Jan. 18, 1955 J. B. KIRBY 2,699,660

WASHING AND EXTRACTING MACHINE

Filed May 23, 1946 3 Sheets-Sheet 1

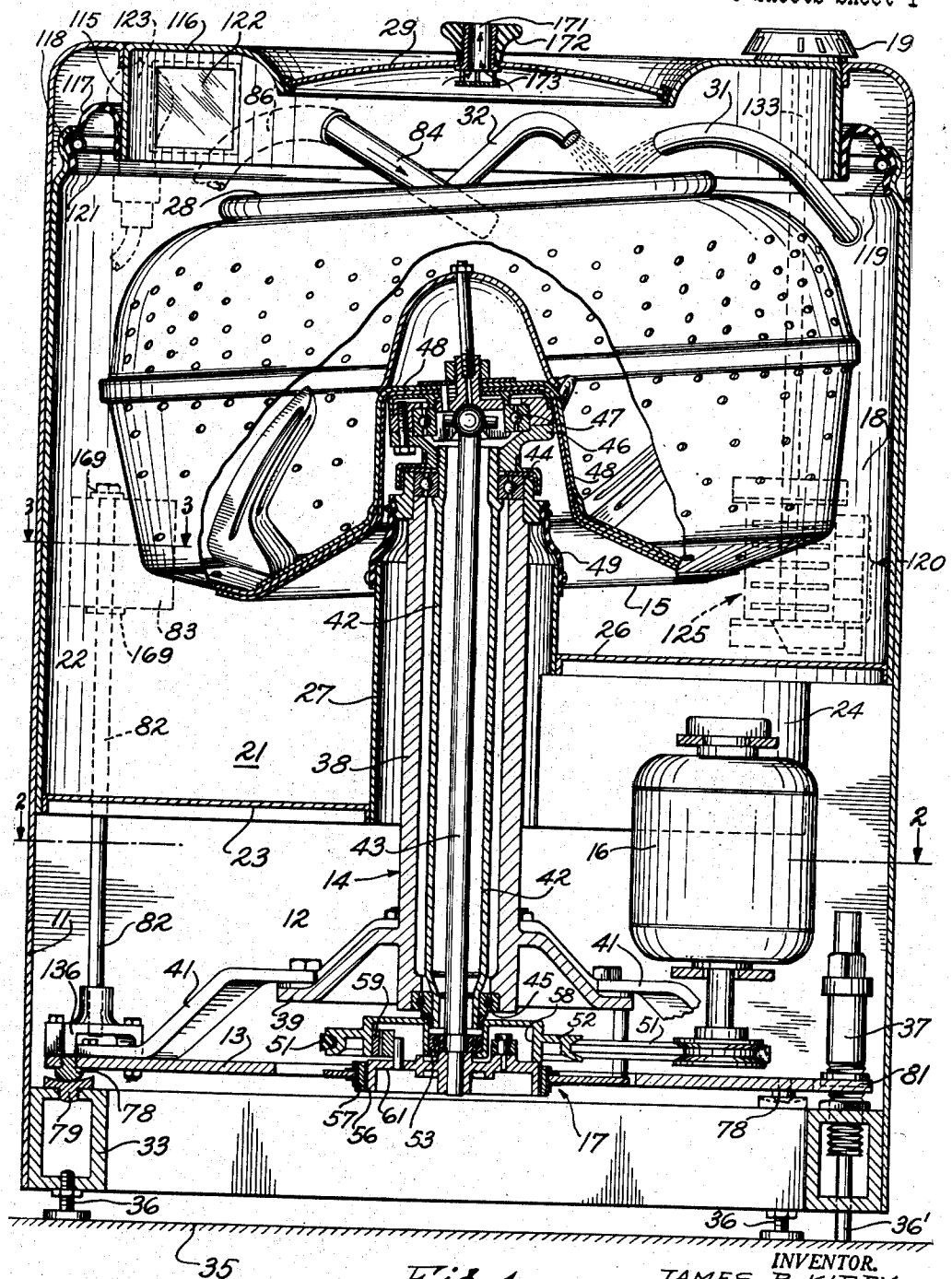


Fig. 1

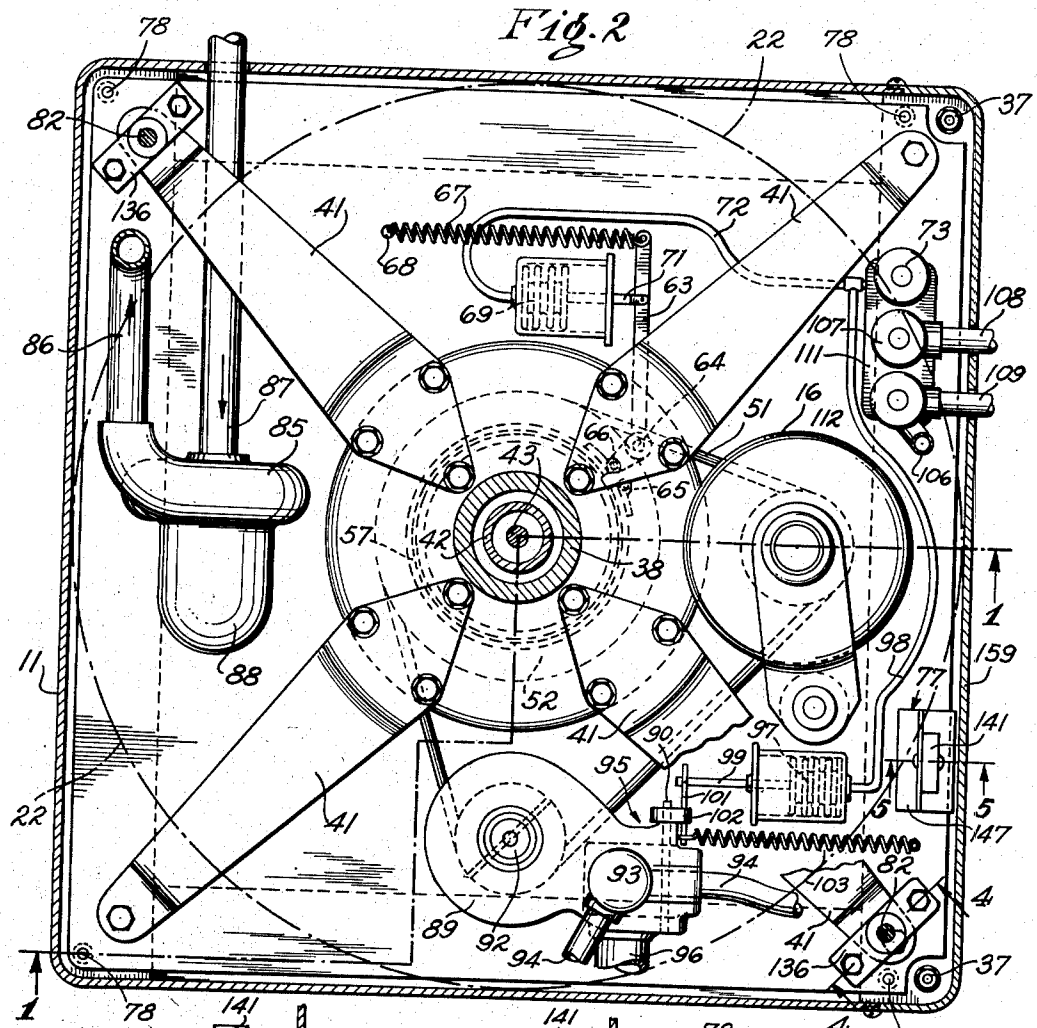
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Fig. 2



