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(54) Dishwasher apparatus

(57) Dishwasher apparatus comprising a wash cabinet (1) adapted to receive articles to be washed, spray means (6, 7) mounted within the cabinet and operable to spray wash liquid within the cabinet, and a service unit (5) removably mounted with respect to the cabinet, the service unit having mounted therein wash liquid supply means (34, 35), pump means (54) operable to supply wash liquid from the wash liquid supply means, and electrical control means operable to control a wash cycle. In the wash cycle the liquid used for the final rinse of a load may be retained within the apparatus to pre-rinse and wash the following load.

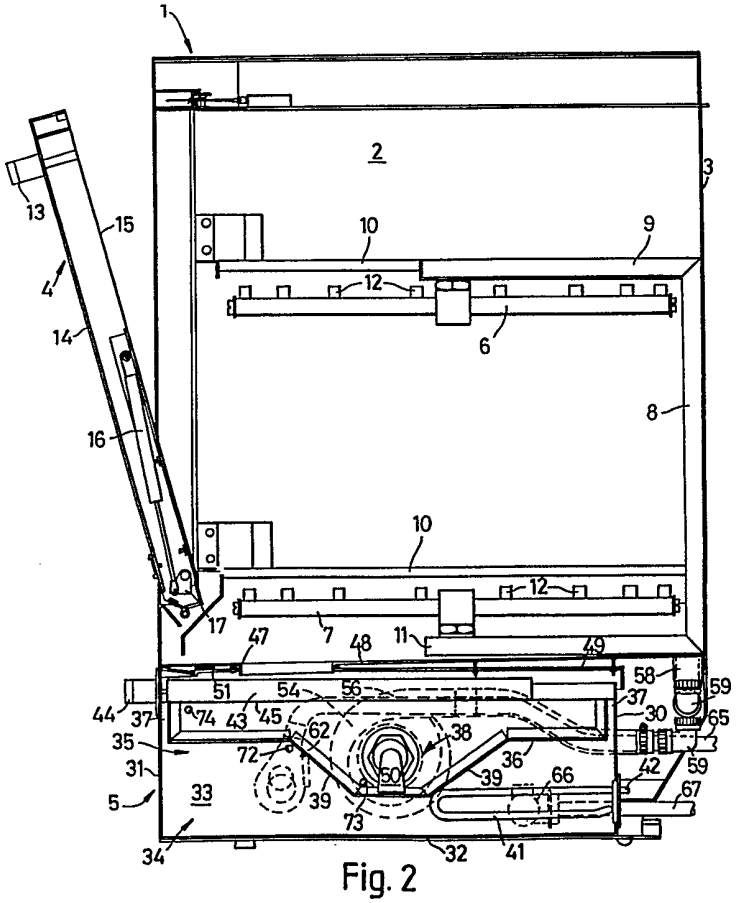

Fig. 2

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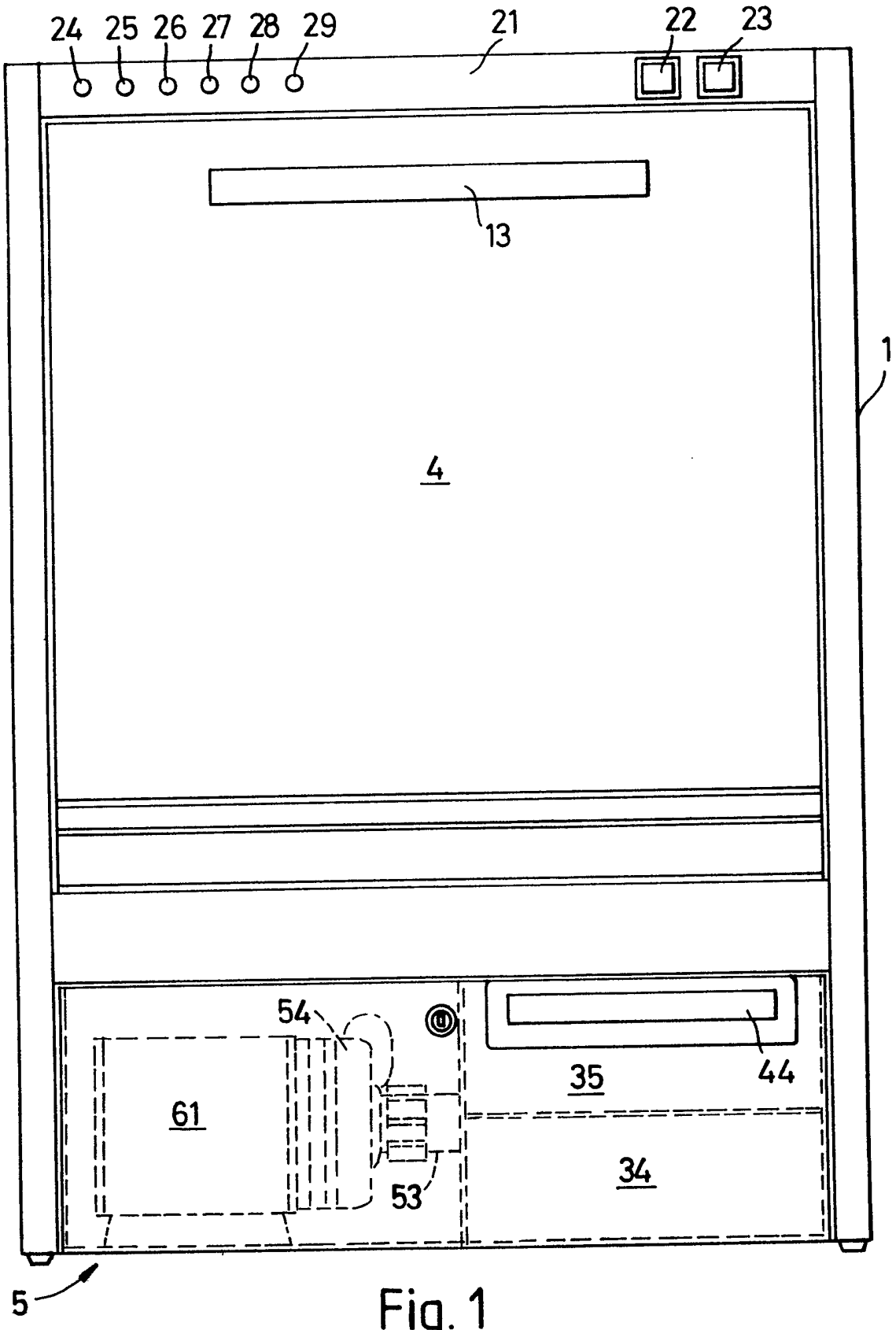

