

WATER FILTRATION APPARATUS

FIELD OF INVENTION

The present invention relates broadly to a water filtration apparatus, a kit of parts for assembling a water filtration apparatus, and a method of assembling a water filtration apparatus.

BACKGROUND

In rural areas or areas struck by disasters or in the wilderness etc., clean water may be scarce. Typically, in these areas, electricity is also not readily available. Thus, conventional portable water treatment facilities available for use in these areas usually come containerized with built-in electric power generation devices. However, these containerized portable water treatment facilities are bulky and may not be able to reach certain remote areas. Further, these portable water treatment facilities are dependent on the availability of fuel for operation, and may be expensive to purchase and maintain.

Available in the market is another type of water treatment systems, which are small and compact. These water treatment systems are suitable for use during hiking, travelling and camping in remote areas. Although these small compact water treatment systems may be able to reach the most remote areas and are independent of electrical power, they can only provide small amount of clean water typically sufficient for personal usage. Moreover, the pressure generated by these compact system is typically not sufficient to filter very fine particles.

Therefore, there exists a need to address at least some of the issues above.

SUMMARY

According to a first aspect of the present invention, there is provided a water treatment apparatus comprising a foldable freestanding frame comprising two frame members hingedly joined to each other; at least one filter cartridge mounted to the freestanding frame; a pump mounted to the freestanding frame and adapted to move water through the at least one filter cartridge at a predetermined pressure for filtering said water; engagement means connected to the pump and adapted to contact with a driving wheel of a bicycle for driving the pump; and adjustment means comprising a plate hingedly mounted to

one of the frame members, the adjustment means adapted to adjust the engagement means for accommodating different sizes of the driving wheel. The freestanding frame is adapted to suspend the driving wheel of the bicycle, said bicycle being removable from the freestanding frame, and the pump is further adapted to be driven by said suspended driving wheel to move water through the at least one filter cartridge at the predetermined pressure.

According to a second aspect of the present invention, there is provided a kit of parts for assembling a water treatment apparatus. The kit comprises a foldable freestanding frame comprising two frame members hingedly joined to each other; at least one filter cartridge mountable on the freestanding frame; a pump mountable on the freestanding frame and adapted to move water through the at least one filter cartridge at a predetermined pressure for filtering said water; engagement means connectable to the pump and adapted to contact with a driving wheel of a bicycle for driving the pump; and adjustment means comprising a plate hingedly mountable to one of the frame members, the adjustment means adapted to adjust the engagement means for accommodating different sizes of the driving wheel. In the water treatment apparatus assembled from the kit, the freestanding frame is adapted to suspend the driving wheel of the bicycle, said bicycle being removable from the freestanding frame, and the pump is further adapted to be driven by said suspended driving wheel to move water through the at least one filter cartridge at the predetermined pressure.

According to a third aspect of the present invention, there is provided a method of assembling a water treatment apparatus. The method comprises the steps of providing a freestanding frame comprising two frame members hingedly joined to each other; mounting at least one filter cartridge to the freestanding frame; mounting a pump to the freestanding frame, the pump adapted to move water through the at least one filter cartridge at a predetermined pressure for filtering said water; connecting engagement means to the pump, the engagement means adapted to contact with a driving wheel of a bicycle for driving the pump; and hingedly mounting adjustment means comprising a plate to one of the frame members, the adjustment means adapted to adjust the engagement means for accommodating different sizes of the driving wheel. The freestanding frame is adapted to suspend the driving wheel of the bicycle, said bicycle being removable from the freestanding frame. The pump is further adapted to be driven by the driving wheel of the bicycle to move water through the at least one filter cartridge at the predetermined pressure.

BRIEF DESCRIPTION OF THE DRAWINGS

Embodiments of the invention will be better understood and readily apparent to one of ordinary skill in the art from the following written description, by way of example only, and in conjunction with the drawings, in which:

FIG. 1 illustrates a water filtration apparatus according to an example embodiment.

FIG. 2 illustrates a bicycle mounted to the water filtration apparatus of FIG. 1 according to an example embodiment.

FIG. 3 illustrates the bicycle mounted to the water filtration apparatus of FIG. 1 with the engagement means disengaged according to an example embodiment.

FIG. 4 shows a cross-section of a filter cartridge of the water filtration apparatus of FIG.1 according to an example embodiment.

