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Rotter

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[54] **CONTINUOUS WASHING MACHINE**

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[30] **Foreign Application Priority Data**

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[52] **U.S. Cl.** **68/58,** 68/140, 68/142, 68/210

[51] **Int. Cl.** **D06f 21/04,** D06f 37/04

[58] **Field of Search** 68/58, 210, 139, 140, 68/142–145; 34/43, 52, 56, 109, 121, 129; 259/89, 90, 3

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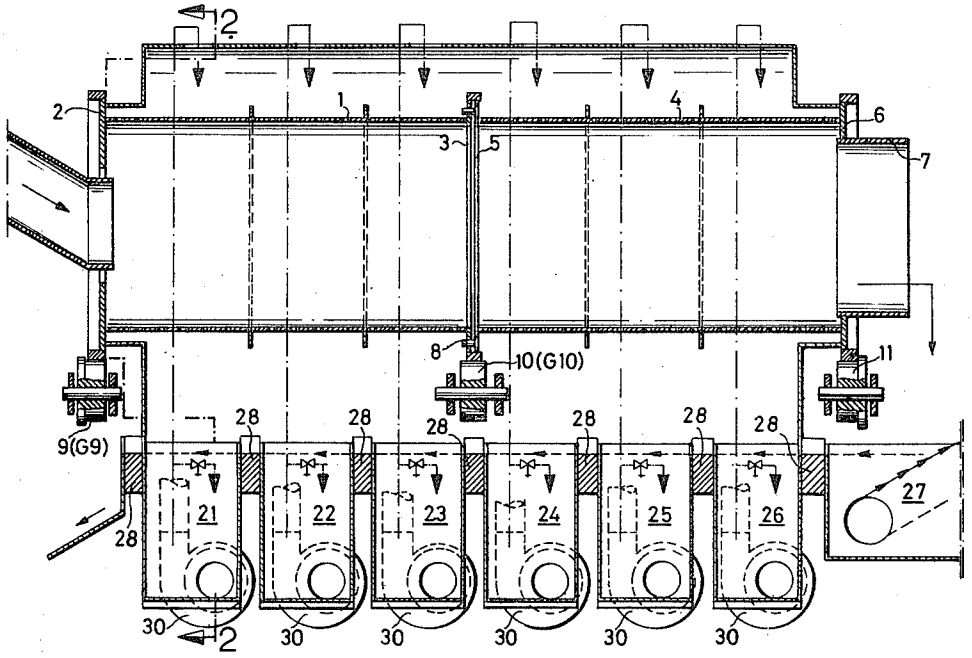
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[57] **ABSTRACT**

A continuous washing machine having a tubular, articulated washing drum, open at both ends and adjustably located above a row of serially arranged tanks, each having a pump for circulating liquid at adjustable rates independent of the rotary motion of the drum, and means for adjusting the inclination of each section of the articulated drum in response to a measured pressure exerted on a drum support and compared to a prespecified reference value.

