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(54) **Title:** SEMI AUTOMATIC, COMPACT AND PORTABLE ROTARY BRUSH DISHWASHER

(57) **Abstract:** A Semi-automatic, compact and portable rotary brush dishwasher consisting uniquely designed brush pair with internal water flow passages that is operated through electric motor with efficient water and dish wash liquid discharge systems capable of cleaning and rinsing kitchen utensils of different sizes, shapes and geometry made up of various materials.

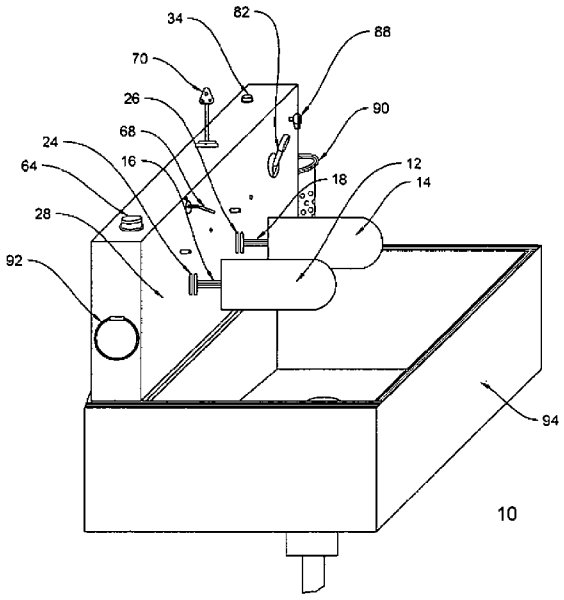


FIGURE - 1

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SEMI AUTOMATIC, COMPACT AND PORTABLE ROTARY BRUSH DISHWASHER

DESCRIPTION

BACKGROUND OF THE INVENTION

1. Field of the Invention

The present invention relates to the field of household appliances, and more particularly to a wall or foot mountable rotary brush dishwasher combination.

2. Description of Related Art

As can be seen by the reference to the U.S. Patent No. 2715741, the prior art lacks features such as compactness and also has high water consumption since the utensils have to be soaked and cleaned inside a water bath. The cleaning is not effective when there is significant increase in grease and stain levels. Also it is difficult to see the degree of cleaning once the water bath loses its transparency by the stains.

On the other hand, regarding another related prior art on the rotary brush with reference to U.S. Patent No. 1393663, although the brush has interior water holes similar to the ones in the present invention, it still lacks the capability of cleaning utensils of varying degree stains since that prior art was intended for different application altogether.

While all of the aforementioned prior art constructions are more than adequate for the basic purpose and function for which they have been specifically designed, they are uniformly deficient with respect to their failure to provide a simple, efficient, and practical portable dishwasher combination.

Although the modern electronics has led to sophisticated dishwashers, most of the commercially available dishwashers still suffer from following problems:

- They occupy large space.
- Their power consumption is high
- Their water consumption is large.
- Utensils have to be pre-cleaned void of any garbage on them.
- Utensils have to be stacked orderly in the racks and made sure they are secure.
- Utensils of shapes too odd cannot be placed or cleaned properly.
- Utensils have to be cleaned in batches but not in small quantities.
- Areas that can be reached by water jets alone can be cleaned properly but grease stains and sediments on corners of utensils cannot be cleaned efficiently.
- They have parts such as filters which need regular attention.
- Their principal costs and maintenance costs are high.
- Needs skilled and trained personnel to do any repairs.
- The quality of water adversely affects the life of the parts in them.
- Not affordable to all classes of people for the reasons mentioned above.

As a consequence of the foregoing situation, there has existed a longstanding need for a new and improved type of portable dishwasher combination and the provision of such a construction is a stated objective of the present invention.

BRIEF SUMMARY OF THE INVENTION

Briefly stated, the present invention provides a portable and compact semi-automatic dish washing machine consisting uniquely designed brush pair with internal water flow passages that is run through electric motor with specialized water and dish wash liquid discharge systems capable of cleaning and rinsing kitchen utensils of different sizes, shapes and geometry which are made out of materials such as stainless steel, porcelain and even glass.

This invention relates to dishwashers and more particularly to such machines which are adapted for household use that is user friendly and is available at affordable cost for mediocre class of people.

