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2,966,052

LAUNDRY MACHINE AND METHOD

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3 Sheets-Sheet 1

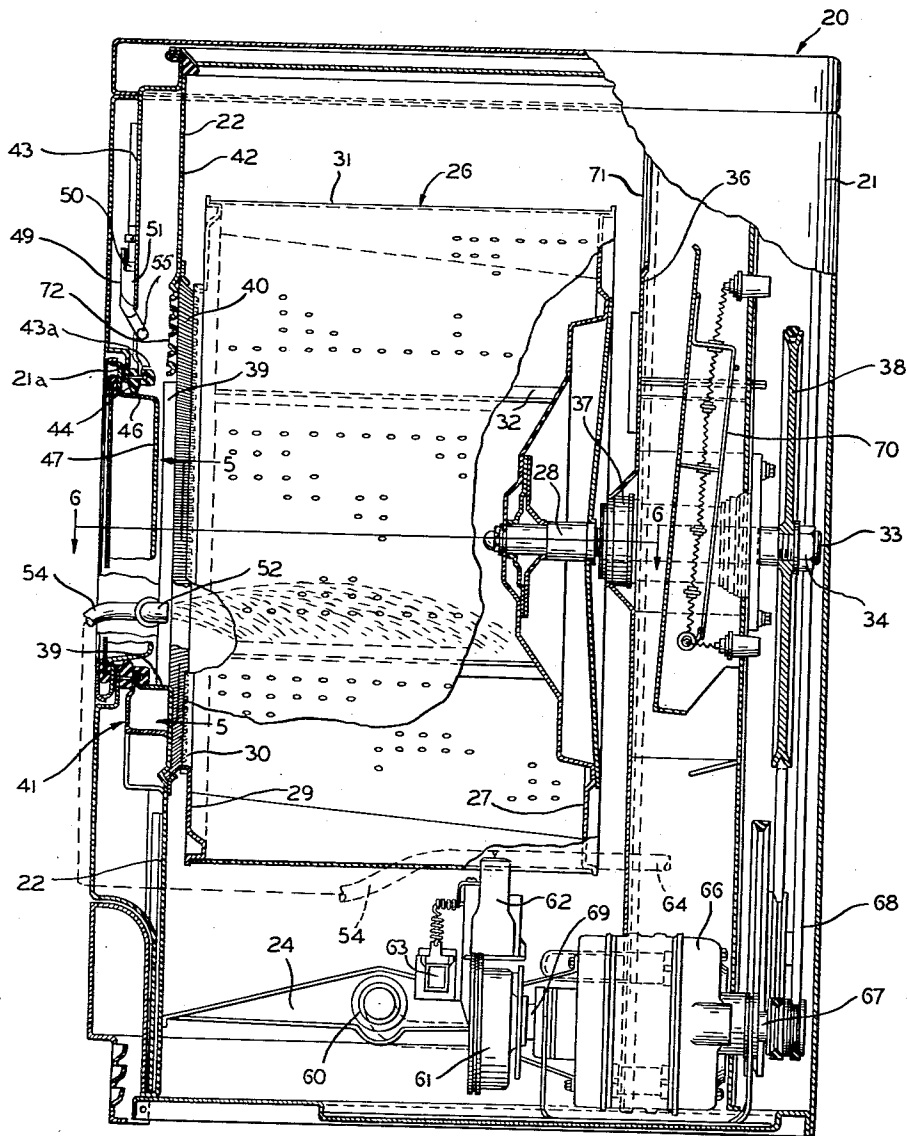


Fig. 1

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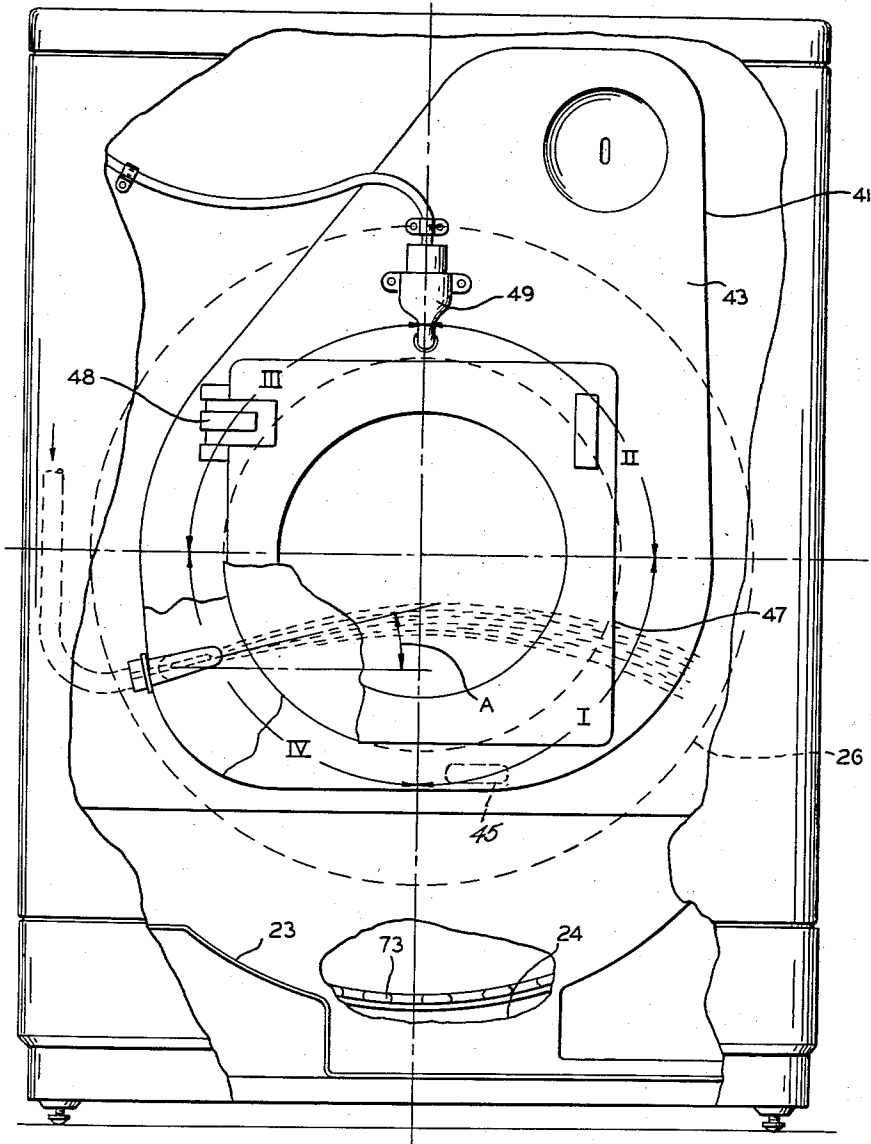


