Oct. 1, 1957 A. H. GERHARDT ET AL 2,807,950

GYRATION SUPPRESSION CONTROL DEVICE FOR A WASHING MACHINE

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Fig. 1

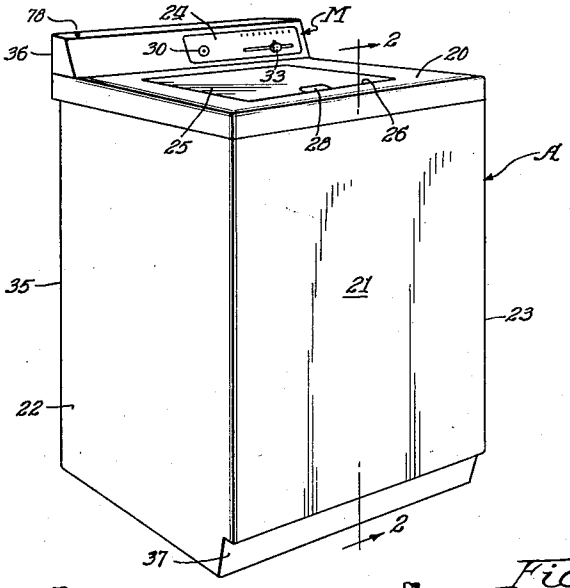


Fig. 5

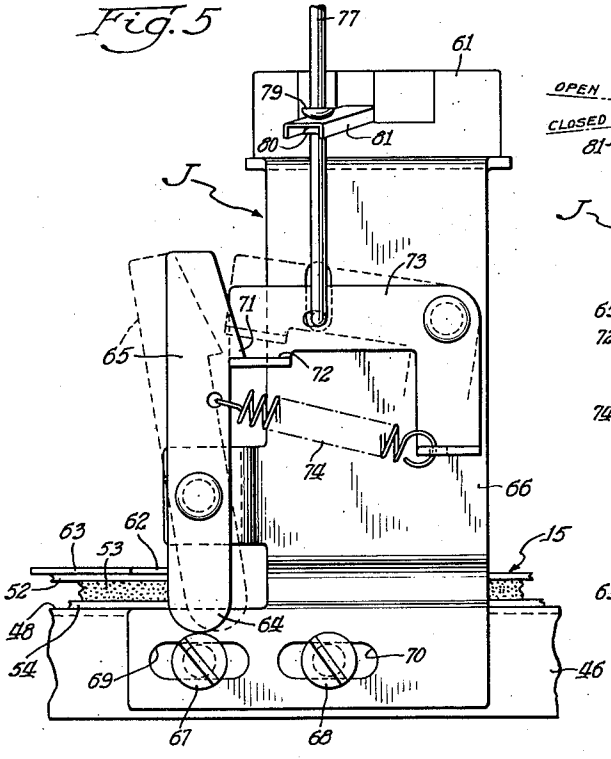
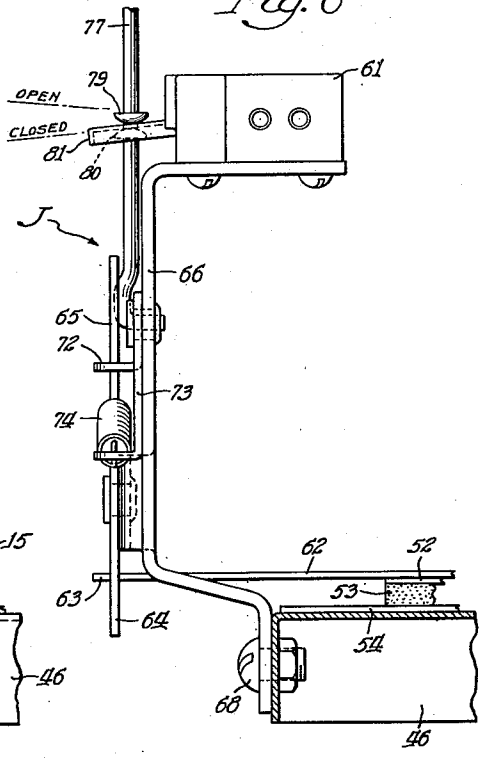


Fig. 6



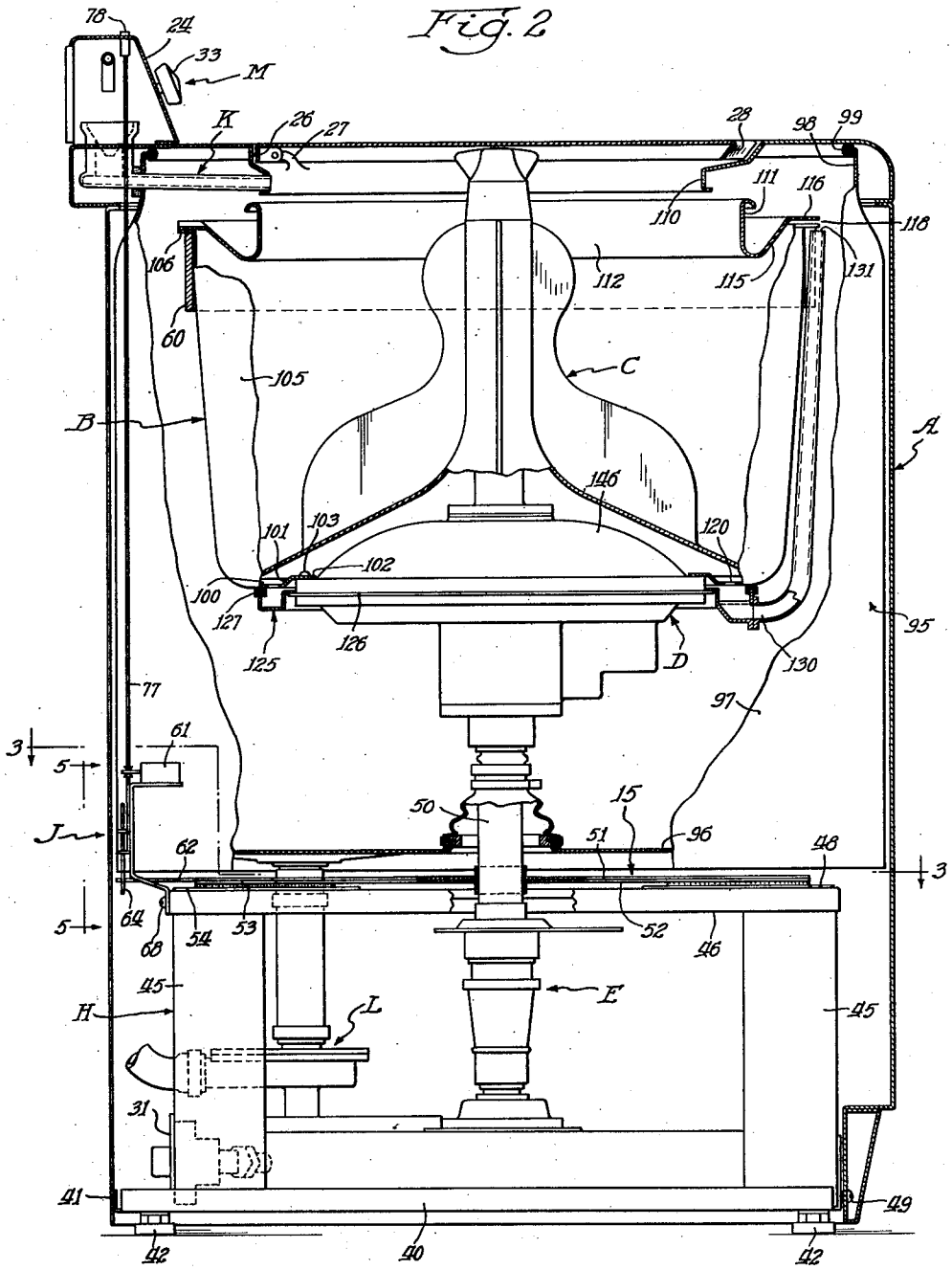
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GYRATION SUPPRESSION CONTROL DEVICE FOR A WASHING MACHINE