Fig. 1

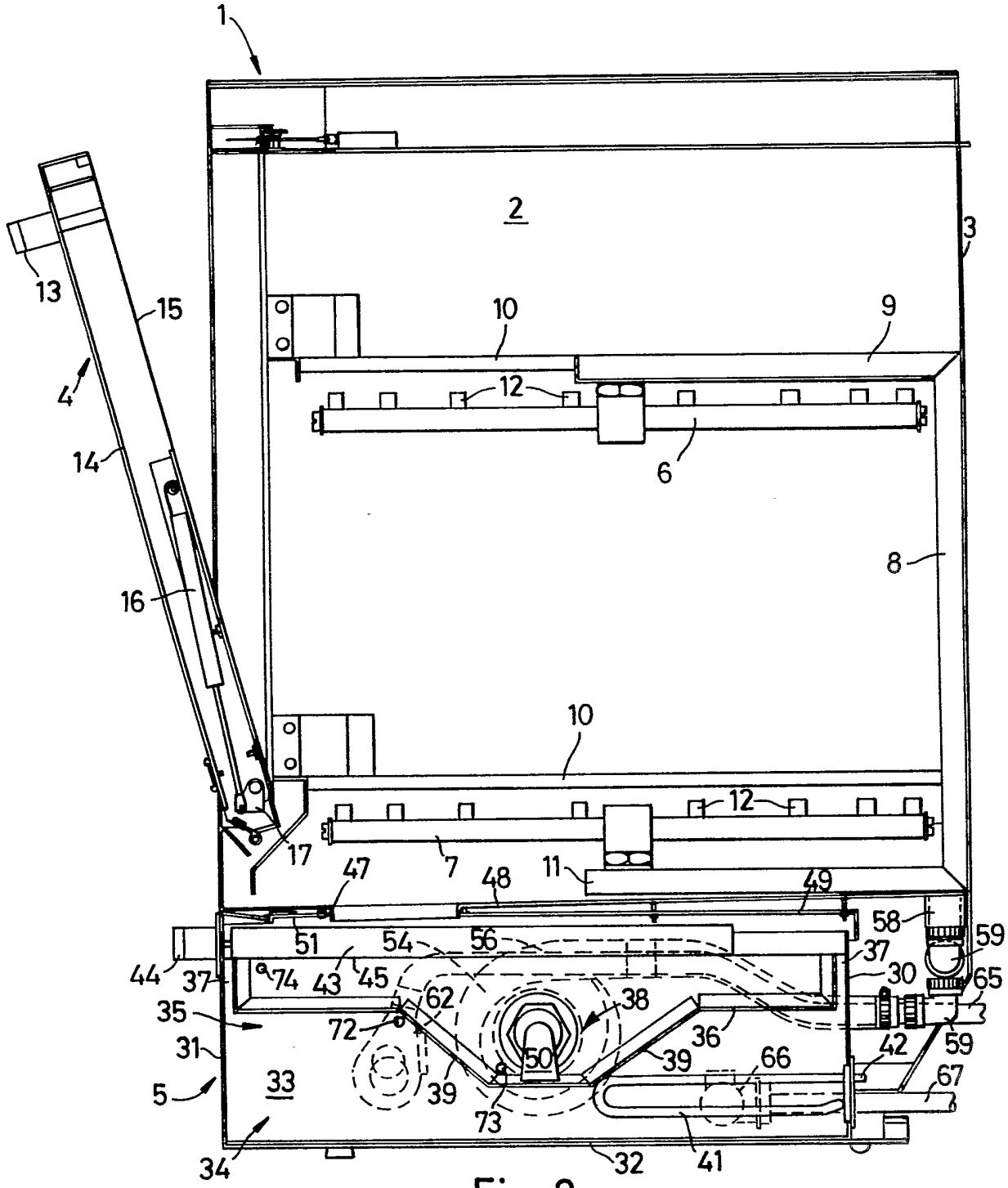
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Fig. 2

