Jan. 20, 1953 K. CLARK 2,625,809

CENTRIFUGAL WASHING MACHINE

Filed March 15, 1946 4 Sheets-Sheet 1

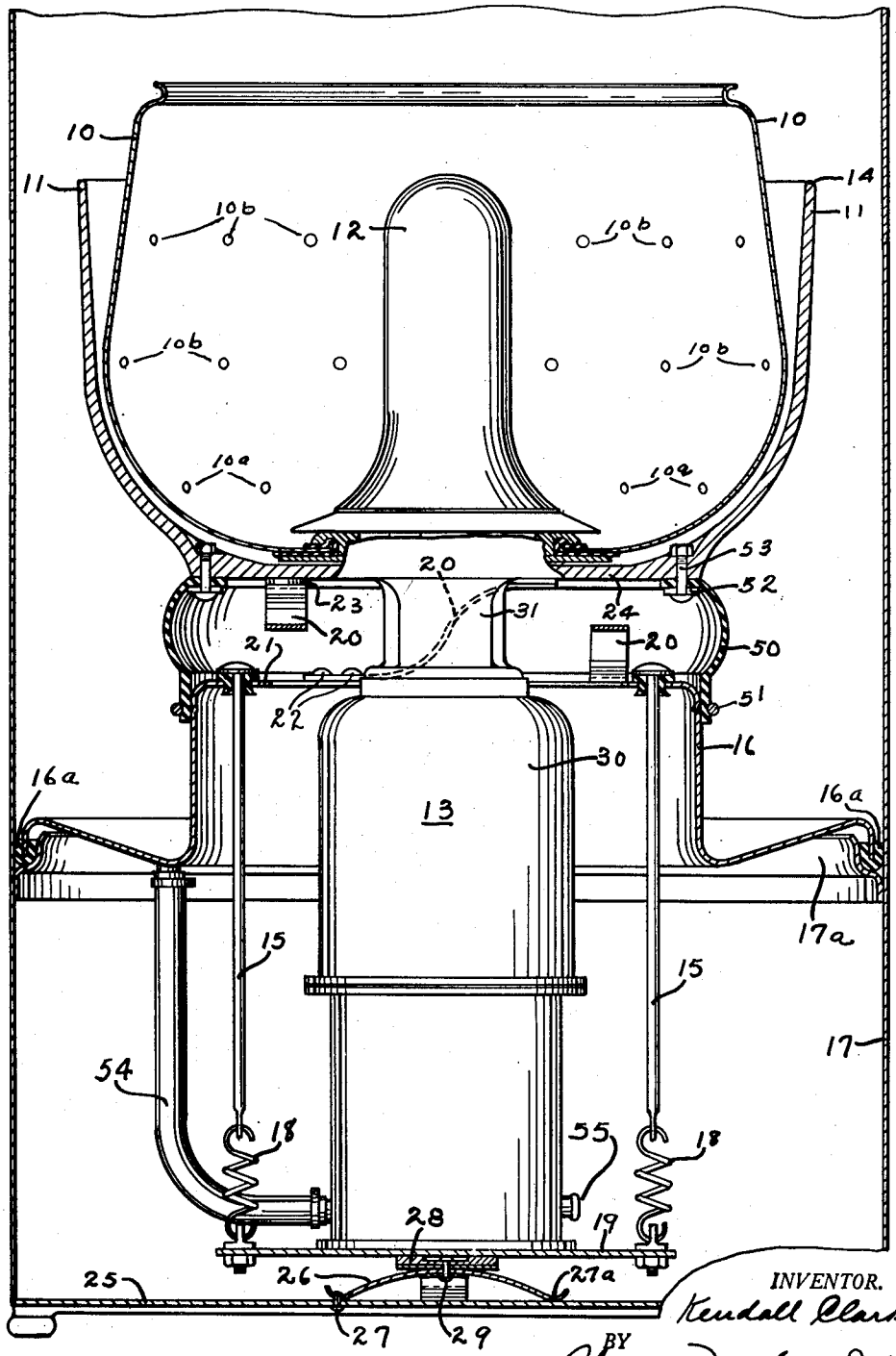


FIG. 1