Fig. 2

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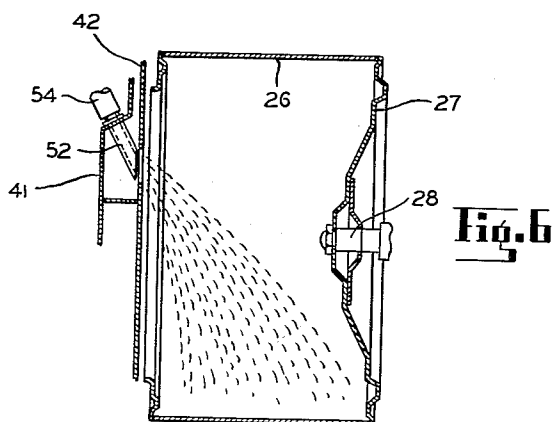
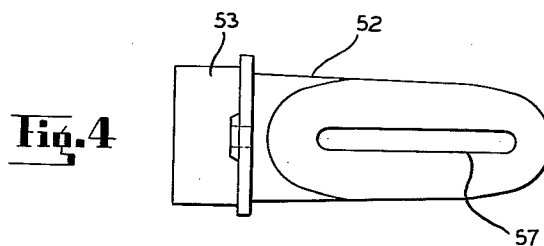
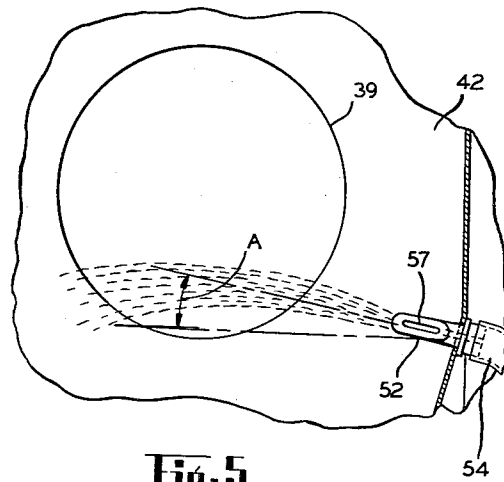
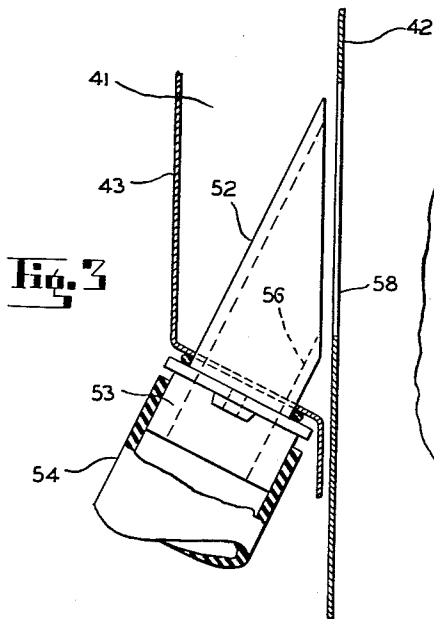
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3 Sheets-Sheet 3



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LAUNDRY MACHINE AND METHOD

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4 Claims. (Cl. 68—58)

This invention relates generally to the art of cleaning textiles and similar materials and more specifically relates to improved methods and apparatus for cleaning materials such as clothes and the like.

There is disclosed herein method and apparatus for washing, rinsing, extracting and drying, in one continuous operation, flexible textile materials such as clothes. In order to combine all of these functions into a single machine, and, more specifically, in order to provide a machine which will effect a complete washing and drying operation, it is desirable to provide a so-called horizontal drum-type machine.

In the laundry machine and method of the present invention, a mass of clothes is manipulated in a treatment zone to change the position of the clothes in the treatment zone in such a manner as to accumulate potential energy. Thereupon, the mass of clothes is released for gravitational acceleration through the treatment zone to convert the potential energy of a mass into kinetic energy. The kinetic energy so developed is used to flex the mass of clothes by abruptly changing the gravitational acceleration of the mass enclosed through impact against a non-liquid impact surface near the lowermost portion of the treatment zone. The impact not only causes maximum flexure of the clothes, but forces a substantial portion of the conditioning fluid out of the clothes to enable the clothes to take on a new supply of laundry liquid, thereby replacing that displaced by impact. The action of the impact in forcing the liquid from the clothes also flushes away the particles of dirt carried by the clothes.

The present invention particularly relates to novel liquid injecting means whereby a stream of laundry liquid is continuously supplied into the zone for conditioning contact with the clothes during the cyclic manipulation thereof. The laundry liquid thus employed is trapped after it leaves the treatment zone in a pool located below the level of the treatment zone. The liquid is continuously returned from the pool to supply a stream of laundry liquid at the liquid injecting means communicating with the treatment zone.

More specifically, it is contemplated according to the present invention to provide a recirculating means including a nozzle which is positioned to align a generally slotted outlet in substantial horizontal position. The nozzle acts to diffuse the stream of liquid in a spray pattern extending across the entire treatment zone and directly against the clothes being tumbled near the lowermost portion of the zone.

Since the present invention contemplates the utilization of a horizontal drum, the treatment zone can be considered as being of generally cylindrical configuration having portions disposed in four geometrical quadrants around the axis of rotation corresponding to a lower first quadrant and an upper second quadrant on one side of the axis and an upper third quadrant and a lower fourth quadrant on the other side of the axis. The drum or receiver is perforated and is mounted in an outer container, both the receiver and the outer container having registering openings formed therein whereby a mass of materials to be laundered can be charged into the receiver and removed therefrom. The nozzle

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is carried by the outer container adjacent the opening formed therein in the fourth quadrant of the treatment zone. Thus, the stream of liquid is forcibly ejected through the opening or aperture formed in the drum or receiver and is projected in the direction of the first quadrant while the receiver is being rotated to tumble the materials successively through the first, second, third and fourth quadrants.

