



(12) **EUROPEAN PATENT APPLICATION**

(43) Date of publication:
05.12.2001 Bulletin 2001/49

(51) Int Cl.7: **A47L 15/42, D06F 39/04**

(21) Application number: **01106079.5**

(22) Date of filing: **13.03.2001**

(84) Designated Contracting States:
AT BE CH CY DE DK ES FI FR GB GR IE IT LI LU
MC NL PT SE TR
 Designated Extension States:
AL LT LV MK RO SI

(72) Inventor: **Favret, Ugo**
33072 Casarsa (Pordenone) (IT)

(74) Representative: **Busca, Luciano et al**
PROPRIA S.r.l.
Via Mazzini 13
33170 Pordenone (IT)

(30) Priority: **30.05.2000 IT PN000020 U**

(71) Applicant: **Electrolux Zanussi S.p.A.**
33170 Pordenone (IT)

(54) **Washing machine with through-flow water heating arrangement**

(57) The washing machine comprises a conduit (9) in which the water is caused to circulate in a heat-exchange relation with heating means (11). In correspondence of a portion (12) of the conduit (9), in which there

are provided said heating means (11), the same conduit features a reduced passage cross-section area, in such a manner as to cause the flow velocity of the water there-through to increase and the deposit of dirt and limestone particles suspended in the water to be diminished.

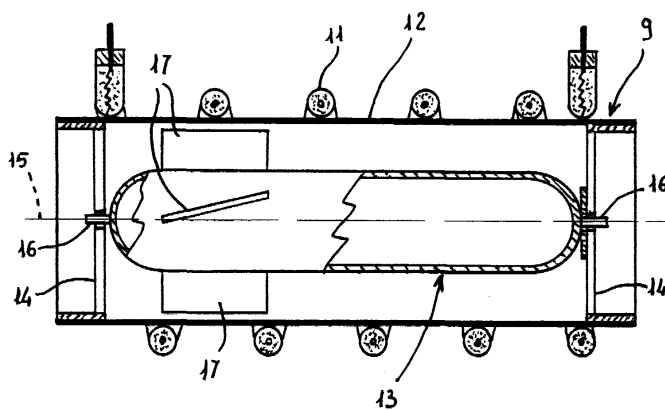


Fig. 2

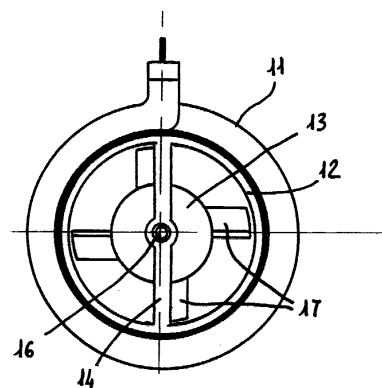


Fig. 3

Description

[0001] The present invention refers to a washing machine, in particular of the household or residential kind, provided with a water heating arrangement of the through-flow type, that is of the type in which the water (to which detergent or similar chemical aids are possibly added) is caused to circulate through a conduit in a heat-exchange relation with heating means.

[0002] According to a most reliable and simple embodiment thereof, through-flow water heating arrangements of such a kind call for the heating means to comprise an electric resistance wire that is wound in a coil form on a portion of the conduit, preferably made of metal, in order to heat up the water as it flows through the same portion of said conduit. A solution of this kind can be advantageously applied not only to dishwashing machines, but also to clothes washing machines of the water-recirculating type such as described for example in US-A-4 794 661.

[0003] Anyway, it is by now a widely known fact that dirt particles (as well as limestone particles) suspended in the water tend to settle on the inner surface of the conduit, in correspondence of the portion on which the heating coil is wound, where a considerable deposit, ie. scaling eventually forms, thereby noticeably reducing the efficiency with which heat is exchanged between the same heating coil and the water circulating through the conduit. Furthermore, in the long run said deposit of dirt and limestone particles tend to considerably reduce the passage or flow cross-section area of the heating conduit. Conclusively, it can be stated that it is the overall performance capability of the machine that is most likely to be eventually affected in a quite unacceptable manner.

[0004] It therefore is a main purpose of the present invention to provide a washing machine with a water heating arrangement of the through-flow type which is particularly effective and reliable even in the long run, ensuring a high efficiency and, as a result, a reduced energy usage.

[0005] In particular, it is a further purpose of the present invention to provide a washing machine of the above cited kind, which is particularly simple in its structure, economic and substantially free of deposits of dirt and limestone particles along the water heating conduit.

[0006] According to the present invention, these aims are reached in a washing machine provided with a water heating arrangement of the through-flow type having the characteristics as recited in the appended claims.

