May 7, 1963 W. E. STILWELL, JR 3,088,593

LEVELING AND STABILIZING APPARATUS

Filed March 2, 1959 5 Sheets-Sheet 1

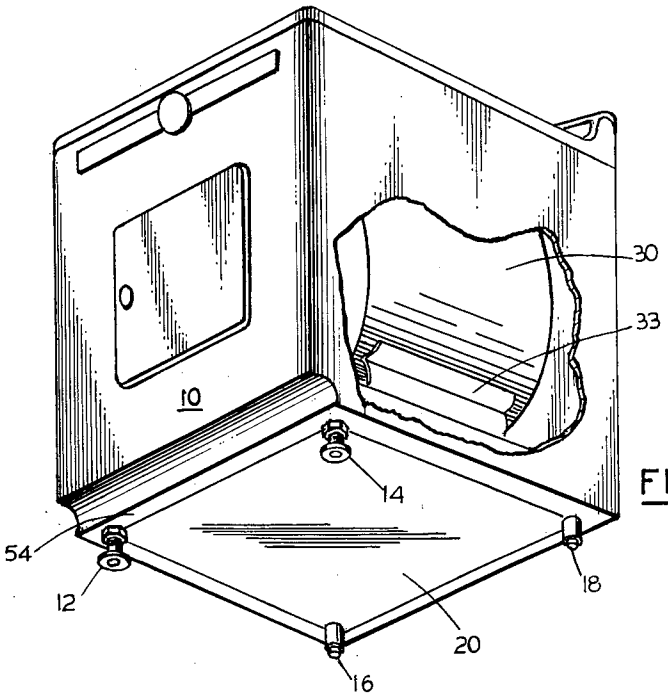


FIG. 1

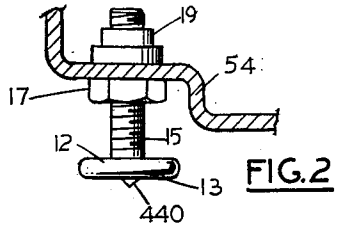


FIG. 2

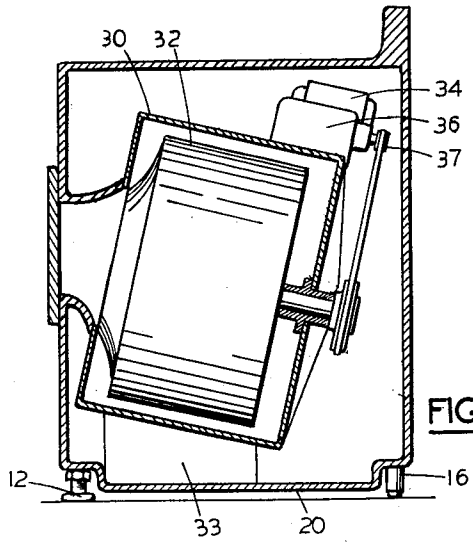


FIG. 3

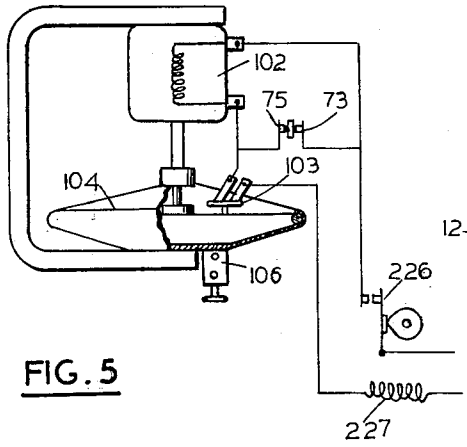


FIG. 5

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LEVELING AND STABILIZING APPARATUS

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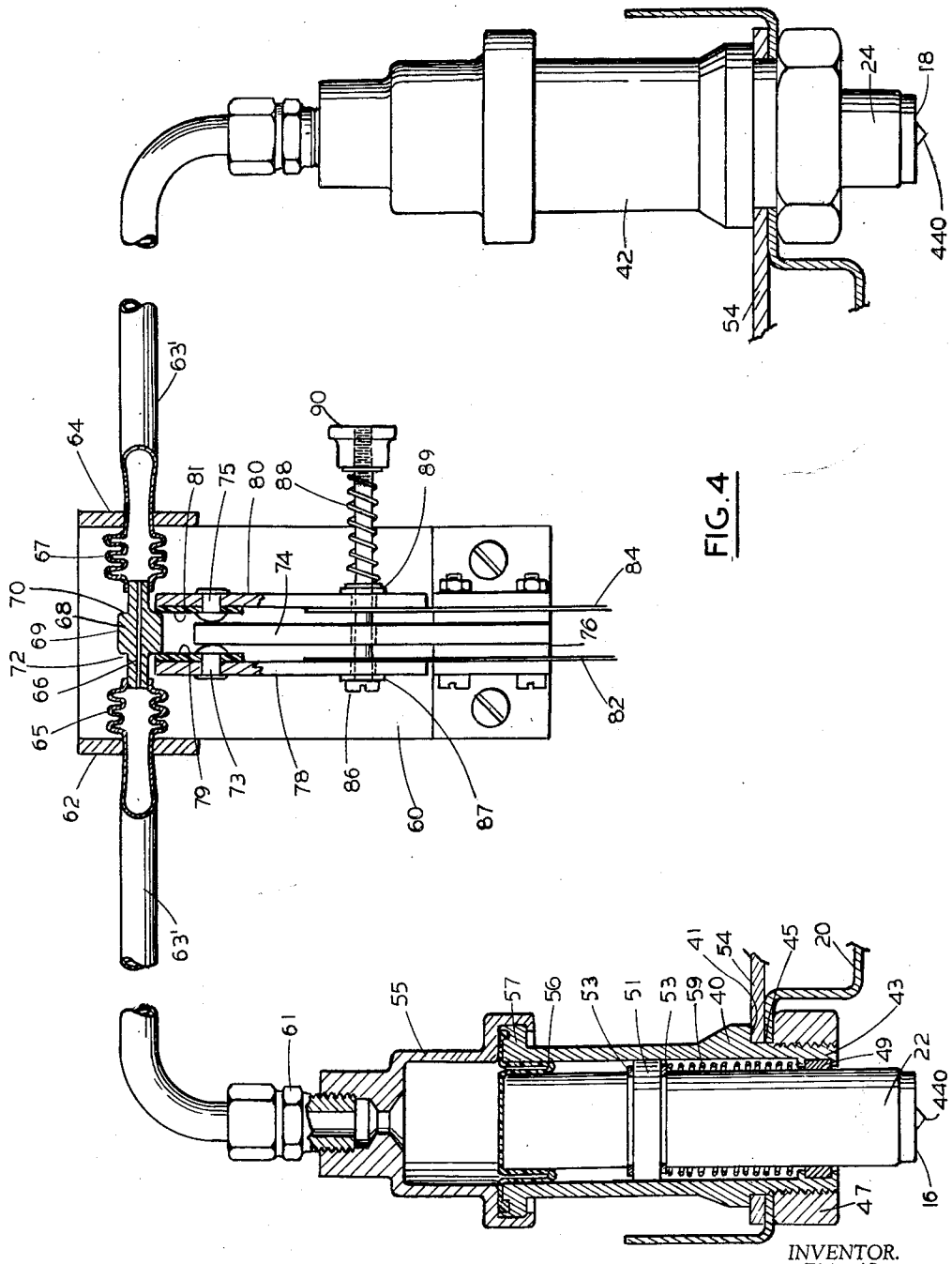


