

Sept. 22, 1942.

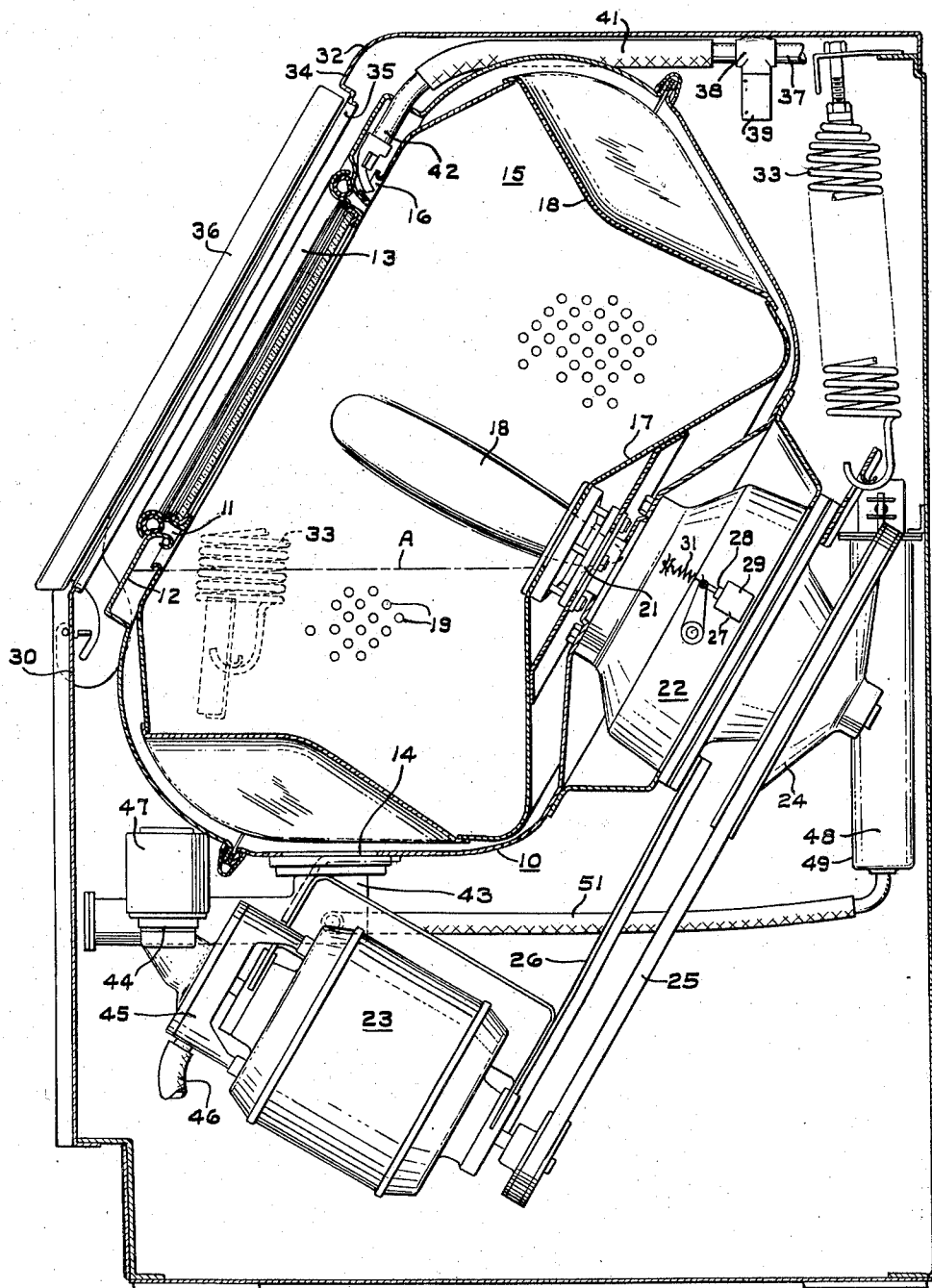
F. BRECKENRIDGE

2,296,263

CLEANING APPARATUS

Filed June 1, 1940

3 Sheets-Sheet 1



WITNESSES:

R. A. Rugh
E. H. Lutz

Fig. 1.

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Sept. 22, 1942.

