Oct. 25, 1966 B. PANKER 3,280,604

TUMBLER TYPE CLOTHES-WASHING MACHINE

Filed April 27, 1964 2 Sheets-Sheet 1

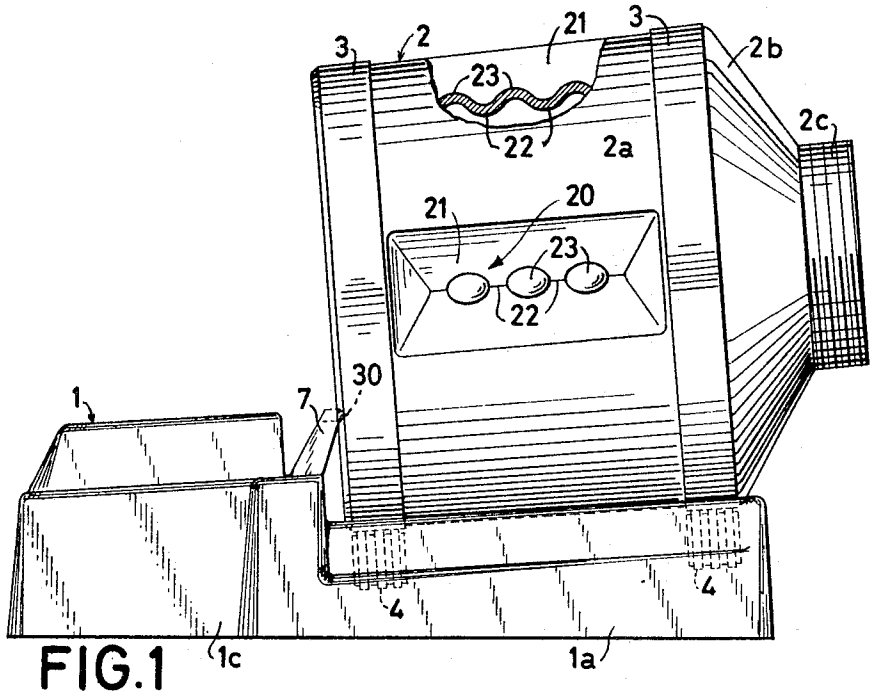

FIG.1

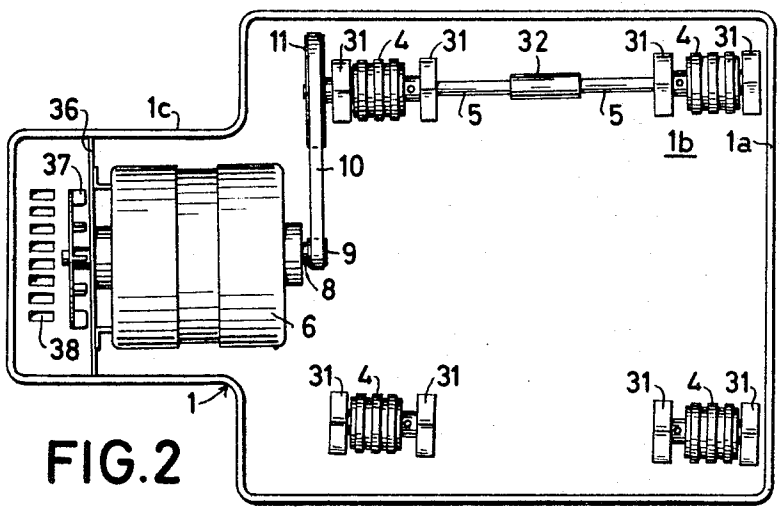

FIG.2

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TUMBLER TYPE CLOTHES-WASHING MACHINE