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Fig. 2



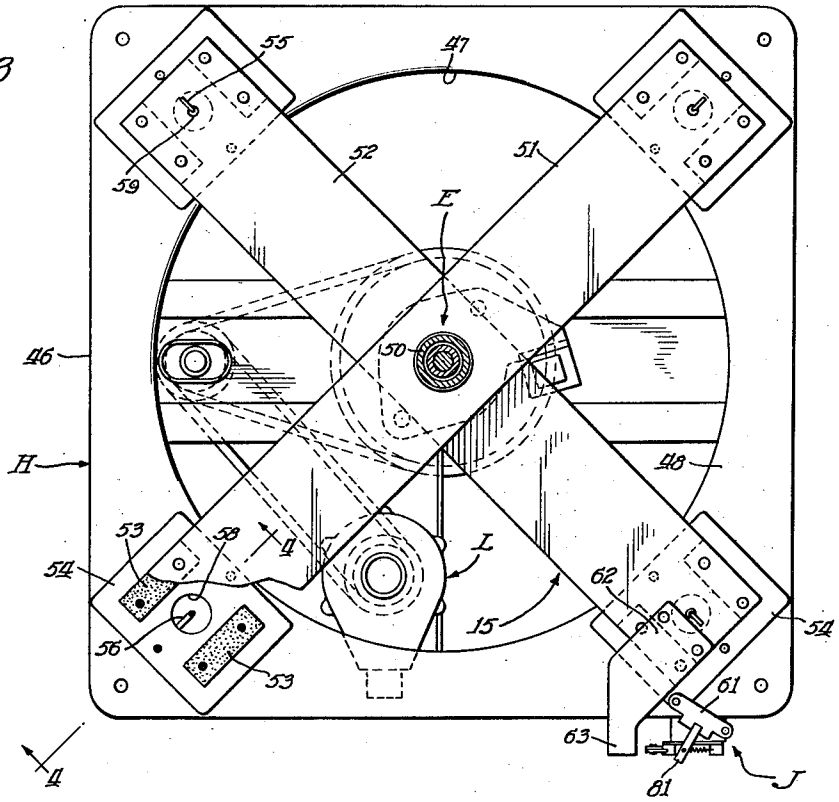
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GYRATION SUPPRESSION CONTROL DEVICE FOR A WASHING MACHINE

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Fig. 3



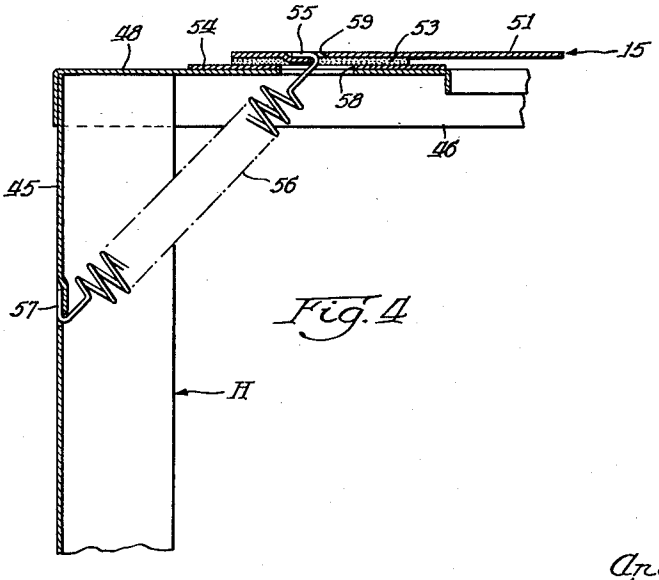


Fig. 4

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2,807,950

GYRATION SUPPRESSION CONTROL DEVICE FOR A WASHING MACHINE

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Application September 14, 1951, Serial No. 246,603

9 Claims. (Cl. 68—23)

This invention relates, in general, to improvements in washing machines and is particularly concerned with a gyration suppression control device especially adapted to washing machines for both washing and drying of textile fabrics.

Otherwise stated, the instant invention is concerned with a gyration suppression control device adapted for advantageous incorporation in a domestic or household washing machine of the character completely disclosed in our co-pending patent application, Serial Number 246,601, filed September 14, 1951 and entitled "Washing Machine," and which is designed so that it will automatically realize and maintain dynamic balance when drying the fabric after the washing thereof is finished.

More specifically stated, this invention is embodied in a gyration suppression control device for incorporation in a washing machine in which forces that would otherwise produce a state of unbalance and entail rough and noisy operation in the drying stage are automatically and immediately counteracted by means incorporated in the machine that insure a continuous smooth and silent operation until the fabrics are thoroughly dried and ready for removal.

Automatic washing machines in which the gyration suppression control device contemplated by this invention may advantageously be employed embody the features prevalent in the general class wherein an oscillatable agitator is mounted within the basket for performing the washing operation upon the clothes, and wherein the basket in which the clothes are washed may be subsequently caused to rotate at a relatively high rate (600 to 615 R. P. M.) of speed, about an upright axis, for the purpose of extracting the water from the clothes. Machines of this type may also be constructed and arranged so as to permit performing a rinsing operation upon the clothes as part of a series of sequential operations, which by way of example, may be as follows: First filling the tub with water, then rinsing the clothes, then performing a water extracting operation upon the clothes, then performing one or more rinsing operations upon the clothes, and finally a water extracting operation upon the clothes.

It is the primary purpose of such apparatus as that to which the present invention pertains to reduce the burdensomeness of laundry or cleaning processes and to obviate the necessity of constant attention on the part of the operator to the apparatus in the course of its operation. The machine is entirely automatic to the extent that the operator is enabled to set the controls therefor to instigate the filling and washing operation, leave the same and return at a later period with the clothing or the article to be cleansed, completely washed, rinsed and the water extracted from the clothes to leave the same in a semi-dry state.

Accordingly, it is an important object and accomplishment of the invention to provide a supporting structure for a washing machine which will absorb the out-of-balance vibration in such manner that the machine may be set on a floor without bolting or otherwise positively securing the machine to the floor.

