April 21, 1959 E. M. LARGEN 2,882,746

AUTOMATIC BALANCING DEVICE

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Fig. 1

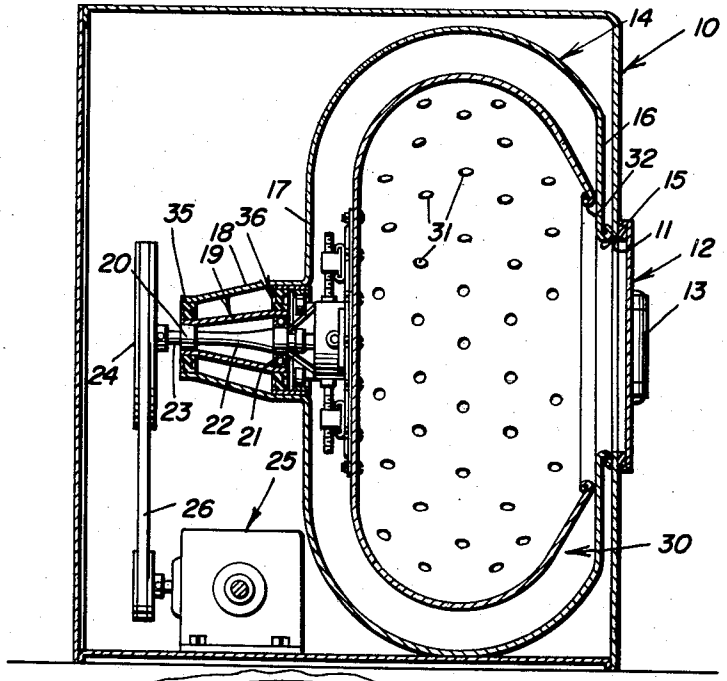
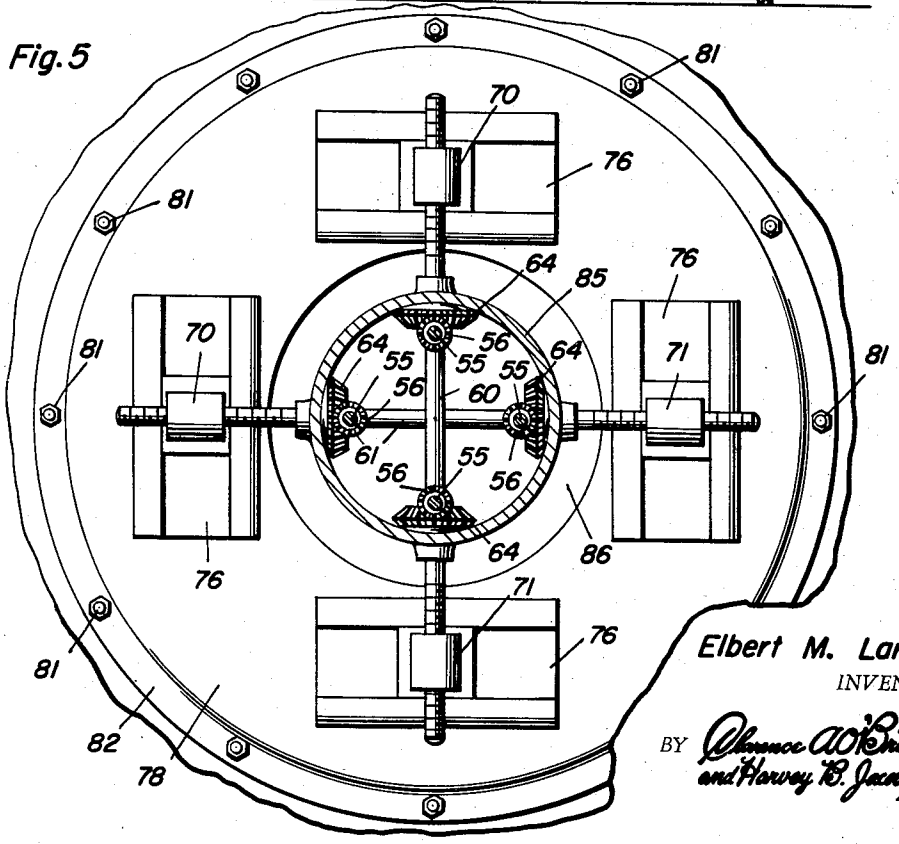