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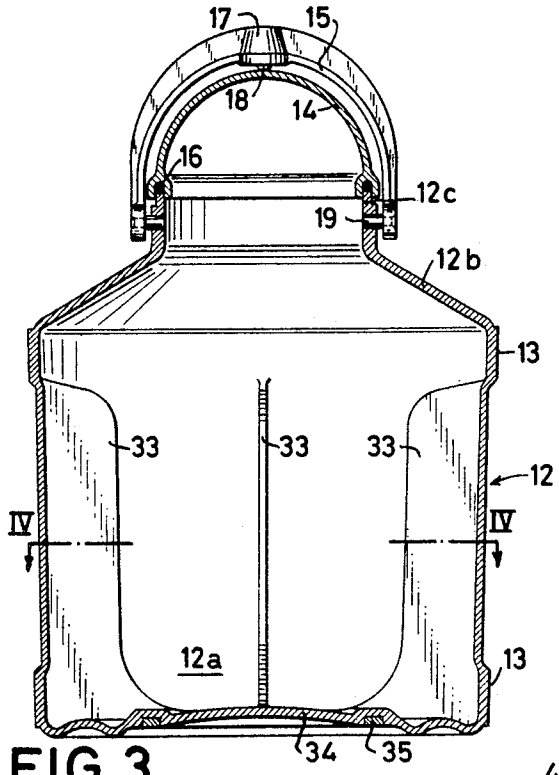

FIG. 3

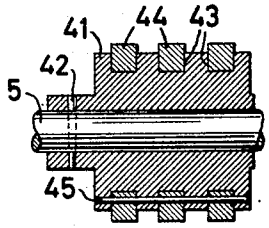

FIG. 5

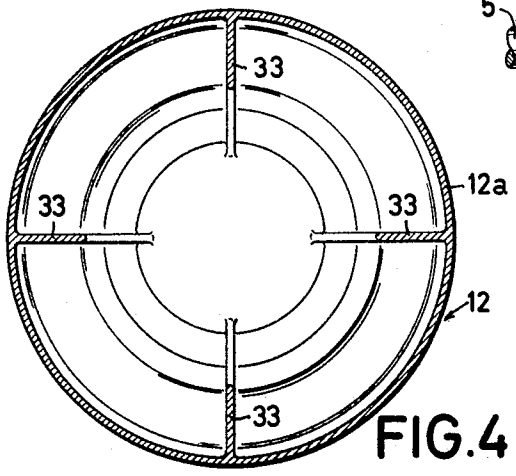

FIG. 4

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3,230,604

TUMBLER TYPE CLOTHES-WASHING MACHINE

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Claims priority, application Denmark, May 2, 1963, 2,075/63
8 Claims. (Cl. 68—146)

This invention is concerned with a motor-driven domestic machine, especially a clothes-washing machine, comprising a rotary working drum, which has a detachable cover and which is detachably mounted with a wholly or substantially horizontal axis of rotation and supported on supporting rollers journaled in a frame, of which rollers at least one is a drive roller.

This invention has amongst other things for its object to provide a machine of the said type which can be produced in a particularly simple and economical way, and which is easy to operate and economic in service. According to the invention the drum and its cover are made of heat-resistant plastic, and the body of the drum is substantially cylindrical with a diameter mainly equal to its length.

The prescribed design and dimensioning of the drum as well as the use of plastic as the material for the components mentioned above are important in that during a washing operation the drum is only subjected to a small heat loss and that, consequently, it can operate with a relatively small amount of washing lye. In the prior art drums made of metal it has been necessary to to give the drum a rather large diameter in order that it may contain an adequate amount of lye which will not be cooled too quickly during the washing process whereby the washing effect would be reduced. The great diameter of the drum implies in the prior art machines that it must have a relatively low rate of revolution and, consequently, complicated and expensive transmissions will have to be used between the motor and the drum to ensure the required low number of revolutions. In contrast thereto the machine according to the invention may require only a simple belt or chain transmission between the motor and the drive rollers of the drum whereby the price of manufacture of the machine can be kept so low that the purchase thereof will lie within the means of almost anybody.

Further advantages and characteristics of the invention will appear from the below description in which reference is made to the accompanying drawing, where

FIG. 1 is an elevation of an embodiment of a machine according to the invention and comprising a drum especially designed for clothes-washing,

FIG. 2 is an inverted plan view of the machine illustrated in FIG. 1 where the base plate, not otherwise shown, of the machine has been removed,

FIG. 3 is a longitudinal section through a washing drum of modified construction,

FIG. 4 is a section taken on line IV–IV in FIG. 3, and

FIG. 5 is a section on a larger scale of a preferred embodiment of the drive rollers of the machine.