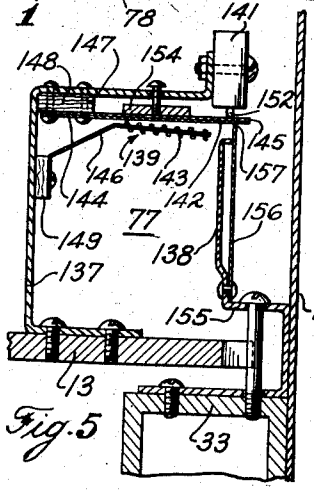


Fig. 5

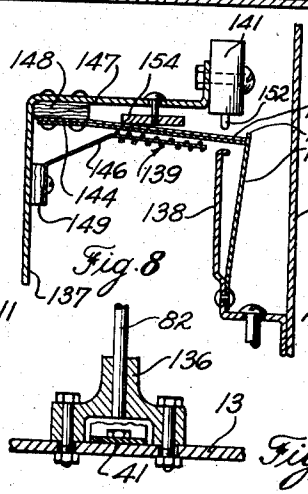


Fig. 8

Fig. 4

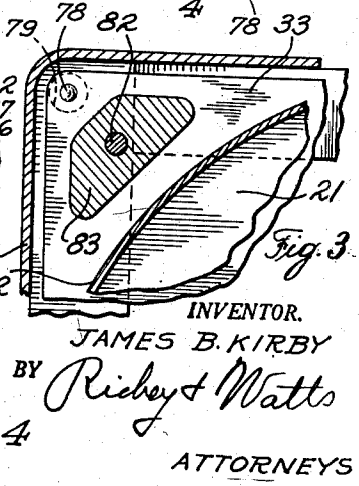


Fig. 3

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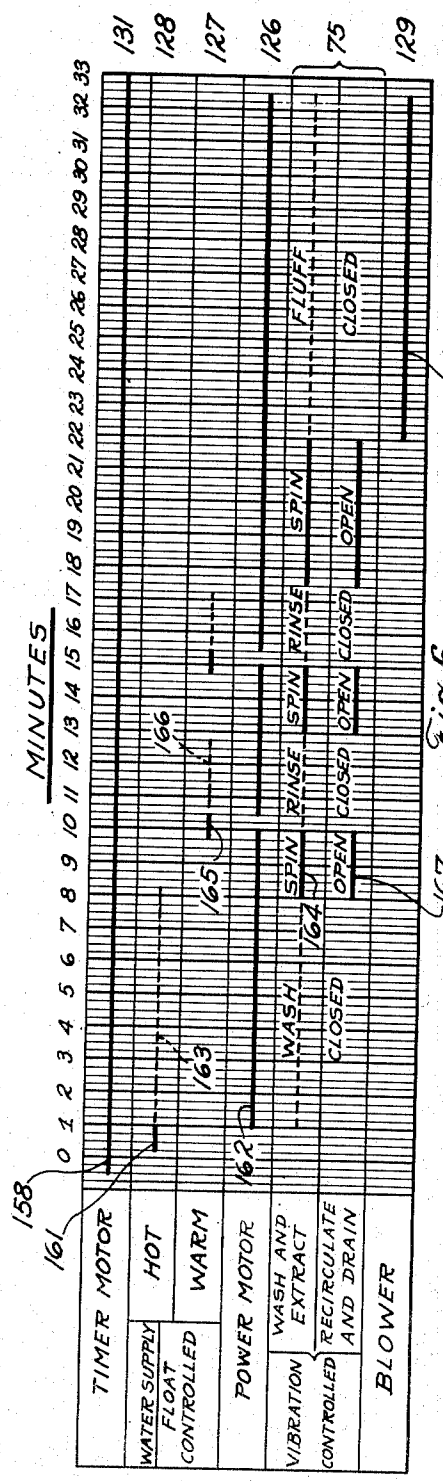


Fig. 6

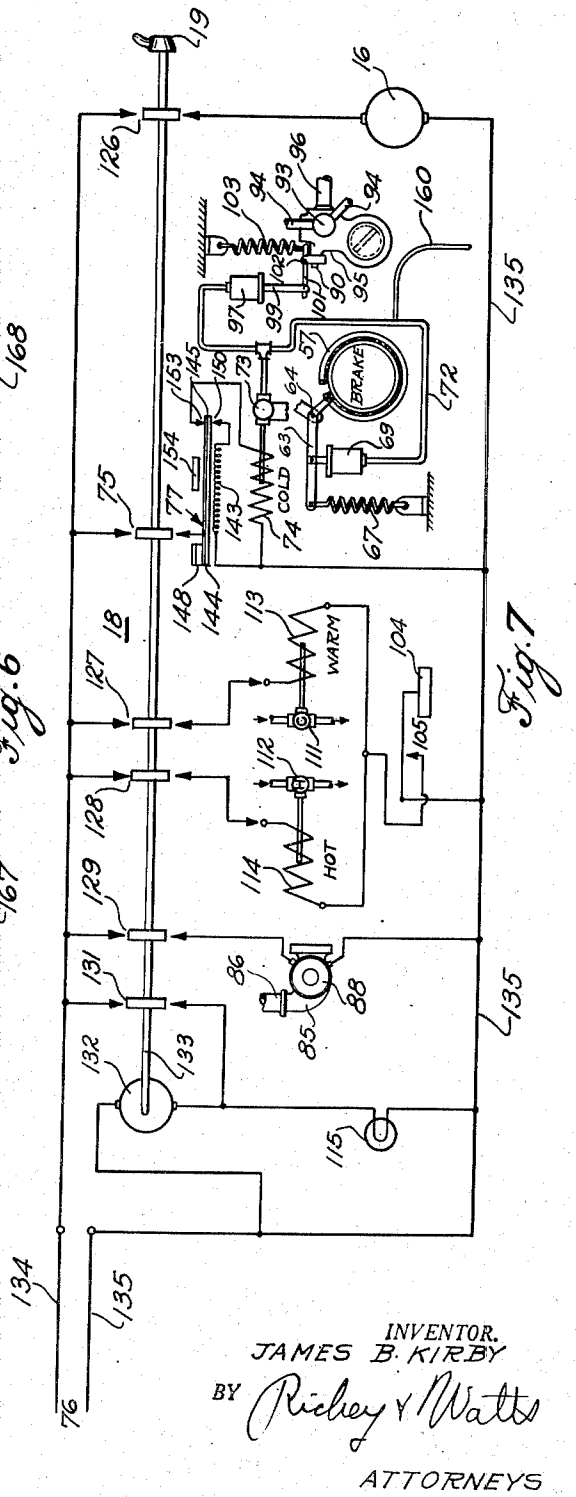


Fig. 7

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2,699,660

WASHING AND EXTRACTING MACHINE

James B. Kirby, West Richfield, Ohio, assignor to The Apex Electrical Manufacturing Co., Cleveland, Ohio, a corporation of Ohio, as trustee

Application May 23, 1946, Serial No. 671,779

9 Claims. (Cl. 68—23)

This invention relates to laundering and concerns particularly the washing and rinsing of fabrics and the like.

One object of this invention is to control and minimize vibration in a centrifuge apparatus, and particularly in a combined washing and extracting laundry machine. Another object is to decelerate or stop the rotation of a centrifuge when the load contained therein is unbalanced to such an extent as to cause excessive vibration, to subject the load to forces tending to balance the same, and again accelerate the rotation to bring the centrifuge up to the desired speed.

Another object of this invention is to wash flexible fabric articles rapidly with a small amount of fluid, to rinse them rapidly with little fluid, and then remove moisture content to a greater degree than possible by simple centrifuging.

A further object of this invention is to provide improved arrangements for washing, extracting and rinsing articles and further removing moisture content without rehandling the articles between the washing and rinsing operations or between the rinsing and moisture extracting operations.

A further object of the invention is to provide an automatic washer requiring a small amount of fluid having rapid washing and rapid rinsing characteristics and cutting the overall time of articles handled to a very short cycle.

Still another object of the invention is to carry on washing, rinsing and extracting operations in a vertical container and to diminish moisture content during the fluffing operation, all while the clothes are in a vertical container.

Still another object of the invention is to counteract vibration and to overcome deleterious effects of vibration in apparatus containing rotating mechanism or in other apparatus subject to vibration.

A further object is to provide a very rapid means for washing with a small amount of water to give a very short overall cycle of operation, with power supplied by a conventional fractional horse power motor.

Another object is to prevent transmission of vibration to an enclosing casing by allowing mechanism to vibrate or move freely within the casing and tuning the mechanism with vibration counteracting means.

Still another object of the invention is to guard against excessive vibration in rotary apparatus by cutting down the applied rotary power in response to vibratory tendency.

A further object is to restore and cut out the rotary power periodically in such rotary apparatus until the cause of the vibration has been reduced or eliminated.

Other and further objects, features and advantages of the invention will become apparent as the description proceeds.