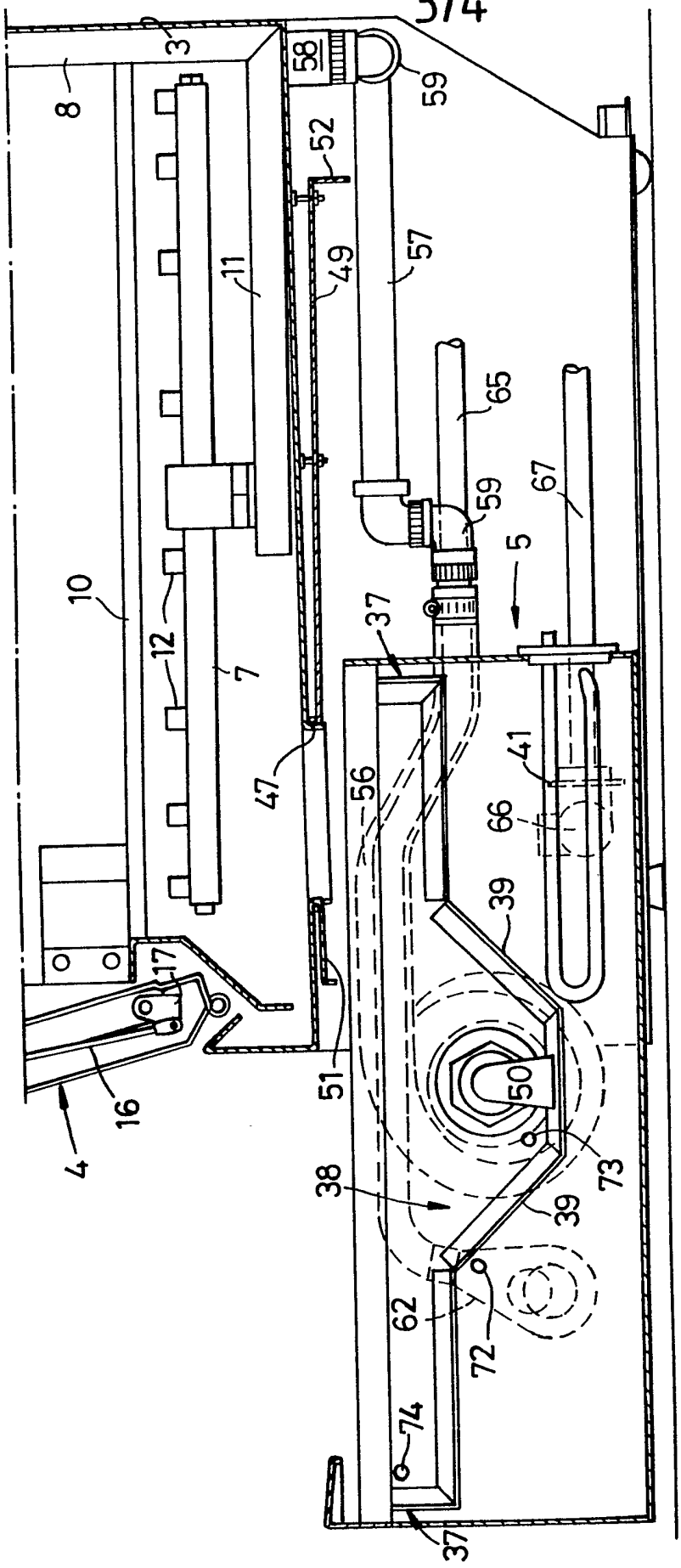
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Fig. 3

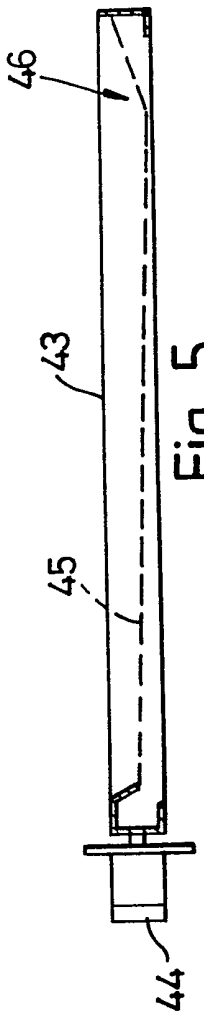
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Fig. 5

