

MOBILE DISHWASHERS

[0001] The present application relates to mobile dishwashers. The application also relates one or more methods for making, assembling, disassembling, installing, configuring, maintaining, repairing and using the mobile dishwashers.

[0002] A mobile dishwasher machine which is a mechanical device for cleaning crockery, utensils and cutlery. Unlike a manual dishwasher, which relies largely on physical scrubbing to remove soiling, the mobile dishwasher machine cleans by spraying hot water, typically between 45 and 75°C, at the crockery, utensils and cutlery. A mix of water and dishwasher detergent is pumped to one or more spray arms, which blast the crockery, utensils and cutlery with the cleaning mixture. Once the wash is finished, the water is drained. After the rinse cycle finishes and the water is drained, and the crockery, utensils and cutlery are dried using one of several drying methods. Typically, a rinse-aid, a chemical to reduce surface tension of the water, is used to reduce water spots from hard water or other reasons. Industrial dishwasher machines are available for use in commercial establishments such as hotels and restaurants, where a large number of dishes must be cleaned. Washing is conducted with temperatures of 65–71 C and sanitation is achieved by either the use of a booster heater that will provide an 82°C "final rinse" temperature or through the use of a chemical sanitizer.

[0003] Usually at a hawker centre or a food court, a diner who finishes his food will leave his soiled crockery and cutlery on the table and depart from a dining table. The leftover food on the crockery attracts pests and birds which dirty the environment when the crockery is not cleared in time. The soiled crockery is usually cleared by a cleaner or a human operator who collects the soiled crockery in a trolley and sent it to a washing department. The washing department has a specialised dishwasher machine which is man handled by a steward. The specialised dishwasher machine is usually bulky and takes up much space.

[0004] The present dishwasher machines address the above issues by having a mobile dishwasher machine that can be operated by the human operator with ease.

[0005] The present application aims to provide one or more new and useful mobile dishwashers. The present application further aims to provide one or more new and useful

methods for making, assembling, disassembling, installing, configuring, maintaining, repairing and using the one or more mobile dishwashers. Essential features of the relevant inventions are provided by one or more independent claims, whilst advantageous features are presented by their dependent claims respectively.

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[0006] The accompanying figures (Figs.) illustrate embodiments and serve to explain principles of the disclosed embodiments. It is to be understood, however, that these figures are presented for purposes of illustration only, and not for defining limits of relevant applications.

- 10 Fig. 1 illustrates a schematic of a dishwasher machine having a front face being loaded with a mobile trolley;
- Fig. 2 illustrates a sequence of events in which the human operator clears the table and load the soiled crockery in the dishwasher machine;
- Fig. 3 illustrates the mobile trolley with crockery going under a pre-washing cycle;
- 15 Fig. 4 illustrates the mobile trolley with crockery going under a washing cycle;
- Fig. 5 illustrates the mobile trolley with crockery going under a rinsing cycle;
- Fig. 6 illustrates three spray arms with nozzles;
- Fig. 7 illustrates an alternative spray arm system;
- Fig. 8 illustrates a cantilevered mobile trolley;
- 20 Fig. 9 illustrates yet another cantilevered mobile trolley;
- Fig. 10 illustrates a plan of a straight spray arm above a rack of plates;
- Fig. 11 illustrates a plan of an articulated spray arm in an initial state;
- Fig. 12 illustrates the articulated spray arm extending diagonally across the detachable rack;
- 25 Fig. 13 illustrates the articulated spray arm in a final state;
- Fig. 14 illustrates a diamond-shaped spray arm configuration in an initial state;
- Fig. 15 illustrates the diamond-shaped spray arm spray arm pivoting to the left;
- Fig. 16 illustrates the diamond-shaped spray arm spray arm pivoting to the right;
- Fig. 17 illustrates a plan of a horizontal spray arm travelling from a first position to a second position;
- 30 Fig. 18 illustrates a last angled nozzle located at a distal end of the spray arm;
- Fig. 19 illustrates a nozzle that is orthogonally directed at the plate with reference to the horizontal spray arm;
- Fig. 20 illustrates an alternative mobile trolley in possible misalignments with respect to an alternative dishwasher machine;
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- Fig. 21 illustrates the alternative dishwasher machine on an uneven ground;
- Fig. 22 illustrates the base from a side view where the two castors (a front and a rear castor) are visible;
- Fig. 23 illustrates the base with two castors from a front view where the two rear
5 wheels are locked on a track;
- Fig. 24 illustrates the base with castors travelling on an uneven and inclined ground;
- Fig. 25 illustrates the use of the track to provide a levelled ground for the base with castors to rest;
- Fig. 26 illustrates a plan of the base with guiding wheels on the sides of the base;
- 10 Fig. 27 illustrates a front view of the alternative dishwasher machine with a pair of L-shaped track communicatively engaging with the mobile trolley;
- Fig. 28 illustrates a plan of the U-shaped profile base sliding into a pair of side plates;
- Fig. 29 illustrates a front view of a dual spraying hybrid spraying arm;
- 15 Fig. 30 illustrates a plan of the dual spraying hybrid spraying arm;
- Fig. 31 illustrates a front view of the internal alternative dishwasher machine;
- Fig. 32 illustrates a side view of yet another alternative dishwasher machine having a drawer type system;
- Fig. 33 illustrates a side view of the alternative dishwasher machine having the
20 mobile trolley loaded with three tiers of detachable racks;
- Fig. 34 illustrates a mechanical lifting latch tilting a drip pan;
- Fig. 35 illustrates a self-wheel locking mechanism of the mobile trolley; and
- Fig. 36 illustrates the alternative dishwasher machine with meters on the front face.
- 25 [0007] Exemplary, non-limiting embodiments of the present application will now be described with references to the above-mentioned figures.

