeve is rotatably connected to the inlet fitting and a second end of the rigid sleeve is rotatably connected to the nozzle.