With such an arrangement the clothes are thoroughly wetted during the elevation thereof and immediately after the clothes have been conditioned by impact to receive additional quantities of laundry liquid. Furthermore, since the stream of laundry liquid is projected directly against the clothes in the direction of rotation or tumbling thereof the flushing and wetting action is effected with great efficiency.

It is an object of the present invention, therefore, to provide an improved laundry method and machine.

Yet another object of the present invention is to provide improved means for supplying a stream of laundry liquid into a treatment zone.

Yet another object of the present invention is to provide an improved means for utilizing the incoming water for filling the machine to also wash lint or other matter out of the air duct.

Yet another object of the present invention is to provide means for maximizing the flushing and wetting action in a horizontal drum type washing machine.

A further object of the present invention is to provide an improved nozzle construction and arrangement for the recirculation means of a laundry machine provided in accordance with the principles of the present invention.

Many other features, advantages and additional objects of the present invention will become manifest to those versed in the art upon making reference to the detailed description which follows and the accompanying sheets of drawings in which a preferred structural embodiment of an apparatus incorporating the principles of the present invention and capable of practicing the methods herein is disclosed.

On the drawings:

Figure 1 is a cross sectional view with parts shown in elevation and with parts broken away illustrating a laundry machine provided in accordance with the principles of the present invention.

Figure 2 is a front elevational view with parts broken away and with parts shown in cross section of the laundry machine of Fig. 1.

Figure 3 is a fragmentary cross sectional view of the parts shown in elevation of the nozzle construction provided in accordance with the principles of the present invention.

Figure 4 is a front elevational view of the nozzle of Fig. 3;

Figure 5 is a fragmentary view taken generally on line V—V of Fig. 1;

Figure 6 is a fragmentary view taken generally on line VI—VI of Fig. 1;

As shown on the drawings:

Although the principles of the present invention are of general utility in the cleaning art, a particularly advantageous application thereof is made to a combination washer-extractor-drier apparatus wherein a batch of soiled textile materials such as clothes may be cleansed in one continuous operation by a series of cycles which include washing, rinsing and drying, the step of drying being advantageously expedited if desired by an intermediate extraction procedure. The inventive principles herein disclosed may be embodied equally well in a washing machine, per se, or any other sub-combinations of the preferred embodiment shown by way of illustrative example.

There is illustrated in the drawings a laundry machine comprising a combination washer-extractor-drier indicated generally at 20 comprising an outer shell 21 suitably finished to enhance the decorative appearance of the machine. Inside the shell 21 is a casing or outer container indicated generally at 22 which is generally rectangular in over-all configuration but which is provided with a curved generally arcuately shaped bottom wall 23 and a sump 24 is provided at the bottom portion thereof subjacent a large hollow space enclosed by the casing 23 and which shall be characterized as a treatment zone in which the washing, rinsing, extracting and drying operations are carried out.

In order to manipulate a mass of flexible textile material such as clothes or the like within the treatment zone by prescribing the confines within which the clothes are manipulated, there is provided a rotatable generally cylindrical foraminous drum indicated at 26. The drum 26 has a rear wall 27 connected to a shaft support 28 and a front wall 29 characterized by the provision of a centrally disposed front opening 30. A peripheral wall 31, preferably foraminous, is disposed between the front and rear walls 27 and 29 and carries a plurality of circumferentially spaced up-standing radially inwardly extending ribs 32.

The shaft support unit 28 includes a rotatable shaft 33 to which the drum 26 is firmly connected for corotation by means of a fastening nut 34. The shaft unit 28 is supported in a rear wall 36 of the outer container 22 and together therewith serves to support the shaft unit 28 by means of a bearing housing unit 37.

Adjacent the free end of the shaft 33 is a pulley wheel 38 held in firm assembly with the shaft 33 by means of the fastener 34.