[0008] Fig. 1 illustrates a schematic of a dishwasher machine having a front face being loaded with a mobile trolley. The mobile trolley is loaded with a plurality of detachable
30 rack. The one detachable rack is loaded onto the mobile trolley by a human operator (not shown). The human operator is a dedicated person who operates the dishwasher machine. An automatic guided vehicle (AGV) is seen to transport the detachable rack to the dishwasher machine. The detachable rack is loaded with crockery (plates, bowls, cups) or trays. One detachable rack can be loaded with different items which is

determined by the position (proximal, distal) and orientation (vertical, slanted, sideways) of the jigs on the detachable rack. The jig comprises a plurality of vertical finger or peg.

5 [0009] The mobile trolley is rectangular in shape comprising three tiers. The three tiers are supported by four vertical supports. The four vertical supports are supported by castors attached at each lower end thereof.

10 [0010] A directional arrow indicates the direction of movement of the mobile trolley. The mobile trolley is either pushed in or pulled out of the dishwasher machine via a first access that is shaped according to a width of the mobile trolley. As shown in Fig. 1, there are two accesses along the front face of the dishwasher machine.

15 [0011] At the front face, between the first access and a second access is a hand-held water sprayer attached to a water hose. There is a sink providing a washing area of the soiled crockery or tray. Above the sink is a tactile display screen.

[0012] Fig. 2 illustrates a sequence of events in which the human operator clears the table after the diner left his table, A. The human operator pushed the mobile trolley to the dishwasher machine, B. After the dishwasher machine wash the soiled crockery and trays, C. The human operator pulls the trolley out from the dishwasher machine. The human operator then pushes the mobile trolley and deliver cleaned crockery and trays to the individual stalls, D. The human operator then reiterates the process, E.

25 [0013] Fig. 3, 4 and 5 illustrates a schematic of the dishwasher machine washing the mobile trolley loaded with crockery and trays. The crockery includes plates, bowls and cups. Figs. 3, 4 and 5 illustrate three different operations of the dishwasher machine. Figs. 6 and 7 show the structure of a plurality of spray arm and its alternative respectively.

30 [0014] Fig. 6 shows three spray arms with nozzles. A top spray arm, a middle spray arm below the top spray arm and a bottom spray arm below the middle spray arm. The top spray arm has a plurality of nozzle facing downwards towards a direction of the bottom spray arm. The middle spray arm and the bottom spray arm have the plurality of nozzle facing upwards towards a direction of the top spray arm and downwards towards the direction of the bottom spray arm. The dual nozzles on the middle and the bottom spray arms provides spacing saving and washing efficiency.

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[0015] The spray arms are positioned according to a structure of the mobile trolley specifically the height of the mobile trolley and its associated levels thereof. The spray arms are statically supported by a vertical hollow pipe. The three spray arms are horizontally disposed with respect to the vertical hollow pipe. The vertical hollow pipe is connected to the three spray arms at three points along the vertical hollow pipe. The water ejected from the nozzles are able to cover the extreme ends of the detachable rack. However, the, intensity may not be uniform. An alternative spray arm system is shown and described in Fig. 7.

[0016] The mobile trolley as shown in Fig. 3 to 5 has three tiers. The top tier holds a plurality of tray supported by a tray jig. The middle tier holds a plurality of bowl or plate by a bowl and plate jig. The bottom tier holds a plurality of cups by erecting fingers or pegs. Underneath the bottom tier are a plurality of castor. The middle tier and the top tier are supported by four vertical supports. The four vertical supports are supported by the bottom tier specifically at the four corners thereof. Each end of the four vertical supports are supported by castors.

[0017] The mobile trolley comprising the three tiers slidingly communicates with the three spray arms as it is pushed into the dishwasher machine via the first access. The top spray arm is above the top tier. The middle spray arm is above the middle tier and the bottom spray arm is above the bottom tier.

[0018] The mobile trolley, the spray arms, and the vertical hollow pipe is made of stainless steel. A height of the mobile trolley is about one metre. A height of the top spray arm is at 1.6 metres which is above the height of the mobile trolley. The height of the dishwasher machine is about 1.8 metres.

