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(54) WATER DISTRIBUTOR FOR AN AUTOMATIC LAUNDRY OR DISHWASHING MACHINE

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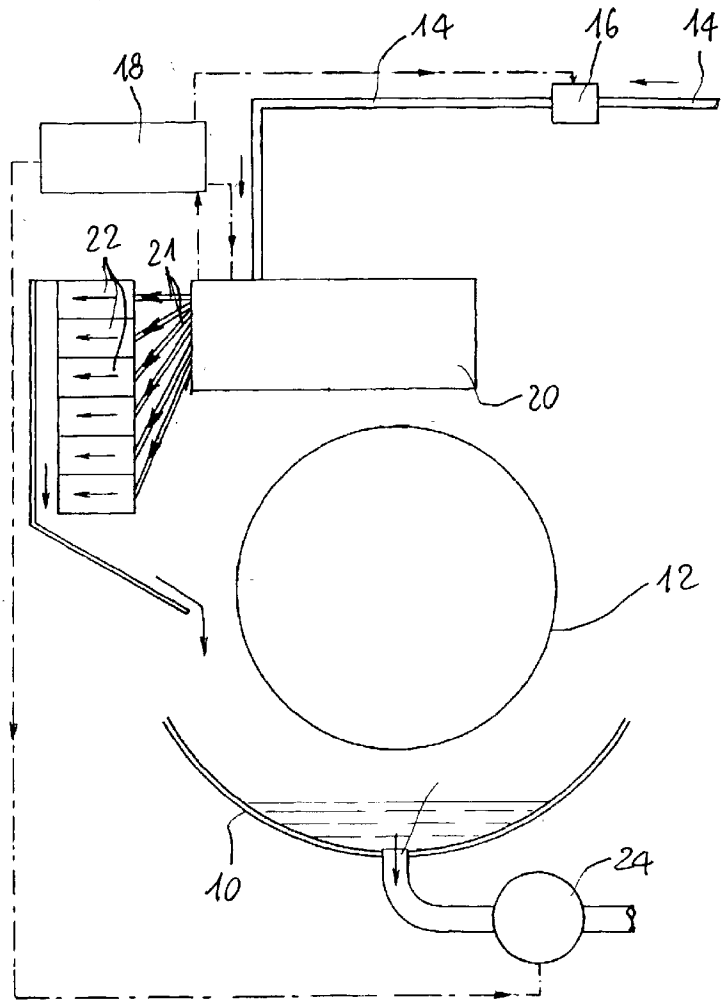
(57) **ABSTRACT**

A water distributor for an automatic laundry or dishwashing machine, comprises a water inlet that is controllable by a programming device of the machine and a movable element controllable by said programming device which serves for supplying water to a predetermined detergent dispenser for carrying a selected detergent towards the washing tub according to the washing program of the machine. The movable element is driven through a shape memory alloy wire electrically connected to a drive circuit that is part of the programming device.