In carrying out my invention in accordance with a preferred form thereof, I subject clothes or other fabric articles to forces tending simultaneously to oscillate them and redistribute them while driving air, washing fluid, or both through them. There is a substantially vertically oscillatory component of force for washing action, a circumferential component of force for distributing action on the clothes and a roll-over or inwardly over-turning component of force for redistributing action. For extracting, the clothes are revolved at sufficient speed to expel the major portion of the washing fluid.

For accomplishing these actions, the clothes or other articles are held in a container having liquid discharging openings in it and the same container is employed for holding the clothes during both the washing and extracting operations. In the preferred embodiment a single rotary

driving member is employed for actuating the container to produce both the washing and drying actions, and means are provided for recirculating water through the container during the washing action. Mechanism is interposed between the driving member and the container for alternatively, either converting the rotary motion of the driving member into oscillatory or jigging motion of the container for washing action or rotating the container for drying action. The preferred mechanism is such that when the container is prevented from rotating, the oscillatory motion is produced and when the container is left free it rotates with the driving member. The mechanism is such as to impart to the container during washing action a rocking or seesaw motion rotatively progressing around its center, what may be described as vertical reciprocation of the container with successive portions of the container around its center being reciprocated in progressively different phase.

Preferably the driving mechanism and mounting for the container are secured to a carriage, and a casing is provided in which the carriage is free to move sidewise. Vibration counteracting reeds are mounted upon the carriage for counteracting any vibratory force acting upon the carriage and preventing it from being transmitted to the casing by the carriage.

To guard against excessive vibration during extraction in case the articles in the container are badly unbalanced, a vibration sensitive switch is arranged to control the rotation. In one form, a thermal latch mechanism is provided, which is normally set or "cocked" for braking or reducing speed of revolution of the article container or extractor and tending to produce "jigging" action as in washing, but is normally not released for effecting such speed reduction except in case of excessive vibration. An electrical cutout switch is associated with the latch. The arrangement is such that upon release of the latch and operation of the cutout switch the thermal latch is reset after a predetermined lapse of time by a change in temperature resulting from operation of the switch so as to relatch the mechanism until the vibration again becomes excessive.

To accomplish greater extraction of moisture from the clothes and to obtain fluffing action after the extracting action has been completed, the washing action is repeated without liquid and simultaneously fresh dry air is directed at the articles as they continually shift positions during fluffing action in the container.

A better understanding of the invention will be afforded by the following detailed description considered in conjunction with the accompanying drawings, and the scope of the invention will be set forth in the claims.

In the drawings:

Fig. 1 is an elevation view, largely in vertical medial section, of a washing and extracting machine forming an embodiment of my invention;

Fig. 2 is a view of a cross section represented as cut by a horizontal plane 2—2, indicated in Fig. 1;

Fig. 3 is a fragmentary view representing a section cut in one corner of the casing through the weighted end of a vibration counteracting reed by the horizontal plane 3—3, indicated in Fig. 1;

Fig. 4 is a fragmentary view of a section cut by a vertical plane 4—4, indicated in Fig. 2, passing through the supporting end of a vibration counteracting reed;

Fig. 5 is a fragmentary sectional view of a portion of the apparatus represented as cut through the excess vibration cutoff apparatus by a vertical plane 5—5, indicated in Fig. 2;

Fig. 6 is a switch operation diagram illustrating the sequence of operation of the apparatus;

Fig. 7 is a circuit diagram schematically representing the sequence controlling time switch and parts of the mechanism controlled by the time switch; and

Fig. 8 is a fragmentary view of the apparatus of Fig. 5 showing the parts in the position assumed after the thermal latch has been released by excessive vibration.

Like reference characters are utilized throughout the drawings to designate like parts.

An illustrative embodiment of the invention as shown in the drawing and which will be described comprises a casing 11 within which is mounted a washing machine

carriage 12 including a base plate 13 arranged to be free to oscillate horizontally within the casing 11. The plate 13 has mounted thereon a pedestal 14 for supporting a container 15 for articles to be cleansed, a driving motor 16, and other pieces of mechanism which will be pointed out more particularly in connection with a detailed description of the apparatus. Brake and clutch mechanism for controlling the transmission of power from the motor 16 to the container 15 and for alternatively effecting the washing and extracting action is represented generally by the reference numeral 17 in Fig. 1. For automatically controlling and timing the sequence of operations, a time switch 18 is provided having a manual starting knob 19.

For forming a water reservoir or tub 21 below the container 15, sheet metal pieces are provided including a cylindrical shell 22, a bottom 23 with a recessed portion 24 around the motor 16 having a raised wall 26 above the motor 16 joined to the shell 22 and to a tubular sheet 27 surrounding the pedestal 14. The container 15 for clothes or other fabric articles to be washed has a top opening 28 to permit articles to be washed to be placed therein or removed, and the casing 11 has a removable cover 29 which may be transparent.

A water supply nozzle or spout 31 is provided for directing water into the top opening 28 of the container 15 and a pair of nozzles 32 (one visible) is provided for recirculating water into the container 15. The casing 11 is provided with a base or frame comprising hollow rectangular members 33.

For supporting the casing 11 and the frame 33 upon a horizontal surface 35 such as a floor in a home, for example, which may be composed of wood flooring, cement, or other surfaces subject to uneveness, vertically adjustable feet 36 are provided, preferably four in number, and one of the feet is provided with a self leveling mechanism 37, preferably comprising a hydraulic stabilizer. The hydraulic stabilizer 37 may be of the type described in greater detail in my co-pending application, Serial No. 619,849, filed October 2, 1945.

The container 15 and the alternative driving mechanism therefore to produce washing and extracting action are also of the type described in greater detail in my said co-pending application, Serial No. 619,849, filed October 2, 1945. In this type of apparatus the container 15 is provided with openings to permit continuous circulation of water through the mass of clothes or articles to be washed held in the container, and obstacles such as L-shaped sloping cleats or ribs 34 are provided which are fastened within the lower edges of the container to retard circumferential motion of fabric articles around the container during the washing operation and to promote roll over motion of the articles.

As indicated in Fig. 1 the driving and supporting mechanism for the container 15 is carried by the pedestal 14 concentrically therewith. The pedestal 14 comprises a tubular portion 38 and a flange portion 39 supported by a plurality of legs 41, preferably four in number. Rotatably mounted within the tubular portion 38 of the pedestal 14 are a tubular or hollow, rotating drive shaft 42 and a control shaft 43, the latter being within the hollow shaft 42. For rotatably supporting the hollow shaft 42 within the pedestal 14, upper and lower ball bearings 44 and 45, are provided.

A fitting 46, which serves as a rotatable driving member for the container 15, in turn carries an inclined bearing 47 upon which the container 15 is journalled through a supporting hub 48. An apron 49 is provided for preventing water from splashing over the wall 27 and falling upon the mechanism below the tub bottom 23.

The apron 49 is composed of suitable flexible material impervious to water such as sheet rubber, for example, to avoid interfering with sidewise motion of the pedestal 38 and the container 15, relative to the reservoir or tub 21 and the casing 11. As shown in Figs. 1 and 2, the motor 16 is arranged to drive the hollow shaft 42 rotatively through a belt 51 engaging a pulley 52 secured to the hollow shaft 42 at the lower end thereof.

For supporting the control shaft 43 at the lower end in such a manner as to permit relative rotation between the inner or control shaft 43 and the outer shaft 42, a bearing 53 is provided. A suitable flexible connection or universal joint is provided between control shaft 43 and the container 15. This may take the form, for example, of cross pins 54 secured to the upper end of the shaft 43 and fitting loosely in a vertical slot 55 formed in the hub 48 of the container 15. For releasably preventing rotation of the control shaft 43 when the hollow shaft 42 is rotated, a brake drum 56 is secured to the lower end of the control shaft 43 and a brake band 57, adapted to grip the drum 56, is provided.

Suitable means are provided for bringing the control shaft 43 up to the speed of the hollow shaft 42 when the brake band 57 is not in engagement with the brake drum 56. To this end the pulley 52 may be constructed in hollow form with an inner clutch surface 58 and a plurality of centrifugal friction clutch dogs 59 may be pivotally mounted, as illustrated more clearly in Fig. 1, upon the web portion 61 of the brake drum 56. Suitable means such as biasing springs are provided for preventing engagement of the clutch dogs 59 until a predetermined speed of the brake drum 56 has been reached.