[0019] In particular, Fig. 3 shows the mobile trolley with crockery going under a pre-washing cycle. A water is mixed with a water-soluble cleansing agent in a pre-washing tank and is channeled to the three spray arms via a pre-washing conduit. The pre-washing tank is located at a low level. A pre-washing water pump pumps the mixture from the pre-washing tank to the spray arms which are located at a high level. The mixture in the pre-washing tank is tepid (lukewarm).

[0020] Fig. 4 shows the mobile trolley with crockery going under a washing cycle. The water is mixed with a detergent in a washing tank and conveyed to the three spray arms via a washing conduit. The mixture of water and detergent is contained in the washing tank which is positioned at the low level. A washing water pump pumps the mixture from the washing tank to the spray arms which are located at the high level. The mixture has a temperature of above sixty degree-Celsius (60°C).

[0021] Fig. 5 shows the mobile trolley with crockery going under a rinsing cycle. A fresh clean water is fed to the three spray arms via a rinsing conduit. The fresh clean water is heated in a water heating drum which is located at the low level. The fresh clean water has a temperature above eighty degree-Celsius (80°C).

[0022] Fig. 3, 4 and 5 described three different types of conduits that are connected to the three spray arms because pre-wash (or purging) and wash conduits share the same conduits, whilst a rinsing conduit is independent from others. The three conduits comprise the pre-washing conduit, the washing conduit and the rinsing conduit. The three conduits are fed to a four-way port comprising a three-input channel and one output channel. The three-input channel is connected to the pre-washing conduit, the washing conduit and the rinsing conduit. The output channel is then connected to the spray arms by the vertical hollow pipe.

[0023] Alternatively, the pre-washing conduit and the washing conduit can share a same conduit. The same conduit is then connected to the three spray arms. In such a case, a three-way port is used to channel the required water into the spray arms at the three different wash cycles.

[0024] Fig. 7 shows an alternative spray arm system. A top and a bottom rotatable spray arms are rotatably attached to a top horizontal arm and a bottom horizontal arm. The middle spray arm remains the same. The top and bottom rotatable spray arms rotate at the axis which is supported by the top and the bottom horizontal arms. Note that only the top and bottom spray arms are able to rotate but not the middle spray arm which is static. In the alternative spray arm system, the bottom spray arm has only upward facing nozzles because it is designed to eject water from below the bottom tier. Comparing to Fig. 6 the bottom spray arm is positioned between the middle tier and the bottom tier which requires the nozzles to be positioned in the upward facing and the downward facing direction.

[0025] Fig. 8 illustrates a cantilevered mobile trolley. As described in Fig. 3-5, the mobile trolley having three tiers has a four-legged support supported by the bottom tier. The mobile trolley shown in Fig. 8 comprises three tiers. The top tier and the middle tier are supported by a vertical support located at a short edge of the mobile trolley. Only the top and middle tiers are cantilevered. The vertical support is supported by the bottom tier. The bottom tier is supported by four castors.

[0026] Fig. 9 illustrates yet another cantilevered mobile trolley. The vertical support is positioned at a long edge of the mobile display and is supported by the bottom tier. The top and middle tiers are supported at the long edge by the vertical support.

[0027] The spray arm system shown in Fig. 8 is mobile in a forward and a backward direction as indicated by the bidirectional arrow which is able to wash the crockery and tray on the mobile trolley. That is to mean the spray arm with the vertical pipe are able to maneuver along a track and to freely move back and forth the trolley to wash the crockery. For example, the spray arm can be programmed to divide the wash area into three sections. The wash area is defined by the surface area of the mobile trolley as seen from the top. The spray arm can travel back and forth in a first section (either ends of the mobile trolley) then proceed to a second section and perform the same back and forth action in the second section. The same action takes place in a third section (opposite end of the first section). Then finally the three sections are washed from the first section to the third section.

[0028] The spray arm system shown in Fig. 9 moves in one direction. The spray arm system travels on the track in one direction in a cycle then travels back to the initial position and travels down the track again for the next cycle. It is not able to continuously spray water or detergent at the same time when travelling back to the initial position. When travelling back to the initial position, the nozzles are shut or not spraying any fluid.

[0029] The spray arms in Fig. 8 and 9 adopt the system as shown in Fig. 6 where the spray arms are non-rotational.

[0030] Fig.10, 11, 12 and 13 illustrate a plan showing a series of movement of the spray arm in the dishwasher machine. Fig. 10 shows a top view of a straight spray arm

extending over a rack of vertically erected plates. The broken lines show the arc of travel by the spray arm. The spray arm of Fig. 10 uses much space as a result of the straight spray arm.

5 [0031] Fig. 11, 12 and 13 provides an articulated spray arm. The articulated spray arm comprises three pivoting joints. As seen in Fig. 11, the articulated spray arm is in an initial state. A first pivoting point is at a southeast position with reference to the detachable rack. A second pivoting point is at a southwest position with reference to the detachable rack. A third pivoting point is at a northwest position with reference to the detachable rack.

10 [0032] Fig 12 shows the articulated spray arm straightening extending diagonally across the detachable rack in which the first, the second and the third pivoting point form a straight line. Fig. 13 shows the articulated spray arm in a final state in which the second pivoting point has travelled diagonally across to a northeast position with reference to the
15 detachable rack.