8 Claims, 4 Drawing Figures



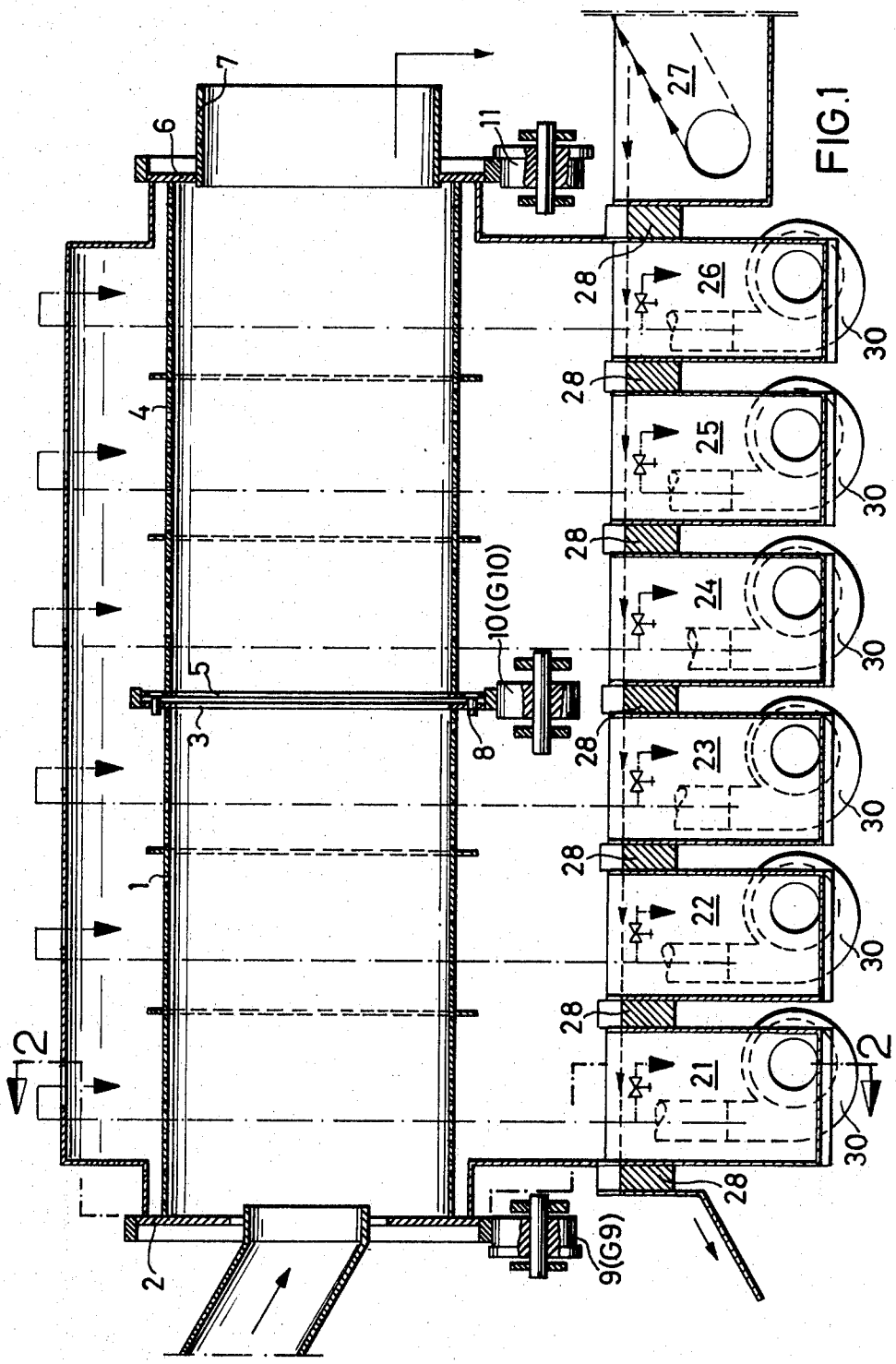


FIG.1

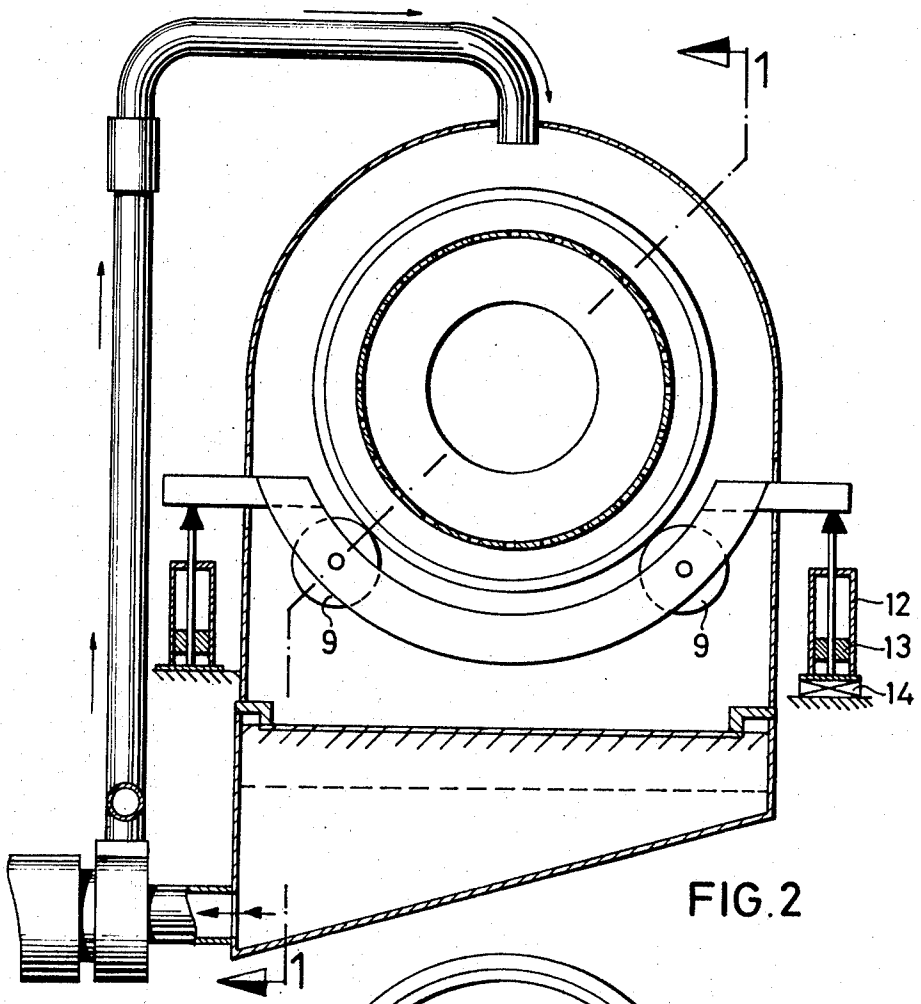


FIG.2

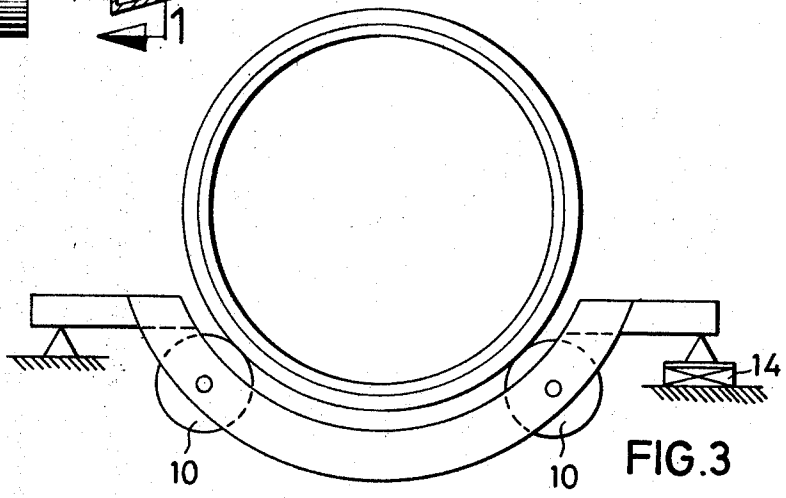
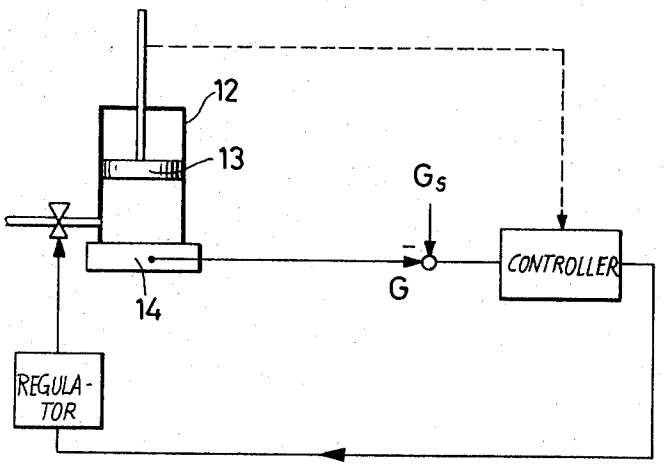


FIG.3

FIG. 4



CONTINUOUS WASHING MACHINE

BACKGROUND OF THE INVENTION

1. Field of Invention

The invention relates to continuous washing machines with a tubular washing drum open on both ends and located above a row of serially arranged communicating tanks, particularly large-size machines for use in industrial or institutional laundries.

2. Description of Prior Art

In presently known washing machines of this structure, the washing drum is provided with scooping devices which rotate along with the washing drum for circulating the liquid from a tank to the washing drum and therefrom back to the tank. In this embodiment, it is very difficult to prevent the floatable dirt particles and flotsam released in the washing processes, notwithstanding their floatibility, from being again and again reconveyed to the laundry. In this process, the necessary continuous adjustability of the laundry transit time and of the ratio between the liquid rate of flow and the laundry rate of travel is difficult to achieve and complicated.