More specifically stated, it is an important object and accomplishment of this invention to provide a washing machine support structure which will allow limited movement of the centrifuging unit away from its normal geometrical axis of rotation and with provision of resistance means to such movements effective to reduce vibrations transmitted to a floor support.

Another important object of the invention is to provide a gyration suppression control device operatively associated and cooperating with the spinner tub of a washing machine to permit limited movement of the tub away from its normal geometric axis of rotation but to afford frictional resistance to such allowed movement and in addition the provision of resilient restraint to the movements away from the normal geometric axis of rotation and effective to urge and maintain the tub substantially on its normal geometric axis of rotation during spinning operation.

A further object of this invention is to provide a washing machine that can easily be controlled so as to be changed from one mode of operation to another, and which will always be stable and noiseless in operation under all working conditions.

Difficulties in balancing the baskets of centrifugal extractors are caused primarily by the load being out of balance, that is to say, the center of mass of the rotating body does not coincide with the geometrical axis of rotation. The machine therefore tends to rotate about its center of mass, generating a couple and tends to gyrate the entire machine about the said center of mass and causes the well-known vibration.

In general, two main methods have heretofore been proposed to overcome this serious problem. One method is to balance the basket itself in such a way as to overcome or minimize the effect of the unbalanced load. The second method is to accept the unbalanced condition of the basket and so construct the machine as to permit the basket to rotate about its center of mass with a minimum of disturbance.

An example of the first and general method of overcoming vibration heretofore proposed is the use of a heavy basket or heavy balanced rings to provide a flywheel effect so that any unbalance due to uneven distribution of the clothes will be small compared to the mass of the balanced flywheel. Other examples involve movable balance devices including various liquid arrangements wherein the liquid shifts under centrifugal force to correct the unbalance.

One example of the second method of overcoming unbalance heretofore employed, is the use of a flexible mounting between the rotating basket and the frame of the machine whereby the basket can rotate about its own center of mass without disturbing the rest of the machine. Another example is to permit the entire machine to dance or gyrate around the floor, flexible legs or caster cups being provided to limit the amount of dancing or gyration. In this regard the present invention embodies features overcoming the deficiencies of the aforementioned methods in overcoming unbalanced conditions and constitutes an improvement over both of the general methods above mentioned by the provision of a balancing means associated with the basket of the machine and so arranged to cooperate with mechanical means effective to stop and overcome any undue unbalanced conditions.

It is another object and accomplishment of the invention to provide an automatic washing machine which is economical to manufacture, simple to operate, substantially free from noise and vibration and yet rugged and reliable in use.

An ancillary object and accomplishment of the invention is to provide a new and improved washing machine having incorporated therein an improved gyration sup-

pression control device which is adapted to be economically manufactured and which is so designed as to permit the manufacture and assembly thereof in accordance with present day large scale mass production manufacturing methods of construction and assembly.

In the invention seeks, as a final object and accomplishment, to provide for an automatic washing machine of the character indicated an improved gyration suppression control device which is particularly characterized by a design arrangement to more advantageously and satisfactorily perform the functions required of it and adapted to provide a compact unit which will successfully combine the factors of structural simplicity and durability and yet be economical to manufacture.

Additional objects, features and advantages of the invention disclosed herein will be apparent to persons skilled in the art after the construction and operation are understood from the within description.

It is preferred to accomplish the various objects of this invention and to practice the same in substantially the manner as hereinafter more fully described, and as more particularly pointed out in the appended claims.

Embodiments of the invention are illustrated in the accompanying drawings forming a part hereof and wherein:

Fig. 1 is an isometric view of the washing machine cabinet;

Fig. 2 is an elevational view of the washing machine depicted in Fig. 1 with parts thereof removed and shown in section to more clearly illustrate the construction thereof, this view being taken substantially on the plane of the line **2—2** in Fig. 1;

Fig. 3 is a top plan view of the gyration stabilizer mechanism contemplated by this invention and being taken substantially on the plane of the line **3—3** in Fig. 2;

Fig. 4 is an elevational view of a portion of the gyration stabilizer mechanism contemplated by this invention and being taken substantially on the plane of the line **4—4** in Fig. 3;

Fig. 5 is an enlarged elevational view of the gyration shut-off switch otherwise depicted in Figs. 2 and 3, this view being taken substantially on the plane of the line **5—5** in Fig. 2; and

Fig. 6 is an end elevational view of the gyration shut-off switch depicted in Fig. 5.

The drawings are to be understood to be more or less of a schematic character for the purpose of illustrating and disclosing a typical or preferred form of the improvements contemplated herein and in the drawings like reference characters identify the same parts in the several views.

Attention is invited to the drawings, particularly Figs. 1, 2, 3, 5 and 6, wherein the gyration suppression control device with which the present invention is particularly concerned is designated in its entirety by numeral **15** and shown incorporated in a washing machine comprising, in general, the component part assemblies respectively indicated in their entirety by the letters as follows: A cabinet A exemplifying the external appearance of the automatic washing, rinsing and water extracting machine as shown in Fig. 1 and being hereinafter referred to simply as a "washing machine"; a basket B of the centrifugal extracting type disposed within the cabinet A; an improved agitator C operatively disposed within the basket B; a transmission D, a housing of which forms a part of and is carried by the basket B for rotation therewith when the basket is rotated for centrifugal water extraction operations and is adapted to impart an oscillatory motion to the agitator C, and the bulk, mass and weight of said transmission cooperating with the gyration suppression control means **15** contemplated by this invention; a drive mechanism E; a supporting structure H; water inlet and water drain assemblies respectively indicated as at K and L; and a sequential control M as disclosed in a co-

pending patent application of Joseph M. Gartner, Serial Number 262,270, filed December 21, 1951, and entitled "Sequential Control," and which is adapted to regulate the operation of the various elements in proper sequence to perform the operations involving filling, washing, rinsing and water extraction.

Attention is directed to Fig. 1 wherein there is illustrated the cabinet A which houses the entire mechanism and control system therefor and which comprises a cover **20**, a front panel **21**, side panels respectively indicated at **22** and **23**, and a control panel **24** forming a part of and projecting upwardly from the cover **20** as illustrated in Figs. 1 and 2.

In Figs. 1 and 2, it can be seen that the cover **20** is provided with a hinged lid **25** to form a closure member for an opening **26** through which clothes or other articles to be cleansed may be introduced to the machine. The hinged lid **25** is so disposed with respect to the opening **26** that it will be flush with the surface of the cover **20** when it is in its closed position. One or more metal straps **27** pivotally disposed in the mountings secured to the under side of the cover **20** serve to provide a hinged mounting for the lid **25** with respect to the cover **20**. A depression formed in the surface of the hinged lid **25** provides access to a handgrip **28** disposed at one edge of the lid **25** opposite its hinged mounting.

On the left-hand side of the control panel **24** there is disposed a control switch **30** which provides a means for manually selectively presenting the operation of an automatic temperature control mixing valve **31** forming a part of the water inlet assembly K. This mixing valve **31**, which will be described in greater detail hereinafter, serves to provide for the introduction of cleaning fluids, in this case, water, at a proper temperature to insure proper cleansing of the articles to be laundered.