[0033] Fig. 14, 15 and 16 illustrate a plan showing a series of movement of an alternative spray arm. Fig. 14 shows a diamond-shaped spray arm configuration in an initial state. The alternative spray arm pivots at one pivoting point. The pivoting point is at a south
20 position with reference to the detachable rack. Fig. 15 shows the alternative spray arm pivoting to the left and Fig. 16 shows the alternative spray arm pivoting to the right. Similar to a pendulum, the alternative spray arm pivots to the right and the left.

[0034] Fig. 17 illustrates a plan of a horizontal spray arm travelling from a first position to
25 a second position. The horizontal spray arm traverses over the detachable rack as indicated by the arrow.

[0035] The dark diagonal lines as shown in Fig. 12, 15 and 6B indicate the amount of
30 space savings if any of the three suggested spray arms are implemented.

[0036] Fig. 18 and 19 illustrates a side view of the spray arm with two nozzles. Fig 18 shows a last angled nozzle located at a distal end of the spray arm. The angled nozzle is able to project water jet onto the plate covering an area beyond the plate. Fig. 19 shows a nozzle that is orthogonally directed at the plate with reference to the horizontal spray
35 arm. The shaded area shows the uncovered area by the water jet from the last nozzle.

[0037] Fig. 20 illustrates an alternative mobile trolley in possible misalignments with respect to an alternative dishwasher machine from the front facing perspective. The alternative mobile trolley's base with castors is prohibited from entering the dishwasher machine via the access. The alternative mobile trolley comprises a detachable storage compartment, plurality of stand and a base with four castors attached thereto. The stands are mounted on a top surface of the base. The castors are attached to the underneath of the base. The storage compartment seats on two rails. The two rails seat on top of the four stands.

[0038] Only the detachable storage compartment is pushed into the alternative dishwasher machine. The two rails are aligned with a corresponding set of rails which is in the alternative dishwasher machine to facilitate receiving and retrieving thereafter. In contrast, the dishwasher machine allows the mobile trolley to be pushed into itself via the accesses similar to a door access. The alternative dishwasher machine is elevated from the ground and so the access is similar to that of a window. Trolley 1 as shown in Fig. 20 has a slight tilt but because there is alignment mechanism in the alternative dishwasher machine so Trolley 1 is able to be loaded. Trolley 2 and 3 show varying degree of misalignment. The alternative dishwasher machine is able to handle Trolley 2 and 3 tilting to the right or left side respectively.

[0039] Fig. 21 illustrates the alternative dishwasher machine on an uneven ground. The dishwasher machine has a plurality of adjustable support to achieve levelling with respect to the ground. Each adjustable support comprises a plurality of screw bolt. One end of the screw bolt is affixed to a ground contacting element whilst a second end of the screw bolt is attached to the alternative dishwasher machine. A locking nut is used to secure a stable and levelled position. The ground contacting element may comprise a castor, a rubber protective lid and a plastic protective lid.

[0040] Fig. 22, 23, 24, 25 illustrates the base of the mobile trolley. Fig. 22 shows the base from a side view where the two castors (a front and a rear castor) are visible. Each castor is a rigid castor type. The rigid castor only allows forward and backward movement. Rigid castor tends to be stronger than swivel castor. It is rated at the same capacity as the swivel castor for safety reasons. They can be a one-piece construction or a two-piece construction that is riveted or welded to the underside of the base. The castor comprises

a frame, an axle bolt and a wheel. The wheel is rotatably engaged with the axle bolt. The frame supports the axle bolt which holds the wheel. The frame is attached to the underside of the base. A front wheel is seen to be travelling along a track. The track has a ramp to facilitate the receiving of the mobile trolley. The track is lying above a leveller for stability and levelness.

[0041] Fig. 23 illustrates the base with two castors from a front view where the two rear wheels are locked on a track. Fig. 24 illustrates the base with castors travelling on an uneven and inclined ground. Fig. 25 illustrates the use of the track to provide a levelled ground for the base with castors to rest.

[0042] Fig. 26 illustrates a plan of the base with guiding wheels on the sides of the base. The base shown in Fig. 26 has a U-shaped profile having two long sides and one short side. The one short side joins the two long sides at each end of the short side. The broken lines indicate the presence of two side guiding wheels on each long side. There is one front guiding wheel attached on the front end of the long side. The front guiding wheel provides a guide into the alternative dishwasher machine onto a pair of L-shaped track. The two side guiding wheels on each long side provides support on each long side of the mobile trolley when pushed into the alternative dishwasher machine along the L-shaped track as seen in Fig. 27 from a front view. The rear castor wheels are seen as lifted above the uneven ground. Fig. 27 illustrates a front view of the alternative dishwasher machine with a pair of L-shaped track communicatively engaging with the mobile trolley

[0043] 28 illustrates a plan of the U-shaped profile base sliding into a pair of side plates. The side plates are attached to the internal alternative dishwasher machine specifically on the left and right sides. The U-shaped profile base with the front guiding wheels contact the side plates to ensure a smooth insertion of the mobile trolley.

