DEVICE FOR LIQUID COLLECTION

FIELD OF INVENTION

The present invention relates to a device for liquid collection and in particular, but not exclusively, to a tray and a system and method using said tray for collecting and removing liquid from an air conditioning unit.

BACKGROUND TO THE INVENTION

The following discussion of the background to the invention is intended to facilitate an understanding of the present invention. However, it should be appreciated that the discussion is not an acknowledgment or admission that any of the material referred to was published, known or part of the common general knowledge in any jurisdiction as at the priority date of the application.

Air conditioners are systems designed to dehumidify and extract heat from an area. There are generally two types of air conditioners, namely window units and split-system units, which are commonly installed in homes. An air conditioner has a cooling system or a condensing unit that is generally installed on the outside of a home. The cooling system typically comprises a compressor, an expansion valve, a fan motor, and a coolant gas such as Freon and coils for circulating the Freon. As a result of heat exchange, the cooling system generates condensate water as a by-product. The condensate water generated typically drips from the cooling system to the surrounding area.

The dripping of the condensate water from the cooling system of the air conditioner poses a problem especially for people living in apartments, as the condensate water inevitably drips to the lower housing units causing a nuisance to the neighbours. Typically, to prevent the condensate water from dripping to the lower housing units, an air conditioner technician is engaged to connect a funnel to the base of the cooling system, which connects to a pipe that allows the condensate water to be collected. For example, the pipe runs into the apartment for drainage of the condensate water. In this way, the condensate water is directed into the apartment and hence will not drip to the lower housing units.

However, in cases where the base of the cooling system of the air conditioner is corroded, it is not possible to connect a funnel to the base for directing the condensate water into the apartment. In such cases, a conventional tray is fixed to the base of the cooling system of the air conditioner for collecting the condensate water.

The drawback of fixing a conventional tray is that if the residents do not frequently clear the condensate water and debris collects in the tray, the tray will be choked by the debris and the condensate water in the tray will become stagnant causing it to be a breeding ground for mosquitoes. Therefore, the use of conventional trays poses another problem because it creates a potential breeding ground for mosquitoes.

Therefore, the present invention seeks to provide a collecting device for collecting liquids such as condensate water that overcomes, or at least alleviates, the above-mentioned problems.

SUMMARY OF THE INVENTION

In accordance with a first aspect of the present invention, there is provided a collecting device, comprising:

a base having a return end portion for collecting and removing a liquid generated by an air conditioning unit; and

attachment means connected to the base, the attachment means for attaching the base to a portion of the air conditioning unit,

whereby when attached thereto, the base is at an incline to the air conditioning unit with the return end portion being the lower end of the incline.

Preferably, the return end portion comprises a first portion and a second portion connected to the first portion.

Preferably, the first portion comprises at least a surface texture arranged to decrease the velocity of the liquid flowing over the surface texture.

Preferably, the second portion defines a channel for collecting and removing the liquid.

Preferably, one end of the channel is adapted to be connectable to an outlet to further remove the liquid from the channel.

Preferably, a profile of the first and second portions shows at least a part of the first portion extending beyond the periphery of the channel.

Preferably, the profile of the first and second portions is substantially an S-shaped profile.

Preferably, the profile of the first and second portions is substantially a Z-shaped profile.

Preferably, the first portion comprises at least one protrusion arranged to decrease the velocity of the liquid flowing from the first portion to the second portion.

Preferably, the attachment means comprises at least one side wall which extends from the base.

Preferably, the base is positioned at an incline to the at least one side wall with the return end portion being the lower end of the incline.

Preferably, the collecting device is a tray for the air conditioning unit.

In accordance with a second aspect of the present invention, there is provided a method for installing a collecting device according to the first aspect of the present invention to an air conditioning unit, comprising:

attaching the base to the portion of the air conditioning unit via the attachment means such that the base is at an incline to the air conditioning unit with the return end portion being the lower end of the incline.