Suitable linkage is provided for controlling the engagement of the brake band 57 with the brake drum 56. For example, as illustrated in Figs. 2 and 7, a lever 63 may be provided which is pivoted to a pin 64 secured to the base plate 13 of the apparatus. One end of the brake band 57 is fastened to a pin 65 which is also secured to the base plate 13 and the other end is fastened to a pin 66 carried by the short end of the lever 63. For normally producing engagement of the brake band 57, a spring 67 is provided which is fastened at one end to a pin 68 secured to the base plate 13 and is secured at the other end to the outer end of the lever 63.

Preferably fluid pressure means are provided for releasing the brake band 57. This may take the form of a bellows 69 secured at one end to the base plate 13 and connected at the other end through a link 71 to the lever 63. In order that the ordinary water pressure of the water pipes in the dwelling house or other building may be used for producing the requisite fluid pressure, the brake control system is preferably hydraulic. The bellows 69 has an inlet opening connected to a water conduit 72, admission of water to which is controlled by a cold water valve 73, preferably solenoid operated. For making the operation of the valve 73 responsive to the time switch 18, a solenoid 74 is provided, which is connected in series with a pair of time switch contacts 75 to an electric control circuit supply 76. The mechanical connections are such that the valve 73 is normally closed and opens upon energization of the solenoid coil 74.

Means are provided for permitting the container 15 and the carriage 12 upon which it is mounted to move horizontally in the event of an unbalanced overload in the container 15 which might tend to cause vibration. To this end the base plate 13 is provided with button-like feet 78 placed at or near the corners of the plate 13 and adapted to rest in slide cups 79 mounted on the top edges of the hollow base frame members 33. In order to provide space for the upwardly extending hydraulic stabilizer 37, one of the corners 81 of the base plate 13 has been cut out and the slide cup and slidable foot which would normally have been placed in that corner have been moved slightly along the edge as represented in Fig. 1.

In the illustrated embodiment, the tub 21 is substantially circular whereas the casing 11 is rectangular. The casing 11 may be made larger than the tub 21 to provide a clearance between them; however, in the specific embodiment illustrated in my present application, this is not necessary. Freedom for lateral motion is allowed the base plate 13 and the feet 78 together with the pedestal 14 and the other mechanism carried thereby including the container 15 without contacting or transmitting vibration to the center wall 27 of the tub 21, which in the present arrangement, is secured rigidly within the casing 11. The latter, in turn, rests directly upon the floor or other support through the feet 36.

Means are provided to counteract or absorb vibration of the container 15 which may result from an unbalanced distribution of the load in the container. In the illustrated embodiment, this takes the form of inertia members mounted on the carriage 12, which supports the container 15 through the pedestal 14. Resilient reeds 82, preferably steel, are secured at their lower ends to diagonally opposite corners of the base plate 13 by any suitable means, such as the blocks 136 which span the outer ends of the legs 41. Inertia members 83 are secured to the reeds so as to counteract and absorb lateral vibration of the carriage 12 and the container 15.

For avoiding excessive vibration in cases where the unbalance of the articles in the container **15** is so great as to exceed the capacity of the vibration absorbing reeds **82** for taking up vibration, a vibration responsive control is provided. The vibration responsive control is arranged for intermittently decelerating the control shaft **43** and thereby decelerating the rotary motion of the container **15** during centrifugal drying operations in response to any vibration which may occur greater than a predetermined amplitude. Preferably, vibration responsive means are provided for operating the solenoid **74** to reapply the brake **57** bor arresting the extracting action and re-introducing jigging or washing action. This may take the form of a vibration sensitive switch **77**, represented schematically in Figure 7 and shown in detail in Fig. 5, connected in series with the solenoid **74**, which will be described in greater detail hereinafter in connection with Fig. 5.

To decrease the moisture content further and to fluff the articles in the container **15** from which the cleansing liquid has been extracted or is being extracted, means are preferably provided for restoring the jigging motion corresponding to washing or rinsing action after the termination of a normal extraction cycle and simultaneously directing a jet of relatively dry air against the articles within the container **15**. For this purpose a supplementary nozzle **84** projecting into the opening **28** of the container **15** is provided. For supplying air to the nozzle **84** a motor driven blower **85** is provided which has an outlet connection through a length of flexible tubing or hose **86** to the nozzle **84**. The blower **85** is provided with inlet tubing or an intake pipe **87** which is arranged to draw air from the exterior of the casing **11**. For example, in case the washing machine is operated in a basement or laundry having a relatively humid atmosphere, the intake pipe **87** may be connected to a duct leading from the living quarters of a dwelling house, or if desired, special heating means, not shown, may be provided for assuring sufficient warmth and dryness of the air drawn into the pipe **87**. As indicated schematically in Fig. 7, the blower **85** is preferably driven by an electric motor **88** adapted to be controlled by the time switch **18** in accordance with the desired operating cycle.

As illustrated in Fig. 2 and indicated schematically in Fig. 7, a cleansing liquid circulating pump **89** is provided which is arranged to be driven simultaneously with the washer operating pulley **52** by the motor **16** through the belt **51**. The pump **89** is preferably of the vane type so as to draw relatively little power from the motor **16** and has a pair of vanes **91** drawing water from an inlet opening **92** and discharging it through a discharge passageway. There is a twin outlet discharge head **93** connected to pipes or flexible tubing **94** connected in turn to the re-circulating nozzles **32**. The inlet **92** is connected through a length of hose or tubing, not shown, to an opening, not shown, in the tub bottom **23**. The opening is not visible in Fig. 1 since it is assumed to be in front of the plane along which the sectional view of Fig. 1 is taken. These features are shown in greater detail in my co-pending application, Serial No. 619,849, filed October 2, 1945.

A two-way valve **95** is provided in the pump discharge passageway for connecting the pump output either to a drain hose **96** or to the re-circulating discharge head **93**. The two-way valve **95**, indicated in Figs. 2 and 7, is of the type illustrated in greater detail in my aforesaid co-pending application comprising valve discs adapted to cooperate with a pair of inclined valve seats, the valve disc being carried by a lever secured to a rotatable shaft **90** extending through the pump casing.

For enabling the two-way valve **95** to be operated by fluid pressure, preferably hydraulically, a fluid pressure unit such as a bellows **97** is provided which is similar in type to the bellows **69** previously described in connection with the hydraulic operation for the brake band **57**. As illustrated in Figs. 2 and 7, the bellows **97** is provided with an inlet opening connected by a length of conduit or tubing **98** to the output of a valve controlling admission of fluid pressure. Preferably the conduits **72** and **98** are connected to a common line controlled by the valve **73**. In this manner the draining and pumping operation may be controlled simultaneously with the conversion from washing to extraction operation and vice versa, by a single set of switch contacts **75** of the time switch **18**. As shown, the bellows **97** has a link **99** or other suitable mechanical connection to a crank pin **101** carried by a crank **102** keyed to the two-way valve shaft **90**.

A spring **103** is provided for normally holding the drain valve closed and the linkage from the bellows **97** to the valve control shaft **90** is such that the spring **103** holds the valve disc against the valve seat on the drain side so that the drain through the opening **96** is closed except when the solenoid coil **74** is energized to admit pressure to the bellows **97**. A bleed tube **160** may open from the circuit **72**, so that the bellows **69** and **97** are collapsed by the springs **67** and **103** when the valve **73** is closed.

In order to proportion the flow of water recirculated through the nozzles **32** into the container **15** and out through discharge through the drain holes or perforations in the container **15**, means are provided for controlling the supply of water to the nozzles **32**. Preferably a float switch **104**, indicated schematically in Fig. 7, is provided in the lower portion of the tub **21** above the bottom wall **23**. The float switch may comprise a float composed of a light material such as cork or the like, secured to an arm in the form of a thin rod protruding through an opening in the side wall of the tub for operating a micro-switch **105**. Although my invention is not limited thereto, in the specific arrangement here illustrated, the switch **105** is so arranged as to be normally open, and is closed whenever the float **104** falls. As will be explained more in detail hereinafter, the micro-switch **105** is connected in series with a valve operating solenoid for controlling supply of either hot wash water or warm rinse water through the supply nozzle **31**.