[0044] Fig. 29 (front view) and 30 (plan) illustrates a dual spraying hybrid spraying arm. The dual spraying hybrid spraying arm enables one rotating mechanism to allow swinging arms to cover the entire washing rack areas. It also enables one rotating mechanism to house TWO spraying system – namely one cleaned hot water and one recycled water

[0045] Fig. 31 illustrates a front view of the internal alternative dishwasher machine. The top roof area is slanted in order for water condensate formed on the top inner surface to

be guided and slide down to both sides of the alternative dishwasher machine. This minimise water droplets from dripping directly onto the crockery before and resulting in an effective drying.

- 5 [0046] Fig. 32 illustrates a side view of yet another alternative dishwasher machine having a drawer type system. A detachable rack can be placed in the drawer for immediate washing. Each drawer is operated independently from the other. The drawer each has an attached door to prevent water splashing during washing.
- 10 [0047] Fig. 33 illustrates a side view of the alternative dishwasher machine having the mobile trolley loaded with three tiers of detachable racks. At the bottom of the alternative dishwasher machine is a secondary strainer which is slidably removable therefrom. The mobile trolley also has a primary strainer. The strainers provide the receiving of the leftover food and disposables thereon. The primary strainer collects the leftover food and
15 disposables during the collection of soiled crockery and trays by the human operator. The secondary strainer collects the leftover food and disposables during the washing cycle.
- 20 [0048] Fig. 34 illustrates a mechanical lifting latch tilting a drip pan to drain the leftover sauces and gravies. The drip pan is slidably engaged with the cantilever mobile trolley at a sliding end. The sliding end is supported by the vertical support of the cantilever mobile trolley. The drip pan can either slide up or down along the vertical support. The primary strainer is seated above the drip pan.
- 25 [0049] The mechanical lifting latch is located in the alternative dishwasher machine at the sides (left and right sides) near the window access to facilitate the tilt of the drip pan. In practice, the cantilever mobile trolley is pushed into the alternative dishwasher machine. The mechanical lifting latch having a slope pushes the drip pan and the primary strainer upwards until the cantilever mobile trolley is totally in the alternative dishwasher
30 machine. At this point, the drip pan and the primary strainer is pivoting on the mechanical lifting latch. The drip pan with the primary strainer then tilts downwards as a result of the weight acted on the drip pan causing the sauces and gravies to flow off the drip pan opposite the sliding end.

[0050] Fig. 35 illustrates a self-wheel locking mechanism of the mobile trolley. Similar to an airport trolley braking mechanism. In order to move the mobile trolley, the human operator had to consciously depressed the handle downwards releasing the brakes from the castors. To immobilise the mobile trolley, the human operator has to lift up his hands and the mobile trolley will apply brakes on the castors.

[0051] Fig. 36 illustrates the alternative dishwasher machine with meters on the front face thereof. Above the alternative dishwasher machine is a control panel. The control panel has three indicator lights namely a green light, an amber light and a red light on the right side thereof. The green light indicates that the alternative dishwasher machine is ready for use. The amber light indicates washing is in progress and do not open the window access. The red light indicates not ready for use, error or getting ready (initialisation). On the right side of the window access is an online washing progress indicator.

[0052] Functionally, the dishwasher machine provides a washing of soiled crockery and tray. The mobile trolley is required to effect the washing inside the dishwasher machine. The dishwasher machine detects the presence of the mobile trolley as one of the requirement before a commencement of a washing cycle.

[0053] The human operator has the option to disable the detection using the tactile display screen. For instance, during a maintenance, the human operator may disable the detection of the mobile trolley to check the operation of the internal parts. The human operator interacts with the dishwasher machine with the tactile display screen. The tactile display screen provides an interface between the human operator and the dishwasher machine. Some functions that the dishwasher machine provides comprise start/stop wash, maintenance, pre-setting washing time, temperature of the water and amount of water used (water saving wash or normal wash).

[0054] An automatic guided vehicle (AGV) aids in the transport of the detachable rack to the dishwasher machine in a food court. The food court is a place where diners choose their preferred seats, buy their food and consume their food. The AGV has designated invisible paths to the human eyes but only known to the AGV. Above the AGV is a platform. The detachable tray which is empty initially is placed on the platform by the human operator. In practice, the AGV travels around a food court along narrow aisles which are shared with diners. Diners who have finished consuming their food has the

option to leave the soiled crockery and tray into the detachable rack. The AGV has also a trash bin attached for disposing of the leftover food and disposables therein by the diner. Below the detachable rack, there is also a drip tray for receiving the unwanted food, sauces and liquids when the crockery is slotted in the jugged detachable rack. The AGV is installed with an intelligent sensor mounted to detect a movement in front and around its perimeter to avoid collision with diner as well as fixtures. The AGV is able to detect the diner's intention to deposit the tray when the detector detects a movement above the platform by detecting a blocking of the incident ray from the detector. The detector mentioned herein can comprises photoelectric sensors which is used to discover the distance, absence or presence of an object by using a light transmitter, often infrared, and a photoelectric receiver.