On the right-hand side of the control panel **24** there is disposed a control knob **33** which provides a means for manually operating the sequential control M. The length of the washing cycle may be predetermined and set within certain limits by the manual adjustment of the control knob **33** in a manner to be described in detail hereinafter.

It is notable that both the control switch **30** and the control knob **33** are shown as being disposed on the panelled surface **24** so that they provide no obstruction to the operator in the introduction of the articles to be laundered in the machine, or their removal therefrom.

Particular attention is directed to Fig. 1 wherein there is clearly illustrated a recess **35** arranged adjacent the back portions of the washing machine cabinet, this recess being adaptable for convenient receipt of pipes, wiring cables and the like so that the rear portions **36** of the top of the cabinet may be positioned so as to be in engagement with a wall or the like to provide continuity when the washer is disposed in a kitchen and/or laundry cabinet arrangement and yet provide, by means of the recess **35**, for accommodation of obstructions running horizontally along the wall which could be supply pipes and/or electrical conduits and the like.

A recessed toe plate **37** is provided in the lower front portions of the cabinet as shown. This also is to provide obvious advantages of utility and giving design considerations to uniformity when the washing machine is disposed in a kitchen and/or laundry cabinet arrangement.

Attention is now directed to Figs. 2, 3 and 4, wherein there is clearly disposed the structural support H which comprises a base formed of structural angle members as at **40** and **41** to define a substantially square box-like base having disposed in the four corners thereof suitable adjustable legs **42** adaptable to provide a leveling means for the washer when placed in operative position on a floor or the like, a super-structure formed of bent steel elements **45**, as shown, with an encircling cover-like member **46** having a relatively large central aperture **47** and presenting a relatively flat working surface **48** upon

which portions of the gyration suppression means **15** with which the present invention is particularly concerned, are operatively disposed.

It can be seen in Fig. 2 that the lower portions of the cabinet A are secured to and supported by the angle members **40** and **41** of the base by virtue of suitable securing means as at **49**. Thus, it can be seen that the supporting structure H is a self-contained unit and is constructed so as to place the center of gravity in the lower portions of the washing machine which is effective to provide advantageous stabilization of the washing machine in operation thereby to reduce noise and objectionable vibration to the minimum.

Disposed within the cabinet A and mounted on the supporting structure H is a water-tight outer tub designated in its entirety by the numeral **95** (Fig. 2). It can be seen in Fig. 2 that the outer tub **95** comprises a bottom wall **96** and upstanding side walls as at **97** terminating in an open top **98** providing an annular opening, the periphery of which is disposed within the confines of the cabinet top **20** and the peripheral edge of which is provided with an annular shaped seal **99** adapted to engage portions of the inside surface of the cover **20** in order to prevent water from splashing out of the tub **95** and between the outer surface of the tub **95** and the interior of the cabinet A.

Disposed within the tub **95** and arranged for relative rotation therebetween and spaced from the wall **97** of the tub **95**, there is provided the combination washing tub and water extracting basket B. As will best be seen in Fig. 2, the combination washing tub and water extracting basket comprises an imperforate bottom wall **100** having an annular offset **101** projecting inwardly of the tub and terminating in an annular inwardly projecting flange **102**, the periphery of which defines a centrally disposed annular opening.

Integrally formed with the cover **20** of the cabinet A and projecting inwardly thereof substantially coaxially with the geometrical axis of rotation of the tub B, there is provided an annular flange **110** adapted to present a relatively smooth surface to define a throat through which the fabrics and other materials to be washed may be introduced to the combination washing tub and water extracting basket B without danger of the fingers of the operator being injured or caught between the adjacent operating parts of the washer.

In order to provide further for the advantageous insertion of the clothes into the combination washing tub and water extracting basket B there is provided an annular flange **111** defining an annular opening **112** forming a continuation of the aforementioned throat for the purpose of directing the passage of the clothes or other material to be washed into the combination washing tub and water extracting basket B to perform washing actions thereon. It is notable that the annular flange **111** is formed so that portions thereof will project downwardly within the confines of the combination tub and basket B to present an oblique wall **115** and thereafter terminate in an annular flange **116** which is formed to define a corrugated-like shape so as to provide between these corrugated formations a series of apertures as at **118** through which fluid may pass.

Obviously, the flanged throat element **111** may be suitably supported by any convenient means to the peripheral flange **106** of the combination washing tub and water extraction basket B. Moreover, it can be seen that the peripheral flange **106** and the corrugated-like formations on the flange **116** forming therebetween a series of apertures **118** hereinbefore mentioned and through which water may pass into the outer tub **95** for retention or removal therefrom.

In operation, the rotation of the combination washing tub and water extracting basket B at extremely high speeds during the extraction operation will cause centrifugal forces to move the mass of water outwardly from the geometrical center of rotation and, by virtue of the inclined upstanding annular wall **105** of the combination washing tub and water extracting basket B, the water will tend to flow upwardly through the passage defined by the oblique wall **115** and the adjacent portion of the wall **105**, and thereafter, through the apertures **118** formed by the corrugated-like formations on the annular flange **116**, whereupon the water will be discharged into the confines of the outer tub **95** for disposal. It is important to understand centrifuge action of the basket B will empty the water disposed therein in a matter of a few seconds thus presenting a substantial saving of time in the wash cycle and yet performing a better job than prior art models employing time consuming pumping operations and the like.

One of the features of the present washing machine is the provision of novel means associated with and forming a part of the combination washing tub and water extracting basket B for the purpose of completely emptying out the basket during the extracting cycle, thereby to present objectionable and undesirable scum and other foreign matter to remain in the basket B during subsequent operations in the washing cycle.

In centrifuge type extractors as contemplated by this invention it has been found that during the extracting operation the fabrics contained in the basket B, by virtue of their mass and bulk, will sometimes entrap water and other foreign material in the lower portions of the basket B thereby to prevent the desired removal of such entrapped water from the basket B which will cause an undesirable accumulation of sediment and other foreign matter. In this connection, it is notable that it is desirable to have this objectionable sediment and foreign matter removed to provide a clear rinsing cycle and prevent the sediment laden water from being strained through the fabrics being washed during any of the water extracting cycles.

In order to advantageously accomplish the removal of the entrapped objectionable scum containing fluid there is provided a series of apertures, as at **120**, disposed beneath the agitator in an annular array adjacent to the offset **101** of the bottom wall **100** of the basket B. Operatively disposed below the aforementioned series of apertures **120** there is provided an annular cup-shaped structure indicated in its entirety by the numeral **125** (Fig. 2) and being supported in the position as shown by welding portions thereof to a flange **126** being secured between the two plates forming the housing of the transmission D. An important feature in this construction is that the inner wall of the annular cup-shaped structure **125** has as its central axis the central axis of the tub while the outer wall thereof is eccentric and with the largest space being adjacent the conduit **130**. In order to provide a water-tight annular chamber disposed below the annular array of apertures **120**, there is provided a seal **127** carried by the cup-like structure **125** and adapted for engagement with outer portions of the bottom wall of the basket B.