Casing 22 has spaced away from the rear wall 36 a front wall in which is formed a centrally disposed opening 39 lying in register with the drum opening 30. The front wall is rather closely spaced to the drum 26 and in order to prevent clothes contained within the drum from becoming caught between the stationary front wall and the rotatable front wall of the drum 26, there is provided an annular brush 40 or equivalent seal such as a rubber seal element which overlies the drum opening 30.

As is clearly shown in Figures 1 and 2, the front wall of the outer container or casing 22 forms the inner side of an irregularly shaped air duct indicated at 41. Thus, the air duct 41 has spaced walls which for convenience in reference will be identified as 42 and 43.

The duct wall 43 is also provided with a center opening lying in register with the front wall opening 39 and the drum opening 30. A flange 43a surrounds the center opening. At this locale the flange 43a is formed in the front wall 43 and a flange 42a is formed in the front wall of the casing or outer container 22.

An annular rubber sealing gasket 44 embraces the flanges 21a and 43a and provides a sealing lip 46 to engage the side walls of a door 47 controlling access to the interior of the drum 26. The door is hinged to the casing 22 by a pair of hinges indicated at 48 (Fig. 2) and a handle 49 is carried by the door 47 opposite the hinges 48 to facilitate selective opening thereof. It will be understood that yieldable latch means are provided between the door 47 and the casing 22.

In order to charge the machine 20 with a supply of liquid and in order to supply a stream of rinsing liquid into the treatment zone, a fresh water inlet is indicated at 49 attached to the duct wall 43. The fresh water inlet 49 is of the vacuum-breaking type and includes a conduit adapted to be connected to a suitable source of water supply discharging as at 50 into a funnel-like device 51 which has at its bottom portion a spout 55 projecting inwardly into the air duct 41 having aperture 45 connecting the interior of duct 41 with the interior of outer container 22 to provide for supplying water to container 22 and washing down duct 41.

It is contemplated according to the present invention that the drum or receiver 26 prescribe the confines within the treatment zone in which the clothes or materials being laundered are manipulated. Thus, the drum 26 provides a cylindrical treatment zone having portions disposed in four geometrical quadrants around the axis of rotation of the drum 26. Using the plane of orientation of Figure 2, the four geometrical quadrants correspond to a lower first quadrant indicated by the reference character I and an upper second quadrant indicated by the reference character numeral II on one side of the axis and an upper third quadrant indicated by the numeral III and lower fourth quadrant indicated by the numeral IV on the other side of the axis (Fig. 2).

Making further reference to Figure 2, rotation of the drum 26 in a counterclockwise direction and at a rotational speed insufficient to overcome gravitational force with centrifugal force will result in an elevation of the materials being washed through the quadrant I and at least partially through quadrant II whereupon the materials being washed will be gravitationally accelerated through the remainder of quadrant II and through all of quadrant III. The gravitation acceleration of the materials will continue through a portion of quadrant IV whereupon the gravitational acceleration will be abruptly terminated by impact against the hard surface provided by the drum 26.

It is contemplated according to the present invention that a very small amount of laundry liquid be used compared to the requirements of machines heretofore provided. It is desirable, therefore, that laundry liquid be supplied to the treatment zone within the drum 26 in such a manner as to efficiently flush and wet the materials being washed. In accordance with the principles of the present invention, a liquid introducing means is carried by the outer container or casing 22 adjacent the opening 39 and generally opposite quadrant IV, thereby to forcibly eject a stream of liquid through the opening 30 in the drum 26 directly against the clothes or materials being washed while the receiver or drum 26 is being rotated to tumble the materials successively through quadrants I, II, III and IV.

Referring specifically to Fig. 3, it will be noted that the liquid introducing means takes the form of a nozzle 52 carrying an inlet 53 adapted to be connected to a hose or other conduit 54. The nozzle 52 has a passageway 56 extending therethrough and terminating as shown in Fig. 4 in an elongated slot 57. As shown in Figures 1, 2 and 5, the nozzle 52 is disposed with the outlet slot 57 at a slight angle relative to the horizontal, the amount of the angle being indicated in Fig. 5 at A. The wall 42 of the outer container 22 is also provided with a clearance opening 58 and the nozzle 52 is aligned in such a manner that stream of laundry liquid will be forcibly ejected through the aperture or opening 30 in the front wall 29 of the drum 26 in the direction of quadrant I. The outlet slot 57 diffuses the liquid stream in a spray pattern extending across the treatment zone within quadrant I, thereby impinging directly against the peripheral wall 31 of the drum 26 in quadrant I as the drum 26 is rotated.