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CENTRIFUGAL WASHING MACHINE

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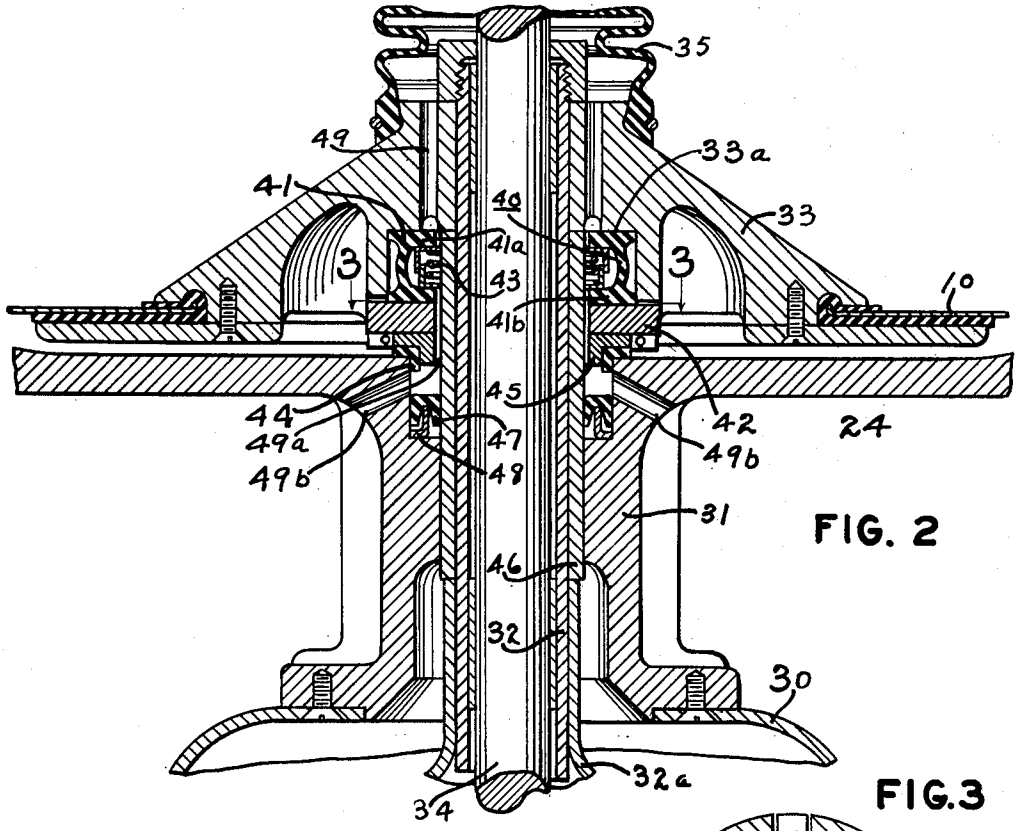