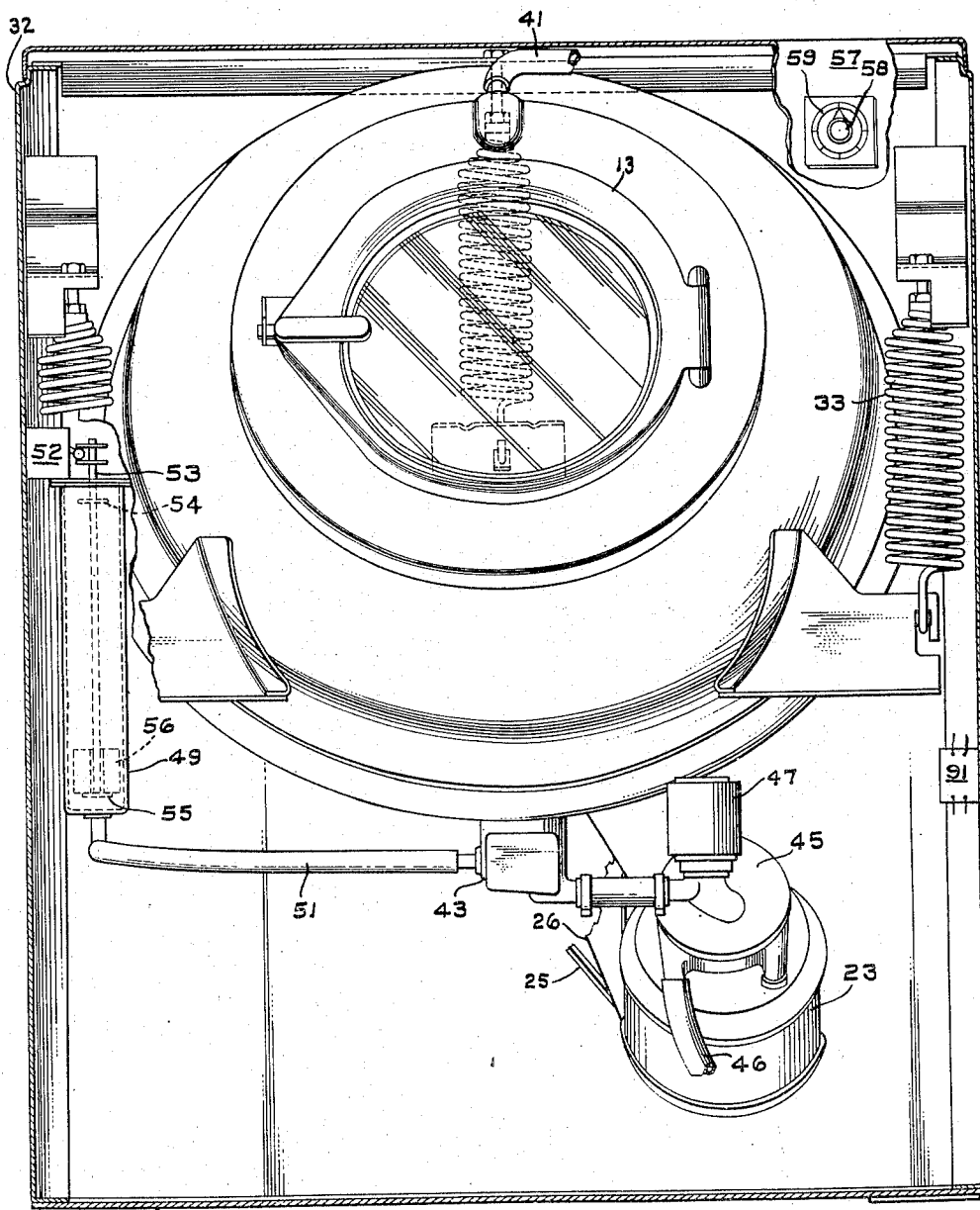
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3 Sheets-Sheet 2



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Fig. 2.