FIG. 4

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LEVELING AND STABILIZING APPARATUS

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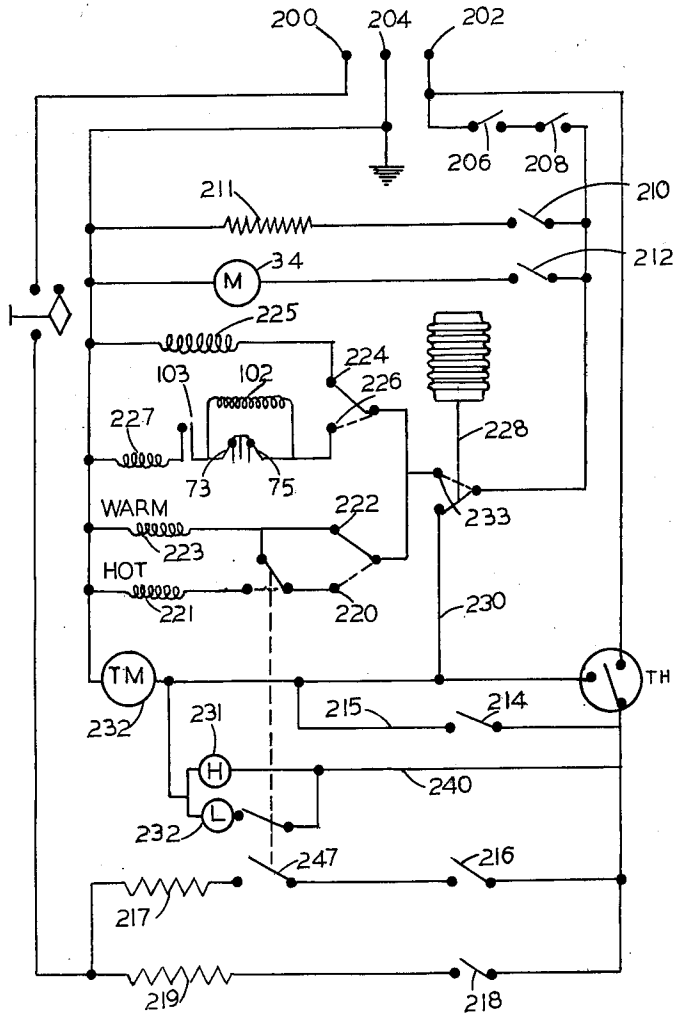


FIG. 6.

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LEVELING AND STABILIZING APPARATUS