As indicated in Figure 1, the sump 24 has an outlet 60 upon which a suction is taken by a pump 61 having a two-way discharge controlled by an electric motor or solenoid operated valve 62, the solenoid being indicated at 63, one of the discharges being provided by a conduit 54 connected to the nozzle 52 and the other discharge being provided by a conduit 64 leading to a drain outlet.

The laundry liquid discharged by the nozzle 52 is projected directly against the clothes in the same direction of rotation or tumbling of the clothes. Since the spray pattern extends completely across the drum 26, an improved washing action occurs because a very efficient wetting action occurs and an adequate supply of liquid

is provided to produce a flushing action on the materials being laundered. Moreover, because of the specific location of the nozzle and the projection of the spray pattern towards quadrant I, the clothes are wetted immediately after they have been conditioned to receive additional quantities of liquid by the impact action against the walls of the drum in quadrant IV.

The laundry liquid projected against the clothes which is in excess of that required to thoroughly wet the clothes drains outwardly of the foraminous wall 31 of the drum 26 and is trapped in a pool below the level of the treatment zone, the pool being formed by the sump 24. Thereupon the laundry liquid is returned from the pool by the pump 61 to continuously supply a laundry liquid stream for conditioning contact with the clothes as they move through the stream upon rotation of the drum during the washing operation.

One of the advantages resulting from the provision of this type machine is that waiting periods for filling and draining the machine are cut down, if not actually eliminated. For example, if water and detergent are used as a cleansing agent, as soon as introduction of water into the machine begins, the liquid finds its way into the sump 24 and recirculation of the liquid can begin. A washing portion of the cycle can be immediately initiated without waiting for the full charge of water to be added since the nozzle 52 immediately establishes a spray pattern extending across the entire treatment zone within the drum 26 to wet the clothes. This saturation of the clothes with laundry liquid prior to impact thereof against the wall of the drum in quadrant IV so that flexure of the fibers will occur in the presence of the laundry liquid also insures that laundry liquid will be present to replace that flushed from the clothes during the force of their impact against the drum.

It will be appreciated that the lowermost portion of the wall 31 of the drum 26 is considerably above the level of the pool in which the laundry liquid is collected. Moreover, it will be further appreciated that the sump outlet 60 permits the pump 61 to take a suction upon the lower portion of the pool in the sump 24. This arrangement insures that any sudsing action will not interfere with any phase of the washing cycle since the suds will merely be harmlessly carried at the top of the pool but below the level of the rotating drum 26.

It may also be noted that the peripheral wall 31 of the drum 26 is conveniently made of metal. Accordingly, the wall 31 of the drum is solid and provides a hard impact surface against which the falling clothes will realize a maximum flexure and which will maximize the flushing effect achieved by the forcing of water contained in the clothes from the clothes.

Upon completion of the washing cycle, the valve 62 may be actuated by energizing the solenoid or control motor 63 whereupon the pump 61 will discharge the laundry liquid collected in the sump 24 through the drain conduit 64.

Rinsing liquid can then be supplied in the same manner as the laundry liquid. A charge of rinsing fluid may be supplied from the fresh water inlet through the spout 52 and projected downwardly through the drum 26 for conditioning contact with the clothes contained therein. Since the clothes in the drum 26 were not immersed in laundry liquid, introduction of the rinsing liquid may be commenced before the laundry liquid is drained from the sump 24 or while it is being drained therefrom with a resultant time savings as contrasted with machines in which all or a major portion of the laundry liquid must be drained away before the rinsing operation can be started. Furthermore, the recirculation of the rinsing liquid may be effected at any selected time by operating the pump 61.

The specific form of the recirculation means provided in accordance with the principles of the present invention also enhance the rinsing action. Thus, the recirculated

rinsing fluid is projected forcibly through the opening 30 and is diffused by the nozzle outlet 57 in a spray pattern extending through the interior of the drum 26 against the clothes being tumbled within the drum 26. The rinsing water thus impinges upon the clothes in quadrant I immediately after the clothes have impacted against the wall 31 of the drum 26 in quadrant IV. Accordingly, the previous supply of water has been forced from the clothes in quadrant IV and the clothes are ready to take on a new supply of water in quadrant I. The projection of the water against the clothes in the same direction of rotation as the tumbling action of the clothes also assists in an adequate flushing action.