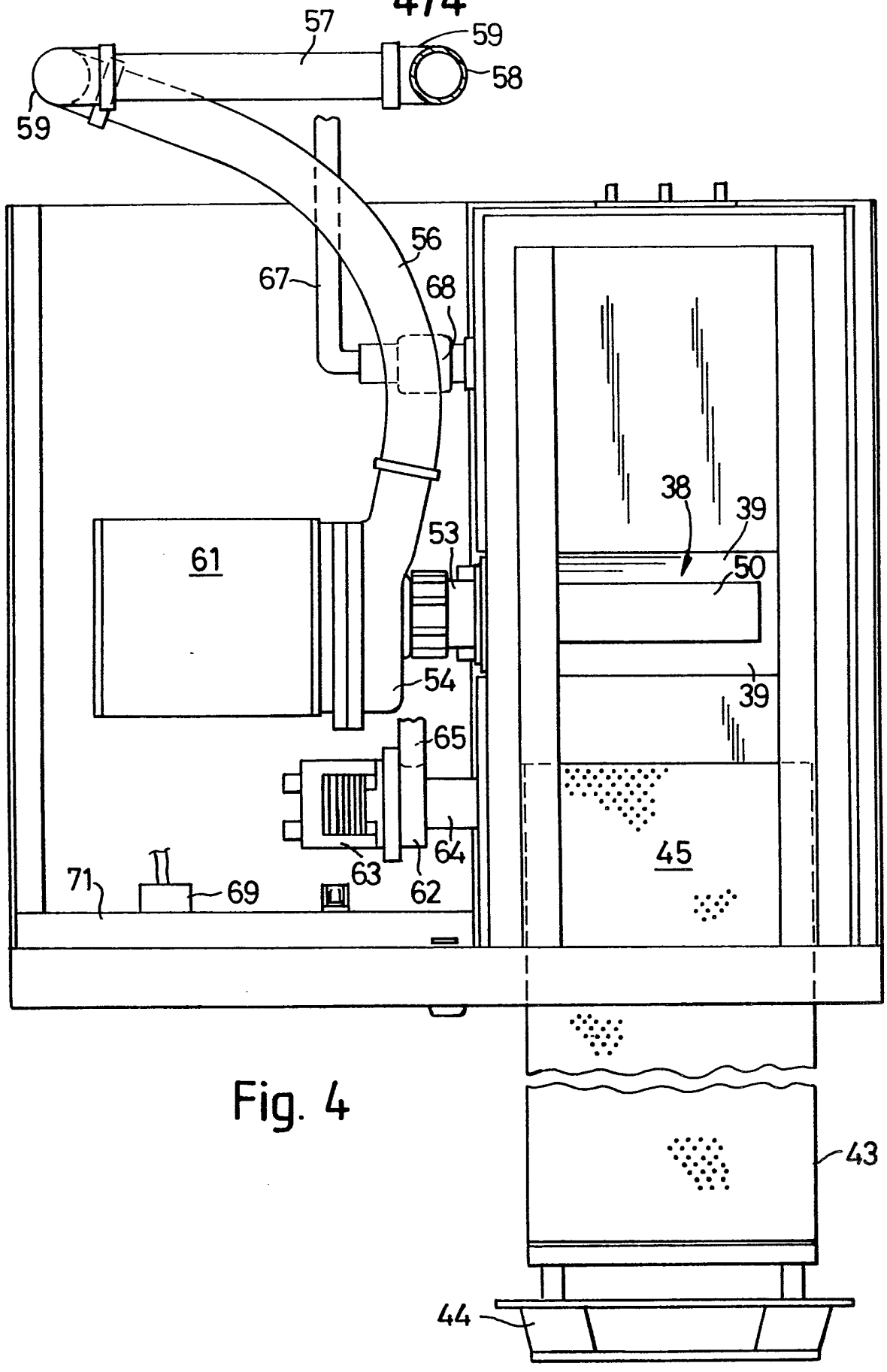

Fig. 4

DISHWASHER APPARATUS

This invention relates to dishwasher apparatus for both domestic and industrial use.

In both domestic and industrial dishwasher apparatus, it is normally necessary to remove the apparatus from its normal operational position in order to gain access to electric motors, pumps, etc which may require maintenance and/or repair. This removal from its normal position may entail disconnecting the apparatus from a power supply and an inlet supply of water, most dishwashers operating on a single fill principle, i.e. it is supplied only with cold water, heating means for the water being provided within the apparatus. Furthermore, it is normally necessary to lay the apparatus at least on its side, if not totally to upend it, in order to work on the relevant components. This invariably means that water which remains in the apparatus from a normal wash cycle needs, if possible, to be collected but invariably becomes spilt. Accordingly, servicing the dishwasher apparatus is cumbersome and potentially messy. These disadvantages are particularly irksome in industrial apparatus which sometimes are accommodated in confined spaces, for example behind a bar in a public house or restaurant.

Another disadvantage of known dishwasher apparatus is that an initial fill of cold water is used to effect a pre-rinse of the articles to be washed to effect general removal of soiling. The cold water is then heated to carry out the actual wash and when the heated water is sprayed over the articles, inevitably some of the previously removed soiling is sprayed with the wash liquid and can be redeposited.

It is an object of the present invention to overcome or obviate one or more of the above discussed disadvantages.

According to one aspect of the present invention there is provided dishwasher apparatus comprising a wash cabinet adapted to receive articles to be washed, spray means mounted within the cabinet and operable to spray wash liquid within the cabinet, and means for supplying wash liquid to the spray means from wash liquid supply means mounted externally of the cabinet, the cabinet comprising a wash liquid outlet in the base thereof which connects with the wash liquid supply means.

Reference throughout this specification to "wash liquid" is intended to cover both liquid which is used for washing and liquid used for rinsing.

According to a second aspect of the present invention there is provided dishwasher apparatus comprising a wash cabinet adapted to receive articles to be washed, spray means mounted within the cabinet and operable to spray wash liquid within the cabinet, and a service unit removably mounted with respect to the cabinet, the service unit having mounted therein wash liquid supply means, pump means operable to supply wash liquid from the wash liquid supply means to the spray means, and electrical control means operable to control a wash cycle.

Due to the fact that according to both the first and second aspects of the present invention the wash liquid supply means is mounted externally of the wash cabinet, it is possible to remove all soiling, food particles, etc., from the wash cabinet during all cycles of the apparatus, i.e. during rinsing and washing, the soiling being retained by a filter. Accordingly, the removed soiling is not reintroduced into the wash cabinet. This is in contrast to known dishwasher apparatus in which larger food particles, etc remain within the actual wash cabinet, with smaller particles being entrained in the

wash liquid and reintroduced into the cabinet. Dishwasher apparatus according to the second aspect of the present invention allows all of the components external to the wash cabinet, which constitute the majority of the moving-part components, to be mounted in a service unit which is removable from the cabinet and can thus be taken to a place convenient for inspection and/or repair and may even be removed to a distant workshop, with a new or previously serviced replacement unit put into the dishwasher apparatus so that the latter is rendered immediately operative. This has a particular advantage as regards industrial dishwasher apparatus which is heavily utilised and requires more frequent servicing than domestic apparatus.

The service unit is preferably arranged to be removable from the front of the dishwasher apparatus so that the entire apparatus is serviceable from the front, the wash cabinet itself normally being accessible from the front.

The pump means may comprise an electric motor drivingly connected to a pump which serves to pump wash liquid into the spray cabinet and may also serve to empty the wash liquid supply means although a separate auxiliary pump may be provided for the latter purpose.

The wash liquid supply means for both the first and second aspects of the invention is preferably in the form of a double tank arrangement, conveniently with the two tanks superposed. Infill water is supplied to the lower tank in which is mounted a heater element. Heated water is preferably supplied to the upper tank using the displacement principle, that is heated water is displaced to the upper tank when further infill water is supplied to the lower tank. The heated water in the upper tank becomes the wash liquid and is pumped by the pump means to the wash cabinet, the water draining from the wash

cabinet back into the upper tank and thus being recycled. Preferably, at least the wall between the upper and lower tanks is metallic to allow heat transfer from the lower tank to the upper tank, whereby wash liquid in the upper tank is heated by heat transfer from the lower tank. To this end, the wall between the upper and lower tanks is preferably formed with a trough to which the pump means is connected, water draining from the wash cabinet, flowing over the floor of the upper tank and draining to the trough, this flow of water being in the form of a film or thin layer when the pump is in operation which maximises heat transfer from the lower tank. Cavitation may occur when extracting wash liquid from the trough but it has been found that this can be avoided if any inverted channel member or some other lead-in means is disposed in the trough means and connected to the pump inlet.