FIG. 2

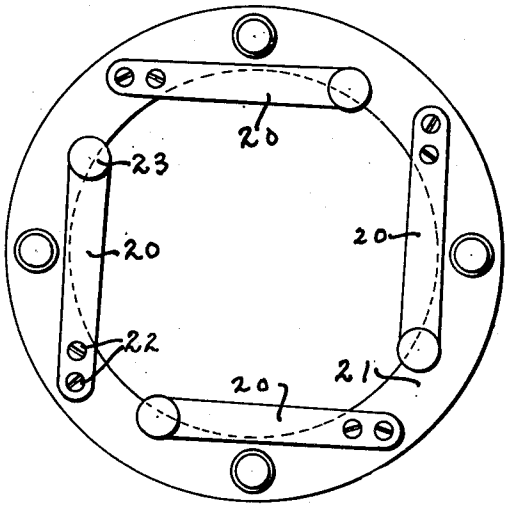


FIG. 5

FIG. 3

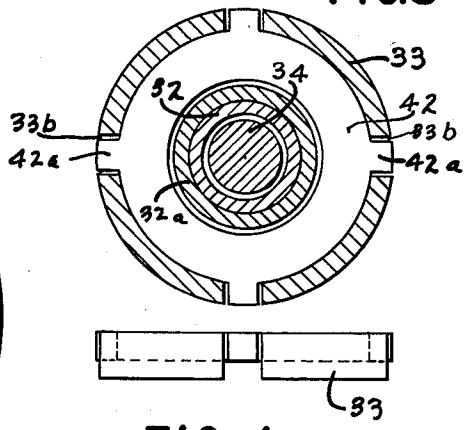


FIG. 4

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CENTRIFUGAL WASHING MACHINE

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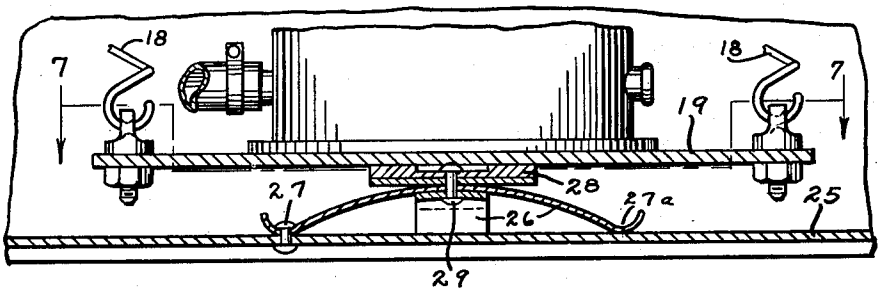