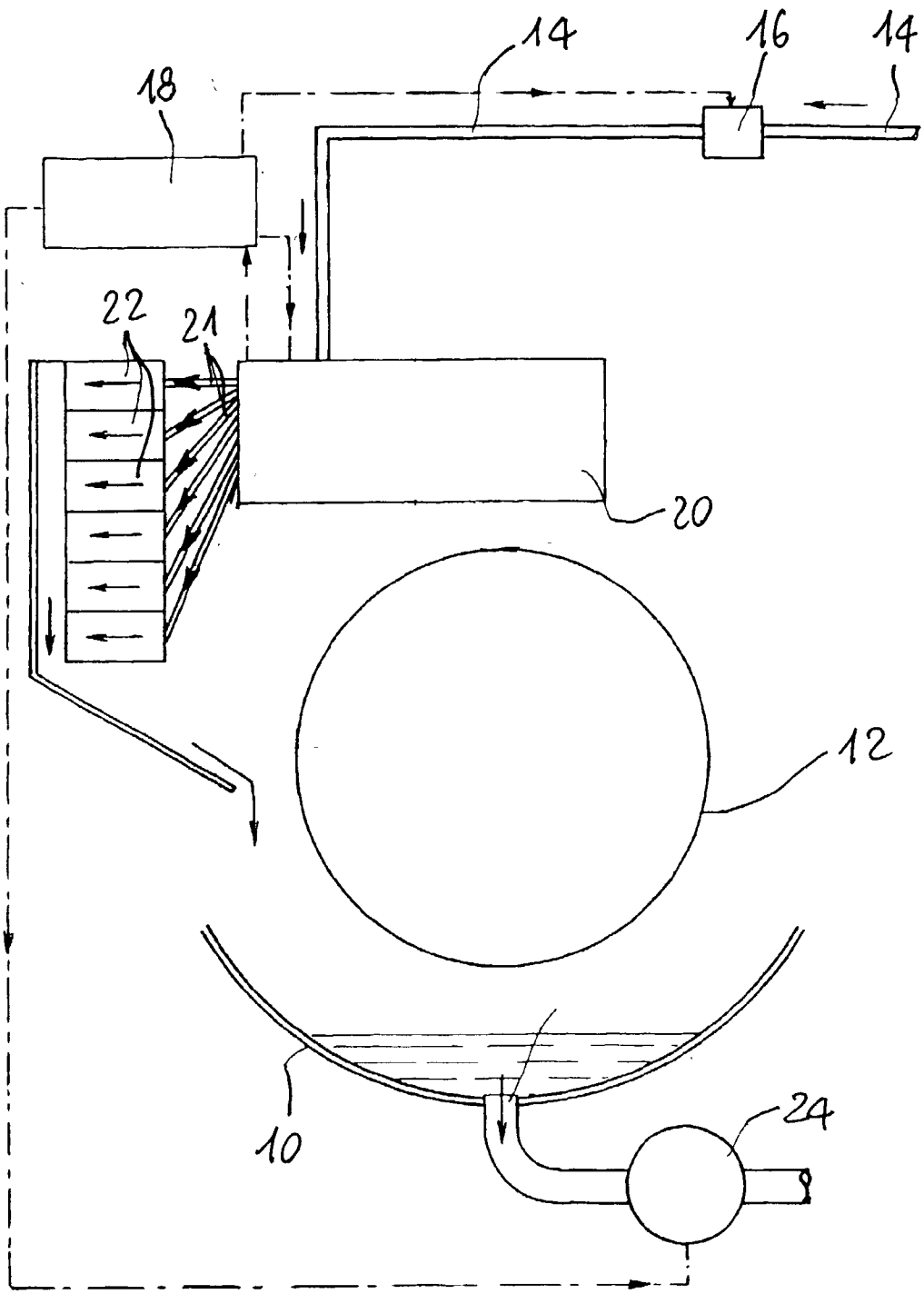


Fig. 1

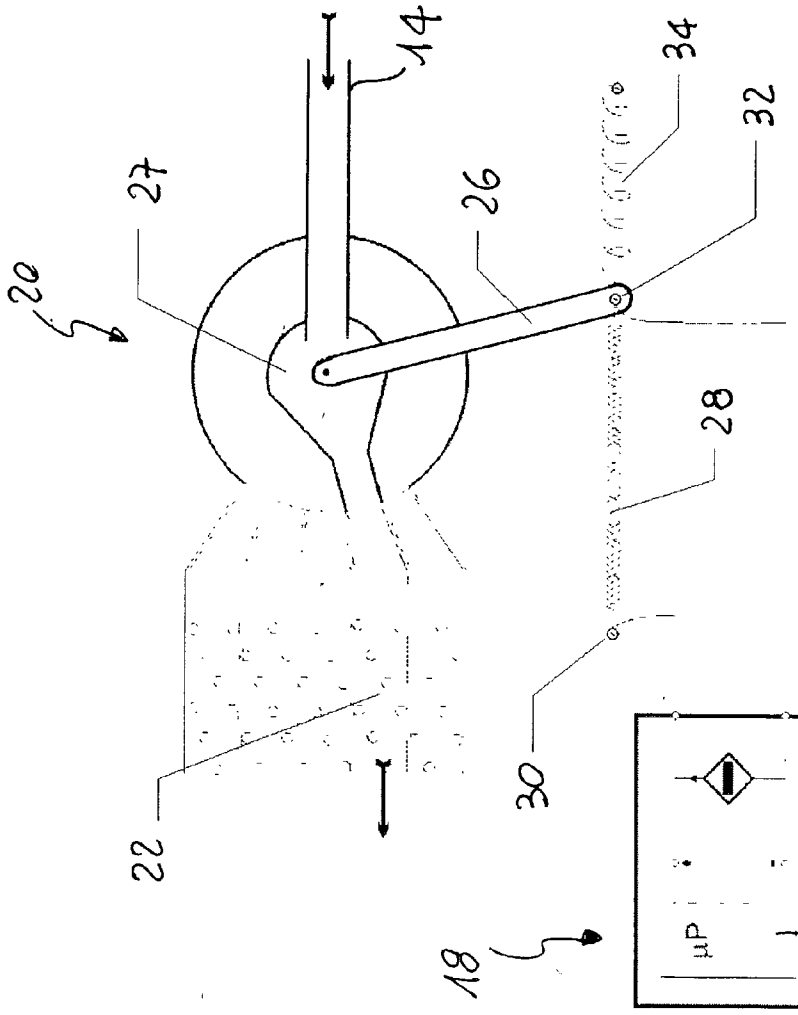


Fig. 2

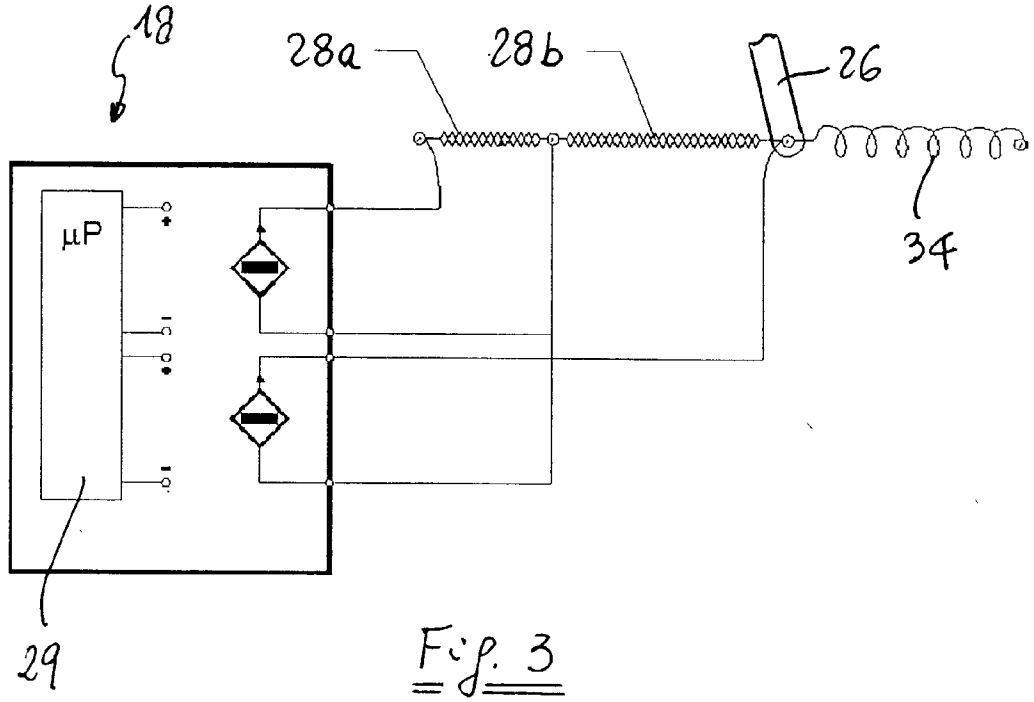


Fig. 3

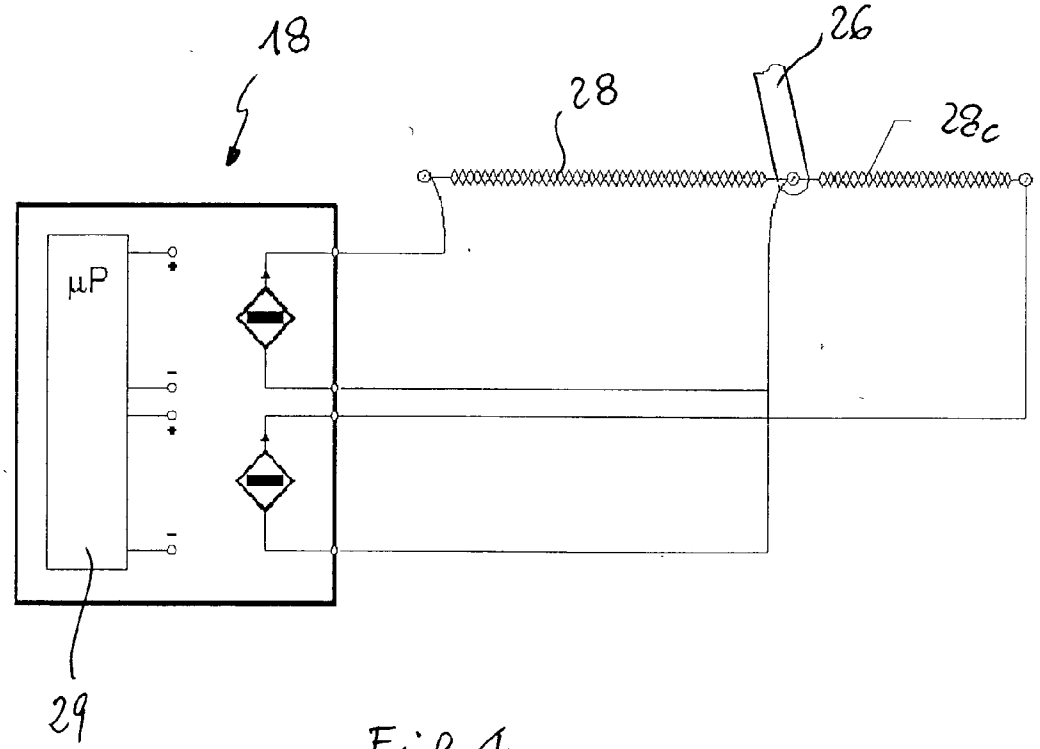


Fig. 4

WATER DISTRIBUTOR FOR AN AUTOMATIC LAUNDRY OR DISHWASHING MACHINE

BACKGROUND OF THE INVENTION

[0001] 1. Field of the Invention

[0002] The present invention relates to a water distributor for an automatic laundry or dish-washing machine comprising a water inlet that is controllable by a programming device of the machine and a movable element, controllable by said programming device, which serves for supplying water to one of detergent or additive dispensers for carrying the detergent or additive towards the washing tub according to the washing programme of the machine.

[0003] 2. Description of the Related Art

[0004] The known water distributors have a movable element that is usually driven by an electric motor. This system is implemented using the existing motor on the electromechanical or hybrid timers by means of a wire. For washing machines provided with electromechanical timers, the motor is already included in the system. For washers equipped with a full electronic control, a motor for controlling the water distribution is added and a feedback of the selected dispenser is required.

[0005] The movable element can be a simple lever carrying a water nozzle which directs the water toward one of the detergent dispenser, or it can be a rotating distributor having channels for conveying water to different detergent dispensers according to the angular position of the rotating distributor. With the term "detergent" we