Thus, it can be seen that the sediment contained water and other foreign matter may pass through the apertures **120** and into the annular cup-like structure **125** and by virtue of a centrifuge action similar to that hereinbefore described with respect to the emptying of the basket B, the sediment contained water will be caused to flow from the annular cup-shaped structure into the conduit **130** which extends upwardly adjacent the exterior of the wall **105** of the basket B and terminates with an open end **131** and through this conduit **130** and by virtue of the centrifuge action imparted by rotation of the basket B at relatively high speed, the sediment contained water will rise in the conduit **130** and be discharged from the open end **131** thereof and into the confines of the outer tub **95** for disposal with the other water being caused to be extracted from the inner portions of the tub B through

apertures **118** formed of the corrugated shaped formations on the flange **116**.

It is well known that a relatively heavy mass or weight should be provided in the centrifuge operation of the basket B. In order to overcome normal unbalance conditions in the basket B caused by uneven distribution of the fabrics contained therein, it has been found desirable to provide centrifugal forces assisted by mass or weight to facilitate the rotation of the basket B coincident, as nearly as possible, with the normal geometrical axis of rotation.

In order to provide the necessary mass or weight, the weighted mass **60** is secured, by any conventional manner, to the exterior of the wall **105** of the basket B in the upper portions thereof adjacent the annular flange **106** (see Fig. 2). It is notable that this weighted mass **60** is of such character as to cooperate with the gyration suppression means **15**, hereinafter to be described in detail, the cooperation of these elements being effective to overcome, in normal operations, any unbalanced conditions and cause the centrifuge or basket B to assume a position, during rotation thereof, coincident with the normal geometrical axis of rotation thereby to substantially minimize noise and vibration during operation of the washing machine, particularly during the spinning or extraction periods.

The invention contemplates the novel disposition of the housing of the transmission D as a part of the lower wall **100** of the basket B at the flange **102** by means of the bolts **103**. Thus, top plate **146** completes the enclosure of the opening in the basket B defined by the inner marginal edge of the flange **102**.

It is recalled that a necessary weight or mass should be given to the centrifuge or basket B in order to provide proper centralizing characteristics in its high speed rotation. It is important to understand that the relatively heavy mass or bulk of the transmission D when disposed in the manner taught by this invention will be effective to contribute to the weight and bulk necessary in the centrifuge or basket B for it to advantageously perform the functions required of it. Thus, it can be seen that the housing of the transmission D is fixedly secured to the centrifuge or basket B and because of this will rotate in its entirety with the centrifuge or basket B in the extracting operations of the washing cycle. This is an advantageous feature of the invention and an important contribution to the art.

Suffice it to say, since the invention is not particularly concerned with the precise construction of the complete automatic washing machine hereinbefore described generally, and/or its associated parts, they will not be further described in detail, and it is sufficient for all intentions and purposes herein contained to show only portions thereof adjacent to and cooperating with the gyration suppression means **15** with which the invention is particularly concerned. It is to be understood that details of construction of such automatic washing machines, and/or their associated parts, may be modified to suit particular conditions or to satisfy the engineering genius of various competitive manufacturers, and we do not wish to be limited to the construction of these elements as set forth except where such construction particularly concerns the invention contemplated herein.

Having thus described, by way of example, a possible adaptation of the gyration suppression control means **15** for an automatic washing machine and having described the general environment surrounding the adaptation, the specific construction and function of the parts of said gyration suppression control means **15** when disposed in an automatic washing machine as hereinbefore disclosed, will now be described in detail.

For an exemplary embodiment of the gyration suppression means **15**, particular attention is directed to Figs. 2, 3, 4, 5 and 6, wherein there are illustrated specific details of construction of the gyration suppression means **15** forming an important feature of the present invention and which comprises an elongated stationary sleeve **50** (Fig. 2) which also forms a part of the driving mechanism E and whose function in this connection will be hereinafter described in detail, said sleeve **50** having fixedly secured thereto and extending outwardly therefrom a pair of arms **51** and **52** disposed in crisscross fashion as shown in Fig. 3 and formed of plate metal to impart a spring-like action to be hereinafter described in the operation of the device. In Fig. 3 it can be seen that the arms **51** and **52** extend in each direction from the center of the machine to the relatively flat working surface **48** forming a part of the support structure H. Since the outer end portions of the arms **51** and **52** are of similar construction, it is deemed sufficient for all intentions and purposes herein contained to describe only one of them. Accordingly, in Fig. 3, the outer end portion of the arm **51** comprises friction means **53** disposed on the underside of the arm and which may be formed of material similar to the conventional automotive brake lining, the friction means **53** being adapted for frictional sliding engagement with a plate **54** (Figs. 3 and 4) suitably secured to the working surface **48**.

Adjacent the end portions of the arm there is provided a recess **59** adapted to receive end portions **55** of a tension spring **56**, the other end **57** of which is secured as shown to the bent steel elements **45** forming a part of the supporting structure H. Of course, it can be seen in Fig. 4 that a suitable aperture **58** is provided in the plate **54** and the working surface **48** in order to accommodate the upper end portions of the spring **56** so that these portions may be in operative engagement with the arm **51**. It is notable that the aperture **58** should be of a size to permit relative movement of the arm **51** with respect to the plate **54**. A further function of the springs as at **56** is to provide a means for preventing rotary movement of the arms **51** and **52** and yet permit relative transverse or off-center movement of the driving mechanism E under certain conditions.

In reviewing Fig. 3 it can be seen that a spring as at **56** is provided at both end portions of the arms **51** and **52**. These springs have a tendency to centralize the driving mechanism E and yet provide a resilient control to permit off-center movement of the driving mechanism in certain unbalanced operations of the tub B and the agitator C, thus insuring virtually complete elimination of vibration in the cabinet A. In addition to the function and operation of the gyration suppression means **15** hereinbefore described, it is notable that this structure effectively cooperates with the weight of the transmission housing D and the weighted balancing means **60** forming a part of the tub B, this cooperation between these elements being effective to provide proper balance to the system, particularly in spinning operations which aggravate the centrifugal forces emanating from the rapidly spinning tub and this aggravation being further emphasized by an unbalanced load caused by uneven distribution of the clothes in the basket.

Although the cooperative effort of the gyration suppression means **15** with the weighted balancing means **60** is effective to overcome unbalanced conditions in the majority of the operations, there may be such uneven distribution of the clothes in the basket, particularly in the case of heavy fabrics such as chenille robes or chenille rugs or such fabrics having great mass such as a blanket to cause an unbalanced condition of such magnitude that cannot be operatively overcome by these elements.

In order to provide safety in such conditions there is provided a gyration suppression control switch generally indicated by the letter J and shown in detail in Figs. 2, 3, 4, 5 and 6. The gyration suppression control J comprises an electric switch **61** disposed in the main electrical supply line and effective to cut off the electric supply to the washing machine, thereby to stop all opera-

tions. The operation of the switch is advantageously accomplished by the provision of a plate 62 (Fig. 5) secured to an end portion of the arm 52 of the gyration suppression means 15, said plate 62 having an arm 63 adapted for engagement with end portions 64 of a latch 65 (Figs. 3 and 5) carried for pivotal motion by a bracket 66 adjustably carried by side portions of the supporting frame H by virtue of the adjusting screws as at 67 and 68 which are adapted to be received respectively in slotted apertures 69 and 70 disposed in the bracket 66, said latch 65 having a lip 71 adapted for engagement with a flange 72 forming a part of a dog 73 mounted for pivotal motion on the support 66, there being a tension spring 74 operatively disposed between the latch 65 and the dog 73, as shown, and effective to urge engagement of the lip 71 with the flange 72. Secured to the dog 73 is a rod 77 which projects upwardly in the rear portion of the cabinet (Fig. 2) and has disposed on its upper end portion a button 78, said rod being provided with stops 79, 80 disposed in operative engagement with the operating arm 81 of the switch 61.