In accordance with a third aspect of the present invention, there is provided an air conditioning system, comprising:

an air conditioning unit; and

a collecting device having a base and attachment means connected to the base, the base having a return end potion for collecting and removing a liquid generated by the air conditioning unit, the attachment means for attaching the base to a portion of the air conditioning unit,

whereby when attached thereto, the base is at an incline to the air conditioning unit with the return end portion being the lower end of the incline.

Preferably, the collecting device is in accordance with the first aspect of the present invention.

BRIEF DESCRIPTION OF DRAWINGS

The present invention will now be described, by way of illustrative example only, with reference to the accompanying drawings, of which:

FIG. 1 is a perspective view of a collecting device in the form of a tray in accordance with a first embodiment of the present invention;

FIG. 2A is a side elevation of the tray of FIG. 1;

FIG. 2B is an enlarged view of the return end portion that is enclosed by the dashed line of FIG. 2A;

FIG. 3 is an end elevation of the tray of FIG.1;

FIG. 4 is a plan view of the tray of FIG. 1;

FIG. 5 is a perspective view the tray of FIG. 1 in accordance with a second embodiment of the present invention;

FIG. 6A is a side elevation of the tray of FIG. 5;

FIG. 6B is an enlarged view of the return end portion that is enclosed by the dashed line of FIG. 6A;

FIG. 7 is an end elevation of the tray of FIG.5; and

FIG. 8 is a plan view of the tray of FIG. 5.

DETAILED DESCRIPTION

In accordance with a first embodiment of the invention, there is described hereinafter a collecting device for collecting and removing liquid from an air conditioning unit in accordance with FIGS. 1, 2A, 2B, 3 and 4. In the drawings and description hereinafter, like elements are numbered with like reference numerals.

Furthermore, all arrows without an accompanying reference numeral in FIGS. 1, 2A and 2B illustrate the flow of the liquid.

FIG. 1 shows a collecting device (typically in the form of a tray 10) for an air conditioning unit (not shown). The tray 10 enables liquids generated by the air conditioning unit, such as condensate water 12, to be collected and removed so as to prevent the liquids from dripping, for example, to lower housing units of an apartment building. The tray 10 also prevents debris (not shown) including leaves, twigs, tissue papers and plastic wrappers from choking the tray 10. Hence, no stagnant water is accumulated in the tray 10, which reduces the risk of the tray 10 becoming a breeding ground for mosquitoes.

The tray 10 comprises a base 14 which has a closed end 16 and an open end 18. The base 14 can be made from materials such as metals including aluminium, or plastics. The open end 18 provides an opening for the removal of debris from the tray 10. The collected debris can be removed from the tray 10 at the open end 18 by for example wind or rain. The base 14 further comprises a return end portion 20 at the open end 18. The return end portion 20 is adapted for collecting and removing the condensate water 12 generated by the air conditioning unit.

The return end portion 20 comprises a first portion 22 and a second portion 24 in which the second portion 24 is connected to one end of the first portion 22. FIGS. 2A and 2B provide a clear illustration of this configuration. In particular, FIG. 2A shows a side elevation of the tray 10 and FIG. 2B is an enlarged view of the return end portion 20. The first portion 22 comprises at least a substantially curved

surface and the second portion 24 also comprises at least a substantially curved surface. Based on the profile of the return end portion 20, the substantially curved surface of the first portion 22 forms a convex portion whereas the substantially curved surface of the second portion 24 forms a concave portion. Together, the first and second portions 22, 24 form a substantially S-shaped profile, with the first portion 22 forming the upper part of the S-shaped profile and the second portion 24 forming the lower part of the S-shaped profile as shown in FIGS. 2A and 2B.

Although the substantially curved surface of the first portion 22 forms a convex portion, the condensate water 12 is able to flow over the surface of the convex portion to the second portion 24 due to surface tension of the condensate water 12. Thus, the condensate water 12 does not drip off the tray 10 when the condensate water 12 flows over the surface of the first portion 22.