SUMMARY OF THE INVENTION

In this apparatus, the laundry is introduced through one end of the washing drum, passes through the rotating washing drum, and then leaves the washing drum through the other end. On its way through the washing drum, the laundry is subjected to the action of a washing and rinsing liquid which varies continuously in consistency and temperature. This takes place preferably in a counter-current process, so that the laundry entering the washing drum is first processed by the most intensely utilized washing liquid and then passes, on its further path through the washing drum, through action zones with increasingly fresher washing liquid. In the zone where it is discharged from the washing drum, the laundry is rinsed with fresh liquid which has entered in opposite direction.

The aim of the present invention consists in arranging the cycles of liquid flow from a tank to the washing drum and therefrom back to the tank in such a way that the dirt particles and flotsam released in the washing and rinsing processes are not continually reconveyed again and again to the laundry, furthermore to make the transit time during which the laundry passes through the washing drum, and also the ratio between the liquid rate of flow and the laundry rate of travel adjustable at will.

According to the invention, the tubular washing drum is located above the level of the washing liquid. Liquid circulating independent of the rotary motion of the washing drum, combines with the tanks to effect a series of liquid cycles. The tubular washing drum consists preferably of at least two component drums flexibly connected by couplings, the ends of the first and of the last component drum and all coupling places rest on support roller pairs whose mutual level is adjustable. Furthermore, means is provided for measuring the pressures exerted by the drum on the support rollers, and comparators which compare these measuring values with prespecified reference values and, depending on this comparison, initiate the positioning of the support roller pairs. Finally, means are provided for adjusting the amounts of liquid flow in the individual liquid cycles.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is an axial section along line 1—1 of FIG. 2 of an embodiment of the continuous washing machine of the invention:

FIG. 2 is a section along line 2—2 of FIG. 1;

FIG. 3 is a presentation in detail of the washing drum support.

FIG. 4 is a schematic representation of the pressure measuring, comparing and adjusting means.

DESCRIPTION OF THE PREFERRED EMBODIMENT

In FIGS. 1 and 2, the tubular washing drum is a two-part articulated drum. It consists of the inlet drum with a casing 1 and flanges 2 and 3, and of the outlet drum with a casing 4, a flange 5 and a flange 6 with a pouring ring 7. Flanges 5 and 3 are flexibly connected through a pin-coupling 8; the pins of flange 5 protruding throught the front of flange 3. Flanges 2, 3 and 6 are provided with treads which rest on tread roller pairs 9, 10, and 11, respectively.

Tread roller pairs 9 and 11 are supported in a vertically adjustable manner by lifting devices 12. When pistons 13 of pressure-operated lifting devices 12 are in an upper position, rollers 9 and 11 are also in an upper position. When pistons 13 are in a lower position, rollers 9 and 11 are also in a lower position.

The support of roller pair 10 shown in FIG. 3 is not vertically adjustable. The rotary drive of the washing drum takes place through support roller pair 10.

Between the right lifting device 12 of roller pair 9 and the base, a pressure cell 14 is inserted. Its measured values will be indicated by G9. A pressure cell 14 of the same kind consists of the right bearing of the support of roller pair 10. Its measured values will be indicated by G10. Measured values G9 and G10 are fed to a comparator, schematically shown in FIG. 4, where they are compared to a reference value Gs which can be set at will.

The washing drum is located above serially arranged tanks 21, 22, 23, 24, 25, 26, and 27. The tanks are interconnected through overflows 28. Overflow 28 at the left on tank 21 is the liquid discharge device. The fresh liquid supply line ends in tank 27. All tanks 21 to 26 are provided with circulating pumps 30. These circulating pumps 30 sustain a circulation of liquid from tank 21 to the drum, then to tank 21; from tank 22 to the drum, then to tank 22; and so forth, up to tank 26 to the drum, then to tank 26. There is, therefore, defined a series of liquid cycles tank 21 — drum — tank 21, tank 22 — drum — tank 22, etc.

Preferably, means for adjusting the amount of liquid traveling in each of these cycles is provided, including means (not shown) for changing the rate of revolution of circulating pumps 30, or by-passes (not shown) to the pumps with adjustable cross sections.

Usually, tanks 21 to 27 are provided with means (not shown) for heating the liquid and with means (not shown) for adding chemicals.