FIG. 6

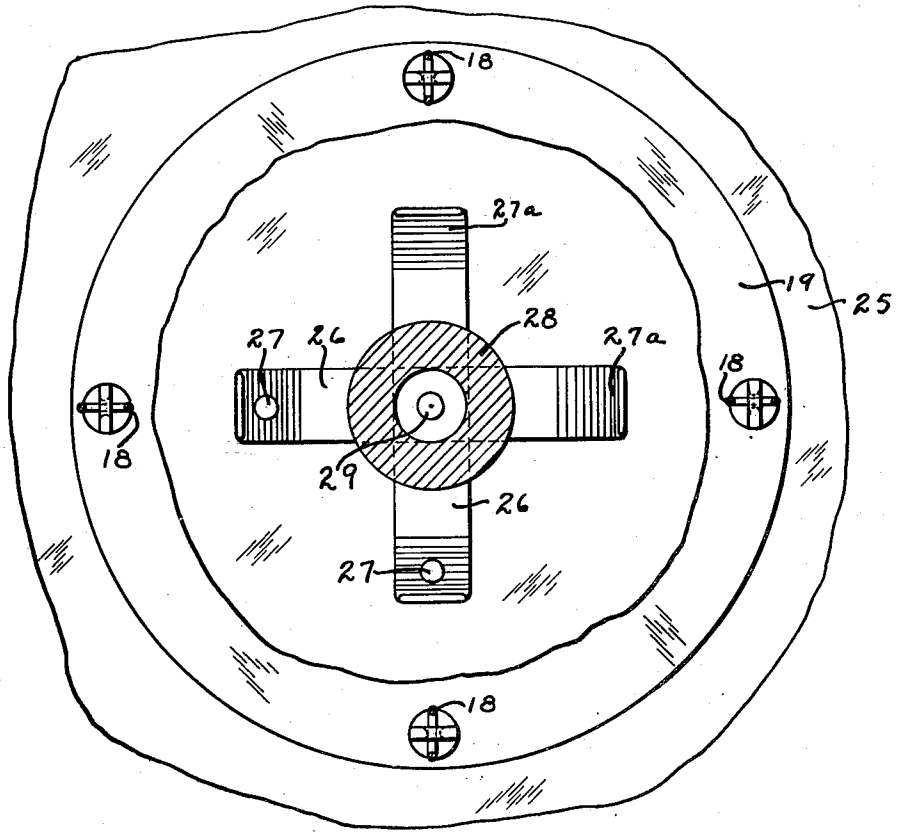


FIG. 7

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CENTRIFUGAL WASHING MACHINE

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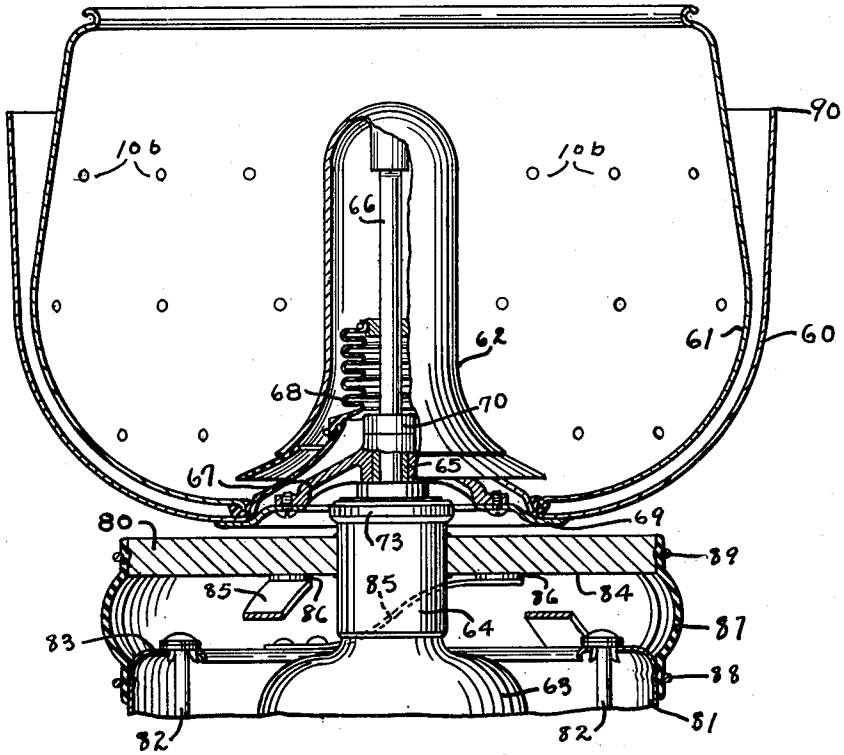


FIG. 8

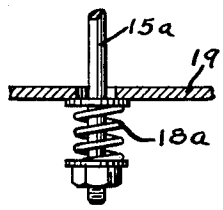


FIG. 10

FIG. 9

FIG. 11

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UNITED STATES PATENT OFFICE

2,625,809

CENTRIFUGAL WASHING MACHINE

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Application March 15, 1946, Serial No. 654,585

5 Claims. (Cl. 68—23)

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This invention relates to domestic washing machines.

An object of this invention is to provide a centrifugal washing machine with a novel and improved support and counterbalance.

Another object is to provide a novel and improved liquid discharge construction.

Another object is to provide an improved liquid retaining spring support construction in the cabinet.

Further objects and advantages of the present invention will be apparent from the following description, reference being had to the accompanying drawing, wherein a preferred form of the present invention is clearly shown.

In the drawing:

Fig. 1 is a vertical cross-section of one embodiment of my invention;

Fig. 2 is an enlarged vertical cross-section of a portion of the machine shown in Fig. 1;

Fig. 3 is a horizontal cross-section taken along the lines 3—3 of Fig. 2, mainly showing water seal structure;

Fig. 4 is a horizontal elevation of Fig 3;

Fig. 5 is a horizontal plan view of a portion of Fig. 1 mainly showing a secondary spring structure for the tub;

Fig. 6 is an enlarged cross-section of a portion of Fig. 1, mainly showing a secondary spring structure for the power mechanism;

Fig. 7 is a horizontal cross-section taken along the line 7—7 of Fig. 6;

Fig. 8 is a vertical cross-section of a portion of a modified form of the invention;

Fig. 9 is a vertical cross-section of a portion of the machine shown in Fig. 8; and

Figs. 10 and 11 show spring modifications, for the bottoms of springs 15.