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3 Sheets-Sheet 3

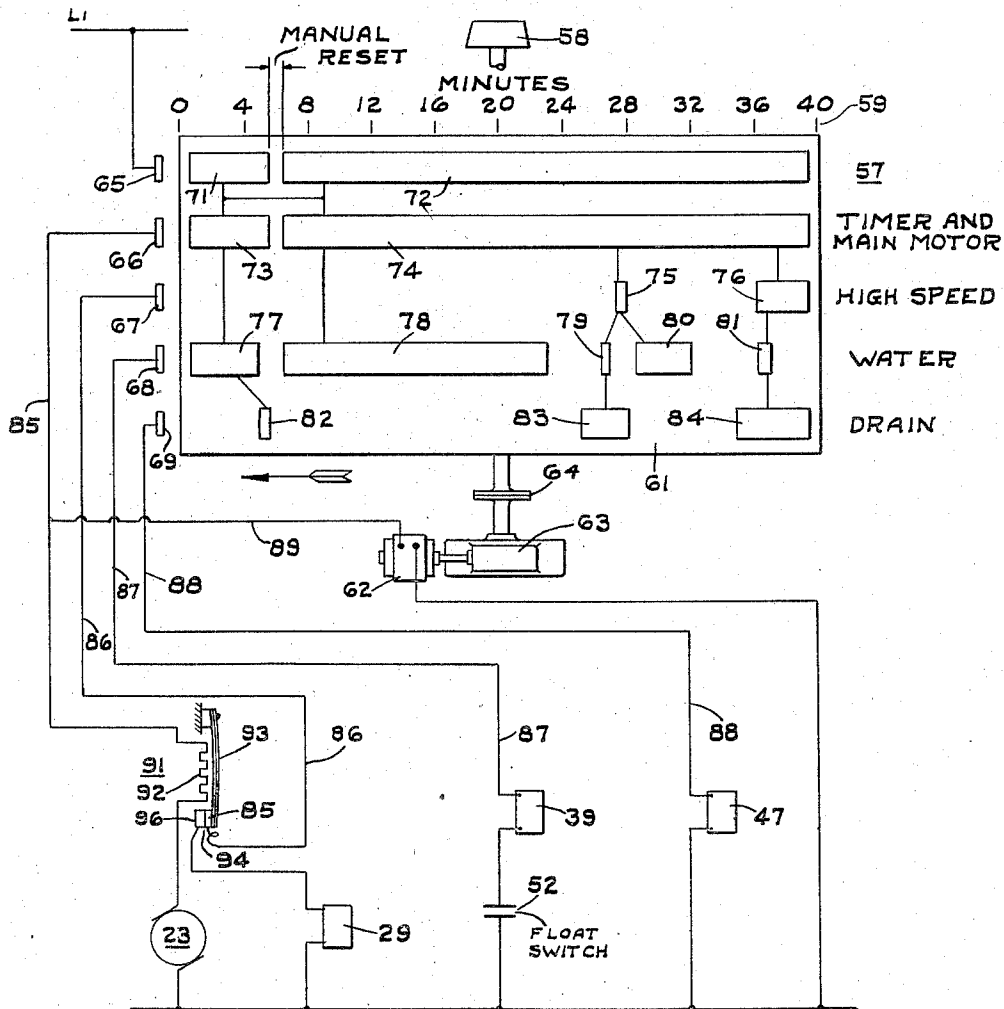


Fig. 3.

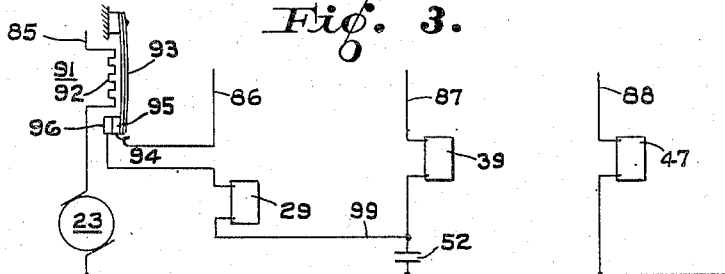


Fig. 4.

WITNESSES:

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UNITED STATES PATENT OFFICE

2,296,263

CLEANING APPARATUS

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pany, East Pittsburgh, Pa., a corporation of
Pennsylvania

Application June 1, 1940, Serial No. 338,316

5 Claims. (Cl. 68—12)

My invention relates to apparatus for cleaning fabrics and has for its object to provide improved apparatus of this kind.

A further object of the invention is to prevent damage to the mechanism of a machine of the type wherein fabrics are cleaned and centrifuged in a single container, in the event that an abnormal condition arises during the centrifuging period.

These and other objects are effected by my invention as will be apparent from the following description and claims taken in accordance with the accompanying drawings, forming a part of this application, in which:

Fig. 1 is a vertical sectional view of a machine for cleaning fabrics which is controlled in accordance with my invention;

Fig. 2 is a front view of the machine shown in Fig. 1 with portions of the enclosing case broken away for the sake of clearness;

Fig. 3 is a diagram of the electrical connections of the apparatus employed for controlling the machine illustrated in Figs. 1 and 2; and

Fig. 4 relates to a second embodiment of the invention and shows a modified form of a part of the diagram shown in Fig. 3.