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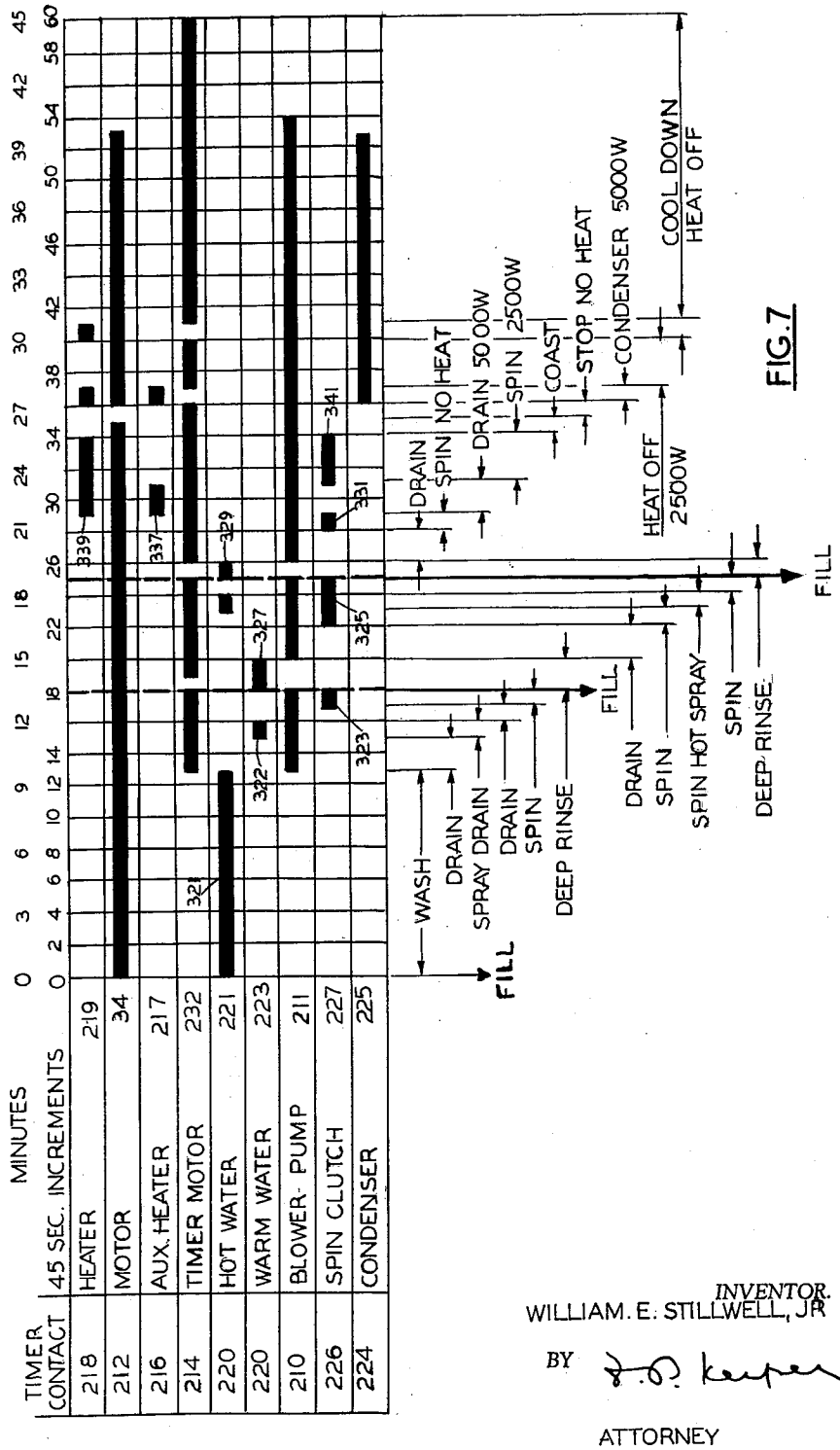


FIG. 7

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LEVELING AND STABILIZING APPARATUS

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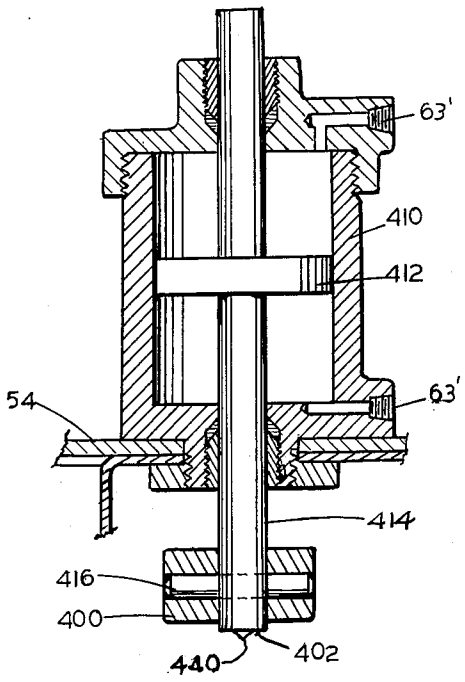


FIG. 9

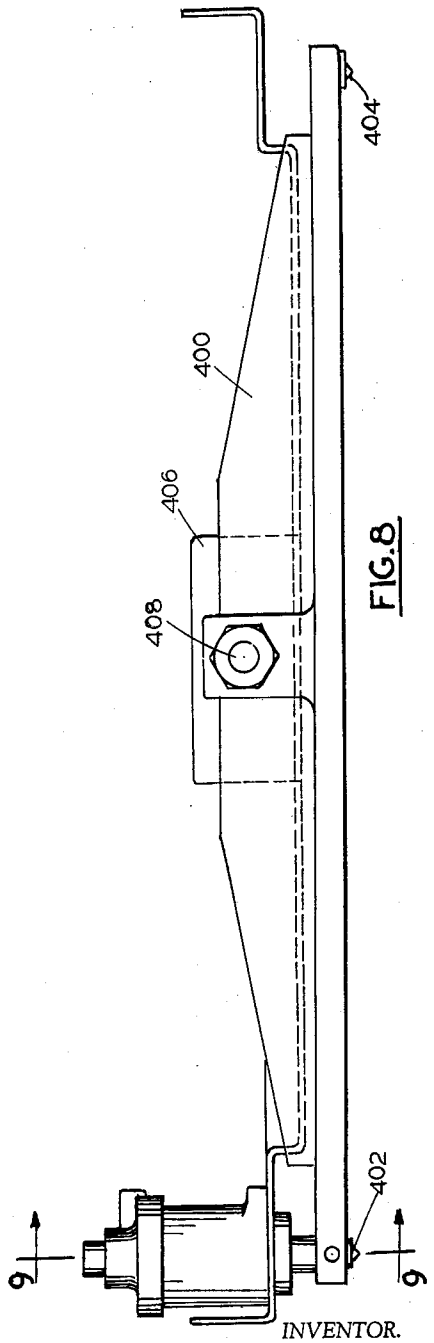


FIG. 8

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United States Patent Office 3,088,593 Patented May 7, 1963

3,088,593

LEVELING AND STABILIZING APPARATUS

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Filed Mar. 2, 1959, Ser. No. 796,650
3 Claims. (Cl. 210—144)

This invention relates to combination levelling and stabilizing apparatus for laundry appliances, and also to the utilization of such apparatus for sensing unbalanced rotational forces and for de-activating the prime mover in response to such forces whenever they become intolerable.