mean all the products (detergent, washing or rinsing aid, softeners etc.) which are usually added during the washing and/or rinsing process of the machine. The cost of known water distributors is presently high due to both the costs of the motor and of its feedback control system. Moreover the mechanical system for moving the movable element is quite complicated and therefore its reliability is not very high.

SUMMARY OF THE INVENTION

[0006] One of the objects of the present invention is to provide a new water distributor that is of low cost and is of high reliability if compared to the water distributors known up to now.

[0007] In the water distributor according to the invention the movable element is driven through a shape memory alloy (SMA) wire. The use of a SMA wire (known also as "muscle wire", since the wire acts as muscle while current flows and the wire becomes shorter exerting a stretching) controlled by the programming device of the machine reduces the cost of the water distributor.

[0008] Moreover the SMA wire offers several other advantages for the distribution system actuation versus the existing solutions:

[0009] no feedback is required;

[0010] reliable, because millions of operations are guaranteed if the SMA wire is used within the specified ranges;

[0011] noiseless, because, differently than a motor, the actuation does not generate any noise;

[0012] faster than a motor, because the movement can be reversed (today motors turn in one direction only so one revolution is required to reach the previous position);

[0013] well suitable for manufacturing (do not required fine tuning, less number of parts to assembly).

[0014] With the term SMA we mean all the metal alloys that undergo changes in shape when heated or cooled. Among SMA, the most common alloys are nickel and titanium alloys ("nitinol") and other alloys as copper-aluminium-nickel, copper-tin, copper-zinc, copper-gold-zinc, copper-zinc-aluminium, iron-platinum, nickel-aluminum, and manganese-copper. According to the present invention, it is preferred to use alloys for use at room temperature (around 20° C.), having a transition temperature range from 70° C. to 95° C. This transition temperature can be easily reached through Joule effect, i.e. by heating the SMA wire through electric current. The force exerted by the wire depends on its section and driving current. The SMA wires offer the possibility to move the movable element of the distribution system, which diverts the water flow to the different dispensers or chambers.

BRIEF DESCRIPTION OF THE DRAWINGS

[0015] The following description and drawings illustrate one example of the device for a machine in accordance with the invention.

[0016] **FIG. 1** is a schematic view of a clothes washing machine provided with a water distributor;

[0017] **FIG. 2** is a view of the water distributor according to the present invention with an DC driver (analog);

[0018] **FIG. 3** is a view of the digital driving mode to control the lever position (digital) with a n-wires system to get 2^n total length for the different positions (the figure shows only the 2 wires case); and

[0019] **FIG. 4** is a view of the application of two wires to get a better position control replacing the spring by an additional wire.