The machine shown in FIGS. 1 and 2 consists of a frame or housing **1** and a drum **2**. The drum **2** has a cylindrical or slightly conical body portion **2***a*, a conical shoulder portion **2***b*, and an externally threaded neck **2***c*, the outer end of which is open. At the upper and lower ends of the body portion **2***a* the drum is provided with two cylindrical running surfaces **3** which in the embodiment shown have a diameter slightly greater than that of the body portion of the drum.

By means of its runing surfaces **3** the drum is supported on four supporting rollers **4**, of which two are secured

to a shaft **5** journaled in the machine frame **1** and connected with the drive motor of the machine. In the embodiment shown the two other rollers **4** are freely rotatable supporting rollers. The running surfaces **3** are preferably knurled, and the rollers **4** are made of, or consist at least on their surfaces engaging the running surfaces **3**, of a material having a suitably high friction.

The front part **1***a* of the frame or housing **1**, wherein the shaft **5** and the two supporting rollers **4** are mounted, is at the top closed by means of a transverse wall **1***b* rounded to conform with the shape of the drum **2**, in which wall there are four cut-outs, not shown, for the rollers **4** whereby the drum is supported by said rollers without contacting the frame.

The rear part **1***c* of the frame **1** is shaped as a hood which supports and covers the electric drive motor **6** of the machine, said motor being mounted on a transversally extending plate **36**, see FIG. 2, which in turn is secured to the frame. A stirrup-shaped handle **7** by means of which the frame can be lifted and conveyed, is secured to the upper side of the frame **1**. To the front end of the handle **7** there is secured a stop member **30** for the drum, the axis of which has a slight rearwardly-directed inclination so that the bottom of the drum rests against the stop member. This stop member may for example by a polished slightly curved metal plate or knob or a rotatable roller or ball so that the friction between the bottom of the drum and the stop member is small. As indicated in FIG. 3, a wearing ring **35** of, for example, nylon is embedded in the bottom of the drum for engaging stop member **30**.

The shaft **5** is driven from the motor **6** through a belt drive, a pulley **9** being secured to the motor shaft **8**, and a belt **10**, preferably a toothed belt, connects the groove of the pulley **9** with a pulley **11** on the shaft **5**.

At either side of each roller **4** the shaft **5** is journaled in a bearing **31** secured to the frame **1**, so that the shaft is safely supported and prevented from vibrating. With a view to compensate for disalignments, if any, in the four bearings for the shaft **5**, for example on account of minor deformations in the self-contained housing or frame **1** preferably made of plastic, the shaft is divided into two halves which are connected by means of a short elastic coupling **32** of for example rubber or nylon, said coupling operating as a universal joint. The two non-driving supporting rollers **4** are similarly journaled in bearings **31** secured to the frame **1**.

In the embodiment shown the drum **2** is slightly conical so that the running surface **3** closest to the neck portion has a slightly greater diameter than the running surface at the bottom of the drum. In view hereof, the shaft **5** forms a small angle with the axis of the two non-driving supporting rollers **4**. If both pairs of rollers **4** were driven by the motor **6**, the latter could be so disposed that the center line of its shaft **8** halves the angle between the two driven shafts which would reduce the wear on the two belts resulting from the disalignment between said shafts.

In its body portion **2***a*, the drum **2** is provided with longitudinally extending internal beads **20** which are integral with the drum wall. In the embodiment shown there are four beads **20**. The beads which operate as carriers for the laundry loaded into the drum, have two inwardly extending inclined side faces **21** which in a cross section at right angles to the drum axis form an angle of about 90° with one another. The internal longitudinal extending edge of the beads between the two side walls **21** are in longitudinal section of wave form with wave crests **22** and wave troughs **23**. During rotation of the drum the troughs **23** operate as channels which ensure circulation of washing lye about the outer side of

the laundry engaging the drum wall and bead edge. Instead of the relatively great and few beads, shown, the drum could also be provided with a plurality of small ribs or fins of correspondingly smaller depth.