An object of the invention is to provide an improved apparatus of the type referred to, in which a pair of engineered helical brushes are in conjunction and operated in such a manner such that they efficiently clean both the interior and external surfaces of kitchen utensils of varying contours rapidly and in a manner that will be safe for use.

Another object of the invention is to provide in such an apparatus with a design that, after repeated use of the apparatus, eliminates the necessitated routine cleansing of the brushes themselves that are in contact with soil or grease during cleaning operation.

A still further object of the invention is to provide an apparatus with a compact design that is installable within the clearance between kitchen sink and adjacent wall.

A further object of the invention is to provide in this type of apparatus an improved construction of the operating connections for driving the rotary brush elements whereby these elements are operated in the association and at relative speeds for effectively and thoroughly cleaning ware of a very wide variation in contour.

Finally, an object of the invention is to provide a compact efficient apparatus for the purposes indicated, which may be economically manufactured, and which may be maintained in operative condition by providing easy replacement of parts, which may be required, as a result of wear or breakage.

BRIEF DESCRIPTION OF THE SEVERAL VIEWS OF THE DRAWINGS

These and other attributes of the invention will become more clear upon a thorough study of the following description of the best mode for carrying out the invention, particularly when reviewed in conjunction with the drawings, wherein:

Figure 1 is a perspective view of the portable dishwasher of the present invention showing the embodiment with all its constituents.

Figure 2 shows the front view of the dishwasher.

Figure 3 shows the rear view with the back lid removed.

Figure 4 shows the schematic electrical diagram of the dishwasher.

DETAILED DESCRIPTION OF THE INVENTION

As it can be observed by reference to the drawings and in particular figure 1, figure-2 and figure-3, the portable dishwasher that forms the basis of the present invention is designated generally by number 10.

The portable automatic dish washer 10 includes a pair of uniquely designed, work safe, helical polyurethane brushes 12 and 14. The brushes 12 and 14 are identical to each other. The description of the brush is as follows

The brush has three main elements. Core shaft, bristle base and Brush.

CORE SHAFT

- The Core Shaft is cylindrical and is fabricated from stainless steel. It has a through hole all along its axis. Also the shaft has a plurality of radial holes in it of a predefined pattern. The radial holes are arrayed both radially and axially along the shaft. The radial holes are not orthogonal but inclined at 45 degrees to the shaft axis. Further, the radial holes are aligned in such a way that their axis is flipped about orthogonal plane alternatively for each set.
- The diameter of the axial hole in the shaft is reduced just at the tip of the shaft.
- These arrangements of the radial and axial holes enable the washing fluid to flow through the axis and then expel out of the shaft radially along the shaft and axially at the tip, creating a fountain of washing fluid.

BRISTLE BASE

The Bristle Base is made up of polymer. It supports the bristle group and forms a rigid base that interfaces with the Core Shaft. The Bristle Base and Core Shaft are glued or fastened to each other. The Bristle Base has radial holes at relatively same locations and same orientation as that of the Core Shaft so that water expels thorough the shaft followed by the Bristle Base.

BRUSH

The brush is made up of bristles and is supported by Bristle Base. The brush envelope has cylindrical profile along its axis and has a hemispherical shape at its end. The cylindrical brushing element consist two groups of brush within. One group being taller and the other group are shorter. The taller bristles are made up of soft nylon material. The shorter bristles are made up of harder nylon than the taller ones. The heights are chosen such that, upon rotating, taller but softer brush does not bruise the hands of the person using it when in contact with the brush. Whereas, upon rotating, by virtue of application of force on utensils, the taller brush group bend laterally letting the shorter but harder brush to apparently protrude out and come in contact with utensils. This feature enables the brush to be unique from a point of view where it is safe on hands but rigor with cleaning of utensils. Also the fountain of water coming out of brush augments the cleaning capabilities of the dishwasher, especially the inner and harder to reach surfaces of the utensils.

Working as a pair, the cylindrical surfaces enable cleaning of utensils' outer, inner and bottom surfaces thoroughly whereas the frontal hemispherical brush groups enable cleaning of the inner bottom surfaces of the utensils. The curved flexible front surface of brush enables cleaning of utensils of both flat and contoured bottom surfaces.