DESCRIPTION OF THE PREFERRED EMBODIMENT

[0020] In **FIG. 1 a** tub **10** of a washing machine is shown, in which is rotatably mounted a drum **12**. Water is supplied through a pipe **14** on which an on/off electrical valve **16** is mounted. An electromechanical or electronic control unit **18** of the machine controls such valve. Downflow the valve **16**, the pipe **14** feeds water to a water distributor device **20** controlled by the control unit **18** and which is adapted to discharge a water flow to different dispensers **22** for detergents or washing/rinsing aids. The different "direction" of the water flow towards dispensers **22** is schematically shown in **FIG. 1** by means of arrows **21**. The water flow entrains the detergent and a mixture of water plus detergent is fed into the tub **10**. The liquid from the tub **10** is then discharged (after washing or rinsing) by means of a pump **24**.

[0021] In **FIG. 2** an example of a water distributor according to the present invention is shown, in which the movement of a lever **26** which turns the nozzle **27** is carried out by reducing the length of a SMA wire **28**.

[0022] SMA length reduction is obtained by the current flowing trough the SMA from terminal **30** to terminal **32** or vice versa.

[0023] SMA length reduction can be controlled by changing the current flow in a "linear" range getting different lengths as function of the current; outside of this "lineal-" range the length reduction is the maximum achievable and the wire is fully contracted. The control of the SMA wire **28** is carried out through a microprocessor **29** that is part of the control unit **18**.

[0024] The SMA wire is preferably made of Austenite or Martensite (Flexinol-conflex Flex 025, 037, 050, 100, 150, 250, 300, 375), has a resistance of 8 to $1770^{Ohm}/_{m}$ at ambient temperature, and has a cross section of 490 to 110450 m^2. A current flow of 20 mA to 3A increases the temperature of the wire from ambient temperature to 68° C.-98° C., therefore reducing its length of a maximum of 8%. The strain of the wire is used to move the lever **26** generating a rotation of the nozzle **27** that diverts the water from one chamber **22** of the dispenser to a different one.

[0025] To take back the lever **26** the current is changed or removed and the tension of the spring **(34)** brings back the lever **26** to another position or to the previous one.

[0026] In **FIG. 3 a** second embodiment of a water distributor according to the present invention is shown. In this embodiment the water distributor is used to get different discrete number of positions so a different number of dispenser chambers **22** can be either managed.

[0027] Each SMA is driven with the maximum current to get the full stretch, that is, the driving method is 'digital' (no current or full current). The advantage is that length reduction is predictable being related to the relaxed length so position feedback is not required.

[0028] The total length reduction is the sum of the length reduction of the SMA that are driven; intermediate positions can be achieved by appropriate activation of each SMA wire.

[0029] In a system with 'n' SMA wires up to 2^n different length can be generated by appropriate selection of the length of each wire.

[0030] For example, in **FIG. 3**, the SMA wire **28** is split in two parts **28***a* and **28***b*. The length of one part **28***b* is double than the length of the other **28***a* to get a binary weight. The electrical driving system is simplified and can be easily controlled by a microprocessor+digital driver.

[0031] In **FIG. 4** an example according to a third embodiment is shown replacing the recovering spring of the first embodiment **(FIG. 2)** by another SMA **28***c* to get the continuous position control.

We claim:

1. A water distributor for an automatic laundry or dishwashing machine, comprising a water inlet that is controllable by a programming device of the machine and a movable element controllable by said programming device which serves for supplying water to a predetermined detergent dispenser for carrying a selected detergent towards the washing tub according to the washing program of the machine, wherein said movable element is driven through a shape memory alloy wire.

2. A water distributor according to claim 1, wherein the movable element is driven by a plurality of shape memory alloy wires connected in series, each of the wires being controllable by the programming device in order to reach different discrete number of positions.

3. A water distributor according to claim 2, wherein it comprises two shape memory alloy wires, the length of one wire being double than the length of the other.

4. A water distributor according to claim 1, wherein the movable element is driven by two shape memory alloy wires, each of the wires being adapted to drive the movable element in a direction different from the other.

5. A water distributor according to claim 4, wherein the movable element is a lever connected to a component which diverts water from one detergent dispenser to a different one.

6. A water distributor according to claim 5, wherein the shape memory alloy wire has a transition temperature comprised between 70° to 95° C.

7. A water distributor according to claim 6, wherein the shape memory alloy wire has a resistance between 8 to $1770^{Ohm}/_{m}$ at ambient temperature.

8. A water distributor according to claim 7, wherein the shape memory alloy wire has a cross section between 490 to 110450 μm^2.

9. A water distributor according to claim 8, wherein the shape memory alloy wire is selected in the group consisting of Flexinol-conflex Flex.

10. Automatic laundry or dishwashing machine having a water distributor according to claim **2**.

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