Laundry appliances, particularly of the tumble wash, centrifugal extraction, vibration isolation type, are normally required to be installed level, irrespective of floor irregularities, and stable, irrespective of the proper distribution of the weight of the machine upon its supporting feet. To achieve both a level and a stable installation, the practice has been to provide individually, manually, vertically adjustable feet at the four corners of the machine.

Two difficulties arise in such installations, since a machine can be level without being stable and stable without being level. To achieve two directional levelness, despite uneven and unlevel flooring, the two, rarely accessible, rear feet and the two, generally accessible, front feet must be properly adjusted. To establish stability, only one foot need be adjusted, but the extreme care and fineness required in making the adjustment is such as to make real stability difficult to achieve and a rarity in practice.

Although levelness is primarily an aesthetic need, stability is an operational necessity. Unless the total weight of the machine is correctly distributed upon the four feet, the centrifuging of an excessively unbalanced load of clothes will cause the machine to rock intolerably on that diagonally opposite pair of feet which bears a disproportionate amount of the total weight of the machine by virtue of one of that pair of feet being overextended a few thousandths of an inch.

Even were the machine completely, structural rigid and the floor exactly level and concrete hard, which rarely occurs in practice, the appliance installation technician would have to resort to expert, micrometer adjustment of the feet to achieve non-rocking, 100% stable, 100% coplanar adjustment of the four feet. Mere touching contact of two, diagonally opposite feet is by no means sufficient; each of the four feet should support the exact weight of its corner of the machine as determined by laboratory tests and calculations. Since appliances of the type contemplated herein are not designed and built to have their true centers of gravity exactly coinciding with their geometric centers, this does not necessarily mean that the total weight of the machine will be evenly distributed on the four feet, rather, it means that the weight must be distributed correctly, from the point of view of stability.

It has been proposed that machine stability can be achieved by employing two adjustable feet in front in combination with a single foot in the center rear, thus producing a tripod effect. In a rectangularly based machine, however, this means that half of the machine overhangs its supports. The triangular base area defined by the three feet and below the machine center of gravity, in such case is but one half of the rectangular area defined by four feet. Forces tending to rock the machine laterally are resisted by a base whose median width below the center of gravity is but one half of what it might be when four feet in proper stable adjustment are used. To

overcome this inherent disadvantage, two interconnected rear corner feet have been proposed as a substitute for the single rear center foot; their interconnection, through linkages, cams, wedges and the like, is intended to balance the load on the rear feet by permitting one foot to recede while the other extends an equal amount. Without any friction in the linkage, such an arrangement is but the kinetic equivalent of the tripod. With friction added, in an attempt to equate the system to the stability of four, precisely adjusted, independent feet, there is too much resistance to permit the feet to adjust themselves automatically, except when large external forces are available. Furthermore, the long term maintenance of a specific amount of friction, in an appliance of the class contemplated herein, is commercially infeasible.

The preferred embodiment of the present invention is directed to a self-stabilizing mounting for appliances of the type contemplated herein. The mounting comprises two, conventional, screw adjustable front feet and two, interconnected, hence oppositely moving, rear feet. The interconnection is hydraulic, essentially friction free and therefore productive of the kinetic equivalence of a tripod mounting. However, designed into the interconnection is that amount of viscous damping that makes the combined means, the kinetic equivalent of four, continuously and correctly adjusted, independent, conventional feet.

At any time, the pressure in the hydraulic system is reflective of the static loading on the rear feet and of the dynamic loading due to the centrifuging of an unbalanced clothes load. The magnitude of the dynamic loading is a running product of the actual unbalance in pounds and the square of the instantaneous speed of the rotatably mounted clothes container. When this product reaches a magnitude capable of perceptibly vibrating a given machine said loading is called the "critical loading" and creates a momentary, critical pressure in the hydraulic system. Unless the accelerating forces that produce said critical pressure are checked immediately the machine's vibratory motions will become definitely intolerable; accordingly, in the subject invention, the imminence of this critical pressure is employed, through a preloaded servo-mechanism, to deactuate the prime mover and thus to decelerate the clothes container immediately.

All of this is accomplished in the fraction of a rotation of a rapidly accelerating clothes container and within just that relatively imperceptible movement of the hydraulically interconnected feet needed to maintain machine stability during the acceleration of unbalanced loads.

The servo-mechanism is made unresponsive to all but the dynamic loading at or above the critical value. In the subject invention the servo-mechanism's deactuation of the prime mover, at the imminence of a critical loading has cooperatively associated with it a time delay means whereby either the machine has an opportunity to become quiescent after a vibratory disturbance or the clothes themselves have an opportunity to re-tumble into a more favorable distribution. The hydraulically interconnected feet, the viscous damping, the critical pressure sensitive servo-mechanism and the time delay means, all specific objects of this invention would fail to achieve maximum usefulness, however, in the absence of providing means for interposing unity coefficient of friction between the feet of the machine and the floor upon which it rests. Without adequate friction at such points of contact the machine would oscillate laterally, long before the otherwise permissible critical loading value had been reached; with adequate friction not only would higher critical loadings be permitted but in addition, the machine's rocking tendencies would be transferred from diagonal axes to fore and aft axes on either side of the

machine, all to the advantage of the workability of the basic concept of this invention.

It is accordingly an object of the present invention to provide adjustable foot support structure for appliances and the like that will permit ready levelling and automatically assure optimum and maximum stability.

A further object of the invention is to provide an adjustable and self stabilizing foot support structure for appliances or the like, employing two adjacent support feet, adapted to continuously equally divide the load applied thereto and in which equilization movement of the feet is viscously damped to achieve stability

A still further object of the invention is to provide a foot structure of the character described, in which hydraulic interconnection with viscous damping between two adjacent feet is employed to balance the loading on the feet.