FIG. 5 shows a cross-section of a filter cartridge of the water filtration apparatus of FIG.1 according to another example embodiment.

FIG. 6 is a schematic diagram illustrating how the water filtration apparatus 100 operates.

FIG. 7 shows a flowchart 700 illustrating a method of assembling a water filtration apparatus according to an example embodiment.

DETAILED DESCRIPTION

In an embodiment, a water filtration apparatus includes a freestanding frame. The water filtration apparatus further comprises at least one filter cartridge and a pump mounted to the freestanding frame. Tubing may be attached to the at least one filter cartridge such

that the tubing may connect the at least one filter cartridge to a water source. The tubing may further be fitted to the pump such that the pump is adapted to move water along the tubing and through the filter cartridge at a predetermined pressure for filtering water.

To prepare the water filtration apparatus for filtering water, a bicycle may be mounted to the freestanding frame of the water filtration apparatus such that a driving wheel of the bicycle may be suspended by the freestanding frame. A free end of the tubing may be inserted into the water source. The free end may include a mesh attached thereto, for preventing debris from entering the tubing.

To operate the water filtration apparatus for filtering water, a person may pedal the bicycle mounted to the freestanding frame to rotate the suspended driving wheel of the bicycle. The pump, which is adapted to be driven by the driving wheel of the bicycle suspended on the freestanding frame, may in turn draw water from the water source, move the water along the tubing and move water through the filter cartridge at a predetermined pressure. Accordingly, the water filtration apparatus may be used to filter water from any water source and output substantially clean filtered water.

FIG. 1 illustrates a water filtration apparatus 100 according to an example embodiment. As shown in FIG.1, the water filtration apparatus 100 includes a freestanding frame 102. The freestanding frame 102 is shown to include two substantially U-shaped frame members 104, 106. An end portion of each leg 108a, 108b of one U-shaped frame member 104 is joined to a respective end portion of a corresponding leg 110a, 110b of the other U-shaped frame member 106 such that each leg 108a, 108b of one U-shaped member 104 forms an inverted-V shape with the corresponding leg 110a, 110b of the other U-shaped frame member 106. It is understood that the arrangement and configuration of the freestanding frame 102 may vary. The number, shape and configuration of the frame members of the freestanding frame 102 may also vary. FIG. 1 is provided by way of an example only.

The water filtration apparatus 100 further includes filter cartridges 130a, 130b mounted to respective legs 108a, 108b of one U-shaped frame member 104, and a pump 120 mounted to the horizontal link 112 of the U-shaped frame member 104. Tubing (not shown) is fitted to the pump 120 and connected to each of the filter cartridges 130a, 130b such that operating the pump 120 may move water through the filter cartridges 130a, 130b at a predetermined pressure for filtering the water. The arrangement and configuration of the filter cartridges 130a, 130b and pump 120 may vary. FIG. 1 is provided by way of an example only.

FIG. 2 illustrates a bicycle 200 mounted to the water filtration apparatus 100 according to an example embodiment. It is understood that the water filtration apparatus 100 is a separate standalone apparatus suitable for attaching to the bicycle 200. In an

embodiment, the bicycle 200 is not permanently fixed to the freestanding frame 102 of the water filtration apparatus 100, but is removable from the free standing frame 102 of the water filtration apparatus 100. In other words, the water filtration apparatus 100 is not integrally formed with the bicycle 200, or dependent on the type and configuration of the bicycle 200. Instead, the freestanding frame 102 allows the bicycle 200 to be easily mounted to and dismounted from the water filtration apparatus 100.

Advantageously, the water filtration apparatus 100, being a standalone freestanding apparatus and separate from the bicycle 200, allows ease of transportation of the water filtration apparatus 100. It does not require being transported together with the bicycle because it is not permanently fixed or integrally formed with the bicycle 200. It is compact and may be easily carried by a person. Thus, the water filtration apparatus 100 may be transported to any areas, including the remote areas, which are reachable by any person. In an embodiment, a carrier may be provided to house the water filtration apparatus 100. The carrier may be in the form of a backpack or suitcase etc.

In FIG. 2 the bicycle 200 is shown to be mounted to the water filtration apparatus 100. It is understood that the bicycle 200 may be of any type of bicycle or of any size. The bicycle 200 may also be changed to other devices with a rotary component capable of being driven, such as an unicycle, electric bicycle, or handwheel etc. FIG. 2 is provided by way of an example only.