Reference will now be had to Figs. 1 and 2 of the drawings wherein I have shown my invention applied to a washing and spinning machine of the type disclosed and claimed in my copending application, Serial No. 203,804, filed April 23, 1938, and assigned to the assignee of the present invention. This form of washer includes a generally frusto-conical tub structure indicated at 10 and having an access opening 11 for the ingress and egress of the clothes to be treated. The opening 11 is formed in an end wall 12 arranged at the end of the tub 10 of major diameter. The access opening 11 is closed by a suitable gasketed door 13 which is hinged to the tub 10. An opening 14 for the discharge of vitiated water from the tube 10 is provided in a wall of the tub and at the bottom thereof.

Arranged within the tub 10 is a basket structure generally indicated at 15 and also of frusto-conical configuration so that it closely follows the lines of the tub 10. The basket 15 is provided with an access opening 16 in registry with the access opening 11 of the tub. The end of the basket of minor diameter defines a re-entrant wall or hump 17 and a plurality of vanes 18 are circumferentially spaced within the basket for providing a washing action to be described hereinafter. The basket is perforate throughout sub-

stantially its extent, a number of the perforations being indicated by the numeral 18.

Rotation of the basket 15 about its axis, which, as shown, is disposed at an acute angle to the vertical, is effected by a shaft member 21 which defines the driven element of a two-speed mechanism, generally indicated at 22. The two-speed mechanism 22 is driven by a motor 23 at substantially constant speed, by means of a pulley 24 which is belted, as shown at 25, to the motor. The motor is suspended from the tub structure 10 by bracket members 26.

As the specific form of two-speed mechanism forms no part of the present invention, it has not been shown in detail. It is to be understood that the mechanism 22 is driven at substantially constant speed by the pulley 24 and may be adjusted to drive the member 21 and the basket 15 at a low speed of approximately 51 R. P. M. during washing periods and at a relatively high speed of approximately 460 R. P. M. during centrifuging periods. The adjustment of the two-speed mechanism is effected by an electro-magnet device, generally indicated at 27 and including a pivoted armature 28 and an electro-magnet 29. The armature 28 is biased to its low speed position by a spring 31 and is movable to its high speed position, indicated by the broken line, upon energization of the magnet 29. A suitable two-speed mechanism of the type shown at 22 is disclosed in my copending application, Serial No. 305,512, filed November 21, 1939, and assigned to the assignee of the present invention.

It will be apparent from the foregoing description that the tub structure 10, the two-speed mechanism 22 and the motor 23 define elements of a unitary structure which may be supported within a casing, generally indicated at 32, in any suitable manner. As shown, the unitary structure is flexibly supported by means of a plurality of springs 33 which define a three-point support. As shown in Fig. 2, two of these springs are disposed on opposite sides of the tub structure 10 at the front end thereof and the third spring is centrally disposed with respect to the tub at the rear end thereof and above the two-speed mechanism 22. The upper ends of the springs are attached to suitable supports forming a part of the casing 32. A spring supporting system, generally of the type disclosed herein, is shown and claimed in the copending application of Frank Breckenridge et al., Serial No. 303,202, filed November 7, 1939, and assigned to the assignee of the present invention.

The casing structure 32 includes a front wall

30, the upper portion 34 of which is inclined upwardly and rearwardly in a plane substantially normal to the axis of the tub and basket. The wall portion 34 includes an access opening 35 in registry with the access opening of the tub and is closed by a suitable cover 36 which may be removed or swung downwardly during periods when the washing and spinning structure is active.

Water from a suitable source and at the proper temperature is admitted to the tub 10 by means of an inlet conduit 37 under control of a valve 38 which is preferably electrically operated and which may include a solenoid 39. As valves of this type are well understood in the art, no detailed description of the same is deemed necessary other than to state that, when the solenoid 39 is energized, the valve is opened and, when the solenoid 39 is deenergized, the valve is closed. The downstream side of the valve 38 is connected by means of a flexible conduit 41 to a nozzle structure 42, the latter being disposed adjacent the access opening 16 of the basket so that it functions to discharge water into the basket through the opening 16. The nozzle structure 42 which I have shown, is generally of the type shown and claimed in the copending application of Stuart R. Baird, Serial No. 315,371, filed January 24, 1940, and assigned to the assignee of the present invention.

