

Dec. 23, 1941.

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2,267,351

WASHING APPARATUS

Filed March 10, 1939

3 Sheets-Sheet 1

FIG. 1.

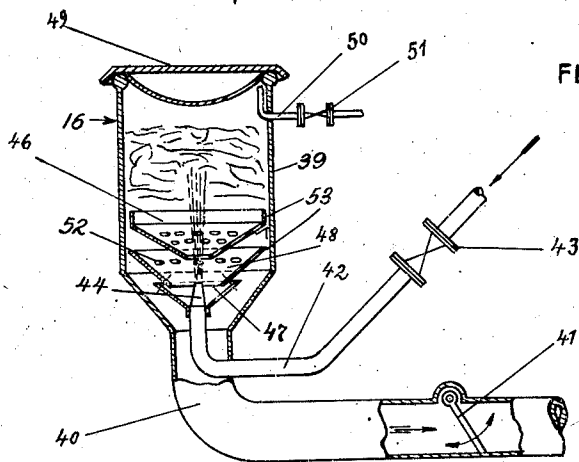
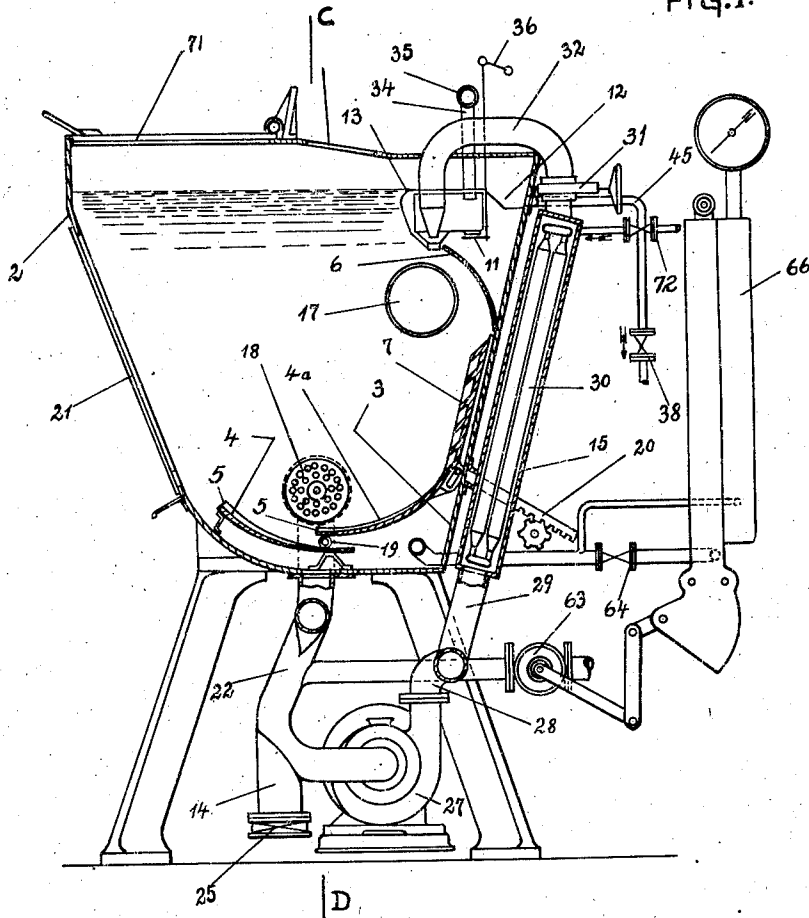


FIG. 2.