To allow the bicycle 200 to be easily mounted to and dismounted from the water filtration apparatus 100, the freestanding frame 102 of the water filtration apparatus 100 may further include attachment means 114 which allow easy attaching and detaching of the bicycle 200. As shown in FIG. 2, the attachment means include a socket 114 for receiving an axle 202 of a driving wheel 204 of the bicycle 200. The socket 114 may include screw thread for screwing onto the axle 202 of the driving wheel 204 of the bicycle 200. It is understood that the freestanding frame 102 is configured to suspend the driving wheel 206 of the bicycle 200 such that a person pedaling on the bicycle 200 to rotate the driving wheel 206 of the bicycle 200 does not move the bicycle 200 forward. Therefore, the configurations and types of attachment means 114 on the freestanding frame 102 may vary as long as it allows the freestanding frame 102 to suspend the driving wheel 204 of the bicycle 200 and further allows ease of attaching and detaching the bicycle 200. FIG. 1 and 2 are provided by way of an example only.

When the bicycle 200 is mounted to the water filtration apparatus 100, the pump 120 may be driven by the driving wheel 204 of the bicycle 200 suspended on the freestanding frame 102 via an engagement means 122, which translate the rotating motion of the rotating driving wheel 204 into a driving force to drive the pump 120. In an embodiment, the engagement means 122 may be connected to the pump 120 and may be arranged to be in

contact with the driving wheel 204 of the bicycle 200 such that rotating of the driving wheel 204 causes the engagement means 122 to drive the pump 120 for moving water through the tubing and the filter cartridges 130a, 103b.

As shown in FIG. 1, the engagement means 122 which is connected to the pump 120 is in the form of a roller 122. The roller 122 may be coupled to an axle of the pump 120. In FIG. 2, the exterior surface of the roller 122 is shown to be in contact with the exterior surface of the driving wheel 204. Thus, when the driving wheel 204 rotates, the rotating driving wheel 204 rotates the roller 122 via frictional contact. Since the roller 122 is coupled to the axle of the pump 120, the rotating roller 122 rotates the axle of the pump 120 and drives the pump for moving water through the tubing and the filter cartridges 130a, 130b. It is understood that the engagement means 122 may be in other forms as long as they are capable of translating the rotating motion of the driving wheel 204 into a driving force for the pump 120. FIG. 1 and 2 are provided by way of an example only.

FIG. 3 illustrates the bicycle 200 mounted to the water filtration apparatus 100 with the engagement means 122 disengaged according to an example embodiment. As shown in FIG. 1, the pump 120 may be mounted to adjustment means 124, which in turn is mounted to the horizontal link 112 of the U-shaped frame member 104. The adjustment means 124 allows the engagement means 122 to be adjusted such that the engagement means 122 may be brought into contact and engage with the driving wheel 204 of the bicycle 200, or moves the engagement means away from the driving wheel 204 of the bicycle 200 to disengage the engagement means 122 from the driving wheel 204 of the bicycle 200.

In FIG. 1, the adjustment means 124 is shown to be in the form of a plate 124 hingedly connected to the horizontal link 112 of the U-shaped frame member 104. The plate 124 may pivot about the hinged joint such that the pump 120 and the engagement means 122 may be adjusted to engage with or disengage from the driving wheel 204 of the bicycle 200.

Advantageously, the adjustment means 124 allows the pump 120 and engagement means 122 to be lowered in the disengaged position during mounting and dismounting of the bicycle 200 for facilitating attachment and detachment of the bicycle 200 to/from the freestanding frame 102 of the water filtration apparatus 100. Further, the adjustment means also allows adjusting the engagement means for accommodating different sizes of the driving wheel for different bicycle.

In an embodiment, the frame members of the freestanding frame 102 may be operable between an "operation mode" and an "idle mode". In the "operation mode", the frame members of the freestanding frame 102 may be set up such that it may stand substantially stable on the ground and capable of receiving the bicycle 200. In the "idle mode", the frame members of the freestanding frame 102 may be retracted and/or collapsed

such that the freestanding frame 102 becomes compact and easy for transportation or storage. The collapsed freestanding frame 102 may then be stowed in a carrier for ease of carriage by a person. The carrier may be in the form of a backpack or suitcase etc.