As stated heretofore, vitiated water is discharged through the opening 14 of the tub 10. The water passing through the opening 14 is conveyed by a conduit 43 through an electrically-operated valve 44 to the inlet of a pump 45, the latter being driven by the motor 23 as shown. Water translated by the pump 45 is discharged through a flexible conduit 46 to a suitable point of discharge. A strainer (not shown) is disposed within the outlet conduit 43 for separating foreign matter from the water conveyed to the inlet of the pump 45. The valve 44 is preferably of the electrically-operated type and includes an operating solenoid 47 which, when energized, opens the valve 44 and, conversely, when deenergized, permits the closing of the valve.

The amount of water admitted to the tub 10 is controlled by a suitable float switch structure, generally indicated at 48 and having a tank or casing 49 that communicates by means of a suitable flexible conduit 51 with the tub 10. As shown, the opposite end of the conduit 51 is connected to the drain conduit 43 on the upstream side of the valve 44. The float switch structure 48 includes an electric switch 52 which is actuated by a rod 53 having spaced upper and lower shoulders 54 and 55 formed thereon. A float 56 is slidably mounted upon the rod 53 and engages the shoulder 55 when the tub is substantially devoid of water. In this position the weight of the float 56 moves the switch 52 downwardly to its closed position. When a predetermined amount of water is admitted to the tub as indicated by the level line A, Fig. 1, the float 56 engages the upper shoulder 54 and moves the rod 53 and the switch 52 to their upper positions in which the switch 52 is opened.

The various electrically-operated elements referred to heretofore may be manually or automatically energized and deenergized to effect a series of steps in a washing and spinning program. In the embodiment disclosed herein these steps are automatically effected by means of a timer, generally indicated at 57 and carried by the front wall 34 of the casing where it is ac-

cessible to the operator. The timer 57 includes a manually-operated knob 58 which cooperates with indicia 59 carried on the face plate of the timer and which may be employed by the operator for setting the apparatus to effect a washing and centrifuging operation of predetermined duration.

In Fig. 3, I have shown a diagram of the electrical translating devices referred to heretofore. The timer 57 includes a rotatable drum 61, shown in development and rotatable in a direction indicated by the arrow by a timer motor 62 through the medium of a reduction gear 63. The motor 62 is of the type commonly employed for driving clocks and effects rotation of the drum 61 at a speed of approximately one revolution in forty minutes. A clutch, diagrammatically indicated at 64, is connected between the reduction gear 63 and the drum 61 which operates to drive the drum 61 at all times that the motor 62 is rotated but which affords movement of the drum 61 relative to the motor 62 during the setting of the timer or when the operator advances the drum 61 by means of the knob 58. The timer 57 includes a plurality of stationary fingers 65 to 69, inclusive, which are engaged by a plurality of electrically-connected movable segments 71 to 84 inclusive. The movable segments 71 to 84 are carried by the drum 61 and engage the stationary fingers 65 to 69, inclusive, in a predetermined sequence, for providing the washing and spinning program. The source of power for the electrical apparatus is indicated by line conductors L₁, L₂.

As shown, the stationary finger 65 is electrically connected to the line conductor L₁ and the finger 66 is connected by means of a conductor 85 to one terminal of the motor 23, the opposite terminal of which is directly connected to the line conductor L₂. The contact finger 67 is connected by means of a conductor 86 to one terminal of the operating magnet 29 of the two-speed mechanism 22, the opposite terminal of which is directly connected to the line conductor L₂. A conductor 87 connects the finger 68 to one terminal of the inlet valve solenoid 39, the opposite terminal of which is connected to the line conductor L₂ through the float switch 52. Contact finger 69 is connected by conductor 88 with one terminal of the drain valve solenoid 47, the opposite terminal of which is connected to the line conductor L₂. The timer motor 62 has one of its terminals directly connected to the line conductor L₂, the opposite terminal of which is connected by the conductor 89 to the conductor 85.

In accordance with my invention, means is employed for protecting the motor against overload during periods when the two-speed mechanism is adjusted for high speed operation. For example, the two-speed mechanism may be adjusted for high speed operation prior to the complete drainage of water from the tub, and, if acceleration is attempted before complete drainage of the water from the tub is effected, the motor becomes highly overloaded because of the retardation of the basket and its load by the body of water remaining in the tub. The latter condition is, of course, abnormal but it may obtain if the discharge of water from the tub 10 is retarded for any reason. For example, the strainer, not shown, disposed within the conduit 43 may be partially clogged and it would, therefore, retard discharge of water from the tub.