The following are the advantages of the brush pairs:

- Utensils of shapes nominally two dimensional or with depth can be cleaned thoroughly.
- The utensils with depth can have cylindrical or non-cylindrical envelopes.
- Virtually impossible to reach areas with acute projections or deep contours such as bottom vanes of mixer jar, inner projected ribs of the mixer jar lid, bakelite handles with hollow constructions, metal handles' inner surfaces, annular holes of vessels can be reached effortlessly. Further, cleaning items such as utensils with thin metal wires, inner blades of mixer jars which pose a safety hazard to hands can be cleaned safely.

The brushes 12 and 14 are supported and rotated by individual Core Shafts 16 and 18. The Core Shafts are driven by geared motor drives 20 and 22. Since the Core Shafts have to carry water in them, a drive system which is non-coaxial with the Core Shaft is adopted. The Core Shaft is supported by two bearing block pairs 24 and 26 that have precision ball bearings inside them. The precision bearings are of sealed type that prevents water ingress into them upon usage. The span of the ech bearing block pair provides a rigid moment resistive support that withstands the turning moment on the shaft in vertical plane caused by the application of force on the brush.

MECHANICAL SUPPORT SYSTEM

The two bearing block pairs 24 and 26 are mounted with precision locating holes of a metal plate named Face Plate 28. The Face Plate 28 also has large holes at the center of locating hole group for the Core Shafts 16 and 18 to be slid in. The bearing block pairs 24 and 26 are assembled one on the front side and other on the rear side of Face Plate 28 such that their axes are practically collinear and does not hinder the rotation of the Core Shafts 16 and 18.

On the rear side of the Face Plate, past the bearing blocks, a bevel gear is fastened to each of the Core Shafts 16 and 18 named driven gear.

DRIVE SYSTEM

DC geared motors 20 and 22 are used to drive the Core Shafts 16 and 18. Each Core Shaft is driven by a separate geared motor individually so that the shaft speeds can be controlled independently. The geared motors 20 and 22 are mounted on Face Plate 28. They have a bevel gear fastened to their shafts named driving gear. The driving gear and driven gear are connected to each other perpendicularly so that power is transferred at 90 degrees. This perpendicular drive assembly generates required torque but also has smaller footprint and occupies very less room in direction of the thickness of the dishwasher ensuring its compactness which is one of the prime objectives of the invention.

The Core Shafts 16 and 18 extend past their driven bevel gear on the rear side of the Face Plate 28 and rotary elbows 30 and 32 are each connected to the rear end of the Core Shafts 16 and 18. The rotary elbows 30 and 32 have a stationary and rotating part with bearings interfacing them and are of leak proof design. The stationary part of the rotary elbows 30 and 32 are clamped to the Face Plate 28 and the rotary parts are fastened to the Core Shafts 16 and 18. When supplied with water, the rotary elbows 30 and 32 are capable of transferring the water from a stationary pipe into the

Core Shafts 16 and 18 without any tangling although the Core Shafts 16 and 18 are rotating. The power supply to the drive system is controlled by the non-contact sensor 42.

WATER DISCHARGE SYSTEM - PRIMARY

The water discharge system consist a terminal for water inlet 34, a flow control valve 36, a normally closed solenoid valve for water 38, electric water pump 40 and a series of piping system 46. The water could be obtained from a flowing water source such as tap water or a stationary water source such as water in a bucket or sump. The water is intended to be available at the inlet 34 during the operation of the dishwasher 10. The flow control valve 36 is used to regulate the flow rate of the water into the system and its orifice opening is preset during manufacturing of the dishwasher which can also be altered during installation of the dishwasher 10 if required. The solenoid valve 38 is controlled by a non-contact sensor 42 that is coupled to a relay and ensures that water does not enter into system inadvertently due to reasons such as excessive water inlet pressure. When power is supplied to the water pump 40, the water is pumped and is fed to the pipes which then branch out to primary system and supply water to each of the rotary elbows 30 and 32. From rotary elbows 30 and 32 water is expelled out of the brushes 12 and 14 as discussed above. The non-contact sensor 42 is controlled by the control unit 44 in such way that each time it is triggered, the control system would turn on the power supply to the water pump 40 and also turn on the drive system motors 20 and 22. The sensor is placed in the mid-position between the brush pair 12 and 14 and would ensure the primary water discharge system and drive system would turn on as soon as User brings a utensil in the vicinity of non-contact sensor 42.