The machine 20 of the present invention is adapted to extract fluid from the clothes being laundered by a centrifuging action. To that end, a variable speed transmission may be provided between the drum 26 and a constant speed drive means which can conveniently take the form of an electric motor 66. Since the structural details of the speed changing mechanism are not essential to the principles of the present invention it may be noted for the sake of brevity that the motor 66 has a power takeoff shaft 67 and driving means indicated generally at 68 are interposed between the pulley wheel 38 and the power takeoff shaft 67. It will further be appreciated that the motor 66 can be utilized to drive the pump 61 and in this connection an oppositely extended power takeoff shaft 69 is directly connected to the pump 61.

Under normal operations, the drum 26 is rotated continuously in one direction, thereby tending to elevate and drop the materials being laundered therein. To enhance this operation, the drum 26 may be rotated at such a speed that the materials will be held centrifugally against the rotating drum until nearer the uppermost portion thereof and then drop by gravity and impact against the rotating drum nearer the lowermost portion thereof. The speed of the motor 66 is maintained in such a range to accomplish the desired movement of the clothes during washing and rinsing operations.

The machine 20 is also adapted to operate as a drier. In this connection, means to generate thermal energy are indicated generally at 70 and may conveniently comprise an electric heater disposed in the ducts of an air system communicating with the treatment zone and the interior of the drum 26 through an opening 71 in the wall 36 and passing through louvered openings 72 formed in the wall 42 and leading to the interior of the duct 41. Further detail of construction of the heating and air circulation system does not appear to be necessary to a proper understanding of the principles of the present invention, however, it may be noted that temperature conditioned air is circulated through the treatment zone by exhausting air from the duct 41, thereby producing a circulation of temperature conditioned air past the heating elements 70, through the opening 71, through the treatment zone in conditioning contact with the clothes, and through the duct 41. A blower (not shown) may be conveniently driven by the same electric motor 66 as drives the drum 26 and the pump 61 and suitable means may be provided to effect actuation of the blower only during the drying cycle of the cleansing operation.

The sump 24 may also be equipped with a sump heater comprising an immersion-type heating coil 73 (Figure 2), whereby the liquid collected in the pool below the level of the treatment zone may have thermal energy transferred thereto. As has been pointed out above, a small amount of laundry liquid required to carry out a washing cycle permits the use of cold water directly from the domestic supply, if desired, the heating coil 73 serving to heat the water to a temperature best suited for washing the fabrics to be washed and maintaining the water at an optimum temperature, all with a minimum of power consumption.

Those versed in the art will appreciate that all of the structural elements herein described can be effectively

actuated and operated by means of a single control system which will insure successive initiation of the various cycles in a fully automatic manner.

By way of summarization, a typical laundering sequence will be described. First of all, a quantity of soiled textile materials are placed within the interior of the drum 26 through the openings controlled by the door 47. Electrical controls for the regulation of water temperature, and for control of the washing and drying cycles are pre-set in advance so that no further manual intervention will be required.

The washing cycle is initiated by the introduction of a charge of water from the fresh water inlet 49. The water enters the conduit associated with the fresh water inlet 49 through an electrically operated thermostatically controlled mixing valve (not shown) of a type well known to those skilled in the art. The supply of water through the mixing valve is cut off when the level of the water in the sump 24 reaches a predetermined amount. A suitable supply of detergent is introduced into the sump 24 by manual or automatic means either while water is being supplied or after the desired level has been reached. The motor 66 is energized to rotate the drum 26 in one direction and the clothes are elevated against the forces of gravity through an appreciable distance and thereafter fall subject to the forces of gravity through an appreciable distance for impact against the sides of the drum 26. This impact results from an abrupt termination of the gravitational acceleration of the falling clothes in quadrant IV. During the washing cycle, the pump 61 supplies a continuous stream of laundry liquid to the nozzle 52 and the angularly inclined outlet slot 57 diffuses the stream of laundry liquid in a spray pattern extending completely across the interior of the drum 26 directly against the clothes being washed therein, the spray of water emanating from the nozzle 52 being directed in the treatment zone towards quadrant I and in the direction of movement of the clothes. Accordingly, the clothes are thoroughly saturated while being elevated within the treatment zone thereby insuring flexure of the textile fibers in quadrant IV in the presence of an adequate supply of laundry liquid. Moreover, by virtue of the impact in quadrant IV the liquid is flushed away from the clothes by impact against the solid surface of the drum 26 and the clothes are reconditioned for absorbing a re-supply of laundry liquid in quadrant I. The liquid leaving the drum 26 is collected in a pool below the level of the treatment zone and the laundry liquid from the pool is returned by the pump 61 to supply a continuous stream of laundry liquid into the drum 26 during the washing portion of the cycle.