Yet a further object of the invention is to provide, in combination with structure of the character referred to, servo-prime mover control mechanism responsive to the dynamic loading of the viscous damping system employed.

A still further object of the invention is to provide, in combination with structure of the character referred to, servo-prime mover control mechanism responsive to the dynamic loading of the viscous damping system employed.

A still further object is to provide, in combination with structures of the character referred to, means for assuring unity coefficient of friction between feet and floor to permit attainment of the maximum advantages from the system.

The above and other novel features of the invention will appear more fully hereinafter from the following detailed description when taken in conjunction with the accompanying drawings. It is expressly understood that the drawings are employed for purposes of illustration only and are not designed as a definition of the limits of the invention, reference being had for this purpose to the appended claims.

In the drawings, wherein like reference characters indicate like parts:

FIGURE 1 is a perspective view from beneath of a laundry appliance showing the feet thereof and with the cabinet broken away;

FIGURE 2 is a sectional view of one of the manually adjustable screw feet of FIGURE 1;

FIGURE 3 is a schematic sectional view through the appliance in the cabinet;

FIGURE 4 is a vertical enlarged fragmentary sectional view taken through the rear feet of FIGURE 1 and hydraulic connections therebetween;

FIGURE 5 is a schematic diagram of the hydraulically actuated electric control circuit;

FIGURE 6 is a circuit diagram of a washer dryer to which the hydraulic control is applied;

FIGURE 7 is a time chart for use in conjunction with FIGURE 6;

FIGURE 8 is a sectional view of a modified form of rear foot support; and

FIGURE 9 is a sectional view taken on the line 9—9 of FIGURE 8.

Referring to FIGURE 1, there is shown an appliance such as a washing machine or washer dryer **10** having provision for support upon four feet **12**, **14**, **16** and **18** located at the corners of the base **20**. Supported on the base and within the cabinet **21** may be a tub **30** (see FIGURE 3) having a rotatable tumbling drum **32** therewithin. A motor **34** and two speed transmission **36** provide the necessary two speeds of rotation of the drum **32** for tumbling and centrifugal extraction respectively. Transmission speed change is effected by a solenoid actuated clutch **37**.

The front feet **12** and **14**, see FIGURE 2, are each of the screw jack adjustable type, each foot comprising a floor pad **13**, a threaded shank **15** and lock nut **17**, with the shank being screw threaded into a threaded member **19** welded or otherwise secured to the base frame **54**.

The rear feet, **16** and **18**, as shown in FIGURE 4 comprise piston-like plungers **22** and **24** located in vertically disposed cylinders **40** and **42**. Each cylinder has a shoulder **41**, and a lower threaded portion **43** extending through an aperture **45** in the frame **54**, and is rigidly secured in place by a nut **47**. The lower end of each cylinder is provided with a guide sleeve **49**, and the plunger is provided with a sleeve **51** held between spaced snap rings **53**. The upper end of each cylinder is provided with a cap or head **55**, the lower end of which is swaged around an external flange **57** on the upper end of the cylinder body. A flexible impervious diaphragm having an annular flexible loop **56** disposed in the clearance between the plunger and the cylinder wall bears centrally upon the upper end of the plunger **22**, and has its rim clamped between the cylinder flange **57** and cap **55**. A coil spring **59** is disposed between the sleeve **49** and the lower snap ring **53**. Each of the cylinder caps is connected by suitable fittings **61** and tubing **63** of adequate size to a detector actuator.

The detector actuator comprises a heavy base plate **60** with rigid spaced ears **62** and **64** having aligned apertures into which the ends of the tubing **63** from each of the cylinders **40** and **42** are rigidly mounted, as by brazing or other means. Between the ears and communicating with each of the ends of the tubes **63**, are a pair of Sylphon bellows or expansible chambers **65** and **67** spaced apart by a piston-like element **69** through which extends an axial capillary port **66** intercommunicating with the bellows or chambers **65** and **67**. It will be seen that the element **69** will be moved in response to pressure differences existing in the bellows **65** and **67**, except for such relief as results from the intercommunicating port **66**. The element **69** and bellows form a unit, and the bellows are connected to the ends of the element in sealed relation as by soldering or brazing or the like. The system thus far described is sealed and completely filled with liquid in the form of oil, or other suitable liquid, such as, for example, hydraulic brake fluid free of air or gases.

The piston member **69** is provided with an enlarged central section **68** affording opposed shoulders **70** and **72**. The plate **60** is provided with a laterally disposed rigid center arm **74**, mounted in a plate bracket **76**. The arm extends toward the piston section **68**, and has on opposite sides thereof electrical contact faces, adapted to be engaged by contact elements **73** and **75** of contact arms **78** and **80**. The arms **78** and **80** are mounted on leaf springs **82** and **84** secured to the bracket, and such springs are suitably insulated from one another and the bracket. The arms at their other ends are provided with piston centering projections **79** and **81** adapted to contact the opposite shoulders **70** and **72** of the central section **68** of the piston member **69**. The projections of members **79** and **81** may be of Micarta or other rigid insulating material. Means are provided for yieldingly urging the contact arms toward one another and yieldingly holding the contacts **73** and **75** carried thereby against the contact faces of the center arm **74**. Such means comprises an elongated screw **86** having its head seated in an insulating bushing **87** in arm **78**. The screw extends through clearance apertures, in the center arm and contact arm **80**. A coil spring **88** bears against an insulating bushing **89** through which the screw extends, in the contact arm **80**. The compression of such spring is varied by a calibrating nut **90** provided on the end of the screw.

The centering members **79** and **81** are spaced a distance slightly greater by a few thousandths of an inch than the spacing between the shoulders **70** and **72** on the piston element **69**, and thereby yieldingly center the piston element, by reason of the tension applied upon the contact arms **78** and **80** through the calibrating spring **88**. At the same time both contacts **73** and **75** will rest on the arm **74**, when the element **69** is centered.