Fig. 5



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2 Sheets-Sheet 2

Fig.2

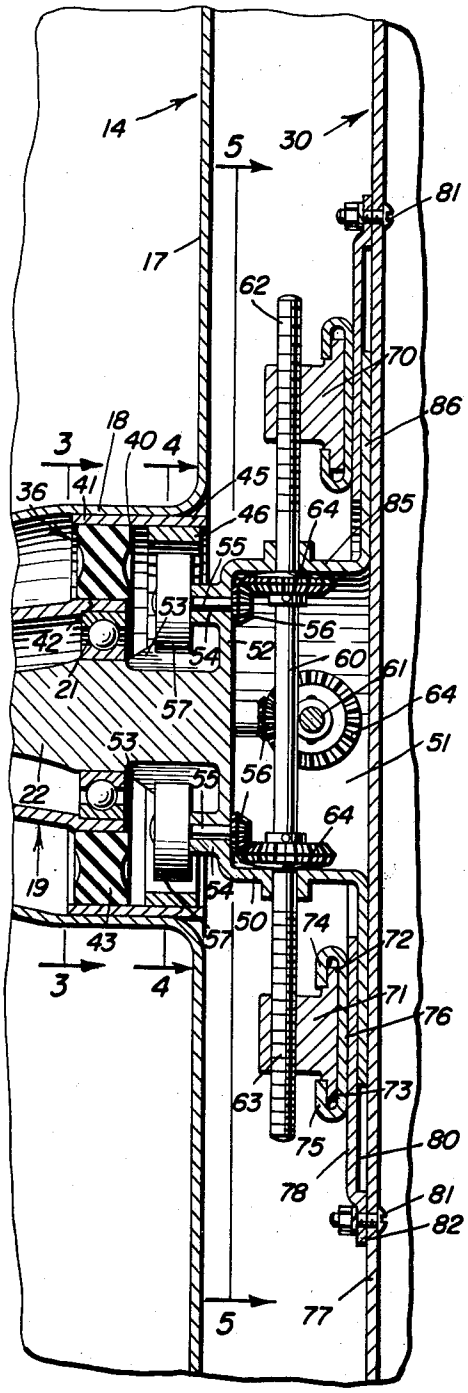


Fig.3

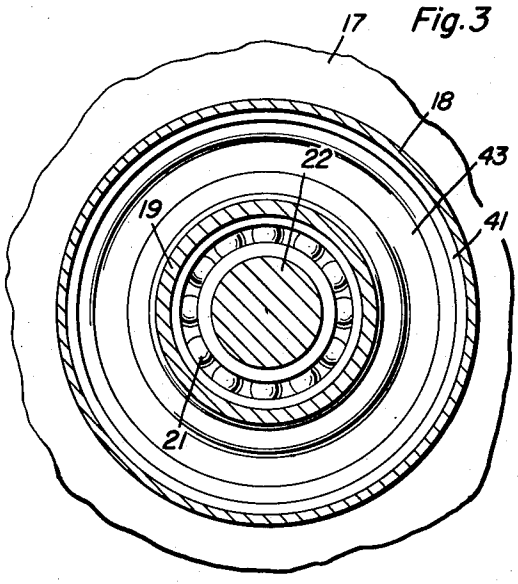
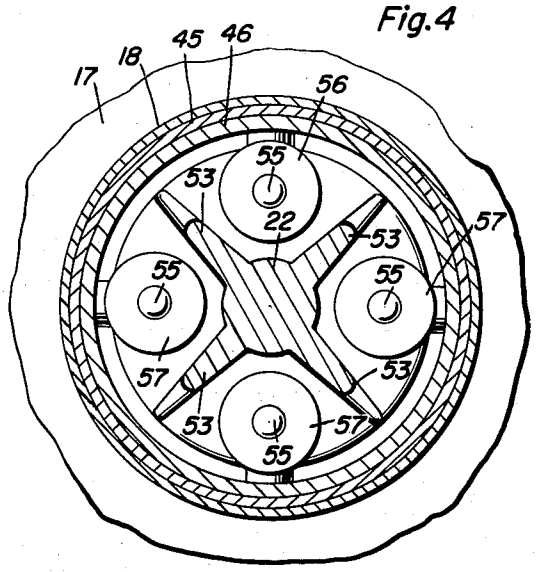