The device as shown in Figs. 2, 3, 4, 5 and 6 is in its normal operating position and the washer will operate through the predetermined cycles; however, in the event that an extreme unbalanced condition becomes present the arm 63 of the plate 62 will become engaged with end portions 64 of the latch 65 thereby to cause the latch 65 to pivot which will effect disengagement of the lip 71 from the flange 72, and by virtue of the force of the spring 74, the dog 73 will pivot causing the rod 77 to move upwardly, and by virtue of the stops 79 and 80 which are in engagement with the arm 81 of the switch 61, the circuit will be opened and stop all operations of the washing machine. It is then necessary for the operator to investigate the unbalanced condition and correct the same. This may be accomplished by giving a more even distribution of the clothes in the tub B. After this is accomplished the operator may reset the mechanism for a continuation of the washing operations by merely depressing the button 78 which projects upwardly and outwardly from the top portions of the control panel 24 for convenience in accessibility by the operator. The depression of the button 78 is effective to urge downward movement of the rod 77 which will close the switch and cause re-engagement of the lip 71 with the flange 72. Of course, it is obvious that the mechanism can only be reset after the arm 63 is in such a position so as not to engage the end portion 64 of the latch 65. This feature facilitates safety in that it is impossible to reset the mechanism for continuance of washing operations without first giving consideration to rectifying the extreme unbalanced condition and/or by manually repositioning the tub B so that its axis of rotation will more nearly coincide with the normal geometrical axis of rotation.

The complete operation of the automatic washing machine representing the illustrated embodiment of the invention and described herein in detail may be briefly summarized as follows:

Clothes or other articles to be laundered are inserted into the basket B of the automatic washing machine through the hinged lid 25 of the cabinet A and a small amount of soap or other suitable detergent is then sprinkled on the top of the clothes or articles to be laundered. The water temperature control switch 30 is now set for the desired water temperature at which the clothes or other articles are to be laundered. The timer control knob 33 is pulled outwardly and moved in its horizontal linear path to the extreme left-hand position (Fig. 1) and when the control knob 33 is pushed inwardly it will set the timing mechanism in motion to perform the various sequential operations of the washing cycle.

As was hereinbefore stated, the instant washer has an adjustable fill from one to six minutes, and since the water valve 31 is set to provide 2 and ⅔ gallons of water per minute regardless of city main pressures, the amount of water disposed into the tub is controlled by time as distinguished from conventional prior art float mechanisms. It has been found practical for all intentions herein contained to have a fill period of approximately four minutes under average conditions. Accordingly, if the timer control knob 33 is set at 0, the mechanism will become operative to permit filling of the basket B for a period of four minutes and as the timer control knob passes through this four minute cycle, the electrical contacts (not shown) in the timer will be actuated by the engagement of a suitable linear profile to shut off the water supply and simultaneously therewith start the washing phase of the cycle. The motor will be set in a direction of rotation to cause the agitator to oscillate to perform its washing function upon the clothes and/or other articles being laundered.

For all practical intents and purposes herein contained and based upon experience as to the length of time desirable for the washing phase of the cycle, it has been found that a ten minute period is most practical under average conditions. It is notable that if the timer control knob 33 is set at the 0 position (Fig. 1) and left undisturbed, there will be a four minute fill period followed by a ten minute wash period in which the agitator performs its oscillating motion. However, it is important to understand that, in certain instances, it may be desirable to vary the wash period. This may advantageously be accomplished by setting the timer control knob 33 at 0 (Fig. 1) and permitting this control knob to pass through the four minute fill period, whereupon the knob may be pulled outwardly and reset at any point between numbers 4 and 14 and pushed inwardly whereupon the timer will continue from that point to complete the washing cycle. The apparatus is thereafter adapted to operate without further attention, all of the remaining operations taking place automatically and proceeding to the completion of the last drying operation.

After the wash period has been completed the electrical contacts of the sequential control, by virtue of the linear profile, will be set to provide a thirty second pause permitting the motor to completely stop and be set for reverse operation to accomplish water extraction operations in the manner hereinbefore described. When the timer control knob 33 has passed through this thirty second pause, the electrical contacts will be set to cause rotation of the basket B for water extracting operations. In this operation, the rotation of the combination washing tub and water extracting basket B at extremely high speeds during the extraction operation will cause centrifugal forces to move the mass of water outwardly from the geometrical center of rotation and, by virtue of the inclined upstanding annular wall 105 of the combination washing tub and water extracting basket B, the water will tend to flow upwardly through the passage defined by the oblique wall 115 and the adjacent portion of the wall 105 and thereafter, through the apertures 118 formed by the corrugated-like formations on the annular flange 116, whereupon the water will be discharged into the confines of the outer tub 95 for disposal. It is important to understand that this centrifuge action of the basket B will empty the water disposed therein in a matter of a few seconds thus presenting a substantial saving of time in the wash cycle and yet performing a better job than prior art models employing time consuming pumping operations and the like.

In centrifuge type extractors, it has been found that during the extracting operation the fabrics contained in the basket B, by virtue of their mass and bulk, will sometimes entrap water and other foreign material in the lower portions of the basket B thereby to prevent the desired removal of such entrapped water from the basket B which will cause an undesirable accumulation of such sediment and other foreign matter. In this connection, it is notable that it is desirable to have this objectionable sediment and foreign matter removed to provide a clear

rinsing cycle and prevent the sediment laden water from being strained through the fabrics being washed during any of the water extracting cycles.

This is advantageously accomplished in the present invention by the provision of the auxiliary sump adapted to facilitate removal of the entrapped objectionable sediment contained fluid by passing the same through the apertures **120** and into the annular cup-like structure **125** and, by virtue of a centrifuge action similar to that hereinbefore described with respect to the emptying of the basket B, the sediment contained water will be caused to flow from the annular cup-shaped structure into the conduit **130** which extends upwardly adjacent the exterior of the wall **105** of the basket B and terminates with an open end **131** and through this conduit **130** and, by virtue of the centrifuge action imparted by rotation of the basket B at relatively high speed, the sediment contained water will rise in the conduit **130** and be discharged from the open end **131** thereof and into the confines of the outer tub **95** for disposal with the other water being caused to be extracted from the inner portions of the tub B through apertures **118** formed of the corrugated-shaped formations on the flange **116**.

