Feb. 10, 1970 A. R. GRIPPO 3,494,471

BALANCING SYSTEMS FOR CENTRIFUGING MACHINES

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Fig. 1

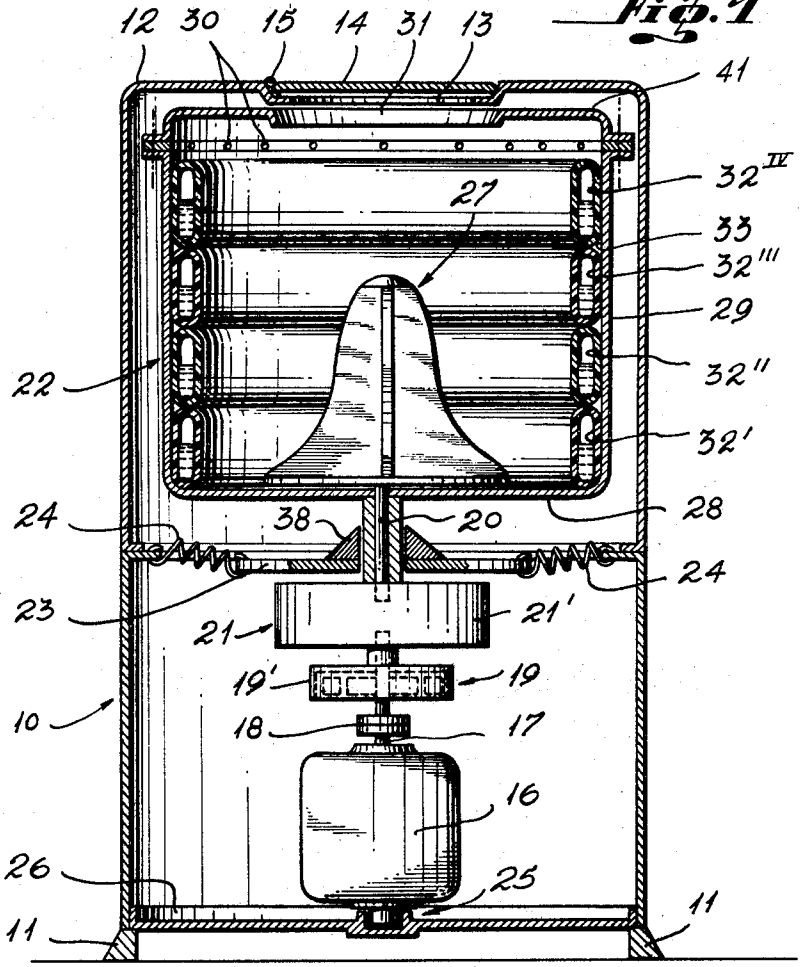
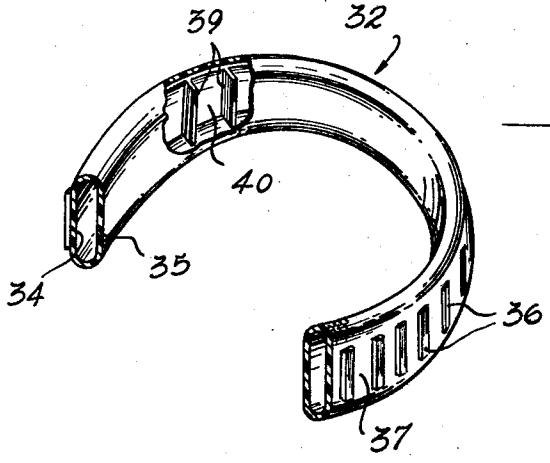


Fig. 2



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BALANCING SYSTEMS FOR CENTRIFUGING MACHINES

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ABSTRACT OF THE DISCLOSURE

A balancing ring system for rotatable receptacles, such as the rotary basket of a centrifugal clothes-drying machine, comprising a plurality of stacked flexible annular chambers against the inner wall of said basket, and a liquid partially filling these chambers, the said chambers being adapted to be deformed by clothes or the like whereby the liquid there will be circumferentially displaced to balance the distribution of weight in said basket.