Fig.4



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AUTOMATIC BALANCING DEVICE

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3 Claims. (Cl. 74—573)

This invention relates to washing machines in general and pertains more particularly to improvements in washing machines of the type having a clothes receiving receptacle rotated at high speeds during at least a portion of the cycle of the machine, the improvement concerning mechanism for counteracting unbalanced loads within the receptacle.

Many types of modern washers utilize a shaft driven receptacle which, usually during the extracting portion of the washing cycle, is rotated at relatively high speed. This high speed rotation is preceded by a slower speed rotation or oscillation during which time the clothes within the receptacle are agitated or tumbled about so as to thoroughly and effectively wash the same. During this time, the clothes will tend to become bunched or otherwise unevenly distributed within the receptacle and, as a result, the load within the receptacle is unbalanced so that the subsequent high speed rotation produces considerable vibration which may be injurious to the machine, not to mention the annoyance thereof. Attempts have been made to overcome this objectionable feature by providing various type of automatic balancing devices but, for the most part, these devices have entailed considerable complexity with attendant high cost of manufacturing and lack of reliability in service. As is usual under similar conditions, a device of this type, in order to be acceptable, must first of all be effective and it must be reliable in service as well as sufficiently simple and rugged in design as to represent only a minimal cost increase over similar products not using such a device. It is therefore a primary object of this invention to provide an improved automatic balancing device for washing machines which achieves all of the above noted desirable features.

Another object of this invention is to provide improvements in automatic balancing devices for washing machines in which the usual casing which forms the washing chamber is provided with a hollow spindle housing and resiliently mounting the drive shaft connected to the clothes receptacle disposed within the casing so that the drive shaft is movable radially thereof with respect to the spindle and wherein means is associated with the drive shaft and receptacle to shift the receptacle radially thereof to counteract unbalanced loads within the receptacle.

Another object of this invention is to provide improvements in automatic balancing device for washing machines incorporating a housing having a hollow spindle extending therefrom and being provided therewithin with resilient means mounting a drive shaft axially through the spindle and which drive shaft is provided at its inner end with a radial flange sandwiched between cooperative portions of an associated clothes receptacle and permitting radial movement in any direction of the receptacle with respect to the drive shaft so as to counteract unbalanced loads disposed within the receptacle and wherein the spindle also serves to cooperate with the drive shaft, in clutching relationship thereto to effect the

radial shifting of the receptacle as required and automatically so as to counteract the unbalanced loads within the recepacle.

Still another object of this invention is to provide improvements in automatic balancing devices for washing machines including a housing of symmetrical shape and being provided with a hollow spindle extending therefrom within the central region thereof, and in combination therewith a drive shaft and sleeve assembly, which sleeve assembly rotatably mounts the drive shaft therewithin for projection coaxially through the spindle, and there being interposed from between the sleeve and the inner surface of the spindle, resilient mounting means whereby the sleeve together with the shaft are permitted of radial movement with respect to the spindle, the drive shaft having rigid with the inner end thereof a hollow hub and terminating in a radially outwardly directed flange, of annular configuration, and which flange is slidably received within a pocket on the rear wall and outer face of an associated clothes receptacle, whereby the clothes receptacle may be moved radially with respect to the drive shaft to counteract unbalanced loads within the receptacle, and there being gear means housed within the hollow hub connection with the receptacle to effect the radial shifting of the receptacle with respect to the shaft, the gear means also being connected to rollers or other clutching devices cooperable with certain portions of the spindle assembly whereby, due to unbalanced loads in the receptacle, the clutching action takes place to operate certain of the gear mechanisms to effect the radial shifting of the receptacle with respect to the shaft.