Since the construction and operation of the centrifuge B facilitates a relatively fast dumping of the detergent fluid in the extract operations, this extracting and dumping operation being accomplished in a matter of a few seconds, and because of this, it is obvious that the pump L would not be of sufficient capacity to dispose of such a quantity of water as rapidly as it is being dumped, therefore, it is necessary for the dumped water to accumulate in the outer tub **95** in the area below the centrifuge until the pump L can dispose of same in its normal pumping operation. It is recalled that the motor will operate in two directions of rotation, that is to say, in one direction when it is desired that the agitator be operated and in another direction when it is desired that the extracting operations be performed. Thus, by virtue of the pump drive arrangement, it can be seen that the pump will operate in both directions of rotation and at all times when the motor G is in operation.

At this point (beginning of the first spin operation) it is deemed important to discuss the functional operation of the gyration suppression control switch J. Although the instant washing machine provides effective means to overcome unbalanced conditions or uneven distribution of the clothes in the basket, particularly in the case of heavy fabrics such as chenille robes or chenille rugs or such fabrics having a great mass such as a blanket, the invention contemplates the provision of an additional safety feature in such conditions by the effective operation of the gyration suppression control switch J hereinbefore described in detail. It is recalled that in such extreme conditions the gyration suppression control switch J will stop all operations of the machine and it is then necessary for the operator to investigate the unbalance condition and correct the same. This may be accomplished by giving a more even distribution of the clothes in the tub B. After this is done the operator may reset the mechanism for a continuation of the washing operations by merely depressing the button **78** which projects upwardly and outwardly from the top portion of the control panel **24**. After the mechanism has been reset and the unbalance conditions are overcome the washing machine will continue through the remainder of the washing cycle.

Attention is again referred to Fig. 1 and it is notable that the timer mechanisms, for purposes of this description of operation of the washing machine, has now moved to the extract spin position and will continue for one minute to perform the water extraction spin operation as hereinbefore described and after the timer has passed through this minute period the electrical contacts will be set in a manner to provide a thirty second spin rinse of warm water. This spin rinse is effective to remove extraneous scum and other detergent fluid remaining in the basket B after the first water extraction spin operation has been completed.

After the timer has passed through the aforementioned thirty second spin rinse, the electrical contacts thereof will be set to shut off the current supply to the motor thereby to stop the spinning of the basket B but, the electrical contacts are now set to permit a three and one-half minute fill period, in which period the basket is again supplied with warm rinse water.

After the timer has passed through this three and one-half minute fill period, the electrical contacts thereof will be set so as to cause reverse rotation of the motor thereby to provide an agitator drive and since the contacts are set for continuous supply of water to the basket B there is provided a four minute agitated overflow rinse which has been found particularly desirable to advantageously clear the clothes and the basket B of all scum, sediment and detergent fluid. It is obvious that if the water supply is continuous as hereinbefore suggested that the water will fill the basket B and thereafter overflow through the apertures **118** and into the outer tub **95** for disposal by the pump L as hereinbefore described.

A one minute agitated rinse period without overflow is provided, this being accomplished by positioning of the electrical contacts so as to cause the water to be shut off at the mixing valve **31**. After the one minute agitated rinse without overflow there is provided a thirty second pause in order to permit the motor to be stopped and the controls be set for reverse operation of the motor for the purpose of water extraction operations to follow. After a one minute water extraction spin operation there is provided a one-half minute spin rinse followed by a six minute water extraction period, making a total washing cycle of thirty-two and one-half minutes.

The instant gyration suppression means being formed of simple parts and readily available materials lends itself to mass production manufacturing principles, thus affording a substantial saving in the manufacturing costs.

From the foregoing disclosure, it may be observed that we have provided an improved gyration suppression means for an automatic washing machine which efficiently fulfills the objects thereof as hereinbefore stated and which provides numerous advantages which may be summarized as follows:

1. Structurally simple, efficient and durable;

2. Economical to manufacture and readily adaptable to mass production manufacturing principles; and

3. The provision of an improved gyration suppression means for an automatic washing machine which is of simple construction and having a novel association of parts which provide efficient operation and which is particularly characterized by a design arrangement to more advantageously and satisfactorily perform the functions required of it and adapted to provide a compact unit which will successfully combine the factors of structural simplicity and durability and yet be economical to manufacture.

While we have illustrated preferred embodiments of our invention, many modifications may be made without departing from the spirit of the invention, and we do not wish to be limited to the precise details of construction set forth but wish to avail ourselves of all changes within the scope of the appended claims.

We claim:

1. In a washing machine having a rotary tub: means associated with said tub for counterbalancing unbalanced loads in said tub, power transmission means forming a part of the bottom wall of said tub and including a downwardly projecting tubular shaft, a stationary base beneath said tub, arms extending from said shaft and in frictional engagement with portions of said base, yielding means for attaching said arms to said base, and friction pads between said arms and said base, said yielding means in-

cluding tension spring means connected between the outward end portions of said arms and said stationary base and disposed so that the tensional pull of said spring means is in a direction downwardly and radially outwardly from the axis of the rotary tub and operable to progressively increase the value of frictional resistance to relative movement of said frictionally engaged portions responsive to movement of said rotary tub away from its normal geometric axis in a direction opposed to the pull of said spring means.

2. In a washing machine, a rotatable tub, driving means secured to the bottom of the tub and including a tubular drive shaft, a stationary base beneath said tub, and means for mounting said tubular shaft for limited gyratory movement and including spider means comprising a hub carried by said tubular shaft and arms yieldingly connected to said base in frictional engagement therewith, with yielding means connecting said arms and said base, said yielding means including tension spring means connected between the outward end portions of said spider means and said stationary base and disposed so that the tensional pull of said spring means is in a direction downwardly and radially outwardly from the axis of the rotary tub and operable to progressively increase the value of frictional resistance to relative movement of said frictionally engaged portions responsive to movement of said rotary tub away from its normal geometric axis in a direction opposed to the pull of said spring means.

3. A washing machine structure comprising a support frame including a vertical axis centrifuging unit structure with motor driving means therefor mounted on said support frame, said support frame and centrifuging unit being so constructed as to have a center of mass substantially coincident with the axis of rotation of said centrifuging unit and having a mass of such amount that the mass supported on said frame is substantially greater than the mass of the washing load intended to be operated on in said centrifuging unit, connections to said support frame allowing limited off-center movement, a resilient member contacting said support frame to frictionally resist said off-center movement, and tension spring means connected between the outward end portions of said resilient member and said support frame and disposed so that the tensional pull of said spring means is in a direction downwardly and radially outwardly from the axis of the centrifuging unit and operable to progressively increase the value of frictional resistance to relative movement of said frictionally contacted portions responsive to movement of said centrifuging unit away from its normal geometric axis in a direction opposed to the pull of said spring means.

4. In a washing machine having a rotary tub: means associated with said tub for counterbalancing unbalanced loads in said tub, power transmission means forming a part of the bottom wall of said tub and the weight of which cooperates with said first-mentioned means to further counterbalance unbalanced loads in said tub, said power transmission means including a downwardly projecting tubular shaft, a stationary base beneath said tub, arms extending from said shaft and in frictional engagement with portions of said base, yielding means for attaching said arms to said base, and friction pads between said arms and said base, said arms, yielding means and friction pads comprising a mechanical means arranged to cooperate with said aforementioned weight to further assist in counterbalancing unbalanced loads in said tub, and said mechanical means including tension spring means connected between the outward end portions of said arms and said stationary base and disposed so that the tensional pull of said spring means is in a direction downwardly and radially outwardly from the axis of the rotary tub and operable to progressively increase the value of frictional resistance to relative movement of said frictionally engaged portions responsive to movement of said rotary tub away from its normal geometric axis in a direction opposed to the pull of said spring means.