Advantageously, to facilitate the flow of the condensate water 12 from the first portion 22 to the second portion 24, the first portion 22 comprises at least a surface texture 25 arranged to decrease the velocity of the condensate water 12 flowing over the surface texture 25 as shown in FIG. 2B. The surface texture 25 forms part of the surface of the first portion 22. Alternatively, the surface texture 25 can form the entire surface of the first portion 22.

The surface texture 25 has a surface roughness higher than the surface roughness of the base 14 or the surface roughness of the second portion 24. Having a higher surface roughness would give rise to greater friction between the condensate water 12 and the surface texture 25. As such, the higher frictional

force between the condensate water 12 and the surface texture 25 decreases the velocity of the condensate water 12 flowing over the surface texture 25. By decreasing the velocity of the flow of the condensate water 12, the surface texture 25 facilitates the condensate water 12 to flow from the first portion 22 to the second portion 24 for collection and removal. Preferably, the surface texture 25 has a surface coefficient of friction value of about 10μm to 90μm.

The second portion 24 defines a channel 26 for collecting and removing the condensate water 12 that flows down from the first portion 22. A side elevation or a profile of the first and second portions 22, 24 shows at least a part of the first portion 22 extending beyond the periphery of the channel 26. This enables debris to slide off the first portion 22 and fall to the ground without being collected in the channel 26 of the second portion 24. Hence, the channel 26 will not be choked by debris. On the other hand, the condensate water 12 flows over the surface texture 25 of the first portion 22 and is collected in the channel 26 of the second portion 24 as described above. The advantage of the first and second portions 22, 24 having a substantially S-shaped profile as described above is that this shape enables the condensate water 12 to be collected in the channel 26 without allowing debris to be collected in the channel 26.

The channel 26 comprises a first end 28 and a second end 30 in which the first end 28 is adapted to be connected to an outlet 32, such as a pipe, to further remove the collected condensate water 12 from the channel 26. The outlet 32 runs from the first end 28 of the channel 26 through a wall 34 of a building (not shown) and is directed into a drainage system 36 that is inside the building, such

as a toilet of a housing unit. The outlet 32 enables the collected condensate water 12 to be further removed into the drainage system 36, thus preventing the condensate water 12 from dripping to the lower housing units of the building. The collected condensate water 12 flows from the channel 26 to the outlet 32 and thus the drainage system 36 by means of gravity. In the event where the amount of collected condensate water 12 be too small an amount to be drained into the drainage system 36 by gravity, the small amount of collected condensate water 12 will be retained in the channel 26 and will evaporate over a short period.

The tray 10 further comprises attachment means in the form of two side walls 38, 40 which extend from the base 14, and the base 14 is positioned at an incline to the two side walls 38, 40 with the return end portion 20 being the lower end of the incline. The length of each of the two side walls 38, 40 runs from the closed end 16 of the base 14 to beyond the open end 18 of the base 14, and the height of each of the two side walls 38, 40 gradually increases across the length from the closed end 16 to beyond the open end 18. With this configuration, the two side walls 38, 40 stop runoff from the sides of the tray 14.

The first side wall 38 is adapted to allow the first end 28 of the channel 26 to pass therethrough, such that the first end 28 protrudes from the first side wall 38. This facilitates the connection of the outlet 32 to the first end 28 of the channel 26 for further remove of the condensate water 12. The protrusion of the first end 28 from the first side wall 38 is shown in FIG. 3 and FIG. 4, which show an end elevation of the tray 10 and a plan view of the tray 10, respectively. On the other hand, the second side wall 40 is in contact with the second end 30 of the channel 26.

