

Oct. 24, 1944.

K. CLARK

2,361,266

DOMESTIC APPLIANCE

Filed Feb. 24, 1941

2 Sheets-Sheet 1

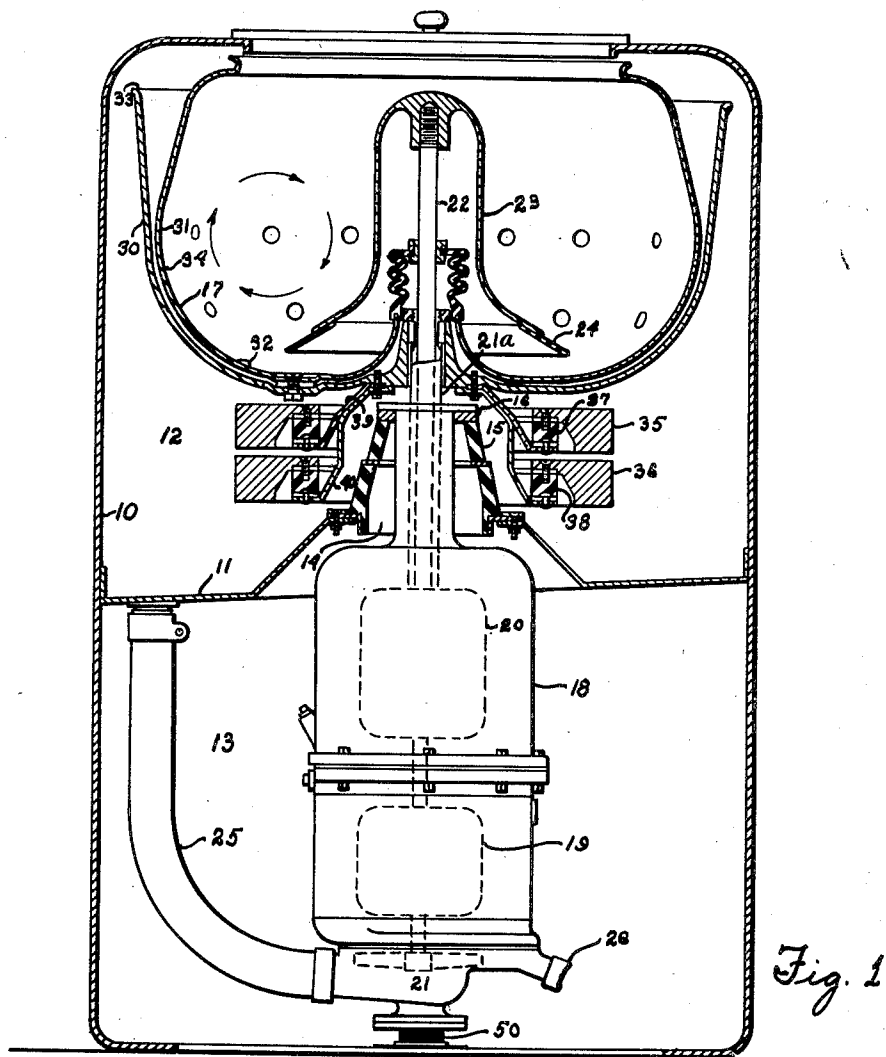


Fig. 1

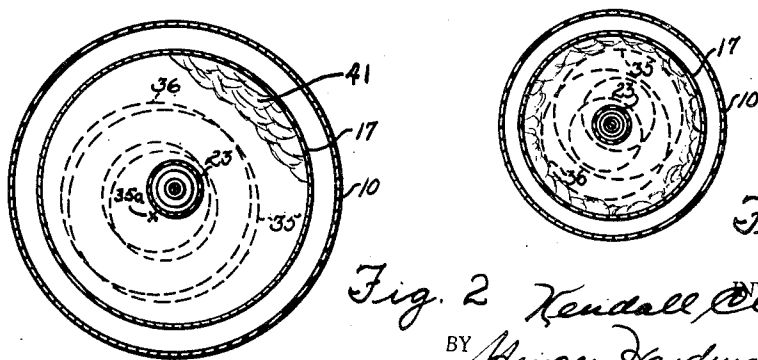


Fig. 3

Fig. 2
INVENTOR
Kendall Clark
BY Spencer Hardman & Co.