[0055] The detachable rack is jugged to support crockery in an upright position. The jig or pegs on the detachable rack is required to be narrow in profile to provide maximum exposure of the cleaning agent onto the soiled crockery or tray. The jig is detachable from the detachable rack is required.

[0056] The detachable rack measures twenty inches by twenty inches which is a standard in the dishwashing market. Based on the standard dimension of the detachable rack, the mobile trolley has a minimum width of five hundred millimetres (500 mm) and a minimum length of one thousand millimetres (1,000 mm). Hence the first access and the second access has an access width of about five hundred millimetres (500 mm) and an access length of more than one thousand millimetres (1,000 mm). A height of the two accesses is about 1.5 metres based on the height of the mobile trolley at one metre plus the height of the detachable rack which is about 80 millimetres plus the height of the plates or trays.

[0057] The three tiers of the mobile trolley provide a frame for the support of detachable racks. Each tier can support at least two detachable racks. Each tier is formed by having two long metallic bars and two short metallic bars forming a rectangular frame with an empty top. Each bar has a cross-sectional L-shaped profile. The L-shaped profile provides a support of the detachable rack and also provide better exposure to the cleaning agent and fluid while inside the dishwashing machine. The mobile trolley is made of aluminum or stainless steel that can withstand the high temperature inside the dishwashing machine.

[0058] The three stages in the dishwashing comprising the pre-washing stage, the washing stage and the rinsing stage. The mobile trolley is pushed into the first access of the dishwashing machine. The three spray arms inside the dishwashing machine are positioned neatly above the top tier, in between the top tier and middle tier and below the bottom tier of the mobile trolley. The top spray arm is equipped with nozzles positioned in the downward direction is in charge of washing the crockery and tray in the top tier. The middle spray arm is equipped with upward facing and downward facing nozzles that are able to wash the top tier and the middle tier crockery. The dual nozzles on the middle and the bottom spray arms provides spacing saving and washing efficiency. The bottom spray arm is equipped with upward facing nozzles that washed the crockery at the bottom tier. Furthermore, the rotatable spray arms are able to rotate to cover the whole area of the detachable rack ensuring improved washing capability. The nozzles are rotationally attached to the spray arms. The nozzles are manually adjusted to certain angles so as to project the water jet onto the targeted area. To facilitate the hard to reach corner of the detachable rack, the last nozzle on the spray arm can be mounted with a plurality of angled nozzles. The angled nozzle also provides a self-cleaning feature. The angled nozzle projecting strong water jet can clean the inner periphery of the dishwashing machine.

[0059] In the alternative dishwasher machine, a door access is changed to a window access. In the latter, the alternative mobile trolley is introduced where only the storage compartment is pushed into the window access. The alternative dishwasher machine provides the advantage of containing the water in the machine itself. Compare to the dishwasher machine in which the machine has to be installed above a designated area. The designated area must have waterproofed flooring to prevent water from seeping into the ground. The door access dishwasher machine allows water to flow directly to the floor which can cause safety hazard.

[0060] In the application, unless specified otherwise, the terms "comprising", "comprise", and grammatical variants thereof, intended to represent "open" or "inclusive" language such that they include recited elements but also permit inclusion of additional, non-explicitly recited elements.

[0061] As used herein, the term "about", in the context of concentrations of components of the formulations, typically means +/- 5% of the stated value, more typically +/- 4% of

the stated value, more typically +/- 3% of the stated value, more typically, +/- 2% of the stated value, even more typically +/- 1% of the stated value, and even more typically +/- 0.5% of the stated value.

- 5 [0062] Throughout this disclosure, certain embodiments may be disclosed in a range format. The description in range format is merely for convenience and brevity and should not be construed as an inflexible limitation on the scope of the disclosed ranges. Accordingly, the description of a range should be considered to have specifically disclosed all the possible sub-ranges as well as individual numerical values within that
- 10 range. For example, description of a range such as from 1 to 6 should be considered to have specifically disclosed sub-ranges such as from 1 to 3, from 1 to 4, from 1 to 5, from 2 to 4, from 2 to 6, from 3 to 6 etc., as well as individual numbers within that range, for example, 1, 2, 3, 4, 5, and 6. This applies regardless of the breadth of the range.
- 15 [0063] It will be apparent that various other modifications and adaptations of the application will be apparent to the person skilled in the art after reading the foregoing disclosure without departing from the spirit and scope of the application and it is intended that all such modifications and adaptations come within the scope of the appended claims.