The water supply spout **31** may be connected to a source of hot or warm tap water through a line such as a flexible hose line **106**, represented in section in Fig. 2. Preferably a single electrically operated valve unit **107** is provided having inlet pipes or flexible tubes **108** and **109** leading from the cold and the hot water taps, respectively, of the water system of a dwelling house or other building. The unit **107** preferably carries the solenoid valve **73** to which the cold water pipe **108** is directly connected, and also warm and hot water control valves **111** and **112**. The unit **107** preferably also contains conventional thermostatic mixing valves, not shown, for furnishing warm water of a predetermined temperature considered suitable for rinsing to the solenoid operated valve **111**, and also furnishing hot water of a higher degree of controlled temperature to the solenoid operated valve **112** which controls the admission of the original supply of hot washing water. As represented schematically in Fig. 7, the valve **111** is provided with an operating solenoid coil **113** and the valve **112** is provided with an operating solenoid coil **114**.

As illustrated in Fig. 1, there is a splash guard **115** formed integrally with the top **116** of the cabinet or casing **11**. The splash guard **115** is to divert into the tub **21** any liquid which may splash from the container **15**. Preferably a flexible seal **117** is provided between the splash guard **115** and the top edge **118** of the tub **21**. The seal **117** comprises an endless band of flexible elastic material such as sheet rubber stretched over the splash guard **115**. The upper edge **118** of the tub **21** is preferably double flared, as shown, so as to provide a groove **119** for receiving a split ring **121** adapted to expand in the groove **119** for stretching the outer portion of the sheet rubber seal **117** and holding it in the groove **119**. A window **122** may be provided in the splash guard **115** for admitting light from a lamp **123** to the interior of the article container **15**. The window **122** may be covered with a suitable translucent or transparent material such as plastic, for example, Lucite.

Preferably the elements of the apparatus are mounted as illustrated in Fig. 2, with the main power motor **16**, the water controlling valve unit **107**, the water inlets **108** and **109** and the vibration responsive cut-off switch **77** at the back of the casing **11**. The rear wall of the casing **11** is provided with a removable panel to facilitate installation and adjustment of the mechanism enumerated.

The present invention is not limited to a specific type of apparatus for the timer or time switch **18**. Preferably, however, for the sake of precision in the operation of the timer and precision in fixing of the intervals, since the time intervals involved are relatively short, I employ a timer of the multiple cam type operating either breaker

points or switches. For example, a timer such as described in my co-pending application, Serial No. 619,849, including a constant speed motor **132** represented schematically in Fig. 7, and a plurality of separate cams **125** (Fig. 1) each actuating the protruding operating pin or button or one of a group of conventional micro-switches **120** may be used. In order to carry out the illustrative operating cycle which will be described hereinafter, the timer micro-switches **120** preferably include six separate switches or pairs of switch contacts schematically represented in Fig. 7. These contacts include the contacts **75** for controlling the operation of the solenoid valve **73** which operates the brake **57** and the drain and circulation control valve **95**; a pair of switch contacts **126** for controlling operation of the pump driving and main power motor **16**; a pair of contacts **127** for controlling the warm rinse water valve **111**; a pair of switch contacts **128** for controlling the hot wash water valve **112**; a pair of switch contacts **129** for controlling the blower motor **88**; and a pair of switch contacts **131** for controlling energization of the illuminating lamp **115** and the timer driving motor **132**. The timer driving motor **132** is preferably a self starting synchronous motor. It is represented as having a driving shaft **133** carrying the cams **125** and also extending upwardly to the manual starting knob **19**. The latter is secured to the upper end of the cam shaft **133** for permitting manual starting and also permitting manual advancement of the cams to a more advanced position, if desired.

The electric circuit arrangement of the electric timer **18** and the electrical apparatus controlled thereby is represented schematically in Fig. 7. A source of electrical current **76** from a conventional house lighting system is utilized having conductors **134** and **135**, the latter of which is designated as a return conductor as a matter of convenience in designating the various branch circuits of the apparatus. During such times as the various contacts may be closed, circuits are formed as follows:

From the conductor **134** through timer contacts **131**, the timer motor **132**, and back to the return conductor **135**; from the conductor **134** through the timer contacts **131**, illuminating lamp **115**, back to the return conductor **135**; from the conductor **134** through the timer contacts **129**, the driving motor **88** for the blower **85** to the return conductor **135**; from the conductor **134** through the timer contacts **128**, the solenoid coil **114** for operating the hot water supply valve **112** and the float switch contacts **105**, back to the return conductor **135**; from the conductor **134** through the timer contacts **127**, the solenoid coil **113** for the warm rinse water valve **111** and the float switch contacts **105**, back to the return contacts **135**; from the conductor **134** through the timer contact **75**, the vibration sensitive switch **77**, a solenoid coil **74** for the control valve **73**, back to the return conductor **135**; and from the conductor **134** through the time switch contacts **126** and the main driving and pump operating motor **16**, back to the return conductor **135**. It will be observed that the timer operating motor **132** and the lamp **115** are operated in parallel.

The circuit diagram of Fig. 7 is merely schematic and does not serve to indicate the order in which the various timer contacts **75** and **126** to **131** inclusive are closed or make contact. The cams are arranged in different angular positions on the shaft **133** to produce circuit closing in the desired succession, and are appropriately shaped to produce closing of the contacts for the desired time duration. The preferred sequence of operation, and an illustrative duration of each are indicated in Fig. 6. Such cam shaping is known to those skilled in the art and thus has not been specifically illustrated. The significance of Fig. 6 will be explained more in detail hereinafter in connection with an explanation of the manner of operation of the apparatus.

The vibration absorbing reeds **82** are welded or otherwise secured in sockets formed in the base blocks **136**. In this manner space is conserved within the casing **11** as the two reeds **82** may occupy two of the corners between the round tub **21** and the square walls of the casing **11**. Manifestly the reeds may be mounted and arranged in any other desired manner to cooperate with a tub and casing of any other configuration. In the illustrated arrangement the weights **83** may be so shaped, as illustrated in Fig. 3 for example, as to utilize to the best advantage the corner spaces within the casing **11**. The length, stiffness and weight or thickness of the vibration absorbing reeds **82** are so chosen in relation to the mass of the tuning weights **83** as to give the vibration absorbing reeds a natural period of vibration or oscillation equalling that at which vibration tends to occur during extracting action in the event of unbalance of articles to be dried within the container **15**. The natural frequency of vibration accordingly is made equal to the frequency represented by the speed of rotation of the container **15** and the shaft **42**, or in some cases, equal to a harmonic or sub-harmonic. The reason that reeds **82** may be tuned to a harmonic or sub-harmonic of the frequency represented by the speed of the container **15** is that two mass-elastic systems may vibrate in resonance either when they are tuned to the same frequency of vibration or when either is tuned to a harmonic, that is, an integral multiple, of the frequency of the other.

The vibration sensitive switch **77**, illustrated in greater detail in Fig. 5, comprises a bracket **137** rigidly secured to the sidewise movable base plate **13** and a vertical rod or stationary fixture **138** rigidly secured to the casing **11** or preferably to the supporting bed frame **33** thereof. Means are also provided to return the switch substantially to normal position after a predetermined time interval, including a temperature responsive electric current operating bendable unit **139** and switch contact mechanism **141** operated by the unit **139**.

The temperature responsive electrically operated bendable unit **139** comprises a bi-metallic strip **142** supported at one end in thermal relation to, preferably above, a current conducting coil or heater **143**. As illustrated, the bi-metallic strip **142** is supported at the left hand end **144** and has a movable end **145**. The heater **143** comprises a coil of wire wound upon an insulating form **146**, also supported at the left hand end. The bracket **137**, in the arrangement illustrated, extends vertically upward having a lateral arm **147** at the upper end thereof to which the strip **142** and the heater supporting form **146** are secured. Preferably there is a spacing block **148** which may be composed of insulating material between the left hand end **144** of the bi-metallic strip **142** and the bracket arm **147** and likewise there may be a spacing block **149** preferably composed of insulating material between the bracket **137** and the supported end of the heater form **146**.