A washing machine embodying features of my invention may include, in general, a centrifugal structure having a perforated rotatable basket 10, within a non-rotatable tub 11. An agitator 12 is placed inside of the basket 10. A power unit 13 is connected to the agitator 12 and basket 10 to agitate the agitator 12 while liquid and clothes are in the basket 10 and tub 11. After the clothes have been washed, or rinsed, the agitator 12 is stopped, and the basket 10 is rotated, to cause the liquid to be discharged over the rim 14, of the tub 11, by the pumping action and air circulation produced by the rotating basket 10.

The discharge of liquid over the rim 14 is accomplished, during rotation of basket 10 for the following reasons: When the basket 10 first rotates, the liquid between the tub 11 and basket

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10 is rotated by frictional contact with the outer surface of the basket 10 with some discharge of liquid over rim 14. This liquid finally is forced into a layer in contact substantially only with the inner surface of tub 11. As the basket 10 continues to rotate liquid and air are forced downwardly and outwardly through perforations 10a, near the bottom of basket 10. This air and liquid create a pumping action on the liquid between the tub and basket, and sweeps this liquid upwardly over the rim 14. Any liquid discharged through the upper perforations 10b is also swept up by the air and liquid pumping action.

The basket 10, tub 11, agitator 12, and power unit 13 are connected together as a unitary centrifugal structure which is supported on a main supporting spring structure arranged around the axis of the centrifugal structure. This main supporting spring structure may take the form of a plurality of spring rods 15, which are supported from a liquid retaining shelf 16. The shelf 16 forms a part of the base, or cabinet 17, within which the centrifugal structure is placed. The rods 15 are provided, at their lower ends, with tension springs 18, which support the lower portion, or plate, 19 of the power unit 13. The plate 19 is of sufficient horizontal extent, so that the centrifugal structure is retained in a vertical position, as it hangs on the rods 15.

A secondary, or subsidiary, spring structure is supported on the liquid retaining shelf 16, and frictionally engages the tub 11. This secondary spring structure may take the form of a plurality of leaf springs 20 secured to the top horizontal flange 21 of the shelf 16, by means of screws or rivets 22, at the lower end of the springs 20. The upper end of each of the springs 20 is provided with a pad 23 which frictionally engages the bottom 24 of the tub 11. These pads 23 are always in contact with the bottom of tub 11.

The lower portion of the base, or cabinet, 17 is provided with a lower transverse support 25 upon which another secondary, or subsidiary, frictional spring support is mounted. This secondary spring support may take the form of leaf springs 26. Each spring 26 has one end secured to the lower transverse support 25 by means of rivets 27, while the other end 27a of each spring 26 frictionally rides on the support 25. The leaf springs 26 are bowed upwardly and intersect at their center, where they are provided with a pad 28, secured to the springs 26 by means of a rivet 29. The pad 28 frictionally engages the bottom plate 19 of the power unit 13. The pad 28 is constantly in contact with plate 19.

The pads 23 and 28 preferably are of sintered porous bronze containing 6% graphite. The surface 24 and the bottom of plate 19 preferably are plated with chrome, or have a ferro-manganese phosphate coating.

The power unit 13 may be of any suitable construction capable of agitating the agitator 12 and rotating the basket 10. Merely by way of example, the power unit may be of the character shown in my Patent No. 2,366,236, patented January 2, 1945. This power unit may include the outer casing 30 which is secured to the lower cylindrical neck 31 integral with, and depending from, the bottom 24 of the tub 11. The rotatable sleeve 32, which corresponds to sleeve 24 of my patent, is secured to the hub 33 of the basket 10. The sleeve 32 is fixed to, and is rotated by, transmission cage 32*a*, which corresponds to transmission cage 23 of my patent. Rotation of the sleeve 32 produces rotation of the basket 10. The vertically reciprocable shaft 34, which corresponds to vertically reciprocable shaft 14 of my patent, is secured to the agitator 12. Vertical reciprocation of the shaft 34 produces a vertical reciprocation, or agitation, of the agitator 12 and produces a toroidal circulation of the clothes and liquid. A bellows 35 is secured to the hub 33 and to the top of the shaft 34, in a manner (not shown) similar to the manner of securement of the bellows 14*a* of my patent.