Still another object of this invention is to provide, in an automatic balancing device for washing machines, improvements therein consisting of the particular type of mounting for the drive shaft thereof in association with a spindle mechanism on the housing of the washing machine which serves as a support for the resilient mounting means.

These together with other objects and advantages which will become subsequently apparent reside in the details of construction and operation as more fully hereinafter described and claimed, reference being had to the accompanying drawings forming a part hereof, wherein like numerals refer to like parts throughout, and in which:

Figure 1 is a vertical section taken through a washing machine constructed in accordance with this invention illustrating the relative disposition of the component parts thereof;

Figure 2 is an enlarged partial section taken through the automatic balancing device and showing the manner in which the sleeve and shaft are resiliently mounted within the spindle of the housing and the relative disposition between the gear means, the shifting means and the clutch means;

Figure 3 is a transverse vertical section taken substantially along the plane of section line 3—3 of Figure 2 and illustrating the construction of the inner resilient mount;

Figure 4 is a view similar to Figure 3 but taken substantially along the plane of section line 4—4 in Figure 2 and illustrating the disposition of the clutch assemblage; and

Figure 5 is a sectional view taken substantially along the plane of section line 5—5 in Figure 2 and illustrating the disposition of the shifting mechanism.

Referring at this time more particularly to Figure 1, the reference numeral **10** indicates the outer casing of a washing machine having an access opening **11** therein and being provided with the usual access door **12** hingedly mounted thereon as indicated by the reference character **13**. Disposed within the outer enclosure **10** is an inner

casing 14 of symmetrical shape and being provided with an opening 15 in the front wall 16 thereof in registry with the access opening 11 in the outer casing 10. The casing 14 is provided substantially centrally of its rear wall 17 with a laterally directed hollow spindle and disposed concentrically within this spindle is a sleeve indicated generally by the reference character 19 carrying a pair of ball bearings or similar bearing members 20 and 21 to journal the drive shaft 22 centrally thereof and which drive shaft includes the outer end portion 23 having a pulley 24 thereon.

A suitable drive motor indicated generally by the reference character 25 is connected, through the belt 26 to the drive pulley 24 for rotating the shaft 22.

The specific construction of the washing machine in so far as its washing cycle is concerned is of no moment in connection with this invention. However, it is necessary to understand that during the washing cycle, there is a period of high speed rotation of the shaft 22, the motor 25 being operatively controlled for this purpose and also for the purpose of establishing other types of drives or at rest periods to the shaft 22, as required by the particular cycle of operation under consideration.

A clothes receptacle indicated generally by the reference character 30 is disposed substantially concentrically within the casing 14 and is of a shape similar thereto and is provided with perforations or openings 31 throughout so as to permit water to escape therethrough and to be collected within a housing 14 for eventual drainage. The receptacle 30 is provided, like the casing or housing 14 with an access opening 32 which is in registry with the access opening 11 in the outer housing 10 so that the receptacle may be loaded or unloaded.

Interposed between the spindle 18 and the outer end of the sleeve 19 is an annular disk or doughnut of resilient material 35 which is formed of natural or synthetic rubber or the like and at the inner end of the sleeve 19 is a further resilient mounting assembly indicated generally by the reference character 36, the purposes of the two mounting assemblies 35 and 36 being to resiliently house the sleeve 19 and consequently the drive shaft 22 coaxially within the spindle 18 so as to permit relative radial movement of the drive shaft and sleeve with relationship to the spindle to accommodate for unbalanced loads disposed within the receptacle 30. As is shown most clearly in Figure 2 the mounting assembly 36 includes an annular collar or ring 40 having one end 41 thereof disposed in over-lapping spaced relationship with respect to the inner end 42 of the sleeve 19 and with there being a doughnut or disk 43 of resilient material interposed between these overlapping portions of the sleeve and ring or collar 40. Further, the collar 40 is provided with an inner end portion 45 which projects beyond the inner end of the sleeve 19 and which is provided on the inner surface thereof with a band 46 of material such as rubber or the like having a high coefficient of friction, and forming a clutch surface, as will be presently described.