[0007] Anyway, features and advantages of the present invention will be more readily understood from the description that is given below by way of nonlimiting example with reference to the accompanying drawings, in which:

- Figure 1 is a schematical, partially cross-sectional view of a washing machine according to the present

invention;

- Figure 2 is a longitudinal-section, enlarged view of a detail of the illustration in Figure 1, according to a preferred embodiment of the present invention; and
- Figure 3 is a front view of the component part illustrated in Figure 2.

[0008] With reference to the above listed Figures, the washing machine is for instance a dishwashing machine and comprises mainly, within an outer casing 3, a washing vessel 4 that houses at least a rack 1, 2 for the dishes to be washed, as well as water spray means associated therewith. These water spray means preferably comprise respective rotating spray arms 5, 6 adapted to be supplied with water under pressure by a circulation pump 7, which in turn is adapted to take in the water collecting on the bottom of the washing vessel 4. In particular, the delivery side 8 of the pump 7 is connected to the rotating spray arms 5 and 6 via respective water supply conduits 9, 10, in a substantially per se known manner.

[0009] Again in a substantially per se known manner, the water is furthermore capable of being heated up by means of a heating arrangement of the through-flow type, that is of the type in which the water is caused to circulate in a heat-exchange relation with heating means provided in correspondence of at least a portion of the water circulation circuit of the machine.

[0010] In the example of a preferred embodiment that is described here, the heating means comprise an electric resistance wire 11, or the like, that is wound externally on a portion 12 of the water supply conduit 9, wherein such a portion has a pre-determined flow cross-section area.

[0011] According to a feature of the present invention, the conduit 9 has a passage or flow cross-section area that is reduced, substantially in correspondence of said portion 12 thereof. In a preferred manner, this is obtained by arranging, in said portion 12 of the conduit 9, at least a substantially concentric body 13 adapted to bring about the above mentioned restriction, ie. reduction in the flow cross-section area. In correspondence of this body 13, in fact, the water will flow along the conduit 9 through a reduced flow cross-section area in the shape of substantially an annulus or circular crown. In all cases, such a reduction in the flow or passage cross-section area of the conduit gives rise, in correspondence of the portion 12 of the conduit, and therefore in correspondence of the heating element 11 wound thereon, to a substantial increase in the flow velocity of the water and this greater flow velocity, as this has been found also experimentally, correspondingly minimizes the possibility for the dirt and limestone particles suspended in the water to settle and deposit on the inner surface of the conduit 9 that is in contact with the heating element 11.

[0012] In a preferred manner, the body 13 has an axially elongated shape with an either constant or variable cross-section, and is supported at its opposite end portions by respective cross-members 14 extending diametrically inside the conduit 9, to which they are fixed. 5

[0013] In a preferred manner, said body 13 is also adapted to rotate about an axis of its own 15 (which coincides with the axis of the conduit 9 in the example described here), so as to bring about a whirling motion in the water flow passing through the portion 12 of the conduit 9. This may be obtained in a simple manner by hinging the body 13 freely on the cross-members 14 by means of respective journals 16 and providing the same body 13 with peripheral propelling fins 17 that are appropriately inclined with respect to the axis 15 of the conduit 9. 10 15

[0014] As a result, the flow of water that moves through the portion 12 of the conduit 9 causes the body 13 to rotate with the fins 17 associated thereto, which in turn bring about the above mentioned whirling motion that is effective in boosting the "self-cleaning" effect of the conduit portion 12. 20

[0015] It will be appreciated that the above described washing machine may be the subject of a number of modifications without departing from the scope of the present invention. 25

[0016] For instance, the heating coil 11 may be provided in another location along the water-carrying circuit of the machine, which may be a clothes washing machine, rather than a dishwashing machine as described in the above example. 30

[0017] Furthermore, in correspondence of the portion 12 thereof, the conduit 9 may simply feature a reduced diameter, in which case the inner body 13 may be omitted. 35

Claims

1. Washing machine with a water heating arrangement of the through-flow type, comprising a conduit in which the water is caused to circulate in a heat-exchange relation with heating means provided in correspondence of at least a portion of said conduit having a pre-determined passage cross-section area, **characterized in that**, substantially in correspondence of said portion (12) of the conduit (9), the same conduit has a reduced passage or flow cross-section area, in such a manner as to cause the flow velocity of the water therethrough to increase and the deposit of dirt and limestone particles suspended in the water to be diminished. 40 45 50
2. Washing machine according to claim 1, **characterized in that** in said portion (12) of the conduit (9) there is housed at least a substantially concentric body (13) adapted to bring about said restriction in the passage or flow cross-section area thereof. 55

3. Washing machine according to claim 2, **characterized in that** said substantially concentric body (13) is adapted to rotate about an axis of its own (15), in such a manner as to bring about a whirling motion in the flow of water passing through said portion (12) of the conduit (9).