Oct. 24, 1944.

K. CLARK

2,361,266

DOMESTIC APPLIANCE

Filed Feb. 24, 1941

2 Sheets-Sheet 2

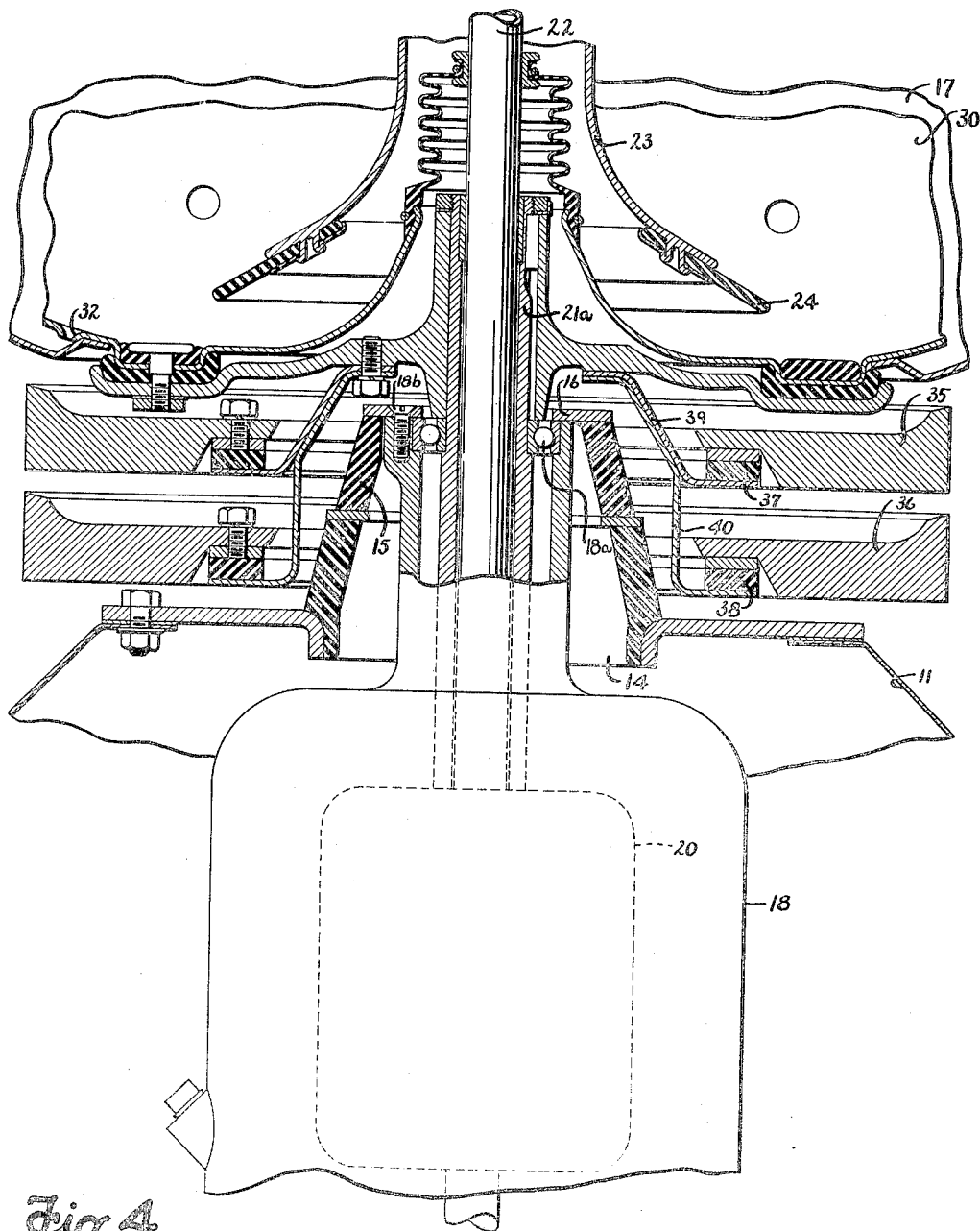


Fig. 4

INVENTOR.

Kendall Clark

BY

Spencer Hardman & Co.