The drum **12** shown in FIGS. 3 and 4 is mainly designed as the drum **2** shown in FIG. 1, i.e. with a slightly conical body portion **12***a*, a shoulder portion **12***b* and a cylindrical neck portion **12***c* and two running surfaces **13**, by means of which the drum can be supported on and driven by rollers corresponding to the rollers **4** shown in FIGS. 1 and 2. Whilst the drum **2** shown in FIG. 1 is intended—during operation—to be closed by means of a screwed-on cover, not shown, the drum **12** is closed by a hemispherical cover **14** which by means of a handle or clamp **15** swingably connected with the drum is pressed against the edge of the drum opening in the neck portion **12***c*. An elastic packing **16**, for example a rubber ring, is provided between the edge of the drum opening and a recess in the edge of the cover.

A widened portion **17** at the middle of the clamp **15** is hollow and contains a spring-loaded thrust pad **18** which protrudes from the widened portion **17** so that the spring keeps the pad pressed against the center of the cover **14** with a suitable constant force. In so doing, the cover is pressed against the mouth of the drum neck. The widened portion **17** may be shaped as a handle.

The clamp **15** swings on two pins **19** rotatable in the neck portion **12***c* and secured to the clamp. The pins **19** may be protected against unintentional withdrawal from the drum neck, for example by means of a transverse pin or the like which engages a circumferential groove in the pin **19**. As the center of the hemispherical cover **14** is disposed substantially in the plane of the drum opening, the clamp **15** will, on being swung aside away from the position shown in FIG. 3, withdraw from the surface of the cover whereby the spring pressure exerted on the thrust pad **18** decreases. Thus, in its swung-out position the thrust pad can go quite clear of any bead on the edge of the cover, as shown in FIG. 3, and in its swung-up locking position it can extend closely to the cover.

The drum **12** is provided with four internal beads or ribs **33** which extend radially from the drum wall in the body portion **12***a* thereof towards the axis of the drum. In the longitudinal direction the beads extend in the embodiment shown from the upper end of the body portion **12***a* near the running surface **13** down to the bottom **34** of the drum and through a rounded portion merge evenly into the bottom. Like the beads **20** shown in FIG. 1, the beads **33** operate as carriers for laundry loaded into the drum. The embodiment of the beads shown in FIGS. 3 and 4 is particularly expedient when the drum is produced by injection molding and in two parts, namely the bottom portion and the neck portion with the shoulder portion, respectively. The number and the shape of the beads may differ from those shown, and similar beads may also be provided on the shoulder portion of the drum.

The drum and the cover are preferably made of plastic which is heat-resistant, i.e. stands temperatures of 100° C. or above. Such materials are for example polypropylene or ABS (an acrylonitrile-butadiene-styrene copolymer). The drum may be produced in any suitable manner, for example by injection molding or by blowing, if desired. The cover and/or the drum, or at least part thereof, may expediently be made of a transparent material so as to afford the possibility of watching the washing process from the outside. The drum may, as stated above, be made of two parts, namely a body portion and a neck portion with the associated shoulder portion, respectively. If so, particularly attractive effects may be obtained in that the two portions and, if desired, also the cover may be of different colors, or one portion may be transparent, so that the progress of the washing process may be observed from the outside, and another portion may be opaque. The two portions of the drum may be interconnected in a known manner, for example by friction welding or by the so called fusion welding, wherein the two portions are pressed against each other, and the materials in the joint are locally dissolved by means of a suitable solvent so that the two materials can fuse together.

In another embodiment, not shown, of the machine according to the invention, the body portion of the drum may be smooth, and a web or shell of perforated plate, for example metal plate, may be secured slightly spaced from the inner side of the drum wall, whereby a liquid space is provided between the shell and the drum wall. On this shell provision may be made for internal beads or ribs which, if the machine is designed as a washing machine, operate as carriers for the wash. In other uses of the machine, the internal shell may be designed in an analogous manner according to the purpose of application. For example in the case of a potato peeling machine it may be provided with knife members.