WATER DISCHARGE SYSTEM - SECONDARY

The water system optionally also has a secondary water dispensing system which is branched off from primary water discharge system and feeds the other piping system 48. From there on, the water is fed to the two water discharge nozzles 52 and 54. The water discharge nozzles 52 and 54 are mounted on the other side of the Face Plate 28 in such a way that they eject water onto the top of the brushes 12 and 14. This feature enables simultaneous cleaning and rinsing of inner and outer surfaces of the utensils. The flow to secondary water discharge system is controlled by another normally closed solenoid valve 50. And the solenoid valve 50 is controlled by a non-contact sensors 56 and 57 coupled to a relay. This sensor is also of similar operational configuration as that of primary water system's sensor wherein the control system 44 would turn on the power supply to the solenoid valve 38 whenever at least one of the non-contact sensors 56 and 57 is triggered. The two sensors placed at a spatial distance ensure that, as soon as larger vessels (that require relatively higher water flow for efficient and quicker cleaning) are brought in the vicinity of sensors' 56 and 57 range, the secondary water discharge system would turn on.

SOAP DISPENSING SYSTEM

The soap dispensing system consist a container 58 for storing soap solution, electric liquid pump 60 and a series of piping systems 62. The soap solution is intended to be available in the container 58 during the operation of dishwasher. The electric liquid pump 60 is controlled by a non-contact sensor 66. When power is supplied, electric

liquid pump 60 discharges the soap solution into the pipes 62 and then to the soap dispenser nozzle 68 where user deposits required amount of the solution onto the utensil surface.

CONTROL SYSTEM

The electric control system 44 of the dishwasher comprises an electric power cord 70 that receives AC power supply from a receptacle, a power supply unit 72 that converts high voltage AC to low voltage DC power, a plurality of sensors with relays and switches 42, 56, 57 and 66. Figure 4 describes the operation of the total control system 44 schematically. The control unit 44 controls the power supply to the Geared motors 20 (Fig.4 – mt1) and 22 (Fig.4 – mt2), solenoid valves 38 (Fig.4 – s1), and 50 (Fig.4 – s2), and the pumps 40 (Fig. 4 – wt) and 60 (Fig. 4 – sp). All the non-contract sensors 42 (Fig.4 – ss2), 56 (Fig.4 – ss3), 57 (Fig.4 – ss4) and 66 (Fig.4 – ss1) can be triggered just by waving the hand in front of them. This feature prevents the water ingress into system from user's hand which will be apparently wet during operation of the dishwasher 10. These sensors 42, 56, 57 and 66 activate the relays which subsequently send power supply to their respective units. The whole system operates under low voltage DC power supply reducing the chances of electrocution to great extents. The power supply 72 unit is mounted in a water proof enclosure within the dishwasher 10.

All the non-contact sensors 42, 56 and 66 are looped into control system 44 with individual push buttons (Fig.4 – sp, ws, owt) in parallel circuit. This feature ensures that in case of malfunction of any of the non-contact sensors 42, 56, 57 and 66, the user can still operate the dishwasher manually by using push button for respective operations.

The Face Plate 28 also supports a switch panel 76 (Fig 4. Switching Panel) which has all the switches mounted on it. Also Face Plate 28 has a level indicator 78 to indicate the volume of the soap solution in the container 58. Further, the Face Plate 28 has a LED Panel also indicate the working status of all the non-contact sensors 42, 56, 57 and 66. The level indicator is illuminated with a LED to work with low ambient light conditions.

INSTALLATION OF DISHWASHER

An enclosure 80 is made by attaching surrounding the Face Plate 28 on its four sides. A lid of removable type is envisaged at the back of the enclosure for servicing the parts. The enclosure has two or four anchor bolts with one end connected to the Face Plate that eject out of the dishwasher so that the machine can be fastened onto the wall rigidly. All the forces induced during operation are transferred to the wall through Face Plate and anchor bolts.

OTHER FEATURES

The dishwasher 10 also has a portable shower faucet 82 that has flexible tubing 84. The flexible tubing 84 is contained in a chamber 86 of the dishwasher 10 whereas its head is mounted on the external surface of the dishwasher 10. The other end of the flexible tubing is connected to the main water inlet 34 via a flow control valve 88. The maximum flow rate of the shower faucet 82 can be controlled with the flow control

valve 88 such that the water is delivered on the sink directly similar to the regular kitchen sink faucet. The arrangement is made in such a way that the head can be pulled out along the flexible tubing when needed and can be slid back in position once done. This feature enables manually rinsing things other than utensils. Also, since the dishwasher will be installed in lieu of existing faucets (tap), it serves as a standby water supply system in the event of power failure so that, manual dishwashing or other essential tasks can be still carried out.