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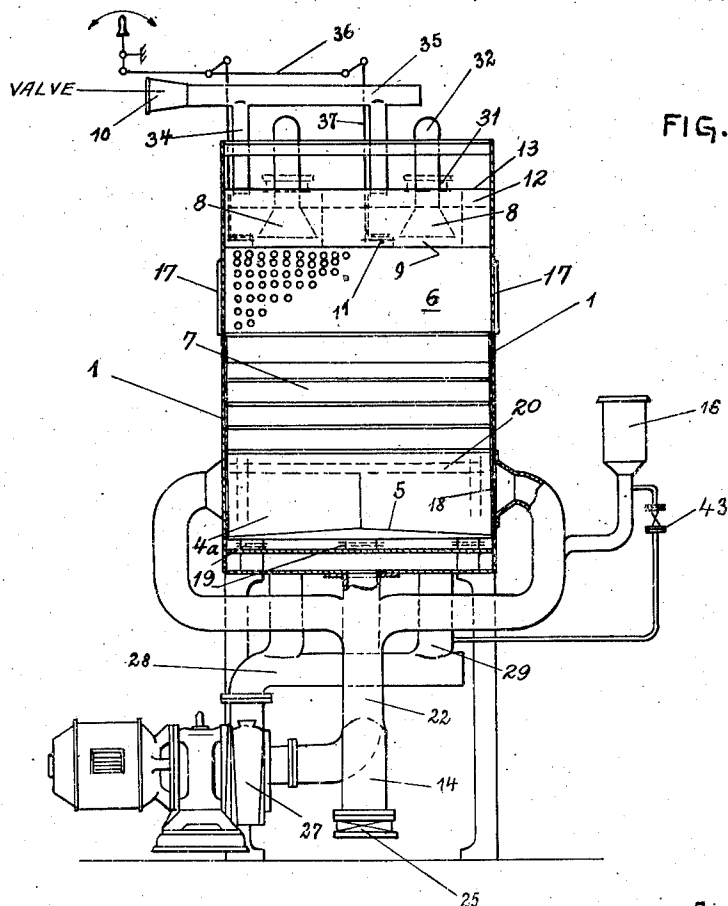


FIG. 3.

FIG. 4.

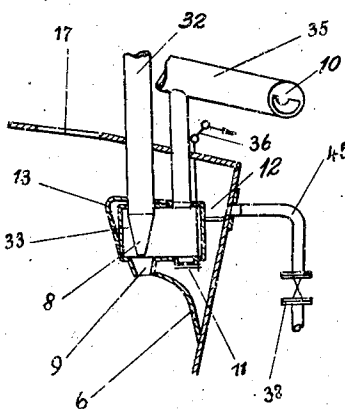
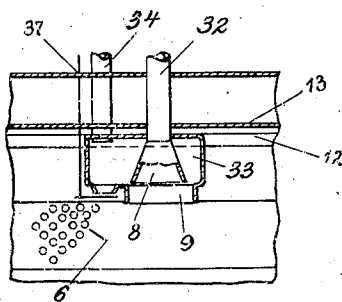


FIG. 5.



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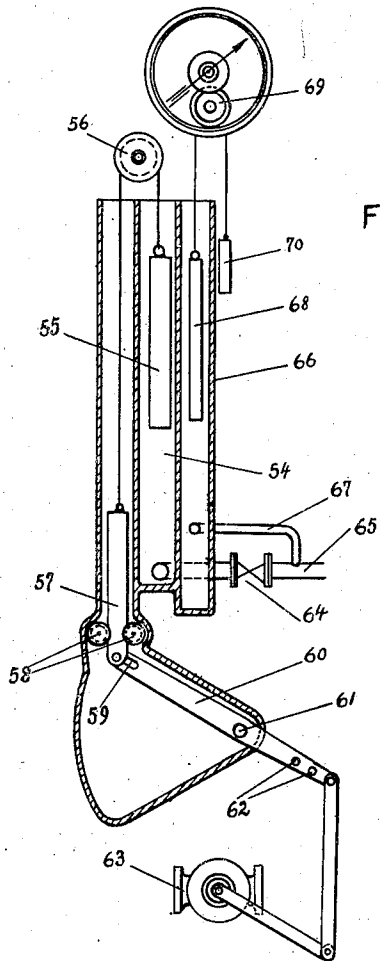


FIG. 6.