In accordance with my invention, an electri-

cal relay, preferably of the thermal type as shown at 91, is employed for protecting the motor. The relay 91 includes a heater 92 connected in series with the motor 23 and its conductor 85 and a thermal-responsive or bi-metallic member 93 disposed in heat transfer relation with the heater 92. The bi-metallic member 93 operates a switch 94 having a contact 95 movable with the bi-metallic member 93 and normally engaging a stationary contact 96. During normal operation, the switch 94 is closed. During an abnormal period or when the motor 23 is overloaded, the increased current carried by the heater 92 heats the bi-metallic member 93 sufficiently to disengage the contact 95 from the stationary contact 96. The switch 94 is connected in series with the two-speed magnet 29 so that, when the switch 94 is opened, deenergization of the magnet 29 is effected. Accordingly, an abnormal load on the motor 23, effects movement of the two-speed mechanism to its low speed position wherein the load on the motor is substantially reduced. The motor continues operation, however, and operates the pump 45 for the discharge of water from the tub 10. After a predetermined period of time, determined by the cooling of the thermostatic element 93, the switch 94 is again closed for effecting high speed operation of the basket 15. If sufficient water still remains in the tub 10 to overload the motor, the relay 91 will again operate to deenergize the magnet 29 and effect low speed operation of the basket. This cycle of operation will continue until all of the water is drained from the tub or the cause of the overload removed, at which time high speed operation of the basket will continue for centrifuging water from the fabrics. The relay 91 is preferably carried by the casing 32, as shown in Fig. 2, where it is not subjected to vibratory forces set up in the suspended washing and spinning structure.

The relation between the overload and the period of time that the motor is operated prior to the opening of the switch 94 may be predetermined by rate of heat transfer between the heater 92 and the heat-responsive element 93. I propose to employ a high speed relay which will permit an accelerating load of 1500 watts at 115 volts for a period not to exceed 30 seconds and which will be actuated substantially instantaneously by a load of 3000 watts, the latter corresponding to a locked rotor condition. These values are for a $\frac{1}{4}$ H. P. driving motor. Under normal accelerating conditions, the relay set forth would never open but would respond, in the event of an abnormal overload, to open its switch in a period of time determined by the severity of the overload.

Operation

When the washer is to be operated, the fabrics are deposited in the basket through the access opening 16 and the door 13 is closed, it being understood at this time that the cover 36 of the casing is either removed or swung to an open position. The operator then advances the drum 61 manually until contact segments 71, 73 and 77 engage the fingers 65, 66 and 68. Accordingly, the timer motor 62 and the main motor 23 are energized and the inlet valve solenoid 39 is also energized to admit water to the basket. The admission of water to the tub 10 is discontinued when the level of water within the tub has risen to the line A, at which time the float switch 52 is

opened for deenergizing the inlet valve solenoid 39. As the magnet 29 is at this time deenergized, slow speed rotation of the basket 15 is effected for agitating the fabrics in the water.

At this time the fabrics are elevated from the body of washing water by the vanes 18 to an upper region of the basket, the vanes becoming more and more inclined as they are elevated because of their rotation about an inclined axis. The fabrics slide from the vanes 18 and drop from their elevated position upon the hump 17 and are carried by the hump in the direction of its rotation into the body of washing water. Some sliding of the fabrics by gravity over the hump is also effected at this time. The fabrics launch in the body of washing water and move forwardly therein and are again elevated by the vanes. This period of operation defines a break or soaking period, it being understood that there is no detergent in the water at this time. The soils in the fabrics are softened by the scrubbing action of the vanes 18 and the hump 17 and the agitation of the fabrics in the body of water.

After approximately five minutes of operation, the segment 82 engages the finger 69 so that the solenoid 47 is energized and the drain valve 44 opened for the discharge of water from the tub. At the conclusion of approximately five minutes of operation, all of the segments are disengaged from their respective fingers and the apparatus is rendered inactive.

The operator then deposits a supply of detergent in the basket through the access opening 16 and after closing the door 13 again advances the drum 61 until the segments 72, 74 and 78 engage the respective fingers 65, 66 and 68. The timer motor and the main motor are again started and the admission of water to the tub 10 is effected as described heretofore. Slow speed operation of the basket at this time effectively removes the soils from the fabrics during the elevating and dropping of the fabrics as described in connection with the break.

After a period of time determined by the setting of the drum 61, the segment 83 engages the finger 69 for opening the discharge valve 44. Engagement of the segment 79 and the finger 68 admits water to the basket 16 for flushing away lint and scum which may collect upon the fabrics during the discharge of wash water from the basket. This water is drained away faster than it is admitted, it being understood that the drain valve 42 is open at that time.