CROSS REFERENCE TO RELATED APPLICATIONS

This application is a continuation-in-part of U.S. application Ser. No. 430,119 filed Feb. 3, 1965, now abandoned.

BACKGROUND OF THE INVENTION

Field of the invention

The present invention relates to a balancing ring system for rotatable receptacles such as for example a centrifugal action clothes-drying machine.

Although reference is made to clothes-drying machines, it is to be expressly understood that the present invention is also applicable to any other centrifugal action machines which require a dynamic balancing of the centrifuging component.

Description of the prior art

Centrifugal clothes-drying machines generally comprise a rotatable tub or basket driven by a mechanism which comprises an electric motor to which the basket is connected through a vertical shaft transmitting thereto the axial rotary motion for centrifuging the clothes to be treated, said basket having a plurality of perforations for discharging the water saturating the clothes during the centrifuging operation.

In machines of the aforesaid type, the vibrations imparted to the basket during the centrifuging process and particularly at the start thereof, due to an unbalanced distribution of the clothes in the basket, frequently create a series problem. This problem is present even when the clothes are properly distributed in the spinning basket, the vibrations causing jerks transmitted to the basket at the time of starting the centrifugation, with a resulting multiplication of the vibrations imparted to the driving shaft, to the extent that in most cases it has been found necessary to limit the speed of rotation to about 600 r.p.m. in order to avoid damage to the machine.

It is well known that the higher the rotary speed of the basket, the more effective and accelerated will be the clothes-drying process. This explains the need of an arrangement which will make it possible to raise the speed of rotation considerably. The improvements provided by the present invention make it possible to obtain normal operation of a machine with a 25 to 30 cm. radius basket rotating at a speed of about 1500 r.p.m. with a resulting higher degree of drying of the drying process.

Various devices and arrangements have been proposed in the past in order to solve the same or similar problems although none of the known devices have been successful in offering a simple efficient solution. Much to the contrary the known devices and arrangements for example contain movable counterbalancing components which are displaced by centrifugal forces acting thereon as a result of unbalanced loads. These known devices have many drawbacks two of which are that the unbalanced load does not act directly against the movable components in order to produce their displacement, and that these components are of rather large size and therefore the finite variations in balancing effect introduced by their change in position does not entirely agree with the infinite variations of the unbalancing force.

A further type of known device incorporates the use of thyxotropic substances housed in an annular ring surrounding the outside of a centrifuging drum. By not enabling the unbalanced load, such as a bundle of clothes, to act directly thereagainst, the compensating effect of this arrangement is indirect and accordingly subject to error; what is more these thyxotropic substances only become effective after certain speeds have been reached so that on starting, they provide no balancing effect.

Devices somewhat more smilar to those of the present invention have been provided, these devices including an annular body of for example water surrounding the centrifuging drum. This type of device more truly balances any eccentricity of the load although they do not avoid the basket from suffering an angular displacement in a vertical plane which is still a drawback sufficiently important to keep manufacturers from offering a clothes-drying machine capable of operating at the mentioned speeds and under the conditions given. This last drawback has been recognized in the art and accordingly an apparatus for achieving synchronized dynamic balance and overcoming such a drawback has been provided. This apparatus comprises flexible receivers for example for water, between a container and a casing, wherein both said container and said casing are movable. This type of device overcomes the problem of vertical angular displacement although its construction is extremely costly its assembly most difficult and what is more it does not act directly in response to the unbalanced load, inasmuch as the mentioned receivers are positioned outside the container. In other words, this type of device incorporates a balancing means external to the container or basket and which must be incorporated into the centrifugal drier during manufacture, it not being possible to incorporate this known type of balancer into a conventional machine, without carrying out a substantial modification.

A further drawback of this type of device is that soapy water becomes entrapped between the container and the casing. This soapy water decomposes quite quickly and gives off a bothersome smell and what is more does much harm to the components in contact therewith.

A still further drawback of this type of device is that the drive force exerted on the clothes basket is transmitted thereto through the mentioned balancing means and accordingly these must be made sufficiently strong to withstand such a stress, obviously this necessary strength is a feature which reduces the balancing effect inasmuch as a truer balance will obviously be obtained if a very flexible material is used. All these known devices incorporating a body of liquid around the rotary basket are provided with a rigid wall for transmitting the force exerted by the unbalanced clothes to this liquid. This feature introduces a further drawback in addition to those already mentioned for this type of device. This new drawback resides in that the liquid displacement produced for balancing the load is not located exclusively in that part where the eccentric load is active.