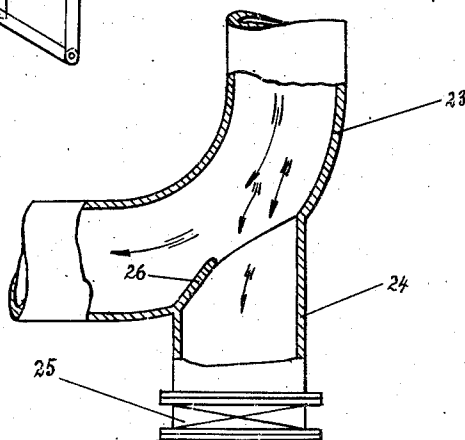


FIG. 7.

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UNITED STATES PATENT OFFICE

2,267,351

WASHING APPARATUS

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Application March 10, 1939, Serial No. 261,114
In Great Britain March 14, 1938

5 Claims. (Cl. 68—38)

This invention relates to a new method for washing household linen, clothes and the like, which is in contrast with the rotary drum type of washing machine commonly employed hitherto, in that the container for the clothes is stationary. The invention provides a novel machine wherein this method is employed.

According to the invention, the improved method comprises the maintenance of a circulatory motion of clothes in a trough containing water or a washing solution, the motion being such that the clothes travel along a substantially triangular path around a substantially horizontal axis. To impart and maintain this circulatory motion to the clothes, water jets are provided, directed downwardly from the upper part of the trough, and the nozzles are so directed that the path of the clothes within the trough is cut more than once. By this means the clothes are struck several times in their passage around the trough, thus being caused to alter both their direction of movement and their positions relative to the direction of movement.

The shape of the water jets in accordance with the invention preferably is that of an elongated rectangle or oval, i. e. ribbon-shaped, and means are provided whereby small quantities of air may be drawn into the water jets to promote penetration of the washing solution and of the clothes by very small air bubbles. The air rising through the washing solution and passing through the clothes takes with it particles of loosened dirt and grease, admixed with consumed soap, and consequently there is formed on the surface of the solution a discoloured foam containing a large proportion of dirt and other undesirable matter. In the method according to the invention this foam is continuously removed, thus increasing the capacity of the washing solution for further absorption of dirt from the clothes.

Other features of the invention will be described with reference to the accompanying drawings showing how the same may be carried into practice, in which

Figure 1 is a sectional view showing the general arrangement of the improved washing machine,

Figure 2 is a section of a device hereinafter referred to whereby a washing agent may be fed into the machine,

Figure 3 is a section on the line C—D, Figure 1,

Figures 4 and 5 are detail views partly in section of nozzles whereby water and air are delivered into the machine,

Figure 6 is a detail view in section to an enlarged scale showing means for controlling automatically the admission of water into the machine, and

5 Figure 7 is a detail view of means for separating and collecting foreign matter from the washing solution.

As shown in the drawings, Figures 1 and 3, the trough or container for the clothes is formed with 10 two substantially vertical and parallel end walls 1, provided with inspection windows 17, and two side walls 2 and 3 converging downwardly, the wall 2 having a curved portion adjacent the lower end thereof which merges into the bottom wall 15 of the container. Apertures closed by perforated plates 18 are provided in the lower part of the end walls 1, such apertures serving to accommodate the ends of pipes connecting the trough with the pump 27. Curved plates 4, 4a are provided adjacent the bottom of the container in spaced, overlapping relation and provides independent curved surfaces slightly above, and substantially coextensive with, the bottom of the container. The plate 4a, which is adjacent to the side wall 3, being hingedly connected at 19 with the bottom of the container. This plate 4a has an upward extension provided with a number of fins 7 which are inclined inwardly and downwardly. Mechanism 20 is provided whereby 30 the plate 4a may be swung inwardly towards the side wall 2, in which is provided a door 21 through which washed clothes are removed. The plates gradually increase in thickness in a direction away from the wall 3 and terminate in relatively thick edges 5. Also the plates 4 and 4a slope downwardly away from the centre of the washing space towards the end walls 1. The effect of these plates is to cause the water jets to strike the linen more often and in a more efficient manner, as the sloping surfaces 5 affect the lengths of the paths taken by the clothes during circulation and thus constantly alter the directions which the clothes are compelled to take.