Preferably, the upper tank is open topped so as to maximise the return flow of water from the wash cabinet and hence maximise the recirculation of wash liquid. With this arrangement, the open top of the tank may be provided with sieve means in order to filter out soiling removed from the articles to be washed, food particles, etc., whereby the filtered soiling cannot be recirculated within the wash cabinet and thus cannot be redeposited on the articles being washed. Preferably, the sieve is removable from the dishwasher apparatus by sliding from the front of the machine, whereby it can readily be cleansed. The sieve is preferably inclined to the horizontal at a shallow angle to provide, in effect, a trough at one end, in which food particles etc can collect and thus not be subjected to constant impact from water draining from the wash cabinet.

It will be appreciated that the outlet of the pump has to be connected to the spray means and that this arrangement has to be addressed if the service unit, according to the second aspect of the invention, is to be removable. In order to avoid any bunching of a flexible pipe connection between these two components, a preferred feature of the invention is to provide a flexible pipe which rotatably connects the outlet of the pump means to a substantially rigid pipe or swing arm which is rotatably coupled to an inlet of the spray means, whereby the rigid arm swings when the service unit is moved with respect to the dishwasher apparatus. Should it be necessary totally to remove the service unit, then all that is necessary to this end is to disconnect the pipe from the swing arm or the swing arm from the spray means, and also to disconnect the electrical power. To this end, the flexible pipe may be coupled to the swing arm and the swing arm coupled to the inlet of the spray means by simple push-on fittings which provide the necessary sealing and rotary characteristics required.

The wash cabinet is provided with a door and this is preferably hollow and hinged about its lower edge, i.e. about a generally horizontal access. With this arrangement, gas springs are conveniently employed in order to control the opening and closing movement of the door, access to the gas springs being readily obtained simply by removing the front panel of the door.

The door is preferably provided with a combined latch and electrical switch.

Dishwasher apparatus constructed in accordance with the present invention will now be described in greater detail, by way of example, with reference to the accompanying drawings in which :-

Figure 1 is a front view of the dishwasher apparatus,

Figure 2 is a side view of the dishwasher apparatus, partly in section, and showing the door in a partially open position,

Figure 3 is a cross-section, to a larger scale, of a lower portion of Figure 2 and showing a service unit in a partially withdrawn position,

Figure 4 is a plan view of the service unit of Figure 3, and

Figure 5 is a cross-sectional view of a component of Figure 4.

Referring now to the drawings, the dishwasher apparatus is designed for industrial use (for example in a restaurant or public bar) and for fitting in relatively confined spaces. The apparatus comprises a framework on which is built a wash cabinet 1 enclosed by sidewalls 2, a rear wall 3 and a front door 4. Beneath the wash cabinet 1 the framework accommodates a service unit 5 in the form of a drawer which is slidably mounted in the framework for removal from the dishwasher apparatus.

Within the wash cabinet 1 there are mounted upper and lower spray arms 6 and 7 of conventional form, the spray arms being rotatable and the upper spray arm receiving wash liquid via ducts 8 and 9, and the lower spray arm receiving wash liquid via a duct 11. Each spray arm 6 and 7 is provided with conventional jets 12 operable to spray wash liquid, under pressure, within the wash cabinet and hence over articles contained therein. These articles are held in upper and lower baskets (not shown) which run on upper and lower rails 10.

The door 4 of the wash cabinet 1 is provided with a handle 13 by which the door can be opened and closed and the door itself is of hollow construction and comprises a

removable front panel 14 and a fixed rear panel 15, the door being hingedly connected to the framework of the apparatus. Within the hollow door 4 are mounted gas springs or actuators 16, one at each side of the door, the cylinder of each actuator being pivotally connected to the rear panel 15 of the door and the piston being pivotally connected to the framework, part of which is shown at 17. The arrangement is such that the gas actuators serve automatically to close the door 4 once the latter has been moved from a generally horizontal dishwasher-loading position, to a position towards the closed position in which the pivot of the cylinder is ahead of the pivot of the piston. The actuator 16 can be adjusted so as to effect a positive but gentle closure of the door 4. The fact that the front panel 14 of the door is removable means that the gas actuators 16 can be serviced from the front of the machine without difficulty. A combined latch and electrical switch 18 is mounted on the top wall 19 of the wash cabinet 1, the switch being of the type in which positive disengagement of the electrical contacts is effected when the door 4 is opened in accordance with current safety requirements.

A front panel 21 of the dishwasher apparatus is provided with ON/OFF switch 22, and a START switch 23 at the right-hand side, and six LED or other indicators 24 to 29 on the left-hand side. The ON/OFF switch 22 is a rocker switch and initiates power to the machine when rocked in one direction and interrupts power when rocked in the other direction but not before a cleansing cycle has been completed, as will be explained. The indicator 24 has a red lens and the LED is illuminated when mains power is switched on to the apparatus. Indicator 25 shows when illuminated, that the dishwasher is being filled, indicator 26 that detergent is being added, indicator 27 that a wash or rinse operation is in

progress, indicator 28 that rinse-aid is being added, and indicator 29 that the wash liquid is being pumped out. Thus, it is readily seen at a glance the status of a wash cycle the apparatus is in at any given instant.

Returning now to the service unit 5, this has a rear panel 30, a front panel 31, bottom panel 32 and side panels 33. On the right-hand side of the service unit 5 there is provided wash liquid supply means in the form of a double tank arrangement comprising a lower tank 34 and an upper tank 35, the top 36 of the lower tank forming the base of the upper tank. This common panel 36 is attached to the side walls of the upper and lower tank 34 and 35 but is spaced at 37 from the front and rear walls 31 and 30 at which it has an upturned edge. Thus, the lower tank 34 is in essentially open communication with the upper tank 35 for a purpose to be described. The common panel 36 is provided with a generally central and transverse trough 38 having sloping front and rear walls 39.