As the basket 10 is perforated at 10*a* and 10*b*, a seal 40 is provided between the tub 11 and the rotating shaft, to prevent liquid from flowing into the casing 30 of the power unit. The seal 40 includes a rubber-like ring 41, having an upper flange 41*a* seated on the surface 33*a* of the hub 33. The lower flange 41*b* is seated on the disc 42, which is rotatable with the hub 33 through the medium of keys 42*a* extending into slots 33*b* formed in the inner part of hub 33. The ring 41 is expanded longitudinally by the spring and flanged ring construction 43. The ring 41 prevents the flow of liquid from the tub 11 past the flanges 41*a* and 41*b* into driving parts of the mechanism 13.

The seal structure also includes a flanged rubber-like ring 44 seated on the bottom 24 of the tub 11. A porous metal, flanged, seal ring 45 rides on the ring 44 and has sealing and sliding contact with the lower side of the disc 42. This structure also prevents the flow of liquid from the tub 11 into the power unit.

An oil seal structure is placed between the bearing sleeve 46 and the neck 31. This seal structure includes a grooved, rubber-like ring 47 supported on a flanged ring 48. The bearing sleeve 46 is non-rotatively secured to the neck 31. Any oil, or washing liquid, which might find its way into the seal structure or within the bellows 35, may flow down the passages 49, 49*a*, and will be arrested by the ring 47. This liquid will drain through the passages 49*b* into the lower part of the cabinet 17.

The shelf 16 is supported on the rubber-like ring 16*a*, which is secured between the cabinet 17 and the flanged ring 17*a*, which is welded to the cabinet 17. This forms a liquid-tight joint between the shelf 16 and cabinet 17, which, at the same time, prevents the transmission of noise to the cabinet.

A water-tight seal is provided between the tub 11 and the upper end of the shelf 16. This may take the form of a rubber-like collar 50, which has its lower end secured by wire 51 to the upper end of shelf 16. The upper end of collar 50 is secured by ring 52 and bolts 53 to the bottom 24 of tub 11. This is a water-tight construction which prevents the flow of water discharged over the rim 14 from flowing into the lower part of the cabinet. The water is all arrested by the shelf 16, and is discharged through hose 54 (corresponding to hose 92 of my patent) into a pump (not shown; but corresponding to pump 93 of my patent) from whence it is discharged by pipe 55 through a flexible hose, not shown, to a suitable drain or stationary laundry tub, not shown. This construction permits the tub 11, basket 10, and power unit 13 to swing relatively to the cabinet 17; but insures the proper discharge of washing liquid to the stationary drain.

In the operation of the foregoing embodiment, detergent, liquid and clothes are placed within the basket 10 and tub 11. The power unit 13 is energized, under the control of a timer, such as disclosed in my Patent 2,376,901, granted May 29, 1945, to reciprocate the agitator 12 vertically to wash the clothes. After a suitable length of time, the agitation is stopped, and the power unit 13 is energized to rotate the basket 10. The pumping action and air circulation, produced between the basket 10 and tub 11, causes the liquid to be forced over the rim 14 from whence it falls to the liquid-retaining shelf 16. From this shelf it flows through the hose 54 to the pump, not shown, at the bottom of the unit 13, from whence it is discharged through the pipe and hose 55 to a laundry tub, drain, or other liquid disposal means. This operation may be repeated for one or more rinses, without the detergent.

As the basket 10 is rotated from a stationary condition, through its critical speed, to a top, substantially constant speed, the centrifugal structure swings on the spring rods 15. Any swinging action which would otherwise tend to be synchronized with the rotation, is damped out by the frictional supports produced by the secondary spring supports 20 and 26. Therefore the machine tends to accelerate smoothly to its top speed without any violent vibrations, and when it reaches its top speed, it tends to rotate smoothly about an axis which is substantially coincident with the axis of the shafts 32 and 34. No substantial vibrations are transmitted to the cabinet 17.