The inclined fins 7 provided upon the upward extension of the step 4a form a broken surface 45 which is constantly in contact with the clothes during their circulation, thus increasing the washing effect by a slight rubbing.

When the plate 4a is pivoted on its hinges 19 50 to move towards the side wall 2, the washing space is reduced, enabling washed clothes within such space to be squeezed slightly before and after the rinsing process, and also facilitating the unloading of the machine. The washing space 55 of the machine is connected to the pump by suc-

tion pipes 22 and also to a collector 14 for foreign matter.

The collector of foreign matter, as shown in Figure 7, comprises an elbow pipe 23 having a vertical branch pipe 24 terminating in a discharge valve 25. An upwardly projecting wall 26 is provided within the elbow 23, such wall 26 being slightly inclined into the stream of liquid passing through the elbow, in order to separate from the liquid any foreign matter which may be contained therein and which is heavier than the liquid, the foreign matter being removed from time to time from the pipe 24, e. g. when the machine is emptied. The stream of liquid passing towards the pump is diverted through a right angle by the elbow 23, with the result that foreign bodies which are relatively heavy cannot follow this change of direction, and settle down within the pipe 24.

The discharge side of the pump 27 is connected by pipes 28 through pipes 29 to a preheating unit 15 in which are provided heating pipes 30. Washing liquid passes through the preheater 15 to the nozzles 8 in the trough through regulating valves 31 and pipes 32. Each water nozzle 8 has combined therewith in a single unit an air nozzle 9, as shown in Figures 4 and 5. Each water nozzle 8 having preferably an elongated or ribbon-shaped orifice projects downwardly toward an air nozzle 9 and is enclosed in a casing 13. Air is introduced into the casing 13 by pipes 34 entering from the main air pipes 35 which are provided with regulating valves 10 at their open ends. The casing 13 is situated within the washing space, but is separate partially therefrom by baffles 5 having perforations therein. A release valve 11 is provided in the bottom of the casing 13 operated by mechanism 36, 37 to allow air to escape from the casing 13 when desired.

A dirt collecting device 12 is provided adjacent the nozzle casing 13 and pipes 45 connected thereto are provided through which the collecting device may be emptied through a gate 38.

When a washing operation is taking place the liquid level of the washing solution is above the nozzles 8 in the casing 13 and a partial vacuum is produced in the space 33 within the casing 13 by the rapid passage through the nozzles 9 of the ribbon-shaped jets of water leaving the nozzles 8, the valves 10 and 11 being shut. The valve 11 is opened permitting water to enter the casing 13 through the nozzles 9, drawn therein by the partial vacuum within the space 33. The valve 10 is opened slightly to enable air to enter and thereby reduce the quantity of water flowing towards the nozzles. The quantity of air admitted may be controlled by throttling the valve 11. By the arrangement of the nozzles 8 and 9 and the valves 10 and 11, air mixed with the water jets is broken up into a fine spray.

Referring to Figure 2, there is shown a detergent feeding apparatus 16 comprising a cylindrical container 39 connected at the lower end thereof by a pipe 40 to the suction side of the pump 27 through a non-return valve 41. The container 39 has a funnel-shaped plate 46 provided therein having a central aperture through which may pass a jet of water from a nozzle 44 arranged concentrically within the pipe 40 and connected through pipe 42 and valve 43 to the pressure side of the pump. Secured upon the end of the nozzle 44 are funnel-shaped baffles 48, intended to receive for recycling within the container 39 undissolved particles of a detergent

material which is contained in the funnel-shaped hopper 46. A lid 49 is provided to seal the container 39 and in order to be able to remove air from the container before working, the lid 49 having been shut, a pipe 50 is provided leading to the exterior of the container and closable by a valve 51.