FIG. 5 shows a preferred embodiment of the supporting and driving rollers **4** purely diagrammatically shown in FIGS. 1 and 2. The roller shown in FIG. 5 which is secured to a shaft **5**, consists of a body **41** which for example may be produced by injection molding of a suitable plastic. The body **41** is secured to the shaft **5** by means of a cotter pin **42**. In its cylindrical surface the roller body **41** is provided with three circumferential grooves **43** interspaced along the length of the roller. A wearing ring **44** of polyurethane is secured in each of the grooves with the cylindrical surface of the ring projecting from the surface of the roller body **41** so that the surfaces of the three rings **44** constitute the wearing face of the roller in contact with the corresponding running surface on the drum of the machine. One or more, for example three, pins **45** have been driven axially through the roller body **41** and the wearing rings **44** so as to retain the rings in their grooves **43**.

The rings **44** of polyurethane have proved to have extremely good wear-resistance in conjunction with the knurled running surfaces of the drum, and it is consequently possible to give the rings a comparatively small diameter and thereby ensure a good gearing ratio between the shaft **5** and the drum. When mounting the rings **44** in the groove **43**, it is advantageous to use a conical mounting mandrel, the greatest diameter of which corresponds to the outer diameter of the roller body **41**, and which during the mounting operation is placed coaxially with said body, for example located by the projecting hub thereof, and the elastic rings **44** are then successively slid over the mandrel and on to the roller **41** until they slip down into the grooves **43**.

Besides the advantages attached to the described design of the drive rollers, the spaces between the wearing rings **44** can ensure a ventilation of the bearings **31** for the rollers in that a fan **37**, see FIG. 2, secured to the motor shaft **8** sucks in air through the spaces, past the bearings **31**, and out through a number of ventilation openings **38** in the rear wall of the frame or housing **1**.

The invention is not limited to the embodiments here shown and described which may be varied in a multitude of ways within the scope of the invention. It is also possible to apply the invention to machines for purposes other than clothes-washing, for example, as mentioned, for peeling potatoes and other fruits, for churning butter, or for mixing different solid and liquid substances. In the embodiment shown, the drum is supported on supporting rollers, of which only some are driven rollers, but if required it would be possible, as mentioned above to let all these rollers be driven rollers. It would also be possible to support the drum on only two supporting rollers in combination with a journal bearing at the center of its bottom. This journal bearing might be in the shape of a drive member so that the drum can be driven therethrough.

The machine according to the invention, here described and shown in the drawing, is particularly suitable for doing small loads, i.e., that it preferably has a capacity of 1–1.5 kg. of dry clothes. The structure of the machine renders a particularly simplified and economical manufacture possible. It differs from the conventional drum washing machines in that it does not consist of a container with lye and a perforated drum rotatable therein for the reception of the laundry but only a closed drum which contains both the laundry and the lye. Previously such machines have been suggested comprising a single drum, but in these machines the drum is made of metal. The drum and the drive motor including the transmission have in some cases been built together to form an integral structure, whilst in other prior art machines the driving unit is very complicated because the number of revolutions of the drum is relatively small which involves different disadvantages which have been overcome through this invention.

Thus the machines for use particularly in washing small loads comprised no arrangements for heating the lye during the washing operation proper, and the machines made of metal will therefore quickly be cooled so that the washing property of the lye will be deteriorated. The prior art machines wherein the washing drum and the drive unit are built together to form an entity are moreover not handy and practical to operate and store.

In the machine according to the invention, the drum is a separate machine part without fixed connection with the drive unit of the machine, and the drum, if desired, can be stored separately in a vertical position. The provision for a handle at one end of the drum makes it possible to convey the drum in an especially easy manner, also when it is wholly or substantially full. It is easy to lift the drum from the frame or base portion in that one hand can readily get hold of the slightly inwardly curved bottom of the drum, whilst the other hand may lift the drum, for example by means of the above mentioned handle. As the handle, as shown in FIG. 3, is disposed almost directly along the outer side of the cover, when the drum is closed, the risk of accidents by a finger or a part of the garment, for example a sleeve, being jammed between the cover and the handle is avoided. The hemispherical shape of the cover effectively counteracts the possibility of the laundry loaded into the drum getting into contact with the innerside of the cover which, if so, would be scratched by for example buttons, safety pins, etc., in the clothes. The slightly rearwardly inclined position of the drum also contributes thereto.