Any force exerted on the piston element **69**, tending to

move the piston element axially in either direction, by reason of differential pressure in the respective bellows **65** and **67**, will tend to unseat one of the contacts **73** or **75** and open a circuit between the contact leaves **82** and **84**, which circuit is normally maintained closed by both contacts **73** and **75** bearing against the center arm **74**, under the pressure of spring **88**. The contact arms tend to return the piston element to its center position, at such rate as is permitted by the flow of hydraulic fluid through the capillary port **66**.

From the foregoing it will be seen that the apparatus is capable of instantaneously indicating pressure differences occurring in the opposite sides of the system, resulting from instantaneous changes in the loading on the feet **16** and **18**. In accordance with the setting of the calibrating spring **88**, the instant any differential pressure is created that exceeds the preset level, the normally closed circuit between contacts **73** and **75** and leaf springs **82** and **84** is instantly broken.

From a consideration of the foregoing, it will be seen that the piston element **69** is held in its central position under such yielding pressure as is selected by loading the calibrating spring. Flow of hydraulic liquid between cylinders **40** and **42** is permitted at a controlled rate through the capillary aperture **66**, so that the feet **16** and **18** will equally divide the load, after the elapse of the time depending on the viscosity of the liquid and size of the aperture **66**. If the unequal loading on the feet **16** and **18** is sufficient to move the piston **69** and open one or the other of contacts **73** or **75**, and such contacts are in circuit, with the motor **34** or the clutch controlling acceleration to extraction speed, starting of the motor, or extraction, will be delayed until the inequality in the pressure in the bellows **65** and **67** is insufficient to hold one or the other of the contacts **73** or **75** open, against the presetting of spring **88**. Thus operation of the washing machine is delayed until the machine approaches an even or stable footing on all of its feet. The aperture **66** can thus be of such small size as to delay the final levelling over a period of minutes, and once the machine is level, the two sides of the system are substantially isolated against instantaneous flow from one side to the other, and all four feet of the machine provide in effect a rigid support, that is stabilized.

It will thus be seen that the rear feet acting through the hydraulic cylinders and connecting conduits **63**, and capillary passage **66**, coact with the front screw jack feet, to provide for transverse levelling by the relative adjustment of the front feet **12** and **14**, the port **66** permitting the rear feet to adjust gradually and follow the adjustment of the front feet. Levelling depthwise is obtained by the equal upward, or downward, adjustment of both front feet **12** and **14**.

Dynamic forces, resulting from unbalanced extractor loads will create differential pressures within the bellows chambers **65** and **67**, by reason of the highly restricted flow through the aperture **66**. The differential pressure results from the rapidly alternating loading upon the hydraulic feet **16** and **18**, resulting from accelerating an unbalanced laundry load for centrifugal extraction in the drum **32** and the substantially instantaneous transmission of such pressures to the bellows **65** and **67** through the relatively large conduits **63**. As the speed of rotation of the drum increases, the differential pressures created increase. With each complete rotation, with an unbalanced load, pressure is increased sequentially first upon foot **16** and then on foot **18**, and simultaneously pressure is decreased on foot **18** and then on foot **16**, thereby creating two differential pressure impulses sequentially in opposite directions upon the piston member **69** for each complete rotation. By presetting the compression of spring **88**, the contacts **73** and **75** may be employed to open a control circuit, should a corresponding predetermined loading be approached during acceleration. Since either contact may open the circuit, the control circuit is responsive to the increase in loading, due to acceleration, occurring during each half revolution of the drum. The control circuit acts to discontinue the acceleration of the drum by deenergizing the drive motor, or by mechanically disconnecting the same as by actuating a clutch.

Referring to FIGURE 5, wherein a suitable control circuit is shown, the contacts **75** and **73** are in shunt with a solenoid **102**, which is energized the instant either contact **73** or **75** opens the circuit. The solenoid actuates a diaphragm switch **103** in an air cell **104**, to open the switch, and a pneumatic check valve and adjustable air bleed **106** allows the diaphragm to instantly move downwardly in response to energization of the solenoid, and delays the reclosing of the switch **103** for a presettable period such as 20 seconds. The circuit also comprises a timer cam operated switch **226** which determines the overall length of the extraction period, and a clutch actuating solenoid **227**, which shifts the transmission **36** to the high speed ratio to effect acceleration to the extracting speed during such period.

It will be understood that in centrifugal extracting washers of the type referred to, the motor drives the drum **32** at tumbling speed, which effects a continual redistribution of the laundry load. Except for unusual laundry pieces such as, for example, pile fabric rugs, such distribution tends toward an even and balanced distribution. When acceleration takes place with a balanced distribution, objectionable vibration does not occur, and the control circuit remains closed and inactive. Should a badly balanced load occur, as acceleration takes place, the unbalance creates differential pressure pulses in the detector actuator, the magnitude of which increases with speed. On each half rotation, the differential pressure created increases during acceleration. When a differential pressure in excess of the tolerable and preset limit is reached, one or other of the contacts **73** or **75** are opened, and the circuit opened and held open by the air cell pneumatic control for 20 seconds. Deceleration of the drum to tumbling speed results, and tumbling continues until the end of the 20 second period, when redistribution will have been effected, whereupon acceleration to extraction speed is again initiated. If sufficient balance has been established, full extraction speed is attained for the remainder of the extraction period. On the other hand, if severe unbalance is still present, when the speed has been increased to that creating vibration in excess of the tolerable and preset limit, either of contacts **73** or **75** are opened and the 20 second deceleration and tumbling period is repeated. Repeated acceleration up to the critical speed, of an unbalanced load, will effect centrifugal extraction, but to a lesser degree than that obtained when the full extraction speed is initially attained during the extraction period. The lesser amount of water extracted when balance does not occur, however, is not serious and is offset by the complete elimination of intolerable vibration and dangerous forces, which would otherwise occur occasionally from a load that refused to distribute in a sufficiently balanced manner.