SUMMARY OF THE INVENTION

The object of the present invention is to provide means for automatically neutralizing any unbalance in the distribution of the clothes, or other load, within the centrifuging basket by direct action of the unbalanced clothes, or other load, on the mentioned means.

In accordance with the illustrated embodiment of the present invention there is provided a centrifugal clothes-drying machine comprising a rotary basket for containing clothes, said rotary basket defining an inner wall face, of a predetermined circumference, means for rotating said basket about a substantially vertical axis, said inner wall face being substantially parallel to said vertic1 axis, a plurality of annular flexible members axially stacked one above the other against said inner wall face and resting on each other, said flexible members having an outer circumference substantially coinciding with the circumference of said inner wall face, at least the portion of each one of said flexible members facing the middle of said basket being adapted to yield and deform under pressure directly exerted by clothes within said basket and in contact with the portion of said flexible members facing the middle of said basket, and a liquid charge at least partially filling said chambers for automatically balancing the weight in said basket and minimizing the vibration thereof during rotation of said basket.

BRIEF DESCRIPTION OF THE DRAWINGS

In order to facilitate the comprehension of the present invention, reference will now be made to various embodiments, by way of example, in relationship to the accompanying drawings, wherein:

FIG. 1 is a schematic vertical section of a conventional centrifugal clothes-drying and washing machine embodying the improvement in accordance with the present invention; and

FIG. 2 is a perspective view, partially in section, of one of the flexible members in accordance with the present invention.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

Referring in the first place to FIG. 1 there is illustrated an outer casing **10** for a conventional centrifugal clothes-drying machine which as is known in the art is generally also a clothes washing machine. The outer casing **10** rests on the floor by means of legs **11** and has defined on its upper wall portion **12** an opening **13** adapted to be closed by means of a lid **14** connected to the upper wall portion **12** by means of a hinge **15**.

Within the casing **10** there is mounted an electric motor **16** having an output shaft **17** connected to a shaft coupling **18** in turn connected to a clutch **19**. Shaft coupling **18** is connected directly and permanently to the gears of gear box **21** having an output drive shaft **20** for rotating pallets **27**. Clutch casing **19'** is rigid with gear box casing **21'** also rigid with basket **22**. In this way two modes of operations are possible; a first one with clutch **19** free and a second with clutch **19** engaged. In the first mode, electric motor **16** will drive pallets **27** independently af basket **22**, while in the second mode, basket **22** will be rotated due to its connection to clutch casing **19'**. Clutch **19** is of the electromagnetic type, so that when energized coupling **18** is drivingly connected to **19'**. In the first mode, the mechanical connection between electric motor **16** and pallets **27** is established through output shaft **17**, shaft coupling **18**, gear box **21** and drive shaft **20**, while in the second mode, motor **16** is connected to basket **22** through output shaft **17**, shaft coupling **18**, clutch casing **19'** and gear box casing **21'**. The rigid connection between gear box **21'** and basket **22** (which houses drive shaft **20**) is rotatably supported in bearing **38** mounted on a plate member **23**, secured by means of springs **24** to casing **10**. These means for

rotating basket **22** are also supported at **25** on the lower wall portion **26** of casing **10**.

Basket **22** comprises a bottom wall **28**, a lateral wall **29** and an upper bell shaped portion **41** defined by a lateral wall portion and an upper wall portion and an upper wall portion; lateral wall **29** and upper portion **41** are secured to one another for examle by nuts and bolts (not illustrated). At the level of this connection, that is to say at the upper part of the lateral wall **29**, perforations such as **30** are provided in order to enable the water contained within basket **22**, during centrifugation, to be ejected therefrom.

The upper wall portion of upper bell shaped portion **41** defines an opening **31** through which basket **22** can be loaded with clothes.

Obviously as is well known in the art, it is necessary to provide water in-feed and outlet means as well as sealing means in order to avoid that water come into contact with the electrical drive means hereinabove referred to.