At the conclusion of the flush rinse, the segment 75 engages the finger 67 and, therefore, the speed change magnet 29 is energized and acceleration of the basket to its high centrifuging speed is effected. Soapy wash water contained within the fabrics is centrifuged therefrom until the segment 75 is disengaged from the finger 67, which operation deenergizes the magnet 29 and slow speed operation of the basket is initiated. At this time, the segment 80 engages the finger 68 for admitting rinse water to the tub. The fabrics are again agitated, as described heretofore, in the clear rinse water for thoroughly dissolving the detergent.

At the conclusion of the agitating rinse, the segment 84 engages the finger 69 so that the drain valve 44 is open and the vitiated rinse water is discharged from the tub. The segments 76 and 81 next engage their respective fingers 61 and 68 whereupon high speed operation of the basket is initiated and admission of water to the fabrics during their acceleration is effected.

Water is discharged upon the rotating fabrics for a short period of time during which lint or other foreign matter is washed from the fabrics and the clear water discharged through the perforations of the basket, scours the inner surface of the tub 10. At the conclusion of the spray rinse, high speed operation is continued for a period of about four minutes during which a substantial portion of the water contained in the fabrics is centrifuged therefrom. At the conclusion of this period of centrifuging, all of the electrical elements of the apparatus are deenergized and the operator may then remove the damp-dried fabrics from the basket. The foregoing defines one washing and spinning program which may be effected and it will be understood that modifications of these steps or additional steps may be employed.

In the foregoing description of the program of washing and spinning steps, it was assumed that operation was normal throughout, so that the relay 91 maintained its switch 94 closed at all times. If, for any reason, an overload prevails with the two-speed mechanism adjusted for high speed operation of the basket, the relay 91 will function to initiate slow speed operation of the basket in which position the load on the motor is substantially reduced. Overloading of the motor during high speed operation of the basket and the adjustment of the multiple speed mechanism for low speed operation has been described in detail heretofore. The condition causing the overload has been described as an excessive body of water in the tub which would retard rapid rotation of the basket and its load but it will be apparent that other conditions may arise which would overload the motor and which would, of course, effect operation of the protective relay 91 as described. For example, a temporary power failure may occur during a centrifuging period which would stop all operation. Upon resumption of power, the motor may be heavily overloaded in accelerating the basket from a stationary position. In this event, the relay 91 may operate to initiate slow speed operation of the basket and, after the thermal element of the relay 91 closes the switch 94, acceleration of the basket from washing speed is readily effected.

From the foregoing description, it will be apparent that I have provided an improved machine for cleaning fabrics and for centrifuging cleaning fluid therefrom wherein the driving motor is protected against serious overloads which may occur during the centrifuging operation or during acceleration of the fabric-containing basket. Operation of the motor continues at reduced load and with the basket operating at low speed subsequent to an operation of the protective means. The continued operation of the motor is desirable where the motor drives the fluid discharge pump as the drainage of fluid which frequently is the cause of the overload, is continued. Furthermore, as set forth heretofore, operation of the motor to drive the basket at low speed is advantageous in accelerating the basket subsequent to an interruption of power during the centrifuging period.

A second embodiment of my invention is shown in Fig. 4. The apparatus involved here is identical with that disclosed in connection with the first embodiment, the only difference being that the speed change magnet 29 is connected to the load side of the float switch 52, as shown at 99, so that energization of the magnet 29 is under control of the float switch 52. This connection

is shown in the partial wiring diagram of Fig. 4 and it will be understood that the remainder of the diagram of connections is identical with that shown in Fig. 3.

In the embodiment shown in Fig. 4, energization of the magnet 29 for high speed operation is prevented by the float switch 52 until substantially all of the water is drained from the tub or when the float switch 52 is closed. It will be understood that, during a filling operation, the float switch 52 remains closed until a complete charge of water is admitted to the tub at which time the float switch 52 is opened. If, during the filling of the tub, the timer is inadvertently advanced to a position wherein spinning is effective prior to the opening of the float switch 52, damage to the mechanism is prevented by the relay 91 as described heretofore. In other words, if this abnormal condition obtains, the relay 91 would operate to deenergize the magnet 29 and slow speed operation of the basket would be effected. The continued operation of the motor and pump would discharge the water in the tub, as described heretofore, after which normal operation of the apparatus would be effected. It will be apparent that protection against temporary power failures, as described in connection with the first embodiment, is also provided in the second embodiment. Similar reference numerals have been applied to the elements common to both of the embodiments in this application.