In the modification shown in Figs. 8 and 9, the structure is substantially as shown in the foregoing Figures 1 to 7, with the exception of the details shown in Figs. 8 and 9.

The centrifugal structure includes a rotatable tub having an outer imperforate cup 60 and an inner perforate cup 61. An agitator 62 is placed within the cup 61. The power unit 63 is provided with a non-rotatable upper collar 64 through which the rotatable sleeve 65 and the vertically reciprocable shaft 66 extend. The sleeve 65 and shaft 66 correspond to sleeve 24 and shaft 14 of my Patent 2,366,236. The rotatable sleeve 65 is secured to the hub 67 of the cups 61 and 60. The top of shaft 66 is secured to the agitator 62. The power unit 63, and it connection to the cups 60, 61 and agitator 62 may be substantially identical with the connection shown in my Patent 2,366,236, previously referred to. The cup 60 is extended inwardly into the agitator 62 and is connected to the lower end of a bellows 68, which bellows, in turn, is secured at its upper end to shaft 66. These connections of the bellows 68 are water-tight.

The bottom of the cup 60 is supported on, and secured to, the ring 69, which ring is supported on the hub 67. The hub 67 is secured to the rotatable sleeve 65 by means of nut 70, threaded

on sleeve 65. An oil seal structure 70a is provided at the upper end of nut 70. A slot and key construction 71 prevents relative rotation between sleeve 65 and hub 67. The lower end of hub 67 rides on thrust bearing ring 72 held in nut 73 which closes the top of collar 64. A seal structure 74 is placed in the upper part of nut 73 to prevent the flow of liquid into the power casing 63. The nut 73 is threaded to the bearing sleeve 75, which carries bearing sleeve 76. When the sleeve 65 rotates, the cups 60 and 61 are rotated. When the shaft 66 is reciprocated vertically, the agitator 52 is reciprocated vertically.

A non-rotatable counterbalancing weight 80 is welded to the non-rotatable collar 64, in a water-tight manner. The liquid retaining shelf 81 corresponds in structure to the shelf 16 heretofore described, and is connected to a cabinet identical with cabinet 17. The spring rods 82 are supported on the horizontal flange 83 identically as shown with regard to rods 15 and flange 21 heretofore described. The remainder of the structure, not shown below Fig. 8, is substantially identical with that disclosed with regard to Figs. 1 through 7, and include a secondary spring support at the bottom of power unit 63, not shown. The secondary, or subsidiary, spring support mounted on flange 83 frictionally engages the bottom 84 of the weight 80. This secondary spring support includes a plurality of leaf springs 85 mounted on the flange 83 in a manner similar to the way springs 20 are mounted on the flange 21. The springs 85 are provided with pads 86, similar in action to pads 23 and frictionally engage the bottom 84 of the weight 80.

A water-tight seal 87 of rubber-like material, has its lower end secured to shelf 81 by wire 88. The upper end of seal 87 is secured to the weight 80 by wire 89. This provides a water-tight construction between the shelf 81 and the moving parts of the machine.

Wherever reference is made to rubber-like material, it is understood that this term includes well known synthetic substances which have the appearance and resiliency of rubber and which are generally more resistant than rubber to oil and many liquids.

In the operation of the modification shown in Figs. 8 and 9, detergent, liquid and clothes are placed within the perforate cup 61, and the liquid is retained within the imperforate cup 60. The agitator 62 is agitated, by vertical reciprocations, until the clothes are washed. The agitator then is stopped, and the tub structure is rotated, causing the liquid to be discharged over the rim 90 from whence it falls to the liquid retaining shelf 81, corresponding to 16. The operation may be repeated one or more times without detergent for rinsing purposes. These operations may be controlled by a timer such as disclosed in my Patent 2,376,901.