The dishwasher also has few other features such a garbage can 90 that is mounted on the sides of the enclosure 80 to collect garbage on the utensils before cleaning them and a ring 92 on the other side that can be used to hang the cleaning towel if need be.

OPERATION OF THE MACHINE

Upon usage, to clean utensils, the user turns on the power switch on switching panel 76 followed by triggering the water pump power supply by its sensor 42 which creates water fountain all around the two pairs of brushes 12 and 14. User would collect appropriate amount of soap solution from the soap dispensing nozzle 68 by triggering its sensor. To dispense soap solution in higher quantity, the user will wave hand at it multiple times. Then the utensil is made to come in contact with the brushes 12 and 14. The user is free to choose the most appropriate position of the utensil to make in contact with brush. The brush then cleans and rinses surfaces in contact with its bristles and water fountain. The secondary water dispensers 52 and 54 may also be used to simultaneously rinse the other surfaces as required. The soft taller brush groups with densely packed bristles enable thorough cleansing of grease and oil stains, whereas the shorter harder bristles enable removal of tough condensed stains or sediments of utensils as a result of cooking.

The invention disclosed here has several advantages over the conventional dishwasher as follows

1. The dishwasher is very compact, occupies such a less room that it can even be installed just in small clearances between kitchen sink and wall.
2. The dishwasher can be installed in a kitchen whether new or existing and does not need any separate new space to be allocated.
3. The dishwasher needs very low power to run and is operated on low voltage DC power supply negotiating any apprehension of electrocution.
4. The brushes enhance the cleaning efficiency by maximum usage of cleaning surface. The water is not applied as jets at high speeds rather strewed covering a vast area. Since water requirement per unit area is very low the total water consumption is as low as 50% of normal water usage.
5. Since the soap is used just on demand, the soap consumption is also significantly reduced.
6. The unique combinations of brush groups make harder grease or oil stain and sediments to be cleaned.
7. The dishwasher does not need any stacking operation to be done like the conventional dishwasher. User is free to choose which one is cleaned first.
8. The utensils can be cleaned in small batches or large batches or even then and there as wanted.

9. The technology involved in making of this dishwasher is relatively simple making it easier to service even by semi-skilled technicians.
10. The cost of the dishwasher is far less than other dishwashers.
11. There are no consumable parts such as filters and maintenance
12. The entire embodiment is portable and can be carried in a compact case.
13. The dishwasher can be used outdoors as well in occasions such as outdoor parties, picnics etc.
14. The dish washer can be used to clean utensils made out of various materials such as stainless steel, porcelain and even glass.
15. No special training is required to use the dish washer.
16. Dish washer is very much user friendly and its operation is as simple as that of any kitchen equipment being used contemporarily.
17. Any service of the machine that might be necessitated can be done on-site itself.
18. With dishwasher's low capital, operating and maintenance costs, low power and water consumption, it is affordable to people of mediocre class and also for small refreshment stalls.

The dishwasher 10 can also be fabricated in such a way that it comes with an inbuilt kitchen 94 sink where the dishwasher 10 is mounted on the sink 94 in lieu of the water tap. Such embodiment could likely be used in a new house installation. Such installation can negate the use of anchor bolts altogether by supporting the dishwasher 10 at its bottom by the sink 94. To add up, such installation will make the whole unit to look trendy.

Although only an exemplary embodiment of the invention has been described in detail above, those skilled in the art will readily appreciate that many changes or variations are possible without materially departing from the novel teachings and advantages of this invention. Accordingly, all such modifications are intended to be included within the scope of this invention as defined in the following claims.

CLAIMS

1. A portable dishwasher, comprising:
   a brush pair with water flow holes as described in this document and that is supported by Core Shafts with internal water supply passages as described and that is driven by a pair of DC motor drive system;

   a primary water discharge system that supplies cleaning water from a terminal into the rotating brush pair as described below through a pumping system creating a water fountain within the brush pair surfaces;

   a liquid soap pumping system including a container that dispenses soap solution from a nozzle;

   a control system that powers and controls the operation of primary and secondary water discharge system, soap pumping system and brush drive system; and

   an enclosure that encapsulates all the systems described above within it.