Claims

1. A first mobile dishwasher comprising
(a washer that has) a cantilever spray mechanism for discharging a washing liquid
5 onto soiled eating utensils (inside the first mobile dishwasher);
wherein the cantilever spray mechanism is operable to swing within a
predetermined range (back and forth automatically) (including rotation).
2. The first mobile dishwasher of claim 1, wherein
10 the cantilever spray mechanism comprises at least one (horizontal) spay arm (and
optionally a spray pillar); and
an end of the at least one (horizontal) spay arm is connected to the spray pillar for
receiving the washing liquid.
- 15 3. The first mobile dishwasher of claim 1 or 2, wherein
the spray pillar comprises multiple orifices (spouts, taps, spigots or connectors)
(at different places along/on the spray pillar) for connecting the at least one
horizontal spay arm.
- 20 4. The first mobile dishwasher of claim 2 to 3, wherein
the at least one (horizontal) spray arm comprises a range stopper (e.g. roller at a
longitudinal end of the at least one spray arm and the at least one spray arm being
extendable or retractable) for guiding the at least one horizontal spray arm along
an internal wall of the first mobile dishwasher.
- 25 5. The first mobile dishwasher of any of the preceding claims 2 to 4, wherein
the at least one (horizontal) spay arm comprises multiple beams (of the same of
different levels) for connecting to the spray pillar.
- 30 6. The first mobile dishwasher of claim 5, wherein
the at least one (horizontal) spay arm comprises a portion that conforms to an
internal profile (e.g. wall surface) of the first mobile dishwasher.

7. The first mobile dishwasher of any of the preceding claims, wherein the cantilever spray mechanism comprises at least one nozzle (e.g. on the at least one (horizontal) spay arm) that has an orientation different from other (or neighbouring) nozzles of the cantilever spray mechanism.

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8. The first mobile dishwasher of any of the preceding claims, wherein the cantilever spray mechanism comprises a hydraulic drive for moving at least one part of the cantilever spray mechanism by the washing liquid.

- 10 9. The first mobile dishwasher of claim 8, wherein the cantilever spray mechanism further comprises a valve for regulating moving direction of the at least one part (or flowing direction of the washing liquid).

- 15 10. The first mobile dishwasher of any of the preceding claims, wherein the cantilever spray mechanism comprises a first nozzle for spraying the washing liquid in a concentrated pattern (e.g. jet stream) and a second nozzle for spraying the washing liquid in a distributed (or scattered) pattern (and a third nozzle for spraying the washing liquid with different patterns).

- 20 11. The first mobile dishwasher of any of the preceding claims 2 to 10, wherein the at least one (horizontal) spay arm extends substantially to opposite walls of the first mobile dishwasher.

- 25 12. The first mobile dishwasher of claim 11, wherein opposite ends of the at least one (horizontal) spay arm are configured to move from one side of the first mobile dishwasher to the other side of the first mobile dishwasher.

- 30 13. The first mobile dishwasher of any of the preceding claims, wherein the at least one (horizontal) spay arm comprises a high spray arm and a low spray arm that are disposed at different heights (,distances or positions along the spray pillar).

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14. A second mobile dishwasher comprising
a guiding mechanism for directing a (first or second) cart (also known as mobile
carrier) to a washer of the second mobile dishwasher.
- 5 15. The second mobile dishwasher of claim 14, wherein
the guiding mechanism comprises a vertical guide (that is configured to be
adjusted in height at least a portion or corner of the platform) for adjusting vertical
position of the cart.
- 10 16. The second mobile dishwasher of claim 15, wherein
the vertical guide comprises at least one roller (or wheel) for being supported by
a track of (the washer of) second mobile dishwasher.
- 15 17. The second mobile dishwasher of any of the preceding claims 14 to 16, wherein
the guiding mechanism comprise a horizontal (or lateral) guide for adjusting a
horizontal position of the cart.
- 20 18. The second mobile dishwasher of claim 17, wherein
the horizontal (or lateral) guide comprises at least one rail for adjusting horizontal
position of the cart.
- 25 19. The second mobile dishwasher of claim 18, wherein
the guiding mechanism comprises a first rail and a second rail that (have portions)
are spaced apart from each other;
a distance (at one place) between the first rail and the second rail is larger than
another distance (at another place) between the first rail and second rail.
- 30 20. The second mobile dishwasher (or simply dishwasher machine) of any of the
preceding claims 14 to 19 comprising
a cart and a washer,
wherein the cart is detachable from the washer; and the cart comprises a soil
collection tray near its bottom.

21. The second mobile dishwasher (or simply dishwasher machine) of claim 21 comprising
a tilting mechanism for slant the soil collection tray at an angle when receiving the
cart into the washer (or when coupling the washer and the cart).

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22. A third mobile dishwasher comprising
a heat exchanger that comprises a first conduit for passing hot clean water and a
second conduit for passing recycled washing water;
wherein the first conduit and the second conduit are configured to exchange heat
in-between.

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23. The third mobile dishwasher of claim 22, wherein
the first conduit and the second conduit are connected to a common (or same)
spray mechanism or cantilever spray mechanism (of the third mobile dishwasher).

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24. A fourth mobile dishwasher comprising
a washer whose (internal) ceiling is substantially slanted (or not horizontal) for
guiding condensate flowing towards an edge of the ceiling.