An electrical heater 41 is provided within the lower tank 34, an electrical connection 42 being taken from the heater to the electrical supply at the front of the service unit 5. Mounted above the upper tank 35 is a removable sieve or filter 43 which is best seen in Figures 4 and 5, the filter being slidably and removably mounted above the upper tank. The filter 43 is provided with a handle 44 by which it can be removed and re-inserted, and comprises a perforated member or screen 45 extending substantially the full length and width of the filter and being inclined downwardly from front to rear, whereby solid foreign matter tends to collect in the trough indicated at 46, thus formed at the rear end of the filter. It will be appreciated that the filter 43 is removable from the service unit 5 without the latter itself being removed from the framework of the machine so

that the filter can be removed for cleansing whenever is necessary and without disturbing the service unit. It will be seen that the filter 43 is disposed between the otherwise open top of the upper tank 35 and an outlet 47 provided in the bottom panel 48 of the wash cabinet 1. This wash outlet is relatively large so as to maximise flow of wash liquid and does not need to be provided with a filter in view of the presence of the filter 43 therebelow. The bottom panel 48 of the wash cabinet 1 is of double skin construction for its major part as is best seen in Figure 3 of the drawings. The lower skin 49 disposed rearwardly of the outlet aperture 47 and the lower skin 51 disposed forwardly of that aperture together serve to cover the overall tank means constituted by the upper and lower tanks 34 and 35 when the service unit 5 is in the operative position, which is that shown in Figure 2 of the drawings. Thus, water vapour is only allowed to pass into the wash cabinet 1 and not over other components of the machine which might be sensitive thereto. The rear edge of the second skin 49 is downturned at 52 to provide a stop for the service unit 5 when the latter is inserted into the dishwasher apparatus.

The left-hand side of the trough 38, as seen in Figure 4 of the drawings is provided with an outlet aperture to which is connected, internally of the tank, to an anti-cavitation member 50 in the form of an inverted trough, the mouth of which is located close to the bottom of the trough 38 in the upper tank 35. The outlet aperture of the upper tank 35 has connected to it, externally, an outlet pipe 53 which in turn is connected to the inlet of a pump 54, the outlet 55 of which is connected by a flexible hose 56, a rigid pipe 57 and a further pipe 58 to the duct 11 within the wash cabinet 1. The flexible hose 56 is connected to the rigid pipe 57 by

push-on O-ring fittings 59 which provide both the necessary seal between the two components and the required rotational movement therebetween. Thus, these connections are readily broken when it is necessary to remove the service unit from the dishwasher apparatus and equally readily re-made when the service unit is re-inserted. The use of a flexible hose 56 and rigid pipe 57 gives rise to a particular advantage over the use of a single flexible hose because it avoids any bunching of the latter and hence avoids the likelihood of flow of wash liquid being restricted. When the service unit 5 is in position below the wash cabinet 1, the pipe 57 is in the position shown in Figure 4 of the drawings, in which it is generally at right angles to the flexible hose 56, but when the service unit 5 is drawn forwards, the pipe 57 is swung to a position in which it is generally in line with the flexible hose, this position being indicated in Figure 3 of the drawings, the rotational movement necessary to achieve this being accommodated by the fittings 59.

The pump 54 is driven by an electric motor 61 and a second pump 62 and motor 63 are provided to empty the top tank 35 which is provided with an outlet in one of its sidewalls 33, which outlet is connected by a hose 64 to the inlet of the pump 62. The outlet of the pump 62 is connected to a hose 65 by a push-on, O-ring fitting in order to provide ready connection and disconnection as with the fittings 59. The pump 62 has a connection to the lower tank 34, whereby the latter provides a head of water to keep the pump primed. The bottom tank 34 is provided with a water inlet 66 to which is connected a water inlet hose 67 (Figure 4) via a solenoid valve 68.

The electrical connections to the motors 61 and 63, the solenoid valve 68 and the heater 41 are taken to a socket 69 (Figure 4) which co-operates with a plug

provided on a control panel 71 containing all the necessary circuitry in order to control the wash cycle of the apparatus, this control panel also being connected electrically to the switches 22 and 23 and the indicators 24 to 29 already referred to.

For operation, assuming both the upper and lower tanks 34 and 35 are empty, the ON switch 22 is rocked to the right to connected power to the control panel 71, whereupon the solenoid valve 68 is energised (opened) as a result of the sensors 72 and 73 not being wet, and cold water is admitted to the lower tank. The lower tank 34 fills with cold water and a water level sensor 72 provided towards the top of the lower tank 34 is first wetted but water continues to flow into the tank and, in view of the open front and rear ends 37 thereof, will flow over the front and rear walls and into the upper tank 35, the water flowing into the trough 38 where is will contact a further water level sensor 73. Once both sensors 72 and 73 are wetted, a short circuit is effected and this signals to the control panel that the solenoid valve 68 should be closed. Should one or both of the sensors 72 and 73 be inoperative, then cold water will continue to flow and fill also the upper tank 35. However, when a further sensor 74 detects water at that level, then this will serve to actuate the pump 62 and pump water to drain, with indicator 29 being energised to show that a fault is present.

The heater 41 is then energised and the water in the bottom tank heated to the required temperature, for example 90-95°C. Only the water in the lower tank 34 is heated directly, with the water in the upper tank 35 being heated indirectly. A 20 minute start-up time is recommended to allow the water in the upper tank to reach the required temperature. When the START switch 23 is operated, a timed pre-rinse and wash cycle is intiated,

the motor 61 being energised so as to drive the pump 54 and spray this hot wash liquid via the spray arms 6 and 7 into the wash cabinet 1 and over and around the articles to be cleaned, detergent having been added to the water from an external supply, for example using a peristaltic technique as is conventional. It will be appreciated that any initial rinsing of the articles will be effected with hot water which is much more effective than a pre-rinse with cold water which is what is used in known dishwasher apparatus. Any soiling or foreign matter removed from the articles will pass with the wash liquid through the outlet 47 in the bottom panel 48 of the wash cabinet 1 and be retained on the filter 43, being washed down to the trough 46 thereof where it will not be impacted by further wash liquid and thus comminuted to the extent that particles will pass back into the wash liquid and be recycled with the likelihood of becoming redeposited on the articles. When pre-rinse and washing cycle has been completed, the motor 61 is de-energised and the motor 63 energised so as to pump out the used wash liquid. Once the sensor 73 becomes exposed, due to the wash liquid pump-out, the short-circuit with the sensor 72 is interrupted, whereupon the solenoid valve 68 is opened so as to admit cold water to the lower tank 34. This incoming cold water displaces the hot water in the lower tank 34 into the upper tank 35 through the end passages 37, the period of time the valve 68 is open being timed so that in normal operation it will be closed before the water level reaches the sensor 74.