The switch contact mechanism **141** comprises suitable switch contacts with a mechanical connection to the free end **145** of the bi-metallic strip **142**. Preferably, as illustrated, the switch contact mechanism **141** comprises a micro-switch of conventional type, well known to those skilled in the art, shown within a standard casing having a protruding contact operating button **152** extending vertically downward and adapted to bear against the upper surface of the free end **145** of the bi-metallic strip **142**. The micro-switch **141** preferably is o fthe single-pole, double throw type having a pair of normally closed contacts **150** and a pair of normally open contacts **153**. The arrangement is such that the contacts **150** open and the contacts **153** close when the free end **145** of the strip **142** rises and presses upward on the button **152**. For this arrangement the bi-metallic strip **142** is designed so that when cold it tends to bend downward and when heated it tends to straighten out with the end **145** rising against the button **152**. For example, in the case of a copper-steel strip the copper, having the greater temperature coefficient of expansion would be below and the steel above. As represented schematically in Fig. 7, the heater winding **143** is connected serially in a circuit including conductors **134** and **135**, the closed contacts **150** and the timer contacts **75**; whereas, the solenoid **74** is connected serially in a circuit including the conductors **134** and **135**, the timer contacts **75** and the normally open contacts **135**.

Preferably in order to hasten the return of the bi-metallic strip **142** to the downward position when the current through the heater winding **143** is cut off, means are provided for hastening the cooling of the strip **142**. This may take the form of a chill plate **154** mounted between the lateral bracket arm **147** and the bi-metallic strip **142**.

The stationary rod member **138**, as previously mentioned, extends vertically upward and considered as a unit is so mounted that the upper end thereof fits under and adjacent the free end **145** of the bi-metallic strip **142** when the strip **142** is in its upper or heated position. Preferably, however, for reasons which will be explained

hereinafter, the stationary rod unit **138** is formed as a composite member consisting of a relatively stiff strip **155** which may be bent as shown, secured at the lower end to the bed frame **33**, and a relatively flexible easily deflected spring strip **156**. The latter is secured at the lower end to a portion of the stiff strip **155** and extends upward beyond the upper end of the stiff strip **155** so that when the bi-metallic strip **142** is placed in downwardly bending stress the free end **145** thereof bears against the upper end **157** of the strip spring **156**. It will be observed that the strip spring **156** is secured to the side of the stiff strip **155** away from the supported end **144** of the bi-metallic strip **142** so that strip spring **156** is free to deflect to the right to prevent interlocking between the ends **145** and **157** of the strips **142** and **146**, respectively, during any excessive lateral motion of the base plate **13**.

It will be observed that during the washing action, when the control shaft **43** is held stationary by the brake band **57** acting on the brake drum **56**, the tubular shaft **42** rotates the tilted bearing **47** in which the supporting hub **48** for the container **15** is journalled. Consequently, the geometric axis of the container **15** is continuously tilted, being tilted in a different direction progressively moving around the axis of the shaft **42**. For example, a point in the geometric axis of the container **15** above the center of mass thereof revolves around the axis of the shaft **42** whereas the container **15** itself is prevented from rotating about its geometric axis by reason of the engagement of the slot **55** with the pins **54**. Different portions of the mass of water and articles in the container **15** are reciprocated in a vertical direction with progressively different phase around the center to produce a jigging action.

The timer diagram shown in Fig. 6 illustrates diagrammatically the cams **125** of the timer **18** by indicating the preferred sequence of operations and illustrative time periods during which the respective switches **75** and **126** to **131** may be closed. As indicated diagrammatically in Fig. 6 and shown in the circuit diagram of Fig. 7, the timer contacts **127** and **128** controlling the supply of water to the washing machine are subject to the control also of the float switch **105** shown in Fig. 7. Furthermore, as indicated diagrammatically in Fig. 6, the effect of the timer switch **75** controlling extracting and rinsing operations is also subject to modification by the vibration responsive cut-out **77**.

The first operation in using the illustrated apparatus is to place the articles to be washed or cleansed, such as clothes for example, in the container **15** shown in Fig. 1. The starting knob **19** is then turned manually in the starting direction, for example clockwise. A very slight turn causes the switch contacts **131** to close which energizes the driving motor **132** of the timer **18** and from this point on the cams **125** of the timer **18** are automatically driven to carry out the timer operations. As indicated by the continuous heavy line **158** in the chart of Fig. 6, the shape of the timer cam controlling the switch contacts **131** may be such that the contacts are closed one and one-half minutes before the time intended for the main motor **16** to start and remain closed thereafter for a period of thirty-three minutes. That is, the contacts **131** remain closed from the time minus one-half minute on the arbitrarily shown scale of Fig. 6 to the time thirty-three minutes, being a total of thirty-four and one-half minutes.

Preferably the next step is to supply the machine with hot water for washing. Thus, as illustrated in the diagram of Fig. 6, the hot water supply may be opened at the time one-quarter minute, by energization of the solenoid **114**, which in turn opens the valve **112**. Referring to Fig. 7, provided the float switch **105** is closed, the hot water supply valve solenoid **114** is energized by the closing of the switch **128** and water begins to flow into the container **15** through the supply nozzle or spout **31**. Obviously the switch **105** will be closed at the commencement of operations before any water has flowed into the container **15** and drained into the tub **21** to lift the float **104** and open the switch **105**. Thus the water supply is started before the main motor **16** is started.

If it is desired, a separate time switch cam and pair of contacts may be provided as described in my aforesaid co-pending application Serial No. 619,849 for causing the drain valve of unit **95** to be normally open and to close after the starting of the timer motor **132** but before the starting of the main driving motor **16**. However, for the sake of simplicity in the drawings and description and to illustrate the manner of employing a common solenoid operated valve **73** for controlling both pressure operators or bellows **69** and **97** for the washing-spinning control and the two-way drain and recirculation control, the illustrated arrangement is such that the two-way valve **95** is normally in the closed position and is thus already closed when the timer motor **132** is started. Inasmuch as the drain valve controlling the discharge of washing liquid through the drain pipe **96** is initially closed, the hot wash water is allowed to remain in the tub **21** as soon as the valve **112** is opened at the time one-quarter minutes as indicated by the full line **161** in the timer diagram of Fig. 6. Hot washing water in the tub **21** is recirculated by the pump **89** through the recirculating nozzle **32** to the container **15** as soon as the power motor **16** starts upon closure of the contacts **126** which may be at the time one minute as indicated by the full line **162** in the timer diagram of Fig. 6. Soap powder or solution may be added to the tub **21** at any time. The soap mixes immediately owing to the rapid action of the washer. Foam can be seen within a few seconds.

When the switch **126** is closed it energizes the main motor **16** which starts the pump **89** in operation. The motor **16** also rotates the pulley **52** driving the hollow shaft **42** shown in Fig. 1. Owing to the fact that the brake drum **56** is gripped by the brake band **57** in consequence of the force of the spring **67**, shown in Fig. 2, the center or control shaft **43** is prevented from rotating about its geometric axis, so that rotation of the shaft **42** produces a rotatively progressing vertically reciprocatory motion of the lower surfaces of the container **15** as discussed in greater detail in my aforesaid co-pending application Serial No. 619,849. It is sufficient here to point out that this produces a jigging washing action upon the articles placed in the container **15**. As indicated by the extent of the dotted portion of the line **163** in Fig. 6, the hot water supply valve solenoid **114** controlled by the switch **128** may remain energized until the time eight and one-quarter minutes. For the greater portion of this time, indicated by the dotting of the line **163**, the supply valve **112** is not opened owing to the fact that the switch **105** opens as soon as sufficient water has been supplied to the tub **21** for the particular load.

The automatic control of the delivery of water to the container **15** through the supply spout **31** is in part dependent on the quantity of clothes in the container **15**. The water required to saturate the clothes is retained in the container **15** while sufficient water is accumulating in the tub **21** to permit a full stream to be delivered through the spouts **32**. The length of the total cycle of the machine is shortened by reason of the arrangement which requires but a small quantity of wash water so that little time is required for running water in and out of the tub.

Simultaneously with the end of the washing period at the time, for example, of eight minutes, where a single pair of switch contacts **75** is employed for controlling both the bellows **69** and **97**, the drain pipe **96** from the two-way valve **95** is opened by the bellows **97** to cause water to be withdrawn from the tub **21**. Simultaneously the closing of the switch **75** applies pressure to the bellows **69** for overcoming the pressure of the spring **67** and releasing the brake band **57** as indicated by the full line **164**.