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25. The fourth mobile dishwasher of claim 24, wherein
the (internal) ceiling comprises a first ceiling and a second ceiling, the first ceiling
and the second ceiling being symmetrically located inside the washer and joined
at their edges.

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26. A fifth mobile dishwasher (or may stationary dishwasher) comprising
at least one drawer for holding eating utensils; and
the at least one drawer is configured to be opened for accessing the eating utensils.

27. The fifth mobile dishwasher of claim 26, wherein
the at least one drawer is detachable from the fifth mobile dishwasher.

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28. The fifth mobile dishwasher of claim 26 or 27, wherein
the at least one drawer comprises a door sealing the at least one drawer with the
fifth mobile dishwasher during washing.

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29. The fifth mobile dishwasher of any of the preceding claims 26 to 28, wherein the at least one drawer comprises a first drawer and a second drawer that are configured to be stacked on top of each other.
- 5 30. The fifth mobile dishwasher of any of the preceding claims 26 to 29 comprising a first opening and a second opening that are located on the same side of the fifth mobile dishwasher.
- 10 31. A sixth mobile dishwasher (or may stationary dishwasher) comprising a first (or primary) strainer for capturing food debris; and a second strainer located in a straining path of the first strainer.
- 15 32. The sixth mobile dishwasher of claim 31, wherein the first trainer is located on top of the second strainer.
33. The sixth mobile dishwasher of claim 31 or 32, wherein at least one perforation of the first strainer is different (in size or shape) from at least one perforation of the second strainer.
- 20 34. The sixth mobile dishwasher of any of the preceding claims 31 to 33, wherein at least one of the first strainer and the second strainer is detachable from the sixth mobile dishwasher.
- 25 35. The sixth mobile dishwasher of any of the preceding claims 31 to 34, wherein at least one of the first strainer and the second strainer is mounted onto a cart of the sixth mobile dishwasher.
- 30 36. A sixth mobile dishwasher comprising
- a washer for washing soiled eating utensils (inside the washer); and
 - a cart that is detachable from the washer for collecting the soiled eating utensils from different locations;
- wherein the cart comprises a self-lock for locking the cart in the absence of external force (e.g. being pushed by a cleaner).

37. The sixth mobile dishwasher of claim 36, wherein the self-lock comprises an activation trigger that is neighbouring to a handle bar of the cart for being grabbed (or released) by a same hand of the cleaner.

5 38. A seventh mobile dishwasher comprising

- a washer having a first docking port and a second docking port;
- a first cart for coupling with the washer at one of the docking ports; and
- a second cart for coupling with the washer at another one of the docking ports;

10 wherein the washer is configured to operate after being coupled to one of the carts.

39. The seventh mobile dishwasher of claim 38, wherein the first docking port and the second docking port are neighbouring in their lateral directions respectively.

40. The seventh mobile dishwasher of claim 38, wherein the first docking port and the second docking port are neighbouring in their longitudinal directions respectively.

41. The seventh mobile dishwasher of any of the preceding claims 38 to 40, wherein the washer is configured to operate one of the carts in any of the docking port independently.

42. The seventh mobile dishwasher of any of the preceding claims 38 to 41, wherein the washer comprises an elevator for raising one of the cart from a lower docking port to a higher docking port.

43. An eighth mobile dishwasher comprising

- a cart for collecting soiled eating utensils from various locations; and
- a washer for receiving the cart in order to wash the soiled eating utensils; wherein the cart is operable to be detached and/or coupled to the washer.

44. The eighth mobile dishwasher of claim 43, wherein the cart comprises a drip pan near a lower side of the cart for catching soil from above.
- 5 45. The eighth mobile dishwasher of claim 43 or 44, wherein the cart comprises a primary strainer for capturing debris from above; and the primary strainer is located above the drip pan.
- 10 46. The eighth mobile dishwasher of claim 45 further comprising a lifting latch mechanism for tilting the drip pan or the primary strainer when or after coupling the cart to the washer automatically.
- 15 47. The eighth mobile dishwasher of claim 46, wherein the lifting latch mechanism comprises at least one roller mounted onto the washer.
- 20 48. The eighth mobile dishwasher of any of the preceding claims 43 to 47 further comprising at least one optical indicator (e.g. online washing progress indicator) for indicating operation status of the eighth mobile dishwasher.
- 25 49. The eighth mobile dishwasher of claim 48, wherein the at least one optical indicator comprises at least one colour indicator (e.g. red light indicator, amber light indicator, green light indicator) for notifying users on operation status of the eighth mobile dishwasher.
- 30 50. The eighth mobile dishwasher of claim 49, wherein the at least one colour indicator comprises at least one stack light.
- 35 51. The eighth mobile dishwasher of any of the preceding claims 43 to 50, wherein the washer comprises a cantilever spray mechanism that is configured to discharge a washing liquid in opposite directions (e.g. towards top & bottom).
52. The eighth mobile dishwasher of claim 51, wherein the cantilever spray mechanism comprises a cantilever spray arm that has nozzles pointing in different or opposite directions (e.g. dual nozzles towards top & bottom).