In operation the lid 49 is shut and valves 51 and 43 are opened. The detergent material contained in the hopper 46 is encountered by the jet of water from the nozzle 44 and is kept in motion thereby until it is taken completely into solution therewith. As the water in the container rises, the air initially present in the container passes out through pipe 50 and valve 51; when water commences to be discharged through the valve 51 it is clear that all the air has been removed from the container 39, and valve 51 is then shut. The absorption into the water of the cleansing agent slightly reduces its volume, creating a reduction of pressure in the container which causes water to flow downwardly through holes 52 in the baffle 48 and through the narrow annular space 53 between the sides of the hopper 46 and the walls of the container 39, and to pass into pipe 40 through the valve 41 to the suction side of the pump 27. When sufficient detergent solution has been pumped into the washing space the valve 43 is closed, the valve 51 is opened and the lid 49 can be removed to refill the container with detergent material as required.

There is shown in Figure 6 a device whereby the level of the water in the trough may be maintained constant throughout the washing operation. This device comprises a cylindrical tube 54, closed at the lower end thereof and containing a cylindrical float member 55 connected by a cable passing over a pulley 56 to a counterweight 57. The counterweight 57 has guide rollers 58 on either side thereof and is connected by a pin and slot connection 59 to a lever 60 pivoted at 61 and connected by suitable links engaged in one of a number of holes 62 at the end thereof remote from the pin and slot connection 59 to the valve 63 controlling the fresh water inlet. The tube 54 is connected to the suction chamber of the machine by a conduit 65 having a valve 64 therein. A second tubular vessel 66 is provided adjacent the tube 54 to serve as a water-level indicator. The vessel 66 is connected by a conduit 67 to pipe 65 and has a float 68 arranged therein connected by means of a cable passing over a pulley 69 to a counterweight 70.

As the machine is filled with water, water flows through conduit 65 and valve 64 into the float chamber 54. As the level rises, float 55 is lifted, and the counterweight 57 depresses the lever 60 thus gradually closing valve 63. At the same time the float 68 is raised and a pointer on a dial is rotated by means of a gear connection to the pulley 69 to indicate the level of the liquid within the machine. When the machine is emptied, after the rinsing operation, valve 64 is closed before the water level in the chamber 54 has receded, so that the float 55 and its counterweight 57 will remain in the positions in which the valve 63 is maintained closed. When the valve 64 is opened water escapes therethrough from the tube 54 and the valve 63 is opened by the consequent movement of float 55 and counterweight 57 to admit water again into the machine. The level of liquid in the machine, whether rising or falling is always indicated by the movement of the float 68 in the chamber 66, since this chamber is in

open communication with the washing space through pipes 67 and 68.

In accordance with the invention the floats 55 and 68 are formed from solid rod material and are not hollow bodies such as has been previously employed, thus avoiding breakdown of the float system which is liable to occur when hollow floats are damaged and allow liquid to enter the interior thereof.

In carrying out a washing operation, soiled linen is introduced into the washing space through a door 71, the door is closed and water admitted into the machine by opening valve 64. Water rises uniformly in all parts of the machine, valves 31 (Figures 1 and 3) being open to allow escape of air. As soon as the predetermined liquid level has been attained the fresh water valve 63 is automatically closed, as previously explained. Pump 27 is now brought into operation to impel water through nozzles 8 and 9 into the washing space, where the floating clothes are caused to circulate by the water jets and are moved initially in a downward direction, rubbing gently against the fins 7, Figure 1. When the articles of clothing being washed pass over the edges 5 of the plates 4 and 4a they again come within the path of the jets of the water from the nozzles 8 to change their relative positions and are moved upwardly in an oblique direction until they are again circulated to their initial position.

By reason of the inclined arrangement of the plates 4 and 4a, a continual transverse displacement of the clothes is caused. As the air regulating valve 10 is now maintained closed, valves 11 are opened to allow discharge of water through the nozzles 8.