The center shaft or control shaft **43**, shown in Fig. 1, is then allowed to rotate, permitting the container **15** also to rotate and to come up to speed gradually for centrifugal drying purposes. Owing to the inertia and the continual change of oscillation velocity of the container **15** necessary for carrying out the rotatively progressing reciprocatory motion through the inclined bearing **47**, there is a tendency for dynamic coupling between the shafts **42** and **43** so that the shaft **43** and the container **15** tend to come up to a speed approaching that of the tubular shaft **42**. At a predetermined point the speed is sufficient to throw out the clutch shoes **59**, shown in Fig. 1, so that an additional coupling between the shafts **42** and **43** is produced, namely, a slip clutch effect due to the frictional engagement of the clutch shoes **59** with the inner pulley surface **58**. The control shaft **43** is brought up to the full speed of the tubular shaft **42** so long as no braking effect is applied to the drum **56**. Thus by utilizing but one single speed motor **16**, the container **15** may be oscillated or rotated alternatively with the same number of oscillations per minute in one case, or revolutions per minute in the other

case, depending upon whether the washing or the drying operations are to be produced. Furthermore, no more driving power is required for drying or for extracting than for washing. A conventional fractional horse power may be employed which may be thrown directly across the usual 110 volt domestic electric lines in accordance with electric wiring codes. Nevertheless the method of washing is very rapid and short overall cycle results. The rotational acceleration of the basket and the shaft **43** by rotation of the shaft **42** is explained by the fact that the hollow shaft must do work on the basket to oscillate it. This means that the basket is exerting a torque on tthe shaft, which resists its rotation, and that there is an equal and opposite torque reaction of the shaft on the basket. This torque tends to rotate the basket, so that it must be braked against rotation to obtain a pure wobbling motion uncomplicated by rotation. When the brake is released, the torque gives the basket a rotational acceleration.

As the rotational speed of the basket increases, this rotation produces a gyroscopic action which acts to increase the resistance of the basket to wobbling and thus further increases the tendency of the basket to rotate rather than wobble.

As indicated in Fig. 6, the extracting operation may continue for a period of two minutes during which the switch **75** remains closed, and the container **15** continues to spin. However, before the end of this period, for example, at the time nine and three-quarter minutes indicated on the diagram by the full line **165**, the switch contact **127** has closed, causing the warm water supply solenoid **113** to be energized and thereby causing warm rinse water to flow into the container **15** through the supply nozzle **31**. At the termination of the spinning period, for example, at the time ten minutes, the drain control bellows **97** actuated by the switch **75** closes the drain and causes warm rinse water to be retained in the tub **21** and to permit recirculation of warm rinse water to articles in the container **15**. When the full stream is obtained from the recirculating nozzles **32** the float **105** cuts off the warm rinse water as during the washing period, as indicated by the dotted line **166** in Fig. 6. At the end of the spinning period the switch **75** reopens, cutting off pressure from the bellows **69** and causing the brake band **57** to be re-engaged with the brake drum **56** by the force of the spring **67**.

The container **15** then resumes its washing action except that a fresh supply of clean warm rinse water is recirculated instead of the hot soapy water utilized during the first period, and consequently the clothes are being rinsed instead of washed. The rinsing action continues for a desired period indicated as three minutes in Fig. 6, whereupon the switch **75** again closes releasing the brake band **57** and allowing the center shaft **43** as well as the container **15** to be rotated as previously explained at the full speed of the tubular shaft **42** for extracting. The invention is, of course, not limited to any particular number of extracting and rinsing periods. In the specific time diagram illustrated there is a second extracting period continuing for about two minutes followed by another rinsing period continuing for about two and one-half minutes. This is followed in the arrangement illustrated by a further spinning or extracting period of about four and one-half minutes.

As indicated by the heavy lines **167** in the timer diagram of Fig. 6, since the same switch **75** controls the washing and extracting action through the bellows **69** and the recirculating and draining action through the bellows **97**, the drain **96** is open during each spinning or extracting period and closed during the washing and rinsing periods.

At a suitable time, such as a time twenty-two minutes, a spinning or extracting period is terminated and the washing action may commence, the drain necessarily being closed again by reason of tthe construction employed. However, the cam for the time switch contacts **127** is so arranged that these contacts do not reclose and rinse water is not again admitted to the container **15**. The articles in the container are subjected to the washing action without water so that tthe clothes, which may have been packed against the outer walls of the container **15**, are shaken loose or fluffed. Simultaneously with the termination of the spinning period the timer contacts **129** may close, as indicated by the commencement of the full line **168** in the timer diagram of Fig. 6, starting the blower motor **88** and causing a jet of relatively dry air from the air nozzle **84** to be directed into the container **15** and against the clothes or other fabric articles contained therein. This helps to reduce further the moisture content. The blower motor **88**, as indicated by the full line **168** of the timer diagram, may continue to operate supplying relatively dry air until the end of the cycle of operation. At that time, thick, heavy articles are in such condition as to dry quickly upon hanging; and relatively light, flimsy articles, handkerchiefs, shirts, and the like are prepared for immediate ironing.

The shape of the cam controlling the timer contacts **126** may be such that the power motor **16** is shut down for one-half minute periods at the end of the first two rinsing periods, namely, at ten minutes and fifteen minutes, respectively, in the specific operating cycle assumed. This permits fresh rinse water to flow into the container **15** while the drain valve is open before the washing action of the container **15** has recommenced and after spinning has stopped. In this manner, the flushing of dirty soap water from the clothes is aided.

Although a specific operating cycle has been described, my invention is not limited to this specific cycle. Some classes of fabric articles, for example, require different washing, spinning and fluffing periods than others and the desired number of cams and contactors **125** are provided to enable the desired cycle of washing operations to be achieved. The fluffing period shakes up the clothes and separates them so that they are not matted into a doughnut and the clothes may therefore be removed readily from the container **15**.

Preferably the cover **29** is provided with a vent or opening **171** through its knob **172** and an anti-splash guard **173** below the vent **171**, in order to prevent the cover from being lifted by the pressure of air displaced during entry of water in the machine preparatory to and during the washing and rinsing operations. When the water has been removed and the blower **85** is in operation the volume of air entering the casing is sufficient to tilt one side of the cover **29** which is relatively light, and allow the air to escape.

During the extracting or centrifugal drying action when the tubular shaft **42** and the control shaft **43** are rotating together to cause rotation at the same speed of the container **15** about the axis of the shafts **42** and **43**, there may be a possibility of unbalance of the load held in the container **15** which would tend to cause vibration. Such an unbalance might occur, for example, in case a single bulky article were placed in the container **15**, so that notwithstanding the redistribution ordinarily produced during the washing action, a redistribution of the load in the container **15** to balance the load could not occur in this case. Such vibration tends to shift laterally the container **15**, pedestal **14** and base plate **13**, as a unit, the feet **78** shifting in the cups **79** so that the vibration is not transmitted to the supporting frame **33** or the outer cabinet. Motion of the plate **13** sets the reeds **82** in motion so that the inertia members **83** counteract and balance the vibration.

In the event of an extreme out of balance condition tending to cause excessive vibration, the vibration cutout **77**, illustrated in Fig. 5, is carried so far to the left that it slips down off the abutment or end **157** of the strip spring **156** and assumes the position illustrated in Fig. 8. As previously explained, the parts of the cutout **77** are so arranged that when the bi-metallic strip **142** is held upward the switch contacts **153** are held closed. As soon as the base plate **13** is moved so far with respect to the base **33** as to release the free end **145** of the bi-metallic strip **142**, this strip snaps downward owing to its natural permanent set when cool and causes the micro-switch **141** to open its contacts **153** and to close the contacts **150**. This action de-energizes the solenoid **74** and closes the valve **73**. In consequence, pressure is no longer supplied to the bellows **69**, and the spring **67** applies the brake **57**. This action both slows down the speed of rotation of the container **15**, eventually bringing it to a stop, and restores tthe washing or rotatively progressive jigging action of the container **15**. The resulting time delay permits additional water to drain from the articles in the container **15**, and the washing action tends to produce further redistribution of the articles in the container **15**, if the nature of the load permits. If the unbalance is great enough to cause the brake **57** to engage before the speed has reached a

point at which the centrifugal clutch engages, the brake simply opposes the dynamic coupling which tends to accelerate the container, and thus causes deceleration of the container and increase of the speed of the oscillating or washing action. If, before the brake is applied, the speed has increased to a point at which the centrifugal clutch has engaged, the action of the brake throws an additional load on the motor and the centrifugal clutch, causing some deceleration of the motor and slipping of the centrifugal clutch until the speed of rotation of the container decreases to a point at which the centrifugal clutch drops out; at which point the deceleration will continue under the action of the brake. The closing of the contacts **150** causes flow of current through the coil **143**. After a certain time delay the heater coil **143** becomes heated, causing the strip **142** to bend upward again and to close the contacts **153**, whereupon the brake **57** is again released and the spinning or extraction action is resumed. If there is still too much water in the load to avoid excessive unbalance, resultant vibration again releases the strip end **145** and again slows down the spinning. The action described may be repeated for several cycles until the extreme out of balance condition is corrected. The washing action tends to distribute the load evenly, and the spinning action reduces the weight of water in the load, so that excessive unbalance is quickly corrected.