It is to be understood that the foregoing description with reference to the corresponding illustration is intended to only schematically represent a conventional centrifuging clothes-drying machine, without in any way implying that the present invention can only be used with a theoretical machine such as so far referred to.

Dealing specifically now with the improvement in accordance with the present invention, there are provided within basket **22**, a plurality of hollow annular flexible members **32'**, **32''**, **32'''**, **32^{IV}**, axially stacked one above the other against the inner wall face **33** of basket **22** and resting one upon the other, this last feature plus the fact that these flexible members have an outer circumference which substantially coincides with the circumference of said inner wall face **33**, thereby providing a tight fit therebetween, enables them to remain in the position illustrated, during all phase of operation. Flexible members **32**, **32'**, **32''**, **32'''**, **32^{IV}** are preferably made of rubber although the object of the present invention is also achieved by having these flexible members comprise a rigid outer portion **34** (FIG. 2) and a flexible inner portion **35**. Obviously, the flexible portion **35** will face the middle of the basket when flexible members **32**, **32'**, **32''**, **32'''**, **32^{IV}** (FIG. 2) are positioned within basket **22**.

Although hollow flexible members **32**, **32'**, **32''**, **32'''**, **32^{IV}** have been illustrated as being of approximately oval radial section, it is to be understood that the section thereof could be rectangular, square, or any other shape which fulfills the objects to be achieved, and each flexible member defines an annular chamber.

As may be seen from FIG. 2, these flexible members are independent one from the other so that they can be easily incorporated into any conventional centrifugal clothes-drying machine of the type schematically illustrated in FIG. 1 by merely introducing the first one of these annular members **32'** and resting it against the bottom wall **28** in the position illustrated in FIG. 1.

Thereafter a second annular member **32''** is inserted through openings **13** and **31** and positioned to rest upon the already inserted annular member **32'**. This procedure is followed with the remaining annular members which are to be inserted within basket **22**. Although in FIG. 1 annular members **32'**, **32''**, **32'''** and **32^{IV}** have been illustrated as being of the same size, it is possible for them to be of slightly different sizes without this affecting the compensating effect thereof. Furthermore, and although in FIG. 1 the annular members **32'**, **32''**, **32'''** and **32^{IV}** are not spread over the entire lateral wall **29**, it is possible, and in no way a disadvantage, to have them extend entirely from bottom wall **28** to the level of perforations **30**, or over the entire upper portion **29**.

On outer portion **34** at substantially regular intervals there are adhered spacing strips **36**. Each one of these strips may be made of rubber or other suitable material. Fundamentally, the object of these strips is to define

channels **37** therebetween through which the water within basket **22** can move freely. As is known in the art, most centrifuging drums such as basket **22** are generally supported exclusively by their lower portion so that when subject to a centrifugal action the upper portion does not only rotate but suffers a circumferential displacement due to the centrifugal force acting on the free upper portion. It is for this reason that the water contained within basket **22** is carried upwards within basket **22** and ejected through perforations **30**. In order to permit this upward movement of water, channels **37** are defined.

In order to obtain the counterbalancing effect desired, the chambers defined flexible members **32** are partially filled with a liquid, for example water. Obviously, it is desirable that the water contained within flexible members **32** rotate at the same speed as the basket. Due to inertia, upon commencement of rotation of the basket, the water will lag behind for some time until friction makes the entire mass of water rotate at the same speed as the basket. If this time interval is to be reduced, it is desirable to increase the friction between the inner faces of flexible members **32** and the fluid contents thereof, to which effect strips **36** are also suitable. As the outer circumference of the flexible member **32** substantiallly coincides with the circumference of the inner wall face **33**, the existance of strips **36** will cause flexible members **32** to rest against inner wall face **33** with a slight outer radial force whereby outer portion **34** will be circumferentially undulated, such undulation defining internal protrusions within flexible members **32** and channels **37** on the outside thereof. Such protrusions serve to increase the friction between the internal faces of the flexible members **32** and the liquid contents of the flexible members.

Although strips **36** serve to increase the friction between flexible members **32** and the liquid contents thereof it is possible to include, within flexible members **32**, internal deflectors **39** provided for the same purpose (see cut away portion of FIG. 2 which represents a possible alternative).