After addition of soap to the cold water now within the washing space by means of the detergent feeding apparatus 16, valve 72 is opened to admit steam into the preheater 15 to warm the liquid circulating through the machine. After a short period regulating valve 10 is slightly opened to admit air to the casing 13 whence it is drawn into the washing space by the water jets. The air thus drawn into the washing liquid causes the formation of a layer of foam upon the upper surface of the liquid, this foam containing a relatively large proportion of the particles of dirt which have been loosened and removed from the clothes during their passage around the V-shaped trough. This foam, which also contains particles of soap, is carried by the movement of the liquid through apertures in the casing 13 and baffles 6 into the dirt collector 12, from which it is discharged through conduit 45 and valve 38. Regulation of the valve 43 of the feed device 16 enables a substantially constant content of detergent material to be maintained within the washing liquid, which is of great importance for efficient washing. After the liquid has been substantially cleansed by the expulsion through the dirt collector 12 of the major part of the consumed soap and dirt carried by the foam, the air inlet valve 10 is closed and heating of the liquid is continued gradually in order to free albuminous material and other impurities from the texture of the fabric and prevent coagulation of such material. During the cleansing operation the operator can inspect the movement of the clothes and the amount of dirt in suspension in the liquid through the windows 17.

When the washing operation is completed, the pump is stopped, valve 64 of the float device is closed and the liquid is emptied from the washing space by opening valve 25. The washed

clothes, now in the lower part of the washing space, are slightly squeezed or pressed by swinging the member 4a upon its pivots 18. The washing space is then again filled with clean water in order to rinse the washed clothes, and during the circulation of the clothes in the rinsing process, air is admitted to the water jets in quantities larger than were employed in the washing operation, in order to ensure complete removal of consumed soap from the fabrics and from the liquid. After rinsing the machine is emptied through the door 21, this operation being accelerated, if desired, by again swinging the member 4a towards the wall 2.

During the washing operation the path followed by the washing liquid is as follows: From the washing space through the perforated plates 18 into the suction pipe 22 past the collector device 14 to the pump 27, and thence through pressure pipe 28, conduits 29, the preheater 15, through valve 31 into pipes 32 to the nozzles 8 and 9, from which it is discharged again into the washing space.

The path of travel of the clothes is defined as substantially triangular since the clothes travel in three principal directions. From the upper part of the container, adjacent the nozzles 8, the direction is downwardly to the plate 4a, thence in a primarily horizontal direction beyond the plate 4, and thence in a substantially oblique direction to the starting point adjacent the nozzles 8.

I claim:

1. A washing machine comprising a trough for the clothes and the washing liquid, said trough having a bottom wall, two vertical end walls and two inclined side walls, means for causing the washing liquid and the clothes therein to circulate within the trough around a substantially horizontal axis along a substantially triangular path, and a curved plate adjacent the bottom wall for contact with the clothes along the bottom of said path, said plate gradually increasing in thickness in the direction of travel of the clothes therealong and having its upper surface sloping downwardly from the centre line of said path toward the vertical end walls.

2. A washing machine comprising a trough for the clothes and the washing liquid, said trough having a bottom wall and two inclined side walls, means for causing a circulation of the clothes within the liquid around a substantially horizontal axis along a substantially triangular path, and a plurality of curved plates adjacent the bottom wall of the trough and providing independent curved surfaces at different levels for contact with the clothes along the bottom of said path.

3. A washing machine comprising a trough for the clothes and the washing liquid, said trough having a bottom wall, two vertical end walls and two inclined side walls, means for causing a circulation of the clothes within the liquid around a substantially horizontal axis along a substantially triangular path, and a plurality of curved plates adjacent said bottom wall, said surfaces sloping downwardly from the centre line of said path towards the end walls of the trough.

4. A washing machine comprising a trough for the clothes and the washing liquid, said trough having a bottom wall, two vertical end walls, and two inclined side walls, means for causing a circulation of the clothes within the liquid around a substantially horizontal axis along a substantially triangular path, and a pair of plates adjacent the bottom wall of the trough and providing independent surfaces for contact with the

clothes along the bottom of said path, said plates being disposed in spaced overlapping relation.

5. A washing machine comprising a trough for the clothes and the washing liquid, said trough having a bottom wall, two vertical end walls and two inclined side walls, means for causing a circulation of the clothes in the liquid around a substantially horizontal axis along a substantially

triangular path, and a pair of curved plates adjacent the bottom wall of the trough and providing independent curved surfaces for contact with the clothes along the bottom of said path, said plates gradually increasing in thickness in the direction of travel of the clothes and being disposed in spaced overlapping relation.

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