The two side walls 38, 40 are adapted for attaching the base 14 to a portion of the air conditioning unit where condensation takes place. The two side walls 38, 40 can be attached to the supporting brackets of the air conditioning unit. Typically in apartment buildings, the condensing units of air conditioners are installed on the outside of each housing unit. Each of the two side walls 38, 40 has two holes 42 near the edge that is opposite the end of the side walls 38, 40 that extends from the base 14. The two side walls 38, 40 are connected to the portion of the air conditioning unit by connecting means (not shown) such as brackets, hinges, bolts and nuts, locking studs or wires via the holes 42 in each of the two side walls 38, 40. The connecting means provides a strong connection between the side walls 38, 40 and the portion of the air conditioning unit. When the two side walls 38, 40 are attached to the portion of the air conditioning unit, the base 14 is at an incline to the portion of the air conditioning unit with the return end portion 20 being the lower end of the incline.

Prior to using the tray 10, the tray 10 has to first be installed to the portion of the air conditioning unit disposed outside the building. Typically, this portion is where the condensing unit of the air conditioning unit is being placed. The method for installing the tray 10 comprises attaching the base 14 to the portion of the air conditioning unit via the attachment means in the form of the two side walls 38, 40, such that the base 14 is at an incline to the portion of the air conditioning unit with the return end portion 20 being the lower end of the incline.

After the tray 10 has been installed, the tray 10 is ready for use. In use, liquids generated by the air conditioning unit, such as the condensate water 12, drips from the air conditioning unit onto the tray 10. As the base 14 is at an incline to the portion of the air conditioning unit, the condensate water 12 received by the base 14 of the tray 10 naturally flows from the closed end 16 to the open end 18 down the incline of the base 14 due to gravity. The condensate water 12 then flows over the surface texture 25 of the first portion 22 to the second portion 24 of the return end portion 20, and is collected in the channel 26 of the second portion 24. The condensate water 12 is able to flow over the surfaces of the first portion 22 and the second portion 24 in the manner described above due to the surface tension of the condensate water 12. Furthermore, the surface texture 25 of the first portion 22 facilitates the flow as described above. The collected condensate water 12 in the channel 26 will be further removed via the outlet 32 into the drainage system 36 that is inside the building. In this way, the condensate water 12 is prevented from dripping to the lower housing units of the building. The direction of the flow of the condensate water 12 from the closed end 16 to the drainage system 36 is depicted in FIGS. 1, 2A and 2B by the arrows without an accompanying reference numeral.

Furthermore, when there is debris collected on the tray, the open end 18 and the incline of the base 14 facilitate the removal of debris on the tray 10. When there is wind, the debris can easily be blown off by the wind and leaves the tray 10 at the open end 18. When there is rain, the debris can be washed down the incline and off the tray 10 at the open end 18. Thus, the tray 10 is not choked by debris and

no stagnant water is accumulated, which reduces the risk of mosquitoes breeding in the tray 10.

In accordance with a second embodiment of the invention, there is described a collecting device with all the features of the first embodiment. The only difference between the collecting device of the first embodiment and the collecting device of the second embodiment is that the collecting device of the second embodiment comprises an additional feature to decrease the velocity of the condensate water 12 flowing from the first portion 22 to the second portion 24, as shown in FIGS. 5, 6A, 6B, 7 and 8. In the drawings and description hereinafter, like elements are numbered with like reference numerals. Furthermore, all arrows without an accompanying reference numeral in FIGS. 5, 6A, 6B, 7 and 8 illustrate the flow of the condensate water 12.

Specifically, the first portion 22 comprises three protrusions in the form of humps 44 which are elliptical as shown in FIG. 5. The humps 44 are positioned on the part of the surface of the first portion 22 that is substantially linear. The humps 44 are arranged along the width of the tray 10 at the open end 18 with each of the humps 44 being spaced apart from each other. The humps 44 decrease the velocity of the condensate water 12 by disrupting the flow of the condensate water 12. When the condensate water 12 comes into contact with the humps 44, the condensate water 12 is forced to flow around the humps 44 and through the spaces between the humps 44, as shown in FIGS. 5, 6A, 6B, 7 and 8. As such, the flow of the condensate water 12 is disrupted and the velocity of the flow is

decreased thus facilitating the flow of the condensate water 12 from the first portion 22 to the second portion 24.