Generally, these internal deflectors **39** are of flexible material and are secured on a strap **40**, only part of which is seen in FIG. 2. During construction of flexible members **32**, and before the annular flexible member is closed by welding both ends, strap **40** with internal deflectors **39** thereon, is inserted within flexible members **32**.

In operation any mass of clothes which may become eccentrically positioned will act against one or more of the flexible members **32**, depending on the height of the eccentric mass. From this it will already be seen that water displacement is achieved exclusively by direct action of the clothes on the flexible members and that this water displacement will only occur at those points where such as eccentric mass acts.

In this way cause and effect are diametrically opposite and act virtually in the same horizontal plane. It is important to recognize this last fact inasmuch as it is one of the beneficial features of providing a plurality of flexible members **32**. Normal house-hold clothes washing and drying machines require at least three flexible members **32** although more are generally provided in order to increase this effectiveness.

A typical height for these flexible members is approximately 2½ in., this height has been found to yield excellent results. Obviously larger or smaller members can be used without departing from the spirit of the invention as defined in the appended claims.

The beneficial effects achieved by providing a plurality of flexible members can be explained as follows:

Let us suppose to this end that only one flexible member is provided, of a height equivalent to the sum of the heights of the three flexible members **32'**, and **32''** and **32'''** illustrated.

Generally the eccentric clothes form an eccentric mass of trapezoidal cross section while the displaced mass of water will be of rectangular cross section whereby the respective centre lines of action of the centrifugal forces are not at the same height (the centre of the trapezoid is not at the same height as the centre of the rectangle). This difference in height causes the basket to be subject to an angular displacement in a vertical plane, thereby producing an eccentricity which most of the devices of the prior art do not compensate.

From the foregoing it can be seen that the inclusion, as per this invention, of a plurality of annular members **32** overcomes the foregoing problem.

It will be evident, to those skilled in the art that if the annular members **32'**, **32''**, **32'''** and **32^{IV}** are included in a conventional machine, then the drive mechanism thereof can be modified so as to drive the basket at higher speeds compatible with the better balanced basket.

It will be understood that improvements may be introduced into the embodiment described by way of example and modifications may be made in the constructions and material employed without departing from the scope of the invention.

What is claimed is:

1. A balancing ring system for the rotatable receptacle of a machine such as the rotary basket of a centrifugal clothes-drying machine, said rotatable receptacle defining an inner wall face and said machine comprising means to rotate said receptacle about a substantially vertical axis, said inner wall face being subtantially parallel to said vertical axis, the balancing ring system comprising a plurality of hollow flexible members axially stacked one above the other tightly against said inner wall face and resting on each other, each of said members defining an annular chamber, at least the portion of each one of said flexible members facing the middle of said receptacle being constructed to yield and deform under pressure directly exerted by a load within said receptacle and in contact with the portion of said flexible members facing the middle of said receptacle, and liquid partially filling said chambers for automatically balancing the load in said receptacle and minimizing the vibration thereof during rotation of said receptacle.

2. The system of claim **1**, wherein each one of said flexible members is provided with internal deflectors.

3. The system of claim **1**, wherein a plurality of circumferentially spaced apart upstanding strips are secured to the outer portion of each one of said flexible members, said upstanding strips forming, by deformations, protrusions within said flexible members, when these flexible members are in operative position in said receptacle, said protrusions being of such dimension as to cause increased friction between the internal faces of the flexible members and the liquid contents thereof.

4. The system of claim **1**, wherein a plurality of circumferentially spaced apart upstanding strips are secured to the outer portion of each one of said flexible members, said spaced strips causing at least part of the outer portions of said flexible members to be spaced apart from said inner wall surface, thereby defining channels between said strips for circulation of water therethrough when said flexible members are in operative position in said receptacle.

5. The system of claim **1**, including circumferentially spaced apart means positioned radially outwardly from the outer portion of each one of said flexible members, said means forming protrusions within said flexible members, when these flexible members are in operative position in said receptacle, said protrusions being of such dimension as to cause increased friction between the internal surfaces of the flexible members and the liquid contents thereof.

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