After the clothes have been washed in this manner, rinsing liquid is projected over the tumbling clothes, thereby rinsing away the laundry liquid and further contributing to the cleansing of the clothes. The initial charge of rinsing liquid is introduced through the fresh water inlet 49, however, the rinsing operation can be carried out by recirculating the rinsing liquid through the nozzle 52, thereby forcibly ejecting a continuous stream of water through the angularly inclined outlet slot 57 whereby the rinsing water will be impelled in a spray pattern extending across the entire interior of the drum 26 in direct conditioning contact with the clothes being treated.

When the rinsing cycle is complete, the variable speed mechanism is actuated whereupon the drum 26 will be accelerated and the clothes will be evenly distributed in the form of an annulus against the walls of the drum. Rotation of the clothes at a high centrifuging speed for a predetermined interval of time will physically remove a major portion of the liquid from the clothes by centrifuging action.

Either during or after the extracting cycle, a stream of air is supplied through the treatment zone by actuation of a blower means. It will be understood that

during the drying operation the drum 26 is again returned to a speed to effect a tumbling action of the clothes. If it is desired to enhance the water entraining properties of the air, the heating unit 70 may be energized. The heating element 70 may be deenergized near the end of the drying cycle whereupon cool air will be drawn through the treatment zone.

Having passed through the various stages of the laundering operation successively, the completely cleaned and dried clothes are now ready for removal from the machine.

Although various modifications might be suggested by those versed in the art, it should be understood that I wish to embody within the scope of the patent warranted hereon all such modifications as reasonably and properly come within the scope of my contribution to the art.

I claim as my invention:

1. Apparatus for cleaning fabrics comprising, a casing, a drum positioned within said casing and having front and rear walls, said drum being rotatable upon a horizontal axis, a substantially foraminous rigid peripheral side wall on said drum extending circumferentially through a lower first quadrant and an upper second quadrant on one side of the vertical plane through the drum axis and extending through an upper third quadrant and a lower fourth quadrant on the other side of the said vertical plane, said fourth quadrant portion of said side wall constituting an impact surface, driving means rotating said drum at tumbling speed about said horizontal axis to effect cyclical elevation of said fabrics within the drum in said first and second quadrants and a free fall against said impact surface, means including said casing forming a closed liquid circuit having a sump-type reservoir below the level of said drum for receiving cleaning fluid, a pump in said circuit for driving a continuous stream of said fluid through said drum to wet said fabrics prior to impact against said impact surface, and a nozzle in said circuit directed into said drum solely at said fourth quadrant for discharging a stream of said fluid into said drum in a direction having a component towards said first quadrant.

2. Apparatus as defined in claim 1, said front wall of said drum having a charging opening formed therein, said nozzle having a diffusion outlet opening adjacent said charging opening and being constructed and arranged together with said driving means to discharge the stream of said fluid through said charging opening in the direction of rotation of said drum away from said impact surface.

3. Apparatus as defined in claim 1, said nozzle having a diffusion outlet opening slotted in a generally horizontal direction to discharge a fan-shaped stream of said fluid extending across the interior of the drum between said front and rear walls of said drum.

4. Apparatus as defined in claim 1, and means for charging said liquid circuit with a supply of fluid and means for automatically cutting off the supply of fluid when the fluid accumulated in said reservoir reaches a predetermined level below the level of said drum.

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