The tub structure 60, 61 is rotated from a stationary condition, through a critical speed, to a top, substantially constant speed. As the tub structure passes through its critical speed, the vibrations, which would otherwise be violent, are damped out by the frictional action taking place between the pads 86 and the weight 80, as well as between the frictional spring structure at the bottom of power unit 63, which corresponds to members 19, 26, 28, etc., shown in Figs. 1 to 7, and which structure is not shown in Figs. 8 and 9. The tub structure thus accelerates smoothly without violent vibrations, up to its top speed.

While the form of embodiment of the invention as previously described may be used, many modifications may be made. For example, compression springs 18a or rubber washers 18b may be used, as shown in Figs. 10 and 11, in lieu of tension springs 18. If desired tension rubber supports may be used in lieu of springs 18.

While the form of embodiment of the invention as herein disclosed, constitutes a preferred form, it is to be understood that other forms might be adopted, as may come within the scope of the claims which follow.

What is claimed is as follows:

1. A washing machine comprising: a liquid retaining, non-rotatable, upwardly directed and outwardly flared tub having a central opening at the bottom; a rotatable shaft passing upwardly through said opening; a rotatable perforated basket within and closely spaced from said tub and carried by said shaft; a sealing, non-rotative ring yieldingly held and sealed to said tub around said opening; a rotatable ring loosely locked to said shaft for rotation therewith and having sealing engagement with said non-rotative ring; and a yielding ring having sealing engagement with said rotatable ring and said basket, whereby flow of liquid from said tub through said opening is restrained.

2. A washing machine comprising: a liquid retaining, non-rotatable, upwardly directed and outwardly flared tub having a central tub opening at the bottom; a rotatable sleeve passing upwardly through said opening; a rotatable perforated basket within and closely spaced from said tub and having a central upwardly directed hub secured to said sleeve and having an opening therethrough; a vertically reciprocable shaft within said rotatable sleeve passing through said last named opening; a resilient bellows sealingly connected to said shaft and hub and preventing flow of liquid from said basket to said last named opening along said shaft; and liquid seal means around said sleeve between said tub and hub having relatively moving parts and restraining flow of liquid from said tub through said first named opening.

3. A washing machine comprising: a liquid retaining, non-rotatable, upwardly directed and outwardly flared tub having a central downwardly directed bearing casing forming an opening at the bottom; a bearing in said casing; a power casing secured to said bearing casing and having power means therein; a rotatable shaft powered by said power means and extending upwardly from said power casing through said bearing; a rotatable perforated basket within said tub and carried by said shaft; liquid seal means between said tub, shaft and basket having relatively moving parts at the upper end of said bearing casing restraining flow of liquid from said tub into said bearing casing; a second liquid seal means between said bearing casing and bearing spaced from and below said first liquid seal means; said bearing casing having a drain opening to the space outside said bearing casing and power casing leading from the space between said two liquid seal means.

4. A washing machine comprising: a centrifugal structure, including a rotatable basket unit and a power unit drivingly connected together and superimposed one over the other about a vertical axis; a base; a main supporting spring structure arranged around one of said units, supported on said base and having means to support said centrifugal structure; a secondary spring struc-

ture supported on said base; a frictional means carried by said secondary spring structure and having means to engage frictionally the lower end of said centrifugal structure; a third spring structure supported on said base; and frictional means carried by said third spring structure and having means to engage frictionally the upper portion of said centrifugal structure.

5. A washing machine comprising: a cabinet having a vertical wall structure; a liquid retaining shelf sealed to said wall structure and having a central opening; a rotatable basket unit in said cabinet above said shelf; a power unit in said cabinet below said shelf; power transmitting means passing through said opening and drivingly and rigidly connecting said units together; a main supporting spring structure suspended from said shelf, arranged around said power unit, and having means to support said power unit; a secondary spring structure supported in the lower part of said cabinet; a frictional means carried by said secondary spring structure and having means to engage frictionally the lower end of said power unit; a third spring structure supported on said shelf; and frictional means carried by said third spring structure and having means to engage frictionally said basket unit.

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