

1

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MACHINE FOR CLEANING PIPETTES, PETRI DISHES, AND OTHER ARTICLES

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The invention relates to a machine for cleaning pipettes, petri dishes and similar hollow articles which present great difficulties to their effective, convenient and economical treatment by known methods and equipment. However, the invention relates more generally to a machine which is applicable to the cleaning of a great variety of articles so that equipment installed for the cleaning of pipettes or the like may take the place of the equipment customarily used for the cleaning of such other articles.

Among the objects of the invention are the effective, convenient, economical, large-scale cleaning of pipettes, other tubular articles, petri dishes, and of laboratory and other utensils in general.

Among the objections of the invention, furthermore, is a cleaning machine permitting the use of cleaning agents, such as detergents, and of such high temperatures, which proved inapplicable to known machines on account of heavy foaming or destruction of gaskets acting as fluid seals and other parts unless made of special, expensive materials.

The invention achieves these and other objects and advantages, which will become apparent as the description proceeds, by lowering and raising the level of the cleaning fluid in a container in which the articles to be cleaned are so arranged as to permit the complete immersion into and recession from the cleaning fluid. More specifically, the invention contemplates the use of twin tubs or containers and the alternate displacement of the cleaning solution or rinse from one container into the other one by gas, preferably steam, under pressure while keeping all or most of the mechanism for the automatic control of the cycle of operations out of contact with the hot cleaning liquid or solution.

The features of the invention and the advantages attained by them will be more fully and clearly understood from the embodiment illustrated in the attached drawing and described in the following.

In the drawing:

Figure 1 is a perspective view of a cleaning or washing machine incorporating the invention; and

Figure 2 is a diagrammatic section through the cleaning containers, and a sectionalized diagram of the pipe and valve system.

The machine illustrated has two tubs or containers 5, 105 supported side by side in a cabinet structure 6. The tubs are vertically arranged cylinders having bottom walls 7, 107. Lids 8 close the open tops of the tubs. Seals 9 and closing mechanisms 10 of any design known for other pressure vessels, ensure a gas-tight closure and allow the easy opening and closing of the tubs or vessels. Pipettes, petri dishes and beakers 11, to be cleaned, are supported within the containers by removable carriers or cages 12. The shapes of the articles and their arrangement should be such that they form no pockets retaining liquid or trapping air when the liquid level in the containers falls or rises, respectively.

An automatic one-way valve 13, 113 is secured in an

2

opening of the respective bottom walls 7, 107 and connected with a pipe 14, 114. Pipe 14 is connected over valve 15 with a source of water, preferably hot, and a four-way valve 16 is inserted between the two pipes 14 and 114. Valve 16 is designed for establishing an otherwise closed communication between the two vessels 5 and 105 in its position illustrated in the drawing and for connecting in its different positions the one or the other vessel, or both vessels, with a drain pipe 17.

The identical valves 13, 113 have a ball 18, 118 arranged in the valve housing above valve seat 19, 119 and below a perforated retainer 20, 120. The balls are so light in weight, on account of their material or of being hollow, that they float in the cleaning liquid and the rinse water. The balls will therefore be kept away from their seats and the valves 13, 113 will stay open as long as there is liquid in the tubs, but they will close the valves automatically against gas pressure from the interior of the vessel when the liquid is let out, and they will automatically reopen in response to pressure from inside the pipes 14, 114.

A pipe 21, 121 communicates with the top part of the respective vessel. Preferably, the vessels are so deep and the pipes so arranged, that the openings for the latter are well above the upper ends of the articles to be cleaned.

Pipes 21, 121, an admission pipe 22 and a vent 23 are connected to a valve 24 having a reciprocating slide 25. The slide has a recess 26 and is of such length relative to the distance between the openings for pipes 21, 121 that in one of its end positions it establishes connection between admission pipe 22 and vessel 5 via pipe 21 while venting vessel 105 via pipe 121, whereas in its other position vessel 5 is vented and vessel 105 connected to pipe 22. Pipe 22 is connected over a shut-off valve 27 and a needle valve 28 to a source of steam or another gaseous pressure medium. Valve 27 serves for the accurate adjustment of the rate of admission of steam or the like to the cleaning vessels.

Slide 25 has a rod 29 provided with two stops 30, 130 which are spaced from each other and adapted for engagement with a lever 31 arranged between them. Lever 31 has one end journaled at 32 to a fixed part of the machine and another point journaled to the connection 33 between two pistons 34, 134 reciprocally arranged in cylinders 35, 135. Branches 36, 136 of pipes 21, 121 communicate with these cylinders. A compression toggle spring 37 is inserted between a fixed point 38 of the structure and lever 31 in such a manner as to hold the latter resiliently in either one of its end positions.