2. A portable dishwasher of claim 1 further including a secondary water discharge system that casts water over the brush pair; and has added controls to the control system of claim 1.

3. A portable dishwasher of claim 1 further including a sink or washing receptacle that is fitted onto the bottom for the dishwasher to form a single assembly unit that is ready to install onto new kitchens.

4. A portable dishwasher of claim 1 wherein metal bristles are used instead of polymer bristles on the brush pair.

5. A portable dishwasher of claim 1 wherein single brush with one DC motor drive system is applied instead of a pair of brushes and DC motor drive system.

6. A portable dishwasher of claim 1 including a replaceable trash container that can be taken out and cleaned; and a ring to hang a drying towel.

7. A portable dishwasher of claim 2 further including a sink or washing receptacle that is fitted onto the bottom for the dishwasher to form a single assembly unit that is ready to install onto new kitchens.

8. A portable dishwasher of claim 2 wherein metal bristles are used instead of polymer bristles on the brush pair.

9. A portable dishwasher of claim 2 wherein single brush with one DC motor drive system is applied instead of a pair of brushes and DC motor drive system.

10. A portable dishwasher of claim 2 including a replaceable trash container that can be taken out and cleaned; and a ring to hang a drying towel.

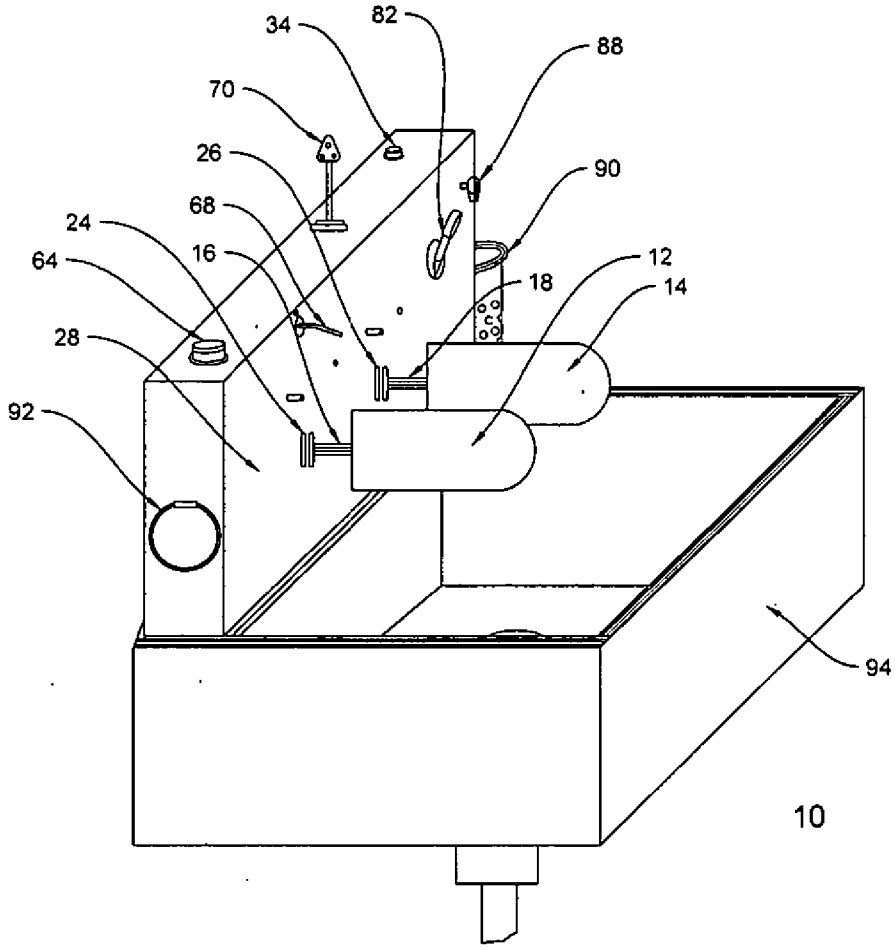


FIGURE - 1

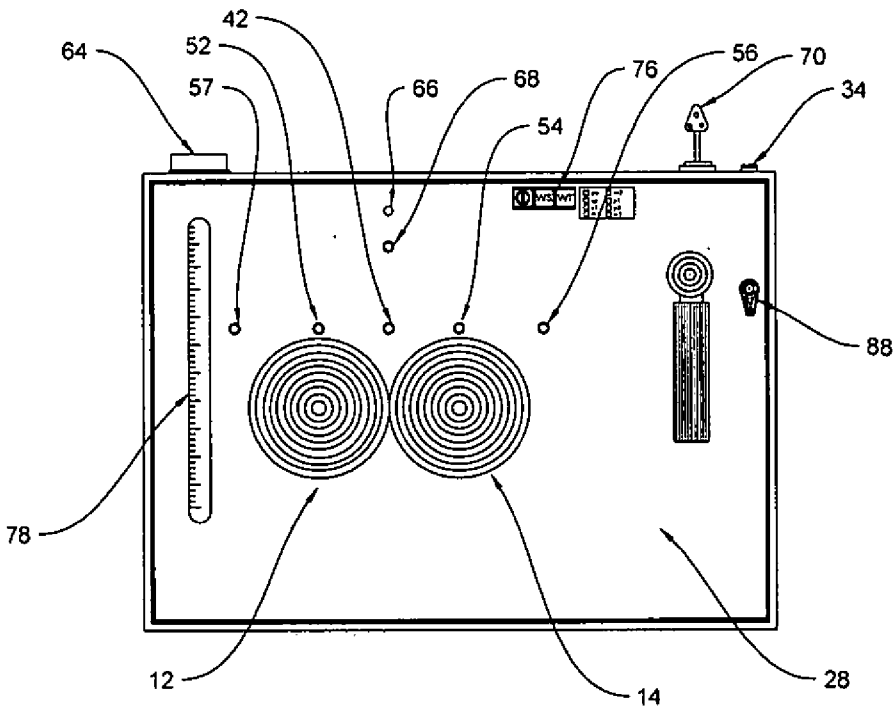


FIGURE-2

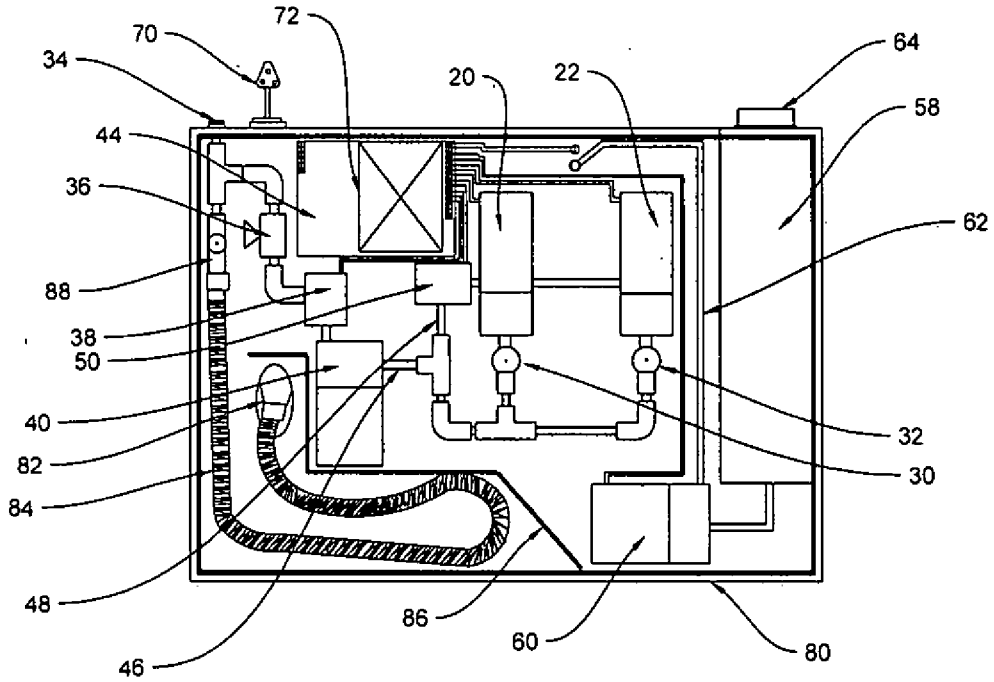
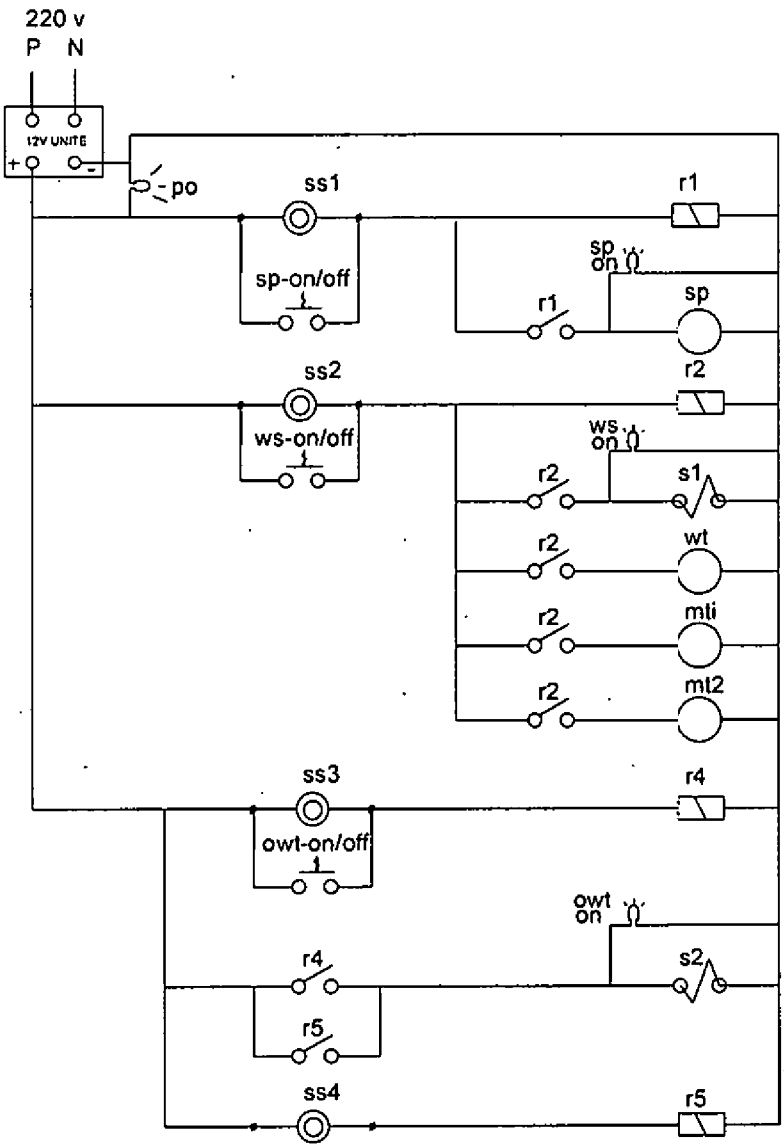


FIGURE -3

CONTROL UNIT SCHEMATIC DIAGRAM



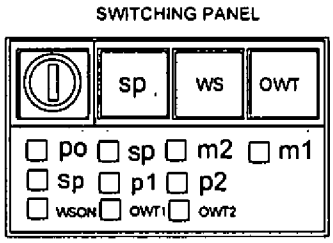


FIGURE -4

INTERNATIONAL SEARCH REPORT

International application No.
PCT/IN2018/000046

A. CLASSIFICATION OF SUBJECT MATTER
A47L15/39 Version=2018.01

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

A47L

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

TotalPatent One, IPO Internal Database, Google Patents

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	US 1907152 A (Fielding George Thomas) 02 MAY 1933 (02-05-1933) & no family page 2 line 8-10; page 2 line 90-94; figure 1-2	1-10
Y	KR 200324656 Y1 (Sim Chang Seop) 25 Aug 2003 (25-08-2003) & no family figure 2-4; claim 1; para [0012] as machine-translated by Google Patent	1-10
Y	US 20170231464 A1 (K-ONE IND PTE LTD) 17 Aug 2017 (17-08-2017) figure 11-12; para [0041]	6, 10

☐ Further documents are listed in the continuation of Box C.

☒ See patent family annex.

* Special categories of cited documents:

"A" document defining the general state of the art which is not considered to be of particular relevance

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Date of the actual completion of the international search	Date of mailing of the international search report
11-12-2018	11-12-2018

Name and mailing address of the ISA/	Authorized officer
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International application No.
PCT/IN2018/000046

Citation	Pub.Date	Family	Pub.Date
US 20170231464 A1	17-08-2017	EP 3206553 A1	23-08-2017
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