For a short period, for example 4 or 5 seconds, the pump 62 remains operative when hot water starts to be displaced from lower tank 34 to the upper tank 35 so that a little of this fresh water is pumped out to ensure that all of the previous wash water has been evacuated. When this water-transfer operation has been completed, a timed

rinse cycle is initiated, with the pump 54 rendered operative and with a rinse aid and/or sanitiser added at the appropriate time from external supplies using peristaltic techniques, as with the detergent in the wash cycle. At the end of the rinse cycle, the rinse water is left in the upper tank 35, with the dishwasher remaining in a standby condition in which the heater 41 remains energised so as to keep the water in both the upper and lower tanks 35 and 34 up to temperature. Thus when the START switch 23 is next actuated, the rinse water from the last dishwashing operation is used to pre-rinse and wash the next batch of articles. Inasmuch as this water has only previously been used for a rinsing operation, then it is relatively clean and the saving in water and energy is significant.

The lower tank 34 may hold 8.5 litres of water and the upper tank 4.5 litres of water. The overall washing cycle can be varied in 2 minute stages up to 6 minutes, with a nominated percentage of the selected period for rinsing. For example, in an overall cycle of 6 minutes, the wash cycle may be 4 or 5 minutes, with the balance being the rinse cycle.

In the standby condition the water in the lower tank 34 may evaporate if the apparatus is not used for a considerable time and the evaporation is to an extent such that the sensor 72 becomes exposed, then a timed refill cycle is initiated. If an overfill occurs then sensor 74 is wetted and the pump 62 is operated until 74 again becomes exposed. It should be noted that the sensor 74 is positioned such that pump 62 is always rendered operative before there can be any backflow of potentially dirty water from the upper tank 35 to the lower tank 34.

When the dishwasher is no longer required, the ON switch 22 is rocked to the left which sends a pulsed signal to the control panel 71 to initiate a pump-out cycle for the upper tank 35 in which the water in the top tank is pumped through the wash cabinet 1 to clean it of all detergent, etc and then pumped to drain. During this close-down or "good-night" cycle, no detergent or sanitiser is added to the water. At the end of this cycle, power to the control panel 71 is switched off.

When the dishwasher is next required, the ON switch 23 is rocked to the right to connect power to the panel 71 and the sequence above described initiated to re-fill the upper tank 35 ready for the next wash cycle, it again being required to allow a start-up period of say 20 minutes to allow the water in both tanks to reach the required temperature.

Inasmuch as the common panel 36 between the upper and lower tanks 34 and 35 is metallic as indeed is the majority of the panelwork of the dishwasher, stainless steel being used as is conventional, then this common panel serves as a heat transfer member so that when the water in the lower tank 34 is up to the required temperature, it serves to heat the wash liquid the temperature of which is lowered by virtue of it being circulated over cold articles. This is an important advantage of the present invention as it makes the washing and rinsing far more efficient. It will be appreciated that the efficiency of the heat transfer referred to is assisted by virtue of the fact that the wash liquid flows over the upper surface of the common panel 36 and into the trough 38 thereof, as it is being recycled from the wash cabinet 1, in a relatively thin film or layer.

Another important feature of the present invention which improves efficiency of operation is the provision of the anti-cavitation member 50 which serves to allow the pump 54 to take wash liquid from the bottom of the trough 38 and thus substantially reduce, if not eliminate, the possibility of cavitation. This allows a virtually uninterrupted flow of wash liquid which thus maximises that flow.

Should it be necessary to service the dishwasher requiring access to any of the components within the service unit 5, the service unit can be withdrawn either partially in order to effect inspection or repair, or entirely if it is necessary to remove it for repair or replacement. If partially withdrawn, the provision of the flexible hose 56 and pipe 57 allows this without having to disconnect the same but if the service unit 5 is to be removed entirely, then one or both of the push-on fittings 59 is disconnected as is the similar fitting associated with the pump 62, and the socket 69 removed from the plug of the control panel 71. In addition, the water supply is turned off and the inlet hose 67 disconnected from the solenoid valve 68. The bottom tank 34 of the withdrawn service unit 5 is readily emptied by tipping the unit and allowing the water to flow out of the end spaces 37. Equally, the reconnection of the same, or replacement, service unit 5 is readily accomplished with the dishwasher apparatus thus being quickly serviceable once again. As already mentioned, any service requirement to the door 4 is also easily accomplished from the front of the dishwasher apparatus by removing the front panel 14. The filter 43 is, as already referred to, readily removed from the service unit 5 for cleansing as and when necessary.

Thus, the present invention affords many significant advantages over known dishwasher apparatus and therefore represents a highly significant advance in the art.

Claims

1. Dishwasher apparatus comprising a wash cabinet adapted to receive articles to be washed, spray means mounted within the cabinet and operable to spray wash liquid within the cabinet, and means for supplying wash liquid to the spray means from wash liquid supply means mounted externally of the cabinet, the cabinet comprising a wash liquid outlet in the base thereof which connects with the wash liquid supply means.

2. Dishwasher apparatus comprising a wash cabinet adapted to receive articles to be washed, spray means mounted within the cabinet and operable to spray wash liquid within the cabinet, and a service unit removably mounted with respect to the cabinet, the service unit having mounted therein wash liquid supply means, pump means operable to supply wash liquid from the wash liquid supply means to the spray means, and electrical control means operable to control a wash cycle.