The surface texture 25 forms part of the surface of the first portion 22 as shown in FIG. 6B. Alternatively, the surface texture 25 can form the entire surface of the first portion 22. In other words, the surface texture 25 can form the surface area of the spaces between the humps 44.

The humps 44 can be made of the same material that is used for the base 14 of the tray 10. The humps 44 can also be made from a different material provided that the material used has a lower surface roughness or a lower surface coefficient of friction value as compared to that of the surface texture 25 of the first portion 22. The relatively smooth surface of the humps 44 facilitates removal of any debris trapped on the tray 10, for example, during heavy downpours.

The installation of the tray 10 of the second embodiment is as described above for the first embodiment. After the tray 10 has been installed, the tray is ready for use. In use, liquids generated by the air conditioning unit, such as the condensate water 12, drips from the air conditioning unit onto the tray 10. As the base 14 is at an incline to the portion of the air conditioning unit, the condensate water 12 received by the base 14 of the tray 10 naturally flows from the closed end 16 to the open end 18 down the incline of the base 14 due to gravity. When the condensate water 12 comes into contact with the humps 44, the condensate water 12 is forced to flow around the humps 44 and through the spaces between the humps 44. The condensate water 12 then flows over the surface texture 25 of the first portion 22

to the second portion 24 of the return end portion 20, and is collected in the channel 26 of the second portion 24. The condensate water 12 is able to flow over the surfaces of the first portion 22 and the second portion 24 in the manner described above due to the surface tension of the condensate water 12. Furthermore, the humps 44 and the surface texture 25 of the first portion 22 facilitate the flow as described above. The collected condensate water 12 in the channel 26 will be further removed via the outlet 32 into the drainage system 36 that is inside the building. In this way, the condensate water 12 is prevented from dripping to the lower housing units of the building. The direction of the flow of the condensate water 12 from the closed end 16 to the drainage system 36 is depicted in FIGS. 5, 6A, 6B, 7 and 8 by the arrows without an accompanying reference numeral.

Various modifications will be apparent to those skilled in the art. For example, the attachment means can be in the form of only one side wall (not shown) which extends from the base 14. The length of the one side wall or the two side walls 38, 40 do not need to run from the closed end 16 of the base 14 to beyond the open end 18 of the base 14, as long as the one side wall or the two side walls 38, 40 can securely attach the base 14 to the portion of the air conditioning unit that is disposed outside the building. The one side wall or the two side walls 38, 40 can be integral with the base 14 or discrete parts that are connectable to the base 14 via connecting means such as brackets, hinges, bolts and nuts, locking studs or wires.

Instead of the tray 10 being positioned at an incline to the two side walls 38, 40 prior to installation of the tray 10, the base 14 can be positioned substantially perpendicular to the two side walls 38, 40, as long as when the two side walls 38, 40 are attached to the portion of the air conditioning unit, the base 14 is installed at an incline to the portion of the air conditioning unit with the return end portion 20 being the lower end of the incline. Furthermore, the height of the two side walls 38, 40 can be the same across the entire length instead of gradually increasing across the length from the closed end 16 to beyond the open end 18.

It would be appreciated that in an embodiment where the attachment means is in the form of the one side wall described above, the base 14 can similarly be positioned substantially perpendicular to the one side wall instead of at an incline thereto, and the height can remain the same across its length. Furthermore, the two side walls 38, 40 or the one side wall can comprise one hole instead of two holes 42.

Instead of having the attachment means to be in the form of the one side wall or the two side walls 38, 40 as described above, the attachment means can be positioned elsewhere such as at the closed end 16 of the base 14.