If, in the position of the parts shown in the drawing, the steam pressure in pipes 21, 36 and cylinder 35 is sufficiently raised, piston 34 will overcome the resistance of spring 37 and push lever 31 past the dead center so that the lever engages stop 131 and pulls rod 29 and slide 25 to the right, thereby connecting pipe 121 and vessel 105 with steam pipe 22 while venting pipe 21 and vessel 5. Subsequent increase of steam pressure in pipe 121 will reverse the movement.

The operation of the machine is as follows. The articles 11 with their carriers 12 are placed in the vessels 5, 105; valve 16 is brought into the illustrated position, establishing communication between the vessels 5, 105; hot water is admitted through valve 15 in a quantity sufficient to fill one of the vessels to a point above the articles and below pipe 21, 121 when the other vessel is empty; cleaning compound—soap, detergent or the like—is added; and the vessels are closed by the covers 8 and mechanisms 10. The sequence of these preparatory steps is immaterial, but during this time the steam admission valve 27 remains closed.

The machine is now ready for its cycles of washing

3

operations. Steam valve 27 is now opened and metering valve 28 so adjusted that the steam admitted to vessel 5 pushes the liquid therein at the desired speed out of vessel 5 and through pipes and valves 13, 14, 16, 114, 113 into vessel 105. The moment the last liquid leaves vessel 5, ball 18 of valve 13 drops on its seat and thereby closes the valve. The steam pressure in vessel 5 and in the pipes 21, 36 now rises until sufficiently high to move piston 34 against the spring 37 thereby operating valve 23 as described before, with the effect that vessel 5 is vented and vessel 105 connected to the source of steam. The liquid from vessel 105 now flows to vessel 5 in opening one-way valve 13. This flow may at first be caused mainly by the difference in the levels of the liquid, but after attainment of the same level, is continued under the influence of the steam pressure until the last liquid has left vessel 105 so that ball 118 settles on its seat 119, the steam pressure rises, piston 134 is moved to the left and vessel 105 is vented while vessel 5 is reconnected to the source of steam.

Without opening the tubs or vessels, the cleaning liquid may be renewed or changed or rinse water may be admitted.

The use of steam as pressure gas has the great advantage that it simultaneously heats the cleaning liquid.

The invention is not restricted to the embodiment illustrated and described, but is susceptible to modifications and to adaptations. The device may have, for instance, more than two containers or tubs for receiving articles to be cleaned, or it may have a single tub for the articles and a reservoir for temporarily storing the cleaning or rinsing fluid displaced from the tub. A great number of different devices may be employed for automatically operating the valves and of valve arrangements. For instance, a float valve near the top of each container may serve for this purpose instead of the illustrated float valve at the bottom and instead of using the increase in steam pressure for moving the steam admission and exhaust valves. The specified and other modifications will easily occur to those skilled in the art upon having become acquainted with the basic principle of the invention and the preferred embodiment illustrated and described herein.

What is claimed is:

1. Machine for liquid-cleaning laboratory and other utensils such as pipettes, petri dishes and beakers, comprising: two vessels, at least one of which is provided with fluid tight fitting, removable cover and adapted for the reception of the utensils to be cleaned; a passage inter-connecting the bottom regions of the two vessels; a pair of fluid conduits connected respectively with the upper regions of said vessels; valve means for connecting alternately the one conduit with an admission pipe for a

4

gaseous pressure medium and the other conduit with a vent; and operating means for said valve means, comprising a fluid pressure motor responsive to increase in fluid pressure in one of said vessels.

2. Machine for liquid-cleaning laboratory and other utensils such as pipettes, petri dishes and beakers, comprising: two vessels, at least one of said vessels being provided with fluid tight fitting, removable cover and adapted for the reception of the utensils to be cleaned; a passage inter-connecting the bottom regions of the two vessels and provided with a one-way float valve for each vessel, said one-way valves being adapted to close when liquid is displaced from the respective vessel; valve means for connecting alternately the upper region of one of said vessels with a source of a gaseous pressure medium and simultaneously the upper region of the other vessel with a vent; and a fluid pressure motor for operating said valve means and actuated by fluid pressure increase in the vessel from which liquid is displaced and the float valve of which is closed.

3. Machine for liquid-cleaning laboratory and other utensils such as pipettes, petri dishes and beakers, comprising: two pressure vessels arranged side by side, at least one vessel being provided with a removable cover and adapted for the reception of utensils to be cleaned; a passage inter-connecting the bottom regions of the two vessels and provided with a one-way valve for each vessel, said valves being adapted to close when liquid is removed from the respective vessel; a pair of fluid conduits, one for each vessel and connected with the upper region thereof; a valve with a slide for connecting alternately the one conduit with an admission pipe for a gaseous pressure medium and the other conduit with a vent; a pair of opposed cylinders, each communicating with one of said conduits; pistons, movable in said cylinders and connected with each other and with said slide; and a toggle spring inserted between a fixed point of the machine and a part connected with said pistons.

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