5. In a washing machine including a rotatable tub, and driving means secured to the bottom of the tub and including a tubular drive shaft, the combination with a stationary base beneath said tub, of means for mounting said tubular shaft for limited gyratory movement and including spider means comprising a hub carried by said tubular shaft and arms yieldingly connected to said base in frictional engagement therewith, with yielding means connecting said arms and said base, said yielding means including tension spring means connected between the outward end portions of said arms and said stationary base and disposed so that the tensional pull of said spring means is in a direction downwardly and radially outwardly from the axis of the rotatable tub and operable to progressively increase the value of frictional resistance to relative movement of said frictionally engaged portions responsive to movement of said rotatable tub away from its normal geometric axis in a direction opposed to the pull of said spring means.

6. For a washing machine structure comprising a base support frame including a vertical axis centrifuging unit having agitation means disposed therein and with driving means therefor comprising a vertical drive shaft means mounted in said support frame, said centrifuging unit being adapted for rotation off its normal geometric center of rotation responsive to centrifugal forces emanating from unbalanced loads in said centrifuging unit, and means for mounting said centrifuging unit in said frame for limited tilting action whereby the centrifuging unit may gyrate in response to gyratory deflection of the centrifuging unit about said vertical axis; gyroscopically effective stabilizing means for said centrifuging unit comprising a power transmission housing including gearing mechanism disposed therein for driving said agitation means and defining a mass of weight mounted centrally of the base of said centrifuging unit and rotatable therewith, and a heavy ring mounted on the upper periphery of said centrifuging unit; and mechanical means to urge said centrifuging unit toward its normal geometric center of rotation comprising, a spider carried by portions of said vertical drive shaft means disposed below said power transmission housing and above said base support frame with the radially outward end portions of the spider being in overlapped frictional engagement with portions of said base support frame, friction means disposed between said overlapped engaging portions, and tension spring means connected between the outward end portions of the spider and said base support frame and disposed so that the tensional pull of said spring means is in a direction downwardly and radially outwardly from the axis of the centrifuging unit and operable to progressively increase the value of frictional resistance to relative movement of said overlapped engaged portions incident to movement of said centrifuging unit away from its normal geometric axis in a direction opposed to the pull of said spring means.

7. For a washing machine structure comprising a base support frame including a vertical axis centrifuging unit with driving means therefor comprising a vertical drive shaft means mounted in said support frame, said centrifuging unit being adapted for rotation off its normal geometric center of rotation responsive to centrifuge forces emanating from unbalanced loads in said centrifuging unit, means for mounting said centrifuging unit in said frame for limited tilting action whereby the centrifuging unit may gyrate in response to gyratory deflection of the centrifuging unit about said vertical axis: means operable to oppose said unbalancing centrifugal forces comprising, a first counterbalancing weight means secured to the upper periphery of said centrifuging unit and rotatable therewith; and a power transmission housing including gearing mechanism disposed therein, said housing being secured directly to the lower regions of said centrifuging unit and rotatable therewith, said trans-

mission housing being secured to said vertical drive shaft means, and friction means disposed between the centrifuging unit and the frame and below the housing, said friction means being radially spaced from the shaft means the mass and weight of said housing and said gearing mechanism cooperating with said first counterbalancing weight means and said friction means effective to stabilize said centrifuging unit in opposition to said unbalancng centrifugal forces.

8. A gyroscopically effective stabilizing means for a centrifuging unit having agitation means disposed therein and comprising: a power transmission housing including gearing mechanism disposed therein for driving said agitation means and defining a mass of weight mounted centrally of the base of said centrifuging unit and rotatable therewith, and a heavy ring mounted on the upper periphery of said centrifuging unit, in combination with mechanical means to urge said centrifuging unit toward its normal geometric center of rotation comprising, a base support frame for said centrifuging unit, a spider disposed below said power transmission housing and above said base support frame, the radially outward end portions of the spider being in overlapped frictional engagement with portions of said base support frame, friction means disposed between said overlapped engaging portions, and tension spring means connected between the outward end portions of the spider and said base support frame and disposed so that the tensional pull of said spring means is in a direction downwardly and radially outwardly from the axis of the centrifuging unit and operable to progressively increase the value of frictional resistance to relative movement of said overlapped engaged portions responsive to movement of said centrifuging unit away from its normal geometric axis in a direction opposed to the pull of said spring means.

9. A gyroscopically effective stabilizing means for a centrifuging unit having agitation means disposed therein and comprising: a power transmission housing including gearing mechanism disposed therein for driving said agitation means and defining a mass of weight mounted centrally of the base of said centrifuging unit and rotatable therewith, a support frame, a vertical drive shaft means mounted in said support frame with the upper end thereof secured to said power transmission housing to drive said centrifuging unit and said agitation means, weight defining means including a ring mounted on the upper periphery of said centrifuging unit, said centrifuging unit being adapted for rotation off its normal geometric center of rotation responsive to centrifugal forces emanating from unbalanced loads in said centrifuging unit, and means for mounting said centrifuging unit in said frame for limited tilting action whereby the centrifuging unit may be gyrated in response to gyratory deflection of the centrifuging unit about said vertical axis, in combination with mechanical means to urge said centrifuging unit toward its normal geometric center of rotation comprising, a plurality of first friction members mounted on and movable with said drive shaft means, said first friction members extending radially outwardly from said drive shaft means below the centrifuging unit, a corresponding number of second friction members forming a part of said support frame and being maintained in stationary relationship therewith, said first and second friction members having portions arranged in frictionally engaged overlapping relationship, and spring means cooperating with said first friction members and operable to progressively increase the value of frictional resistance to relative movement of said frictionally engaged portions of said first and second friction members responsive to movement of said centrifuging unit away from its normal geometric axis, and the mass and weight of said transmission housing and said gearing mechanism disposed therein cooperating and coupled with the weight of said ring weight defining means and including the resistive forces of said frictionally engaged portions of said first and second friction members and the forces of said spring means all being effective to stabilize said centrifuging unit in opposition to said unbalancing centrifugal forces.

References Cited in the file of this patent

UNITED STATES PATENTS

1,600,249	Sando	Sept. 21, 1926
1,946,725	Andrews et al.	Feb. 13, 1934
2,035,481	Hume	Mar. 31, 1936
2,161,604	Watts	June 6, 1939
2,344,982	Dyer	Mar. 28, 1944
2,408,509	Clark	Oct. 1, 1946
2,513,844	Castner et al.	July 4, 1950
2,534,194	Emmet et al.	Dec. 12, 1950
2,574,617	Bryant	Nov. 13, 1951
2,578,278	Archbold	Dec. 11, 1951
2,645,108	Smith	July 14, 1953