The use of plastic as a material for the drum remedies the above mentioned drawbacks arising from the quickly decreasing temperature of the lye in the prior art machines comprising a metal drum. The plastic is possessed of considerable heat-insulating properties and consequently affords the possibility of attaining satisfactory washing results without using a built-in heating arrangement in the machine, and this feature makes it possible to manufacture the machine at very low costs. The size and dimensioning conditions of the drum and the design thereof with an opening at one end bottom makes it especially expedient to produce the drum of plastic.

It has proved that a drum according to the invention having a capacity of about 15 liters and having a load of about 5 liters of hot washing lye with a temperature of 80° C. will in the course of about 20 minutes only dissipate so much heat that the temperature of the lye decreases to about 70° C. In prior art machines comprising a metal drum it has been necessary, for the purpose of avoiding too great a temperature drop during the washing operation, to use a relatively large amount of washing lye and, in consequence thereof to give the drum such a large diameter that its number of revolutions—when out of regard to the washing effect the centrifugal force must not be too great—must be so small that mechanical gears of complicated construction are required, also because heretofore it has been necessary to give the drive rollers a rather large diameter lest they should be worn too quickly.

In a machine according to the invention, a drum having a diameter of about 300 mm. is applicable, and it is, therefore, possible to use such large number of revolutions for the drum that a simple belt or chain drive may be used as power transmission between the motor and the drive rollers. When using rollers having wearing faces of polyurethane, which has proved to have particularly great wear-resistance when cooperating with embossed grooves in the surface of the drum, it will become possible to make the rollers with a small diameter so that even with the small drum diameter, a large gearing ratio between the rollers and the drum is attained.

The safety arrangement for the cover of the drum affords the possibility of the drum being brought into rotation in an expedient manner. As a drive member for the drum it would also be possible to use a single roller which is so disposed as to engage the bottom of the drum and rotate the same by friction under the influence of the weight of the drum and the load thereof, and at the same time the roller will operate as an end stop for the displacement of the drum in the axial direction.

What I claim is:

1. A single-drum clothes washing machine, comprising a frame, a driving motor mounted on said frame and including a drive shaft, a plurality of supporting rollers rotatably supported in said frame with substantially horizontal axes, speed reduction gears means mounted on said frame and connecting said drive shaft with at least one of said supporting rollers, an imperforate washing drum detachably supported by said supporting rollers, said washing drum comprising a substantially cylindrical body portion the diameter and length of which are substantially equal, said body portion being closed at one end, a neck portion integrally connected to said body portion opposite the closed end thereof and having an axially facing opening at its end opposite said body portion, a cover for said opening and means secured to said neck portion for detachably clamping said cover against the end of said neck portion to close the opening therein, said body and neck portions and said cover being made of heat-resistant plastic material.

2. A washing machine as claimed in claim **1** in which said supporting rollers comprise wear elements for engaging the outer lateral wall of said drum body portion, said wear elements being made of polyurethane.

3. A washing machine as claimed in claim **2** wherein said rollers comprise a body journaled in said frame and provided with plurality of circumferential annular grooves, and said wear elements are shaped as separate rings of polyurethane held within said grooves and projecting from the circumference of said roller body.

4. A washing machine as claimed in claim **1** wherein said frame is made of plastic material, and at least two of said supporting rollers are secured to substantially coaxial shafts interconnected by flexible coupling means, one of said shafts being connected to said speed reduction gear means at the shaft end remote from said coupling means.

5. A washing machine as claimed in claim **4** wherein said coupling means consists of a bushing of elastic material secured with a tight fit to a free end of each interconnected shaft.

6. A washing machine as claimed in claim **1** wherein the axes of said supporting rollers are slightly inclined, and stop means for engaging the closed end of said drum body portion is provided on said frame.

7. A washing machine as claimed in claim **6** wherein said frame comprises a front portion including bearing means for said supporting rollers and a transverse upper wall having apertures therein for said rollers, and a rear portion contiguous with said front portion and projecting above said portion in the form of a hood, means for

supporting said drive motor below said hood, said stop means for the drum body portion being provided on the outer side of said hood.

8. A washing machine as claimed in claim 1 in which said drum body portion is slightly tapered, and said supporting rollers are arranged in pairs each having a common axis of rotation, said axes of rotation including a small angle between them.

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