The apparatus and circuit thus described may be applied to a washer dryer of the type disclosed in my copending application Serial No. 511,186 filed May 26, 1955, to open the circuit of the extractor accelerating motor when vibration beyond the tolerable limit occurs. Since in that arrangement acceleration occurs for a maximum of two seconds, the time delay for reclosing the contacts **103** will need to extend only to the end of the two second period.

A washer drier circuit and time diagram for the apparatus diagrammatically shown in FIGURE 3 and including the circuit of FIGURE 5 is shown in FIGURES 6 and 7. As previously indicated, the stationary tub **30** is rigidly mounted upon saddles **33**, mounted on the base **20**, and the tumbling drum **32** is rotated on a fixed inclined axis therewithin by the motor **34**, through the two speed transmission **36**, having a clutch actuated by a

solenoid 227 to shift from wash speed to acceleration to the higher extracting speed.

The circuit shown in FIGURE 5 including contacts 73 and 75, solenoid 102 and delay contacts 103 are indicated in FIGURE 6 together with the timer cam switch 226 that controls extractor acceleration. Unbalanced loads may cause gyratory vibration, of such amplitudes as to require instant termination of the motive power accelerating the extractor. The control circuit shown is applied to an apparatus wherein centrifugal extraction is effected in drum 32 at different stages of the wash cycle.

In the circuit, 200 and 202 represent the power supply of a 220 volt system having a grounded neutral 204. Switches 206 and 208 are the manual start switch, usually associated with the timer, and the access door switch respectively. Contacts 210, 212, 214, 216 and 218 are timer cam actuated switches, for the pump and blower control solenoid 211, the drum drive motor 34, the timer motor circuit 215, the auxiliary heater 217, and the low heat heater 219 respectively. Additional timer cam actuated contacts 220 and 222 for hot and warm water solenoids 221 and 223, are provided. Contacts 224 and 226 are also provided for controlling condenser water as by solenoid valve 225, and actuation of the accelerating transmission clutch 37 by its actuating solenoid 227. The cam switch contacts 220, 222, 224 and 226 can only be energized when the tub is empty. The presence of a predetermined water level in the tub 30 actuates pressure switch 228, to open the circuit to switches 220—226, and close a circuit 230 to the timer motor 232 and initiates the washing action. Thus when the tub 30 is filled, the circuits controlling water supply, condensing water, and acceleration are dead.

The time diagram of FIGURE 7 shows the duration of periods in 45 second increments for the sequence of various operations in a complete washing and drying cycle. The wash period ends when the pump and blower switch 210 is closed, thereby draining the tub. At this time, the timer switch 214 is closed. Thereafter, pressure switch 228 opens circuit 230, in response to draining the tub and energizes circuit 233 leading to contacts 220, 222, 224, 226. Contact 222 causes warm water to be sprayed into the drum 32 for a period indicated at 322 while tumbling but near the end of the drain period. After the drain period, cam switch 226 is closed for a 45 second period as at 323, initiating an extraction period since closing switch 226 energizes solenoid 227 actuating clutch 37. Any unbalance creating dynamic forces approaching the critical loading terminates the acceleration period by creating a differential pressure in the hydraulic system sufficient to move the piston 69, to instantly open switch contacts 73 or 75, opening the circuit for 20 seconds for deceleration and redistribution.

At the end of the extraction period thus provided, the contacts 226 are opened, the pump contact 210 opened, and timer contacts 214 are opened, stopping the timer 232. Warm water contacts 222 close. The timer is thus stopped for a "fill" period, until the water level in the tub reaches the desired level, whereupon pressure switch 228 shifts, restoring circuit 230, to start the timer motor, and end admission of further water. Agitated rinse continues for a period of two timer increments indicated at 327, and during the middle of the period, timer contacts again close, and at the end of the rinse period, contacts 210 start the pump, which proceeds to drain the tub.

Thereafter, when the tub is drained, the pressure switch acts in response thereto, and another extraction period 325 of three increments duration starts, during an intermediate part of which, hot or warm spray is introduced. Extraction continues unless interrupted by the opening of contacts 73 or 75 in which case deceleration and tumbling takes place for 20 seconds after which acceleration again occurs.

Timer motor switch 214 is then opened and the timer stops. The inlet valve is opened, to refill the tub for a further rinse. When the tub is filled, switch 228 starts the timer, and starts a second deep rinse period of one increment duration, see 329. Thereafter the timer switch 214 is again closed, and simultaneously, pump switch 210 is closed, to drain the tub.

Extraction follows for a period 331 of one increment in length, with acceleration to full speed, unless interrupted by the opening of contacts 73 and 75 in response to unbalance.

After such period, extraction is discontinued and tumbling with high heat is commenced. Thereafter, the heat rate is lowered, the auxiliary heat period 337 terminating prior to termination of the heater period 339 and the final centrifugal extraction period 341 commences during the balance of the period 339. At the end of the extraction period, a brief period of tumbling is provided for without heat, after which the motor 34 is cut off.

After a brief interval, the remaining stage of drying commences, contacts 216 and 218 closing to establish high or low heat, depending upon manual selection and actuation of switch 217. At the same time, the contacts 212 are closed and the tumbling motor 34 starts. The condenser water is turned on by closure of contacts 224, and the pump and blower contacts 210 remain closed to establish air circulation through the drum and condenser. The timer contacts are opened. Upon a temperature rise, according to which of the thermostats 231, or 232 have been selected, the timer is again started through circuit 240 and the contacts 216 and 218 opened to cut off further heating. After three timer increments, contacts 218 are closed, to add further heat, at which time the timer is again cut out, if the thermostats 231 and 232 are sufficiently cool to open the circuit 240. When the temperature again rises to close thermostat 232 or 231, the timer starts through energization through circuit 240. The heat is soon cut off by timer contacts 218, and a run out period of tumbling is assured at this point by closure of contacts 214. The run out period continues, after which, the motor, blower, and condenser are cut off. The timer motor later cuts itself off after returning to the initial start position.