3. Apparatus according to claim 2, wherein the service unit is removable from the front of the apparatus.

4. Apparatus according to claim 2 or 3, wherein the pump means comprise a single pump driven by an electric motor and operable both to pump wash liquid into the spray cabinet and also to empty at least part of the wash liquid supply means.

5. Apparatus according to claim 2 or 3, wherein the pump means comprises first and second pumps driven by respective electric motors, and operable, respectively, to pump wash liquid into the spray cabinet and to empty at least part of the wash supply means.

6. Apparatus according to any of the preceding claims, wherein the wash supply means is in the form of a double tank arrangement.

7. Apparatus according to claim 6, wherein the two tanks of the wash liquid supply means are disposed one above the other and wherein infill water is supplied to the lower tank in which is provided a heater element, and wherein water heated in the lower tank is transferred to the upper tank for use in an actual wash cycle.

8. Apparatus according to claim 7, wherein a first level sensor is provided in the upper region of the lower tank and a second level sensor is provided in the lower region of the upper tank, the two sensors being linked such that when both sense the presence of liquid a timed further inflow of liquid into the lower tank is initiated.

9. Apparatus according to claim 8, wherein a third level sensor is provided above the normal liquid level in the upper tank and operable to initiate pump-out of the liquid in the upper tank if the third sensor senses the presence of liquid.

10. Apparatus according to any of claims 7 to 9, wherein the water heated in the lower tank is transferred to the upper tank using the displacement principal.

11. Apparatus according to any of claims 7 or 10, wherein the upper and lower tanks are separated by a common metallic wall which serves as a heat-transfer member.

12. Apparatus according to claim 11, wherein the common wall is formed with a trough which is disposed in the upper tank and an outlet for wash liquid from the upper tank to the pump means is disposed in a side wall of the tank.

13. Apparatus according to claim 12, wherein the sides of the trough are inclined, whereby when the pump means is in operation so as to delivery wash liquid to the spray means, wash liquid returning to the upper tank from the wash cabinet flows into the trough in a relatively thin film or layer which aids heat transfer from the next supply of wash liquid being heated in the lower tank.

14. Apparatus according to claim 12 or 13, wherein anti-cavitation, lead-in means are connected to the inlet of the pump means with an open end of the lead-in means being disposed adjacent the bottom of the trough.

15. Apparatus according to any of claims 7 to 14, wherein the upper tank is open topped.

16. Apparatus according to any of claims 2 to 15, wherein removable filter means are provided in the service unit above the wash liquid supply means to filter out foreign matter before wash liquid is returned to the wash liquid supply means from the wash cabinet.

17. Apparatus according to claim 16, wherein the filter means comprises a perforate sheet, the major portion of which is inclined downwardly from front to rear, with the rear portion upturned so as to form a trough in which filtered foreign matter is collected and retained.

18. Apparatus according to any of claims 2 to 17, wherein the service unit is disposed below the wash cabinet and the bottom wall of the wash cabinet is provided on its underside with means which extend over the upper tank in order to prevent water vapour from escaping to components mounted within the service unit.

19. Apparatus according to claims 7 to 18, wherein at least one wall of the lower tank is spaced from the corresponding wall of the upper tank thus allowing free communication between the two tanks for wash liquid.

20. Apparatus according to any of claims 2 to 19, wherein the pump means is connected to the spray means via a flexible hose and a substantially rigid pipe with rotatable connectors being provided at each end of the pipe in order that the latter can swing when the service unit is moved relative to the wash cabinet.

21. Apparatus according to claim 20, wherein the substantially rigid pipe is coupled to the flexible pipe and spray means inlet by push-on O-ring fittings which not only allow for the required rotational movement but also allow ready disconnection and reconnection.

22. Apparatus according to any of claims 2 to 21, wherein the wash cabinet is provided with a front door which is of hollow construction and hingedly connected to

the wash cabinet out its lower edge, gas springs being mounted within the door and being accessible on removal of a front panel of the door.

23. Apparatus according to any of claims 2 to 22, wherein the service unit further comprises a control box in which are mounted control circuits for controlling the wash cycle of the apparatus, the control panel comprising a multi-pin connector which is readily disengaged when the service unit is to be removed from the apparatus.

24. Apparatus according to any of claims 2 to 23, wherein indicator means are provided comprising a plurality of individual indicators which are actuated in sequence so as to show at a given instant the status of a wash cycle.

25. Apparatus according to claim 6 and any of claims 7 to 24 when appended thereto, wherein liquid in one tank is used pre-rinse and wash articles in the wash cabinet and is then disposed of an the liquid from the other tank is used to effect a final rinse of the articles, this liquid remaining in the apparatus and being used to pre-rinse and wash the next load of articles placed in the apparatus.

26. Dishwasher apperatus substantially as herein particulary described with reference to the accompanying drawings.

Examiner's report to the Comptroller under Section 17 (The Search Report)

Application number

9110460.4

Relevant Technical fields

(i) UK Cl (Edition K) A4F

(ii) Int CL (Edition 5) A47L

Search Examiner

TIM JAMES

Databases (see over)

(i) UK Patent Office

(ii) ONLINE : WPI

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Documents considered relevant following a search in respect of claims

Category (see over)	Identity of document and relevant passages		Relevant to claim(s)
X	GB 1113514	(THERMA A G) - see page 2 lines 8-38 and Figure 1	1
X	GB 1076136	(HEINICKE - see page 2 lines 44-54 and Figure 1	1
X	GB 1002532	(KITCHEN MACHINES) - see Figure 3 and page 3 lines 25-35	1,6,16
X	EP 0243631 A2	(BOSCH-SIEMENS) - see the figure	1,2
X	US 3884263	(WRIGHT) - see Figure 13	1,2,6,16
X	FR 2505642	(SMEG) - see the figure	1,2,16

Category	Identity of document and relevant passages	Relevant to claim(s)

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