The profile of the first and second portions 22, 24 can be substantially a Z-shaped profile (not shown) or any other profile similar to a Z-shaped or an S-shaped profile instead of the S-shaped profile as described above.

The drainage system 36 can be an external water collection system such as a common pipe that is disposed outside the building instead of the toilet of a housing unit that is inside the building. The collected condensate water 12 can be recycled for other uses such as for irrigating plants or a garden.

The three protrusions in the form of the humps 44 of the second embodiment can be in any other form so long as each of the protrusions is a raised surface relative to the surface of the first portion 22. Each of the humps 44 can also be of another shape such as a circle, a square, a rectangle, a triangle or a polygon. Furthermore, the first portion 22 can also comprise either one or two protrusions, or more than three protrusions in total, instead of comprising exactly three protrusions as described in the second embodiment.

Alternatively, instead of the first portion 22 comprising the humps 44, padding in the form of a sponge or other materials of the like can be used to replace the humps 44 to decrease the velocity of the condensate water 12 flowing from the first portion 22 to the second portion 24.

Although the foregoing invention has been described in some detail by way of illustration and example, and with regard to one or more embodiments, for the purposes of clarity of understanding, it is readily apparent to those of ordinary skill in the art in light of the teachings of this invention that certain changes, variations and modifications may be made thereto without departing from the spirit or scope of the invention as described in the appended claims.

It would be further appreciated that although the invention covers individual embodiments, it also includes combinations of the embodiments discussed. For example, the features described in one embodiment is not being mutually exclusive to a feature described in another embodiment, and may be combined to form yet further embodiments of the invention.

CLAIMS

1. A collecting device, comprising:

a base having a return end portion for collecting and removing a liquid generated by an air conditioning unit; and

attachment means connected to the base, the attachment means for attaching the base to a portion of the air conditioning unit,

whereby when attached thereto, the base is at an incline to the air conditioning unit with the return end portion being the lower end of the incline.

2. A collecting device according to claim 1, wherein the return end portion comprises a first portion and a second portion connected to the first portion.

3. A collecting device according to claim 2, wherein the first portion comprises at least a surface texture arranged to decrease the velocity of the liquid flowing over the surface texture.

4. A collecting device according to claim 3, wherein the second portion defines a channel for collecting and removing the liquid.

5. A collecting device according to claim 4, wherein one end of the channel is adapted to be connectable to an outlet to further remove the liquid from the channel.

6. A collecting device according to claim 5, wherein a profile of the first and second portions shows at least a part of the first portion extending beyond the periphery of the channel.

7. A collecting device according to claim 6, wherein the profile of the first and second portions is substantially an S-shaped profile.

8. A collecting device according to claim 6, wherein the profile of the first and second portions is substantially a Z-shaped profile.

9. A collecting device according to any of claims 2 to 8, wherein the first portion comprises at least one protrusion arranged to decrease the velocity of the liquid flowing from the first portion to the second portion.

10. A collecting device according to any preceding claim, wherein the attachment means comprises at least one side wall which extends from the base.

11. A collecting device according to claim 10, wherein the base is positioned at an incline to the at least one side wall with the return end portion being the lower end of the incline.

12. A collecting device according to any preceding claim, wherein the collecting device is a tray for the air conditioning unit.

13. A method for installing a collecting device according to any preceding claim to an air conditioning unit, comprising:

attaching the base to the portion of the air conditioning unit via the attachment means such that the base is at an incline to the air conditioning unit with the return end portion being the lower end of the incline.

14. An air conditioning system, comprising:

an air conditioning unit; and

a collecting device having a base and attachment means connected to the base, the base having a return end potion for collecting and removing a liquid generated by the air conditioning unit, the attachment means for attaching the base to a portion of the air conditioning unit,

whereby when attached thereto, the base is at an incline to the air conditioning unit with the return end portion being the lower end of the incline.

15. An air conditioning system according to claim 14, wherein the collecting device is in accordance with any of claims 2 to 12.