



1

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**WASHING MACHINE TO USE IMPACT OF SOLID MATERIALS AND SOLID RECOLLECTING EJECTOR**

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4 Claims

**ABSTRACT OF THE DISCLOSURE**

A washing machine for circulating solid particulate material with a liquid medium including a funnel-like tank and an overlying funnel-like strainer in conjunction with a centrifugal pump operatively connected by an inlet to the tank sump and having an outlet nozzle connected to the pump by an intermediate venturi-type solid particle recollecting means having a vacuum chamber communicating with the sump of the strainer.

This invention relates to a washing machine, and, more particularly, to a washing machine of the type adapted to utilize solid particulate materials in combination with a liquid medium, such as water and detergent, for a direct solid impact action on articles to be cleaned and to recollect the materials to eject the same in a recycling washing operation.

This invention comprises an improvement of my earlier filed patent application entitled "Solid Impact Washing Machine," Serial No. 383,297, now abandoned, and my improvement patent application for "Solid Particle Recollecting Ejector," Serial No. 431,584, now abandoned. An object of this invention is to provide a washing machine for articles which provides a distribution system for a liquid medium with interspersed solid particles therein which are arranged to be impacted on articles to be washed to clean them.

It is another object of this invention to provide a washing machine of the type described hereinafter which is adapted by reason of means to disperse solid particles in a liquid medium, such as plain water or detergent, to impact articles to be cleaned with a steady stream to thoroughly wash the same.

It is another object of this invention to provide an improved washing machine of the type described which includes a recollecting means and ejector for the particulate solid matter incorporated in the delivery system which collects and holds the solid particles so that they are not recirculated through a pump but which, nevertheless, provides the necessary impact of the solid articles and the recirculation of them together with the washing liquid.

It is another object of this invention to provide a solid particle recollecting ejector in a delivery system which includes a venturi type nozzle in a fluid path of materials under the influence of the pump which is circumposed by and in open communication with a supply of particulate matter whereby the said particulate matter is entrained into the mainstream of the fluid flow to be de-

2

livered with the water or fluid being pumped so as to impact upon an article to be washed.

It is another object of this invention to provide a washing machine which is of the type described hereinafter which is inexpensive to manufacture, simple in operation and adapted to preserve pump life and to provide a thorough cleaning and rinsing of articles to be washed.

In accordance with these and other objects which will become apparent hereinafter, the instant invention will now be described with reference to the accompanying drawings in which:

FIGURE 1 is a partly broken away side elevation view of one embodiment of the instant invention;

FIGURE 2 is a plan view in cross section which is partly broken away and which is taken along the plane indicated by the line 2-2 of FIGURE 1 and looking in the direction of the arrows;

FIGURE 3 is a side elevation view of an improved alternative embodiment of the instant invention; and

FIGURE 4 is a view in cross section of that portion of FIGURE 3 with the arrowed line 4-4 therearound.

Referring to the drawings, wherein like reference characters designate like or corresponding parts throughout the different views, and referring more particularly to the embodiments of FIGURES 1 and 2, the numerals 1 and 1' each designate a conveyor shaft in spaced relation, which is mounted and rotatable in bearings numbered 2 and 2' respectively which are attached to a machine frame defining a container 72 for articles to be cleaned. The numerals 3 and 3' designate a driving and a driven chain sprocket wheel which are mounted on each end of the shafts 1 and 1' to rotate with the shafts. Conveyor chains 4 and 4' are connected to sprocket wheels mounted on the shafts and trays designated by the numeral 5 are provided which engage with the conveyor chains and are supported thereby for travel through the device. Power means comprising an electric motor 6 with a reduction gear case may be provided to operate the conveyor at a slow linear speed. Within the frame a centrifugal pump 7 and a driving motor are provided to supply a high pressure flow for washing and rinsing liquids by ejection of fluid through the confronting nozzles 8 and 8'. Suitable tubing and fittings designated by the numerals 9 are provided to interconnect the nozzles and the pump. In the embodiment of FIGURE 1, the numeral 10 comprises a suction pipe connected to the pump, the terminal end of which is disposed near the bottom of an inverted funnel type tank 11 to collect liquid and material in the well type bottom or sump portion. A drain valve 12 is provided in the bottom of the tank as is an appropriate strainer 12' in spanning relation to trap certain size particles. The tank 11 extends from the bottom to the top of the machine with the enlarged mouth opening at substantially the height of the conveyor chain immediately adjacent the line of travel of the trays 5 through the machine. An electric blower 13 is preferably provided with an electric heater element 14 adjacent its nozzle to supply heated air to dry the dishes or the utensils as they complete their path through the washing portion of the washing machine and into the counter portion designated by the numeral 16. The counter portions, which are

designated by the numerals 15 and 16, include lifting tops with hinges at the rear ends and serve to store dishes and utensils and also convey them into and out of the machine. The counters 15 and 16 may also be provided with safety switches to control the operation of the machine by starting or stopping it. The numeral 17 designates a collection of particulate solid material, preferably of generally uniform material, such as buckshot or other small diameter size so as to be lightweight and also so as to have a cleansing effect on continually impacting on a surface of a dish or a utensil in a randomized distribution pattern in a liquid spray. A continuous circulation is provided of this particulate material, the constituent elements of which are picked up on reaching the bottom of the tank 11 in the distribution system.