UNITED STATES PATENT OFFICE

2,361,266

DOMESTIC APPLIANCE

Kendall Clark, Oakwood, Ohio, assignor to General Motors Corporation, Dayton, Ohio, a corporation of Delaware

Application February 24, 1941, Serial No. 380,255

6 Claims. (Cl. 74-573)

This invention relates to domestic appliances and more particularly to washing machines.

An object of this invention is to provide a washing machine having a centrifugal basket for wringing the clothes, which basket is counterbalanced in an improved manner against violent displacement due to unequal distribution of clothes.

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

In the drawings:

Fig. 1 is a diagrammatic representation of a washing machine embodying features of my invention;

Fig. 2 is a horizontal cross-section, on a reduced scale, indicating diametrically the counterbalancing action of the rings;

Fig. 3 is a view similar to Fig. 2; but showing the rings during rotation when there is no unbalanced load; and

Fig. 4 is an enlarged vertical cross-sectional view of the central portion of the machine.

My improved washing machine may include a relatively stationary outer cabinet or tank 10 having an upper tank space 12 with a bottom wall 11 to separate the cabinet into an upper tank 12 and a lower machinery compartment 13. The wall 11 may be provided with an opening 14. A flexible collar, made of rubber or the like 15, surrounds the opening 14 and is supported, at its lower end, by the wall 11. The upper end of the collar 15 is provided with a disc 16 upon which the rotatable basket 17 is rotatably supported through the medium of transmission casing 18 and thrust ball bearing 18a. The disc 16 also supports the power and transmission casing 18, depending therefrom, by means of screws 18b. The casing 18 contains a motor 19, a transmission 20 and a pump 21 all drivingly connected. The motor 19, through the transmission 20 drives an outer rotatable shaft 21a, which is keyed to the basket to rotate the same. The motor 19, through the transmission 20, also vertically reciprocates the reciprocable shaft 22 which is connected at its upper end to a cone-shaped agitator 23 provided with a flexible outer rim 24. The motor 19 also is connected to the pump 21. The pump 21 is of such a construction that it may be rotated in either direction to withdraw liquid through the flexible hose 25 from the tank 12 and discharge the same through a hose 26 which may be placed in any conveniently located drain.

The foregoing elements may be substantially the same as corresponding elements disclosed in my copending application S. N. 358,871, filed September 28, 1940, for Domestic appliance, to

which reference is made, if necessary, for a more detailed description of these parts.

In more detail, the motor 19 is a reversible motor, and the transmission 20 is such, that when the motor rotates in one direction, the tub 17 is rotated through the medium of shaft 21a. When the motor is rotated in the opposite direction, the agitator 23 is vertically reciprocated through the medium of shaft 22. Any transmission mechanism may be used for this purpose capable of rotating and reciprocating the shafts 21a and 22 respectively. The agitator 23 may be given a series of short quick reciprocations, which cause the flexible rim 24 to impart toroidal circulation to the liquid and clothes in the basket 17. The basket 17 comprises an outer cup 30 and an inner cup 31. The inner cup 31 is perforated in such a manner that, when the tub begins to rotate, a vortex is formed in the liquid, and water begins to discharge through the lower openings 32 into the outer cup 30 and from thence over the rim 33 of the outer cup 30. This creates a skimming action adjacent to the bottom of the vortex, and skims any scum which was floating on the liquid and discharges the same through the openings 32 before the scum has a chance to settle on the clothes, which by now have distributed themselves along the equatorial region 34 of the basket.

The clothes are substantially well distributed along this equatorial zone by the agitator action followed by the centrifugal action; but naturally some inequalities are bound to occur, and these inequalities tend to displace the basket from an even balance. I have provided counterbalancing means, somewhat different from the counterbalancing means disclosed in my said copending application.