According to the invention, the liquid circulation from a tank to the washing drum back to the tank permits dirt particles and flotsam released in the washing process to remain on the non-turbulent liquid surface and to float along the communication means constructed as overflows off into the outlet. Thus, they cannot be reconveyed to the laundry.

The amount of laundry passing through the continuous washing machine depends on the amount of laundry introduced usually in successive, suitable, large portions. The rate of travel or period of dwell of the laundry in the washing drum is a function of the value of the inclination of the drum from the upper left (inlet) to the lower right (outlet). The conveying speed increases with increasing inclination.

According to the embodiment, the washing drum can assume four different states of operation with respect to the drum inclination:

State of operation A):

Roller pair **9** up, inclination steep; roller pair **11** down, inclination steep; fast conveyance in inlet drum; fast conveyance in outlet drum.

State of operation B):

Roller pair **9** up, inclination steep; roller pair **11** up, inclination shallow; fast conveyance in entrance drum; slow conveyance in outlet drum.

State of operation C):

Roller pair **9** down, inclination shallow; roller pair **11** down, inclination steep; slow conveyance in inlet drum; fast conveyance in outlet drum;

State of operation D):

Roller pair **9** down, inclination shallow; roller pair **11** up, inclination shallow; slow conveyance in inlet drum; slow conveyance in outlet drum.

The automatic adjustment of the inclination from shallow to steep takes place at the moment when G**9** becomes greater than the established value G*s* provided in the comparator. The inclination shift from steep to shallow takes place when G**9** becomes smaller than G*s*.

The inclination shift from shallow to steep takes place when G**10** becomes larger than G*s*. Vice versa, the inclination adjustment from steep to shallow takes place when G**10** becomes smaller than G*s*.

The transit time for the laundry is a function of adjustment value G*s*. The higher the value to which G*s* is set, the longer the transit time or, respectively, the larger becomes the filling proportion of the washing drum.

The ratio between the liquid rate of flow and laundry travel rate becomes larger when the amount of liquid circulating from a tank to the washing drum and therefrom back to the tank increases. It becomes larger when the rate of revolution of the feed pumps increases or when a provided by-pass section is covered. Increased liquid ratios usually also affect the transit times of the laundry.

I claim:

1. A washing machine comprising a row of serially arranged tanks, a tubular, articulated, rotatable, washing drum located above the tanks, the washing drum comprising at least two flexibly connected component drums, a first component drum having pins extending therefrom and through a flange of a second component drum, means for adjustably and rotatably supporting the washing drum above the tanks, and means for circulating a washing liquid from at least one of the tanks to the washing drum independent from any motion of the washing drum.

2. A washing machine according to claim **1** wherein the tanks are interconnected by overflows for maintaining a counter-current of washing liquid.

3. A washing machine comprising a row of serially arranged tanks, a tubular, articulated, rotatable washing drum located above the tanks, means for circulating a washing liquid from at least one of the tanks to the drum independent of any motion of the drum, and means for adjustably and rotatably supporting the drum above the tanks comprising vertically adjustable support rollers for rotatably supporting the ends of the washing drum and means for measuring a pressure exerted by the drum on at least one of the support rollers.

4. A washing machine according to claim **3** wherein the means for supporting the drum further comprises comparing means for comparing a measured value of the pressure exerted by the drum on the support with a prespecified reference value.

5. A washing machine according to claim **4** wherein the means for supporting the drum further comprises means for initiating the positioning of at least one of the support rollers in response to a value generated by the comparing means.

6. A washing machine according to claim **1** wherein the means for circulating washing liquid comprises a pump, connected to at least one of the tanks, adapted to circulate the liquid from the tank to the drum thereby establishing a liquid cycle.

7. A washing machine according to claim **6** wherein the means for circulating washing liquid further comprises means for adjusting the rate of liquid flow in an individual liquid cycle.

8. A washing machine comprising a row of tanks, serially arranged and interconnected by overflows, a tubular, articulated, rotatable washing drum located above the tanks, vertically adjustable support rollers rotatably supporting the ends of the washing drum, means for measuring a pressure exerted by the drum on at least one of the support rollers, means for comparing a measured value of the pressure on the support roller with a prespecified reference value, means for initiating the positioning of at least one of the support rollers in response to an output of the comparing means, means for circulating a washing liquid from the tanks to the drum independent of any motion of the drum, and means for adjusting the rate of liquid flowing in any circulating means.

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