In FIG. 1, 2 and 3, the two U-shaped frame members 104, 106 are shown to be hingedly joined. In the "operation mode", the two U-shaped frame members 104, 106 are spread out such that each leg 108a, 108b of one U-shaped member 104 forms an inverted-V shape with the corresponding leg 110a, 110b of the other U-shaped frame member 106. In the "idle mode", the two U-shaped frame members 104, 106 are brought together such that each leg 108a, 108b of one U-shaped frame member 104 is adjacent the corresponding leg 110a, 110b of the other U-shaped frame member 106.

It is understood that the frame members of the freestanding frame 102 may be configured or joined in any manner which allows the freestanding frame 102 to be operable between an "operation mode" and an "idle mode". For example, in another embodiment, the two U-shaped frame members 104, 106 may be permanently joined such that each leg 108a, 108b of one U-shaped frame member 104 permanently forms an inverted-V shape with the corresponding leg 110a, 110b of the other U-shaped frame member 106. However, each leg 108a, 108b, 110a, 110b of each of the U-shaped frame member 104, 106, may be extensible such that it can be lengthen into the "operation mode" and shorten into the "idle mode". Thus, FIG. 1, 2 and 3 are provided by way of an example only.

FIG. 4 shows a cross-section of the filter cartridge 130a, 130b according to an example embodiment. The filter cartridge 130a, 130b each includes an inlet 402, an outlet 404, and at least one removable filter set 406 forming a filter medium between the inlet 402 and the outlet 404. Water flowing through the filter cartridge 130a, 130b from the inlet 402 to the outlet 404 is required to pass through the at least one removable filter set 406, which filters the water. Depending on the type of filters, the water may be required to flow at a predetermined pressure so that the water can pass through the at least one removable filter set while particles or substances are being sieved out during the filtering process. Substantially clean drinking water may then be obtained from the outlet 404.

FIG. 5 shows a cross-section of a filter cartridge 500 according to another example embodiment. The filter cartridge 500 includes an inlet 502, and an outlet 504. The filter cartridge 500 further comprises two chambers, a first chamber 506 and a second chamber 508, disposed between the inlet 502 and outlet 504. The first chamber 506 includes a first filter set 510 for removing suspended solids and solutes from the water via a separation process. For example, the first filter set 510 may include but is not limited to stone/rock/gravel/sand/soil based filters, bag filters, cartridge filters, metal filters, mesh filters, resin filters, or membrane filters. The second chamber 508 is in fluid communication with the first chamber 506 and includes a second filter set 512 for removing contaminants

and impurities from the water via an adsorption process, such as by using activated carbon filter. Advantageously, the second chamber 508 with the additional activated carbon filter may eliminate the taste and odor in the drinking water obtained.

In this embodiment, water enters the filter cartridge 500 via the inlet 502 into the first chamber 506. Inside the first chamber 506, the water passes through the first filter set 510 and subsequently enters the second chamber 508. Inside the second chamber 508, water passes through the second filter set 512 before exiting via the outlet 504. Substantially clean drinking water may then be obtained from the outlet 504.

The flow of water through the filter cartridge 130a, 130b, 500 is achieved via the pump 120. Examples of pump 120 are vane pump, peristaltic pump, centrifugal pump, piston pump, gear pump, lobe pump or impeller pump. Depending on the type of pump used, the connections between the pump 120 and filter cartridge 130a, 130b, 500 may vary.

For example, in an embodiment, the pump 120 may be a peristaltic pump. In this embodiment, an end portion of a tubing is connected to the inlet of the filter cartridge 130a, 130b, 500 and the other end of the tubing is inserted into a water source, while a middle portion of the tubing is fitted inside the peristaltic pump. The peristaltic pump will compress part of the middle portion of the tubing and push the water to move through the tubing. Advantageously, the water is maintained within the tubing and does not contact any part of the peristaltic pump, thus reducing contamination and potential choking of the pump.

In another embodiment, the pump 120 may be a centrifugal pump. In this embodiment, a first tubing connects the water source to the inlet of the centrifugal pump, and a second tubing connects the outlet of the centrifugal pump to the inlet of the filter cartridge 130a, 130b, 500. In this embodiment, water is drawn into the centrifugal pump, accelerated by the rotating blades, and exit at the outlet of the centrifugal pump.

It is understood that the configuration and arrangement of tubing may vary depending on the type of pump used.