The inner end of the drive shaft 22 has integrally formed therewith or otherwise rigidly secured thereto a hollow hub 50 presenting a chamber 51 therewithin and which includes the annular radial wall portion 52 joined with the immediately adjacent portions of the shaft 22 by means of suitable reinforcing webs 53 and which is provided with four equidistantly and circumferentially spaced bosses 54, as shown. Each of the bosses 54 is provided with a centrally extending bore therethrough, parellel with the axis of the drive shaft 22 and each recives an axle or shaft 55 therewithin. Secured to the inner side of each shaft 55 is a pinion or bevel gear 56, the same being disposed within the confines of the chamber 51 previously described. The opposite end of each shaft 55 has rigidly affixed thereto a roller 57 and, as will be noted most particularly from Figures 2 and 4, the diameters of the several rollers 57 are such, as compared with the location of the shafts 55, as to just slightly space the outer peripheries of these rollers from the inner surface of the clutch band 46. The purpose of this construction will be presently apparent.

Journaled within the hub 50 are a pair of right angularly disposed, crossed shafts 60 and 61, each having screw threaded portions 62 and 63 at its opposite ends and each having a pair of pinions 64 rigidly affixed to intermediate portions thereof and which pinions are meshed with respective ones of the bevel gears or pinions 56 previously described.

The opposite ends of the shafts 60 and 61 are threadedly engaged with captive nut members 70 and 71, each being provided with the oppositely disposed side flanges 72 and 73 at opposite side edges thereof and which flanges are held by the inturned edge portions 74 and 75 of channel strips 76 which are in turn rigidly affixed to the outer surface of the rear wall 77 of the clothes receptacle 30. These channel strips 76 are mounted directly upon an annular plate 78 having its outer periphery laterally offset and engaging directly against the rear face of the rear wall 77 so as to space the major remaining portion of the plate therefrom, as indicated by the spacing in Figure 2 and designated by the reference character 80. Suitable fasteners 81 are provided at circumferentially spaced points along the peripheral margin 82 of the plate 78 to secure the same to the receptacle 30.

The shafts 60 and 61 are journaled in the annular skirt portion 85 of the hub 50 and the inner end of this skirt 55 terminates in a radially outwardly directed annular flange portion 86 which flange portion is received snugly within the spacing 80 between the plate 78 and the rear wall 77 of the receptacle, but not so snugly as to inhibit or prevent relative radial movement of the receptacle with respect to the drive shaft 22. As can be most clearly seen from a study of Figure 5, the disposition of the several guide or channel strips 76 and their associated nuts 70 and 71 as well as the disposition of the shafts 60 and 61 with respect to each other is such that rotation of either of the shafts in relatively opposite directions will shift the receptacle 30 radially in that particular direction and that a compound motion of both shafts will effect a resultant radial shifting of the receptacle with respect to the axis of the drive shaft 22.

In operation, if there is an unbalanced load in the receptacle 30, the rotation of the shaft 22 will be radially offset from the center line of the spindle 18 by a corresponding amount and if this unbalanced load is of sufficient magnitude, taken in conjunction with the rotational speed of the receptacle, one or more of the rollers 57 will contact the clutch band 46 which, due to the rotation of the shaft 22, will effect relative movement of the corresponding shafts 55 with respect to the hub 50 and cause similar corresponding rotation of either or both of the shafts 60 and 61, effecting a radial shifting of the receptacle 30 such as to counteract the unbalanced load therewithin originating the rotational eccentricity of the drive shaft 22.

It will be appreciated that the construction as above described is of extremely simple nature and yet one which will be fully effective to produce the desired results. It is to be noted that the resilient mountings 35 and 36 may be easily removed and replaced and that the mounting 36 serves not only as a resilient mounting for the sleeve 19 and associated drive shaft 22 but also establishes the clutch drive connection between the stationary housing 14 and the various rollers 57 to counteract unbalance forces within the receptacle.

The foregoing is considered as illustrative only of the principles of the invention. Further, since numerous modifications and changes will readily occur to those skilled in the art, it is not desired to limit the invention to the exact construction and operation shown and described, and accordingly, all suitable modifications and

equivalents may be resorted to, falling within the scope of the invention as claimed.