The counterbalancing means disclosed in this application comprises two or more counterbalancing rings 35 and 36, which are resiliently mounted by rubber rings 37 and 38 upon cone-shaped supports 39 and 40 carried by the basket 17. The basket 17 and transmission casing and contents 18 have a resonant frequency of vibration on the collar 15 and when the basket 17 is rotating at a frequency numerically equal to this resonant frequency, the basket is rotating at critical speed, as is well known in this art. The rings 35 and 36 are tuned on their rubber supports 37 and 38 to this resonant frequency or, in other words, the rings 35 and 36 and supports 37 and 38 are constructed to vibrate at a frequency equal to the resonant frequency or critical speed described in the preceding sentence, and comprise a tuned vibration absorber for the washing machine. Therefore the rings 35 and 36 and supports 37 and 38 have a frequency of vibration equal to the critical speed of the basket 17. Above the resonant speed, critical speed

or frequency, the rings 35 and 36 flex their rubber supports and assume a combined position with their mutual center of gravity diametrically opposite from the unbalanced load 41 and their mutual center of gravity 35a at a correct radius to counterbalance the unbalanced load in the basket 17. The maximum displacement of these rings 35 and 36 may be limited by the cones 39 and 40. The weight of the rings 35 and 36 is so chosen that their combined moment, at this maximum displacement, substantially equals the expected maximum moment of the unbalanced load in the basket 17.

As mentioned above, the mechanism 18, and the tub or cup assembly, 30 and 31, are mounted on the rubber collar 15. During the acceleration of the tub assembly with an unbalanced load, the motion of these parts on the rubber collar acting as a spring sets up an undesirable resonant vibration when the speed of rotation reaches critical speed and is equal to the resonant or "natural" frequency of this vibrating system. As the speed increases above critical speed, the vibration decreases and eventually becomes of minor importance near the top spinning speed of the tubs. The two flywheel members 35 and 36, are mounted on the rubber springs 37 and 38 respectively, and by properly proportioning the mass of the flywheels and the size and resiliency of the springs, the flywheels can be made to perform as tuned vibration absorbers for the resonant or "natural" frequency of the main vibrating system comprising the tubs and mechanism. When acting as a tuned vibration absorbing system flywheels 35 and 36 will materially reduce the amplitude of the resonant vibrations of the main system comprising the tubs and the mechanism.

The term resonant or "natural" frequency means the frequency of vibration that would occur if the system were pulled to one side and released. The vibration absorbers 35 and 36 should have a natural frequency of vibration on their springs approximately equal to the natural frequency of the main vibrating system. The size of the weights 35 and 36 and the size of the springs 37 and 38 should be calibrated to each other so that the resulting natural frequency equals that of the main vibrating system.

Below critical speed, the resilient supports 37 and 38 tend to prevent the rings 35 and 36 from flying out an undesirable distance, and thus prevent the rings from augmenting the below critical speed unbalance, thus overcoming an objectionable feature of the well known counterbalancing loose rings.

With no unbalanced load in the basket the rings assume a position such that their mutual center of gravity coincides with the axis of spin, and thereby impart no unbalance to the machine. This position is shown in Fig. 3 where it will be seen that the rings are displaced radially and opposite from each other, so that their mutual center of gravity coincides with the axis of spin.

The lower end of the transmission casing 18 may be provided with a rubber snubber 50 connected to the bottom of the transmission casing, and frictionally riding on or being connected to the bottom of the cabinet 10 as described in my copending application. This snubber limits the amplitude of oscillations.

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, all coming within the scope of the claims.

What is claimed is as follows:

1. A centrifugal machine comprising a rotatable basket, a resonantly vibratable support for said basket permitting lateral movement thereof when an unbalanced load is in said basket, said basket having a frequency of vibration on said support numerically equal to the critical speed of rotation of said basket, power means connected to said basket to accelerate said basket through said critical speed of rotation and thereafter to maintain said basket at a speed of rotation above said critical speed, means for counterbalancing variable unbalanced loads in said basket thereby substantially to prevent lateral movement of said basket due to an unbalanced load, said counterbalancing means comprising a plurality of weights and resilient means connecting said weights to said basket for permitting lateral movement of said weights and for rotating said weights at the same speed as said basket.
2. A centrifugal machine comprising a rotatable basket, a resonantly vibratable support for said basket permitting lateral movement thereof when an unbalanced load is in said basket, said basket having a frequency of vibration on said support numerically equal to the critical speed of rotation of said basket, power means connected to said basket to accelerate said basket through said critical speed of rotation and thereafter to maintain said basket at a speed of rotation above said critical speed, means for counterbalancing variable unbalanced loads in said basket thereby substantially to prevent lateral movement of said basket due to an unbalanced load, said counterbalancing means comprising a plurality of weights, resilient means connecting said weights to said basket, said weights and their resilient connecting means having a frequency of vibration substantially equal to the R. P. M. of said basket at said critical speed of rotation.
3. A centrifugal machine comprising a rotatable basket, a resonantly vibratable support for said basket permitting lateral movement thereof when an unbalanced load is in said basket, said basket having a frequency of vibration on said support numerically equal to the critical speed of rotation of said basket, power means connected to said basket to accelerate said basket through said critical speed of rotation and thereafter to maintain said basket at a speed of rotation above said critical speed, means for counterbalancing variable unbalanced loads in said basket thereby substantially to prevent lateral movement of said basket due to an unbalanced load, said counterbalancing means comprising a plurality of weights, a resilient means connecting said weights to said basket and rotating said weights at the same speed as said basket, said weights and their resilient connecting means having a frequency of vibration substantially equal to the R. P. M. of said basket at said critical speed of rotation.
4. A centrifugal machine comprising a rotatable basket, a resonantly vibratable support for said basket permitting lateral movement thereof when an unbalanced load is in said basket, said basket having a frequency of vibration on said support numerically equal to the critical speed of rotation of said basket, power means connected to said basket to accelerate said basket through said critical speed of rotation and there-

after to maintain said basket at a speed of rotation above said critical speed, a plurality of counterbalancing weight means symmetrically arranged with respect to the axis rotation of said basket, resilient means connecting said weight means with said basket, said weight means and said resilient connecting means together having a frequency of vibration substantially equal to the R. P. M. of said basket at said critical speed of rotation.

5. A centrifugal machine comprising a primary mass including a basket having a shaft, said primary mass being rotatable about an axis extending longitudinally through the said shaft, said basket having a frequency of vibration on said support numerically equal to the critical speed of rotation of said basket, a support for said basket permitting lateral movement thereof when an unbalanced load is in said basket, said primary mass having a frequency of vibration on said support numerically equal to the critical speed of rotation of said mass, means for accelerating said primary mass through said critical speed of rotation and for thereafter maintaining its speed at a speed of rotation above said critical speed, means for counterbalancing variable unbalanced loads in said basket thereby substantially to prevent lateral movement of said basket due to an unbalanced load, said counterbalancing means comprising a plurality of weights, a resilient means connecting said weights to said primary mass and urging said weights towards the axis of the aforesaid shaft, said resilient connecting means causing said weights to rotate at substantially the same speed as the primary mass, said weights and their resilient means together having a frequency of vibration substantially equal to the R. P. M. of the primary mass at the aforesaid critical speed of rotation, said weights having their center of gravity coincidental with the aforesaid

axis when said primary mass is at rest, and, when said primary mass is rotating at said critical speed, having their center of gravity located on the side of the aforesaid axis opposite to the side of said axis on which is located the center of gravity of the unbalanced load in the basket.

6. A centrifugal machine comprising a primary mass including a basket having a shaft, said primary mass being rotatable about an axis extending longitudinally through the said shaft, said basket having a frequency of vibration on said support numerically equal to the critical speed of rotation of said basket, a support for said basket permitting lateral movement thereof when an unbalanced load is in said basket, said primary mass having a frequency of vibration on said support numerically equal to the critical speed of rotation of said mass, means for accelerating said primary mass through said critical speed of rotation and for thereafter maintaining its speed at a speed of rotation above said critical speed, means for counterbalancing variable unbalanced loads in said basket thereby substantially to prevent lateral movement of said basket due to an unbalanced load, said counterbalancing means comprising a plurality of rings, resilient means connecting said rings to said primary mass and urging said rings towards the axis of the aforesaid shaft, said rings and their resilient means together having a frequency of vibration substantially equal to the R. P. M. of the primary mass at the aforesaid critical speed of rotation, said rings having their center of gravity coincidental with the aforesaid axis when said primary mass is at rest, and, when said primary mass is rotating at said critical speed, having their center of gravity located on the side of the aforesaid axis opposite to the side of said axis on which is located the center of gravity of the unbalanced load in the basket.

KENDALL CLARK.