FIG. 6 is a schematic diagram illustrating how the water filtration apparatus 100 operates. As illustrated, a water source 602 is in fluid communication with the filter cartridge 130a, 130b, 500 via the pump 120. In use, the driving wheel 204 of the bicycle 200 is rotated to drive the pump 120 via the engagement means 122. The pump 120 will then pump water from the water source 602 through the filter cartridge 130a, 130b, 500. As the water moves through the filter cartridge 130a, 130b, 500, the water is being filtered to become clean water. Substantially clean water 604 is then collected from the outlet of the filter cartridge 130a, 130b, 500.

The volume of water filter by the water filtration apparatus 100 as described in the example embodiment may depend on factors such as the speed of the driving wheel 204 of the bicycle 200 and the types of pump 120 and filter 406, 510, 512 used. For example, very

fine filters may require a high supply water pressure, which, in turn, requires a high speed of rotation by the driving wheel 204 and pump 120. Fine filters may also have relatively lower filter rate. The types of filter and pump 120 may be configured depending on the quantity and quality of water to be filtered.

5 Advantageously, the water filtration apparatus 100 is able to filter water without using electricity. It may be easily transported by a person to any area and be fitted to any bicycle found in the area. Furthermore, the amount of water filters by the water filtration apparatus 100 is much more than a typical small compact water treatment system currently available in the market. The actual amount of water filters by water filtration apparatus 100 depends on
10 the type of pump 120 and the type of filters used in the filter cartridge 130a, 130b, 500. For example, in an embodiment using ultra filtration membrane and peristaltic pump, water could be filtered at a rate of approximately 1.5 litres per minute.

In an embodiment, the water filtration apparatus 100 may be provided in the form of a kit. The kit may include a freestanding frame 102, at least one filter cartridge 130a, 130b,
15 500, and a pump 120 as substantially described herein. The kit may further include an engagement means 122 and/or an adjustment means 124 as substantially described herein. The kit may further include testing device in the form of e.g. a water quality test kit. The water quality test kit may be used for testing the quality of the water produce by the water filtration apparatus 100 as a means to determine whether the at least one removable filter
20 set 406 requires to be changed. The kit may also include instructions to assemble and operate the water filtration apparatus, e.g. in the form of diagrams, schematics, etc.

FIG. 7 shows a flowchart 700 illustrating a method of assembling a water filtration apparatus according to an example embodiment. At step 702, a freestanding frame is provided. At step 704, at least one filter cartridge is mounted to the freestanding frame. At
25 step 706, a pump adapted to move water through the filter cartridge at a predetermined pressure for filtering the water is mounted to the freestanding frame. The freestanding frame may be adapted to suspend a driving wheel of a bicycle, the bicycle may be removable from the freestanding frame. The pump may be further configured to be driven by the driving wheel of the bicycle.

30 The method may further comprise the step of connecting engagement means to the pump, the engagement means configured to contact with the driving wheel of the bicycle for driving the pump. The step of connecting engagement means to the pump may comprise coupling a roller to an axle of the pump. The step of providing a freestanding frame may comprise providing at least two frame members hingedly joined to each other.

35 Thus, it can be seen that a water filtration apparatus capable of being easily transported by a person to remote areas, and can filter large amount of water without using electricity has been provided in the various embodiments described.

It will be appreciated by a person skilled in the art that numerous variations and/or modifications may be made to the present invention as shown in the specific embodiments without departing from the spirit or scope of the invention as broadly described. The present embodiments are, therefore, to be considered in all respects to be illustrative and not restrictive.

CLAIMS

1. A water treatment apparatus comprising:
 - a foldable freestanding frame comprising two frame members hingedly joined to each other;
 - at least one filter cartridge mounted to the freestanding frame;
 - a pump mounted to the freestanding frame and adapted to move water through the at least one filter cartridge at a predetermined pressure for filtering said water;
 - engagement means connected to the pump and adapted to contact with a driving wheel of a bicycle for driving the pump; and
 - adjustment means comprising a plate hingedly mounted to one of the frame members, the adjustment means adapted to adjust the engagement means for accommodating different sizes of the driving wheel,wherein the freestanding frame is adapted to suspend the driving wheel of the bicycle, said bicycle being removable from the freestanding frame, and the pump is further adapted to be driven by said suspended driving wheel to move water through the at least one filter cartridge at the predetermined pressure.
2. The water treatment apparatus as claimed in claim 1, wherein the engagement means comprises a roller coupled to an axle of the pump.
3. The water treatment apparatus as claimed in any of the preceding claims, wherein the at least two frame members are hingedly joined to each other such that the frame members are operable between a first state in which the frame members form an inverted V-shape and a second state in which the frame members are folded adjacent each other.
4. The water treatment apparatus as claimed in any of the preceding claims wherein each of the at least one filter cartridge comprises:
 - an inlet;
 - an outlet; and
 - at least one removable filter set adapted to filter water flowing from the inlet of the cartridge to the outlet of the cartridge.