What is claimed as new is as follows:

1. In a washing machine having a housing provided with a casing having a hollow spindle projecting therefrom, a shaft extending through said spindle, an elongate sleeve surrounding said shaft within said spindle carrying bearing means for said shaft, resilient mounting means secured within said spindle adjacent the opposite ends thereof embracing corresponding opposite ends of said sleeve and mounting said sleeve and shaft for freedom of movement radially of the shaft, a receptacle and means fixing the receptacle to the inner end of said shaft within said casing for rotation therewithin, a motor mounted in said housing and connected to the outer end of said shaft for rotating the same together with said receptacle, said spindle including a clutch surface rigid therewith, said means fixing the receptacle to the inner end of the shaft including a plurality of circumferentially spaced rollers normally spaced radially from said clutch surface but movable into engagement therewith in response to deflection of said resilient mounting means for said sleeve and shaft as occasioned by unbalanced loads within said receptacle, and mechanism connected to said rollers for moving said receptacle radially with respect to said shaft to counterbalance the effect of unbalanced loads in said receptacle.

2. In a washing machine, a housing provided with a casing therein defining a washing chamber, said casing having a hollow spindle projecting therefrom, a shaft journaled and resiliently mounted in said spindle for rotation within the spindle and for deflection in radial directions, a hub rigid with the inner end of said shaft and disposed within said casing, said hub including an annular wall projecting radially of said shaft, a circumferential skirt, and a radially outwardly extending flange projecting from said skirt, a receptacle disposed within said casing including a wall opposed to said hub, a plate fixed to said wall having a central opening therein with the portion thereof surrounding such opening being spaced away from said wall, said flange on the hub being slidably received between said wall and that portion of the plate spaced therefrom such that the receptacle is joined to said hub and to permit radial movement of the receptacle with respect to the hub and shaft, means on said hub and plate attaching the same together against relative rotation and operative to effect radial adjustments between said receptacle and hub, a plurality of circumferentially spaced rollers journaled in said annular wall of the hub and disposed within said spindle, an annular clutch surface within said spindle surrounding and normally spaced from said rollers, said rollers being

connected to said means for operating the same to effect radial adjustment of the receptacle with respect to said hub upon deflection of said shaft sufficient to engage one of said rollers with said clutch surface, and means for rotating said shaft.

3. In a washing machine, a casing defining a washing chamber having a rear wall and its opposite side open, a receptacle disposed within said casing having a rear wall spaced inwardly from the rear wall of the casing and having its opposite side open, the rear wall of said casing being formed with a hollow spindle centrally thereof and projecting away from said rear wall of the receptacle, an elongate sleeve resiliently mounted within said spindle for movement radially in any direction, a shaft journaled in said sleeve having one end projecting from the free end of said spindle, means connected to said one end of the shaft for rotating the same, a plate fixed to the rear wall of said receptacle opposite said spindle and having a central portion spaced from the rear wall of the receptacle and a central opening in registry with said spindle, a hub rigid with the inner end of said shaft including an annular wall extending radially outwardly from said shaft, a circumferential skirt projecting from the outer edge of said annular wall toward said receptacle, and an annular flange extending radially outwardly from the free edge of said skirt into the space between said central portion of the plate and the opposed surface of said rear wall of the receptacle and being slidably but snugly received therebetween to join said receptacle with said hub while permitting radial movement therebetween, a pair of actuating shafts journaled in said skirt of the hub, extending diametrically therethrough and crossing each other at right angles therewithin, means connecting the opposite ends of each shaft to said receptacle for adjusting the same radially of the hub upon rotation of said actuating shafts in either direction, a plurality of rollers journaled in said annular wall of the hub having shaft portions projecting therethrough and provided at their inner ends with gears, a pair of gears on each actuating shaft within said hub and meshing with a corresponding roller gear, a clutch surface in said spindle normally spaced slightly from said rollers but engageable therewith to rotate the rollers upon deflection of the first mentioned shaft within said spindle to effect a compensating radial adjustment of said receptacle.

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