While I have shown my invention applied to a laundry machine of the domestic type, it will be understood that it may be applied equally well to other forms of machines for cleaning fabrics, such as, for example, heavy duty laundry machines or dry cleaning apparatus. The invention may be employed in connection with any form of cleaning machine wherein the fabrics to be treated are cleaned and centrifuged in a single container.

While I have shown my invention in several forms, it will be obvious to those skilled in the art that it is not so limited, but is susceptible of various other changes and modifications without departing from the spirit thereof, and I desire, therefore, that only such limitations shall be placed thereupon as are specifically set forth in the appended claims.

What I claim is:

1. In apparatus for cleaning fabrics and for centrifuging fluid therefrom, the combination of a basket for containing a body of cleaning fluid and the fabrics to be treated, a motor, a two-speed mechanism driven by the motor for operating the basket at relatively low and high speeds for respectively cleaning and centrifuging the fabrics, electrically-operated means for adjusting the two-speed mechanism to its low speed position when deenergized and for adjusting the two-speed mechanism to its high-speed position when energized, a heater connected in circuit with said motor and energized at rates bearing a predetermined relation to the degree of energization of the motor, a heat-responsive device disposed in heat transfer relation with the heater and a switch actuated by said device for controlling energization of the electrically-operated means.

2. A machine for cleaning fabrics and for centrifuging fluid therefrom, the combination of a basket for containing a body of cleaning fluid and the fabrics to be treated, an electric motor, a two-speed mechanism driven by the motor for

operating the basket selectively at low and high speeds for the cleaning and centrifuging of the fabrics respectively, means for biasing the mechanism to its low-speed position, electrically-operated means for moving the mechanism to its high-speed position when energized and in opposition to said biasing means, a timer including a switch for controlling the energization of the electrically-operated means, a second switch connected in circuit with the electrically-operated means and normally closed, a heater connected in series with the motor, and a heat-responsive member disposed in heat transfer relation with the heater for opening said second switch in response to a predetermined abnormally high current in the motor and heater.

3. In apparatus for cleaning fabrics and for centrifuging cleaning fluid therefrom, the combination of a basket for containing a body of cleaning fluid and the fabrics to be treated, an electric motor, a speed-changing mechanism driven by the motor for operating the basket selectively at low and high speeds for the cleaning and centrifuging of the fabrics respectively, an electromagnetic device for operating the speed-changing mechanism and effective, when deenergized, to actuate the mechanism to its low-speed position and, when energized, to actuate the mechanism to its high-speed position, a switch controlling energization of the electro-magnetic device and normally maintained in closed position, and means responsive to a predetermined abnormal motor current for opening said switch, said last-mentioned means including time delay means and said last-mentioned means being effective to close the switch after a period of time of predetermined duration has elapsed subsequent to opening of the switch.

4. In apparatus for cleaning fabrics and for centrifuging cleaning fluid therefrom, the combination of a basket for containing a body of cleaning fluid and the fabrics to be treated, an elec-

tric motor, a speed-changing mechanism driven by the motor for operating the basket selectively at low and high speed for the cleaning and centrifuging of the fabrics respectively, and means responsive to a predetermined high load on said motor during high-speed operation of the basket for adjusting the speed-changing mechanism for low-speed operation, said load responsive means including time delay means and said load responsive means being effective to automatically condition the speed-changing mechanism for high-speed operation after a period of time of predetermined duration has elapsed subsequent to the adjustment of the speed-changing mechanism for low-speed operation by the load responsive means.

5. In apparatus for cleaning fabrics and for centrifuging cleaning fluid therefrom, the combination of a basket for containing a body of cleaning fluid and the fabrics to be treated, an electric motor, a speed-changing mechanism driven by the motor for operating the basket selectively at low and high speeds for the cleaning and centrifuging of the fabrics respectively, a pump for removing cleaning fluid from the basket and driven by said motor and means responsive to a predetermined high load on the motor for adjusting the speed-changing mechanism for low-speed operation, said load responsive means including time delay means and said load responsive means being effective to automatically adjust the speed-changing mechanism for high-speed operation after a period of time of predetermined duration has elapsed subsequent to an adjustment of the speed-changing mechanism for low-speed operation by the load responsive means, said pump being continuously operated by the motor at substantially constant speed irrespective of the adjustment of the speed-changing mechanism by said load responsive means.

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