If the apparatus should vibrate and the plate **13** should slide sidewise after the free end **145** of the bi-metallic strip **142** has dropped off the abutment **157** of the spring strip **156**, there might be a tendency for the free end **145** to strike the spring strip **156** transversely thereto. However, owing to the resiliency of the strip **156**, no harm is done. The strip end **145** merely pushes the strip **156** intermittently to the right as illustrated in Fig. 8.

Although a preferred novel arrangement for preventing excessive vibration has been illustrated and described, this invention is not limited to this specific arrangement of parts. Any desired vibration sensitive device to retard or stop the spinning may be used in the broader aspects of the invention.

Similarly the invention is not limited to any particular dimensions; but it has been found that an angle of tilt of 4½ degrees for the axis of relative rotation of the bearing **47**, which gives a maximum movement of 9 degrees, serves to produce satisfactory washing action with a container **15** having an 11 inch radius. With the shaft **42**, of such an arrangement, revolving at a speed from 500 to 600 R. P. M., for example, the vertical component of motion of the bottom surface of the container **15** continuously varies in velocity, with accelerations or decelerations reaching peak values exceeding the acceleration of gravity. Consequently, during a portion of each oscillation each portion of the bottom surface of the container **15** near its periphery drops more rapidly than the articles supported by such portion of the container **15**. Where the arrangement is such that the tubular shaft **42** rotates 600 R. P. M., preferably the vibration responsive reeds **82** are tuned to the natural frequency of vibration of 600 oscillations per minute or 10 oscillations per second which involves the use of relatively heavy weights **83**. Tuning may be accomplished by adding or removing metal to or from the reed **82** or the weight **83**. But preferably suitable means, such as adjusting nuts **169** are provided for permitting the vertical position of weights **83** to be adjusted, thus varying the effective length of the vibration responsive reeds **82** to adjust their natural frequency of vibration.

In normal operation there is insufficient unbalance to produce operation of the vibration responsive cutout **77**. Any vibratory effect which may be present causes the base plate **13** to move horizontally inasmuch as the feet **78** slide within the cups **79**. This movement may take place without transmitting vibration to the casing **11** and there is no tendency for transverse vibratory force on the feet **36** which would tend to cause the casing **11** to crawl. However, sidewise vibratory movement of the carriage including the base plate **13** is opposed by the action of tthe tuned reeds **82**, so that normally sidewise vibration of the carriage reaches but very little amplitude.

The container **15** may be mounted just high enough to provide clearance above the tub well **24** over the motor **16**, so that the center of gravity of the entire machine is kept relatively low.

Very little water is required for washing, although all liquid is discharged at the end of each operation, since the clothes are not immersed and merely a small quantity of water in the tub **21** in addition to that absorbed by the clothes is sufficient to provide water for continuous recirculation. Consequently the machine is highly economical of water, especially important when special sources of soft water are employed, and the machine is also economical of fuel for heating water and economical of soap.

It will be obvious to those skilled in the art that many other modifications may be made without departing from the spirit of this invention, and cover all such modifications as are intended to be covered by the appended claims.

I claim:

1. In a centrifuge, a container for articles from which fluid is to be extracted, means for rotatively accelerating said container, a support on which said container is rotatively mounted, a base on which said support is mounted with freedom of lateral motion of said container with respect to said base, cooperating latch and detent means, one of said means being movable with said container and the other fixed with respect to said base, said detent normally holding said latch but being adapted to release said latch upon excessive lateral vibration of said container with respect to said base, electric circuit means for controlling acceleration of said container, switch means controlled by said latch, and means controlled by said switch for decelerating said container upon vibration-induced release of said latch.

2. A vibration release comprising in combination a bracket adapted to be secured to a first member susceptible of vibration relative to a second member, a temperature responsive bendable strip secured to said bracket at one end, a detent mounted on the second member adjacent the other end of said bendable strip adapted to lock said bendable strip, electric switch means controlled by said strip in circuit opening and closing positions, electro-thermal means for producing bending stress in said strip, said strip acting against said detent in response to change in flow of electric current, whereby the detent normally locks said strip in one of said circuit controlling positions but relative vibration of said members permits release of said strip to the other of said positions.

3. A vibration control comprising in combination, two members susceptible to relative vibration, a delayed-action relay on one of said members including a control contact; a detent on the other of said members located so as normally to retain the said contact in a first position but to release the said contact upon the occurrence of excessive relative vibration between the members operating to disengage the detent; and means energizing the relay upon release of the contact to restore the contact to its first position after a predetermined interval and thus to restore the contact to position to be retained by the detent.

4. A vibration control comprising in combination, two members susceptible to relative vibration, a delayed-action relay on one of said members including a normally open speed control contact; a detent on the other of said members located so as normally to retain the said contact closed but to release the said contact upon the occurrence of excessive relative vibration between the members operating to disengage the detent; and means energizing the relay upon release of the contact to close the contact after a predetermined interval and thus to restore the contact to position to be retained by the detent.

5. A centrifuge comprising a rotatable container, a support member therefor, a base member on which the support member is mounted, the two members being susceptible to relative vibration, a delayed-action relay on one of said members including a normally open speed control contact; a detent on the other of said members located so as normally to retain the said contact closed but to release the said contact upon the occurrence of excessive relative vibration between the members operating to disengage the detent; and means energizing the relay upon release of the contact to close the contact after a predetermined interval and thus to restore the contact to position to be retained by the detent, and means actuated by opening of the speed control contact to decelerate the container.

6. A combined washing and extracting machine comprising a movably supported subframe, a pedestal extending from the subframe, a container mounted on the pedestal, means for oscillating the container at a predetermined frequency for washing, means for rotating the container at substantially the same frequency for extracting, an elastic rod extending from the subframe, and a mass mounted on the free end of the rod, the mass and rod being tuned to vibrate in resonance with the said frequency.

7. A combined washing and extracting machine comprising an upright casing, a tub supported in the upper part thereof, a subframe movably supported in the casing below the tub, a pedestal extending from the subframe into the tub, a container mounted on the pedestal within the tub, means for oscillating the container at a predetermined frequency for washing, means for rotating the container at substantially the same frequency for extracting, elastic rods extending from the subframe, and masses mounted on the free ends of the rods, the masses and rods being tuned to vibrate in resonance with the said frequency.

8. A combined washing and extracting machine comprising an upright casing, a tub supported in the upper part thereof, a subframe movably supported in the casing below the tub, a pedestal extending from the subframe into the tub, a container mounted on the pedestal within the tub, means for oscillating the container at a predetermined frequency for washing, means for rotating the container at substantially the same frequency for extracting, elastic rods extending from the subframe, and masses mounted on the free ends of the rods between the tub and casing, the masses and rods being tuned to vibrate in resonance with the said frequency.

9. A combined washing and extracting machine comprising an upright casing, a tub supported in the upper part thereof, a subframe movably supported in the casing below the tub, a pedestal extending from the subframe into the tub, a container mounted on the pedestal within the tub, means for oscillating the container at a predetermined frequency for washing, means for accelerating

the container to rotation at substantially the same frequency for extracting, elastic rods extending from the subframe, and masses mounted on the free ends of the rods, the masses and rods being tuned to vibrate in resonance with the said frequency, whereby vibrations at the said frequency are absorbed; and means responsive to excessive vibration below the said frequency to interrupt acceleration of the container and initiate oscillation thereof to redistribute the contents thereof.

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