During any of the foregoing extraction periods, should intolerable unbalance become manifest during acceleration, acceleration is immediately terminated for 20 seconds. Following deceleration, redistribution is effected within the remainder of the 20 second delay period, so that upon the next acceleration, balance may be materially improved. When balance is achieved, full extraction speed is attained.

In FIGURE 8, there is shown a variation of rear support feet, which comprises a transverse beam 400 having feet 402 and 404 at the extreme ends. The appliance base 20 is provided with a trunnion bearing 406 at the rear center thereof, from which projects a stub shaft 408, affixed to the mid point of the beam 400. Such support, at the rear of the appliance coacting with mechanically adjustable feet such as 12 and 14 at the front serves to permit levelling as referred to hereinbefore, and provides for proper distribution of the weight.

Viscous damping of movement between an end of the beam and the appliance base 20 is effected by interposing a double acting cylinder and piston 410, 412 therebetween. The cylinder 410 is affixed to the base 20 and the piston has a rod 414 pivotally connected to the beam as at 416. The opposite ends of the cylinder are connected to the opposite sides of the detector actuator of FIGURE 4 as by pipes 63' and 63', and operation is otherwise similar to that of FIGURE 4, as will readily appear.

In order to prevent the appliance from sliding on the floor in response to the forces resulting from unbalanced loads, it is desirable to provide means for assuring a coefficient of friction between the feet and floor of 1 or greater. A single conical projection 440 which may engage the floor and prevent sliding may be

provided on the under surface of each foot, or any other equally effective means may be provided. By preventing sliding action, the unbalance forces, which can be tolerated are increased to a maximum, and if all feet are bearing their proper share of the load, such force is limited only by the force that would cause rocking of the machine on axes extending through the right hand, or the left hand feet where they are in floor contact.

In each of the modifications set forth, the viscous damping means acts upon a pressure increase above a pre-set limit to control the driving means of the rotating unbalanced extractor so as to stop the acceleration, and thereby positively prevent the further increase in magnitude of the dynamic forces, and thus contain such forces below the critical with precision. Whereas various spring suspensions for the rotating extractor drum with damping, have heretofore been provided, in order to permit rotation of the drum about its true center of gravity, such suspensions, in extractor drums rotating on axes out of the vertical have not been entirely satisfactory. Where no spring suspension is provided, in a horizontal axis extractor, it has been the practice to bolt the extractor to a heavy concrete base. By mounting the appliance on feet having a coefficient of friction of 1, apparatus having no spring suspension may be made to operate, by employing the apparatus herein disclosed, during unbalanced extractor loads, at speeds up to a precisely set maximum, so that no dynamic vibrational forces beyond the critical can occur.

During each extraction acceleration of the program set forth in FIGURE 7, the acceleration period is instantly terminated should the dynamic forces reach the preset maximum, and a twenty second delay period is allowed for deceleration and redistribution. The length of such delay period may be varied to suit drum diameter and weight, rigidity of the structure and frictional forces assisting deceleration and other factors.

While the invention has been illustrated and described in several modified forms, and in connection with specific apparatus, it is to be understood that the invention is not limited thereto. As various changes in the construction and arrangement may be made without departing from the spirit of the invention, as will be apparent to those skilled in the art, reference will be had to the appended claims for a definition of the limits of the invention.

What is claimed is:

1. Stabilizing and leveling apparatus for laundry appliances comprising a frame structure having four supporting feet disposed to define a substantially quadrangular area, a centrifugal extractor mounted on said frame including driving means therefor, means acting to continuously divide the static frame load carried by two adjacent feet on said frame equally between said two feet, viscous damping means associated with said last named means to restrict action thereof in response to dynamic unbalanced rotational forces generated by said extractor, means for vertically extending and retracting each of the other two of said four feet, relative to said frame, independently of each other to establish fixed positions thereof to accommodate for floor irregularity, and means responsive to an increase in pressure in said viscous damping means in response to extractor generated dynamic forces for controlling said driving means.

2. In a washing machine, a rectangular base frame adapted to be supported at its four corners, a vertical cylinder affixed to said frame at each of two adjacent corners thereof, a piston in each of said cylinders having a depending floor engaging foot extending therefrom, manually vertically adjustable feet in each of the other corners, a conduit connecting said cylinders, liquid within said cylinders above the pistons adapted to flow from one cylinder to the other through said conduit to balance the load on said feet, a constriction in said conduit to resist flow between said cylinders, a centrifugal extractor mounted for rotation on said frame on an axis out of the vertical, means for sequentially accelerating said extractor, to a centrifugal extraction speed from a tumbling speed, and subsequently decelerating said extractor, and means responsive to differential pressure on opposite sides of said constriction for initiating operation of said decelerating means.

3. In a washing machine, a rectangular base frame, adapted to be supported at its four corners, a vertical cylinder affixed to said frame at each of two adjacent corners thereof, a piston in each of said cylinders having a depending floor engaging foot extending therefrom, manually vertically adjustable feet in each of the other corners, a pair of aligned expansible chamber bellows having their adjacent ends connected by a movable constricting conduit member, and their opposite ends supported in fixed spaced relation, separate conduits connecting each bellows with a corresponding cylinder, means for yieldingly biasing said member against movement in either direction, in response to differential pressures in said bellows below a preset level, a centrifugal extractor mounted for rotation on said frame on an axis out of the vertical and extending between said cylinders, means for applying power for accelerating said extractor to a centrifugal extraction speed from a tumbling speed, and means responsive to movement of said member in response to a differential pressure in excess of said preset level to discontinue operation of said power applying means.

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