5. The water treatment apparatus as claimed in claim 4, wherein the filter cartridge comprises at least two chambers disposed between the inlet and the outlet, a first chamber having a first filter set adapted to remove suspended solids and solutes from the water via a separation process, and a second chamber having a second filter set adapted to remove contaminants and impurities from the water via an adsorption process.
6. The water treatment apparatus as claimed in claim 5, wherein the first filter set is selected from a group consisting of stone/rock/gravel/sand/soil based filters, bag filters, cartridge filters, metal filters, mesh filters, resin filters and membrane filters.
7. The water treatment apparatus as claimed in claim 5 or 6, wherein the second filter set comprises activated carbon filters.
8. The water treatment apparatus as claimed in any of the preceding claims, wherein the pump is selected from a group consisting of vane pump, peristaltic pump, centrifugal pump, piston pump, gear pump, lobe pump and impeller pump.
9. The water treatment apparatus as claimed in any of the preceding claims, wherein the apparatus is configured to fit a backpack or suitcase.
10. A kit of parts for assembling a water treatment apparatus, the kit comprising:
 - a foldable freestanding frame comprising two frame members hingedly joined to each other;
 - at least one filter cartridge mountable on the freestanding frame;
 - a pump mountable on the freestanding frame and adapted to move water through the at least one filter cartridge at a predetermined pressure for filtering said water;
 - engagement means connectable to the pump and adapted to contact with a driving wheel of a bicycle for driving the pump; and
 - adjustment means comprising a plate hingedly mountable to one of the frame members, the adjustment means adapted to adjust the engagement means for accommodating different sizes of the driving wheel,wherein, in the water treatment apparatus assembled from the kit, the freestanding frame is adapted to suspend the driving wheel of the bicycle, said bicycle being removable from

the freestanding frame, and the pump is further adapted to be driven by said suspended driving wheel to move water through the at least one filter cartridge at the predetermined pressure.

11. The kit as claimed in claim 10, wherein the engagement means comprises a roller adapted to be coupled to an axle of the pump.

12. The kit as claimed in claim 10 or 11, wherein each of the at least one filter cartridge comprises at least one removable filter set adapted to be disposed in the filter cartridge.

13. The kit as claimed in any of claims 10 to 12, further comprising a water quality test kit.

14. The kit as claimed in any one of claims 10 to 13, wherein the kit is configured to fit a backpack or suitcase.

15. A method of assembling a water treatment apparatus, the method comprising the steps of:

providing a freestanding frame comprising two frame members hingedly joined to each other;

mounting at least one filter cartridge to the freestanding frame;

mounting a pump to the freestanding frame, the pump adapted to move water through the at least one filter cartridge at a predetermined pressure for filtering said water;

connecting engagement means to the pump, the engagement means adapted to contact with a driving wheel of a bicycle for driving the pump; and

hingedly mounting adjustment means comprising a plate to one of the frame members, the adjustment means adapted to adjust the engagement means for accommodating different sizes of the driving wheel,

wherein the freestanding frame is adapted to suspend the driving wheel of the bicycle, said bicycle being removable from the freestanding frame,

wherein the pump is further adapted to be driven by the driving wheel of the bicycle to move water through the at least one filter cartridge at the predetermined pressure.

16. The method as claimed in claim 15, further comprising the steps of:

mounting the driving wheel of the bicycle to the freestanding frame such that the driving wheel is suspended by the freestanding frame; and

using the adjustment means, adjusting a position of the engagement means such that the engagement means contacts with the driving wheel.

17. The method as claimed in claim 16, wherein adjusting the position of the engagement means comprises pivoting the plate of the adjustment means about a joint with the one of the frame members.

18. The method as claimed in any one of claims 15 to 17, wherein the step of connecting the engagement means to the pump comprises coupling a roller to an axle of the pump.

19. The method as claimed in any one of claims 15 to 18, wherein each of the at least one filter cartridge comprises at least one removable filter set.