In operation, such as in a commercial installation, two units should be used in series with one of the units being for washing and the other being for rinsing and drying. A suitable electric controller is set to start the washing and rinsing operation. The drain valves 12 of both units will be closed first so that water may be flowed into the units to fill the tanks 11 up to a predetermined and pre-set water level. Thereupon, the washing liquid and solid particles 17 of the washing unit and the rinsing liquid and solid particles 17 of the rinsing and drying unit will be caused to circulate as the conveyor chains 4 rotate together to travel the trays 5 through the machine through both the washing and rinsing units of the machine with the path of travel of the trays lying closely adjacent the upper and lower nozzles 8 for providing a high pressure flow of the combined mixture or fluid impregnated with particles to produce a solid impact action upon the surface of the dishes and utensils. When a washing cycle has been completed the washing and rinsing liquids will be caused to stop circulating by de-energization of the pump, whereupon the drain valves 12 may be opened to drain the liquids from the tank; however, the solid particles 17 will be retained by reason of the strainers in the drain valves so that the same may be used again in subsequent operations.

Referring to the improved embodiment of FIGURES 3 and 4, which is similar in general structure and operation to that of FIGURES 1 and 2; although not shown, this embodiment will incorporate the conveyor structure etc. illustrated in FIGS. 1 and 2, for example, the numeral 41 designates a funnel-shaped tank to hold a washing liquid while the numeral 42 designates a centrifugal pump and motor which, as is apparent in view of the foregoing, provides a high pressure flow of a washing liquid. A suction pipe 43 for the pump 42 is provided with the terminal end being adjacent the bottom sump portion or well 46 of the tank 41 for the purpose of extracting liquid therefrom. A solid particle recollecting and ejector means is provided in the high pressure path of the distribution system and is designated by the numeral 44, which is connected downstream of the centrifugal pump. With reference to FIGURE 4, the discharge of the recollecting ejector is designated by the numeral 55 and it is connected to the washing nozzle 45 or nozzles through tubing 48. A funnel-shaped strainer 47 is provided above the tank walls to line the mouth of the tank, i.e., with the mouth of the strainer being connected in the mouth of the tank and with the side walls of the strainer converging to a point spaced upwardly from the lowest point of the tank. The lower or smallest part of the strainer 47 nests in the vacuum chamber 56 and may be in a threaded engagement of the recollecting ejector whereby the solid particles 17 will roll by gravity feed into the vacuum chamber of the ejector, of which the numeral 57 designates the inlet and the numeral 58 designates a discharge nozzle included therein and seen in FIGURE 4.

In operation of this embodiment, the tank is filled with a washing liquid up to a predetermined level which is sufficient to submerge the recollecting ejector. Thereafter, 75

the centrifugal pump is energized to cause a high pressure flow of the liquid past the inlet 57 and nozzle 58 as the recollector and ejector means 44 develops a higher velocity. As a result, the pressure in the nozzle outlet is greatly reduced creating a low pressure area in the vacuum chamber 56 which, due to the vertical position of the discharge tube 55, will permit the solid particles to roll by gravity directly into the discharge tube to be entrained by the discharge liquid stream and directed by the pump pressure to the washing nozzle for solid impact washing action upon articles to be cleaned. When the liquid is drained from the tank the solid particulate matter will drop into the funnel-shaped strainer which will separate the liquid from the solid particles so that the liquid will again be pumped and the solid particles will again pass through the ejector avoiding the portion of the fluid path tracing through the pump.

Thus, it is seen that each embodiment provides a washing machine to employ a stream of solid particles and liquid, and, if desired, detergent, which will flow through the nozzles; and, also, a solid washing impact-recollecting ejector is provided.

While the instant invention has been shown and described herein in what is conceived to be the most practical and preferred embodiments, it is recognized that departures may be made therefrom within the scope of the invention, which is therefore not to be limited to the details disclosed herein but is to be accorded the full scope of the claims so as to embrace any and all equivalent apparatus and articles.

What is claimed is:

1. In a washing machine for circulating a liquid medium and a particulate material of a character to gravitate in the liquid medium, the improvement comprising:
  - a funnel-like tank (41) for containing a liquid medium and converging into a lower sump portion;
  - means (1-4) disposed above said tank for supporting articles to be cleaned;
  - a funnel-like strainer (47) disposed in said tank and extending transversely thereacross and converging thereinto at an angle greater than that of the funnel-like tank and terminating in a lower sump portion disposed above the sump portion of said tank;
  - a mass of particles (17) gravitationally restrained within said strainer and gravitating to the sump portion of said strainer;
  - suction pump means having an inlet (46) communicating with said tank sump portion for drawing liquid therefrom and an outlet for directing liquid away from the pump;
  - solid recollecting and ejection means (44) including a downwardly open vacuum chamber (56) in direct communication with said screen sump portion for gravitationally receiving and drawing said particles directly from said strainer sump portion,
  - said last-mentioned means including a discharge nozzle (58) directed downwardly, downstream of and below said downwardly open vacuum chamber and communicating with said vacuum chamber for providing a vacuum in said vacuum chamber,
  - said particle recollecting means including a discharge outlet (55) below said discharge nozzle in direct communication with said vacuum chamber and discharge nozzle for receiving the particles therein,
  - said recollecting means including an inlet (57) connected to said pump outlet and said discharge nozzle; and
  - a spray nozzle (45) communicating with said recollecting means outlet for receiving a mixture of the particles and liquid and being directed onto said means for supporting articles whereby said mixture will be impacted onto articles being cleaned, be received by said strainer, and the liquid will pass into said tank and the particles will gravitate down into said strainer sump portion as the mixture is circulated.

5

2. The structure as claimed in claim 1 in which said solid particle recollecting and ejection means includes a chamber communicating with said pump outlet and converging toward said discharge nozzle.

3. The structure as claimed in claim 2 in which said last-mentioned chamber includes an intermediate reverse-bend whereby said pump outlet discharges toward said vacuum chamber, and said discharge nozzle is directed in an opposite direction.

4. The structure as claimed in claim 1 in which said means for supporting said articles comprises a substantially open framework, endless conveyor.

6

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