4. Washing machine according to claim 3, **characterized in that** said body (13) is hinged on so as to freely rotate about its own axis (15) and comprises peripheral propelling fins (17) by means of which it is caused to rotate by the water flowing through said portion (12) of the conduit (9).

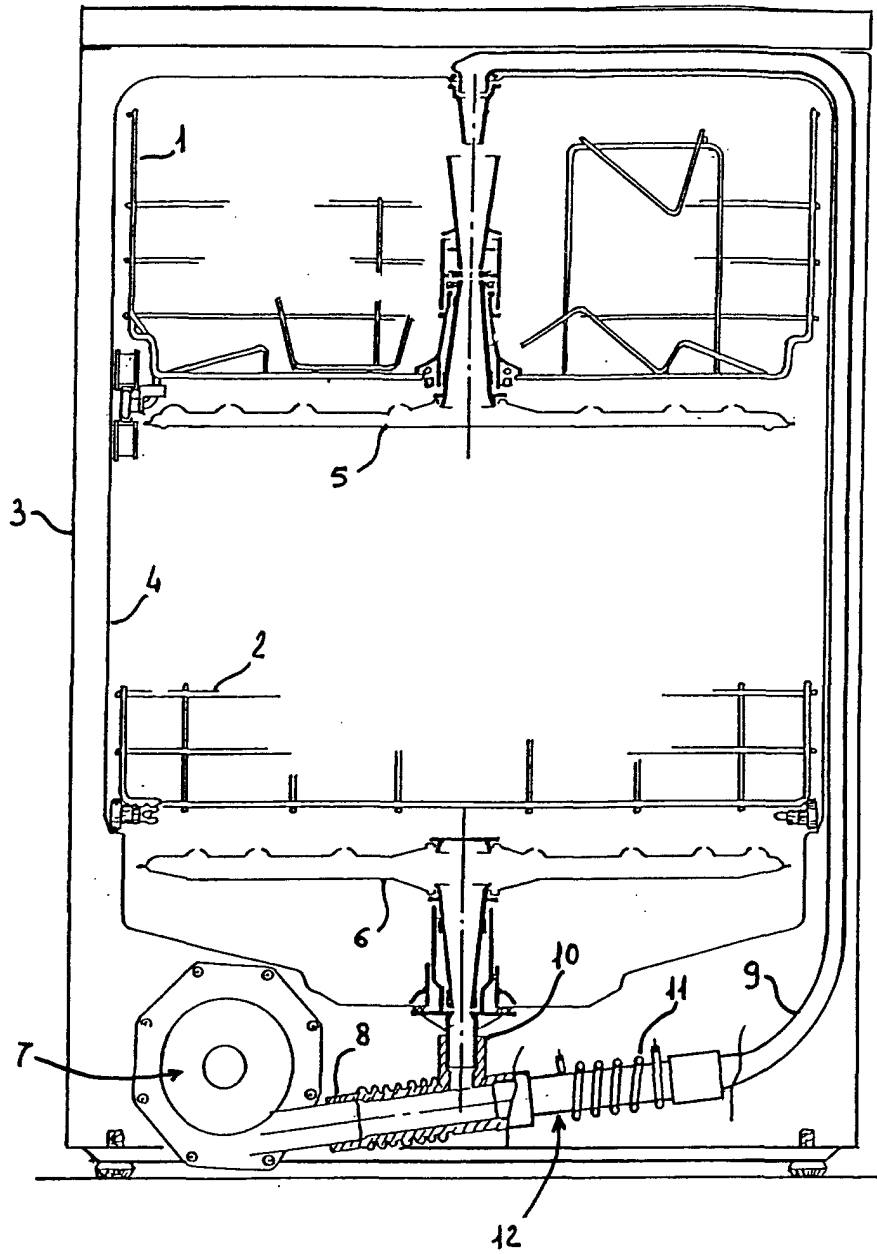


Fig. 1

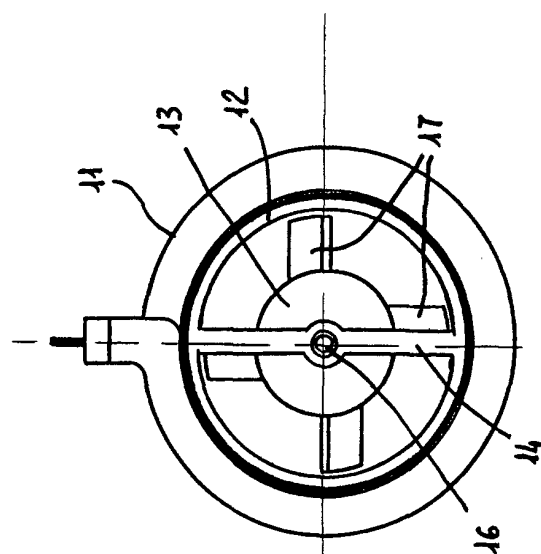


Fig. 3

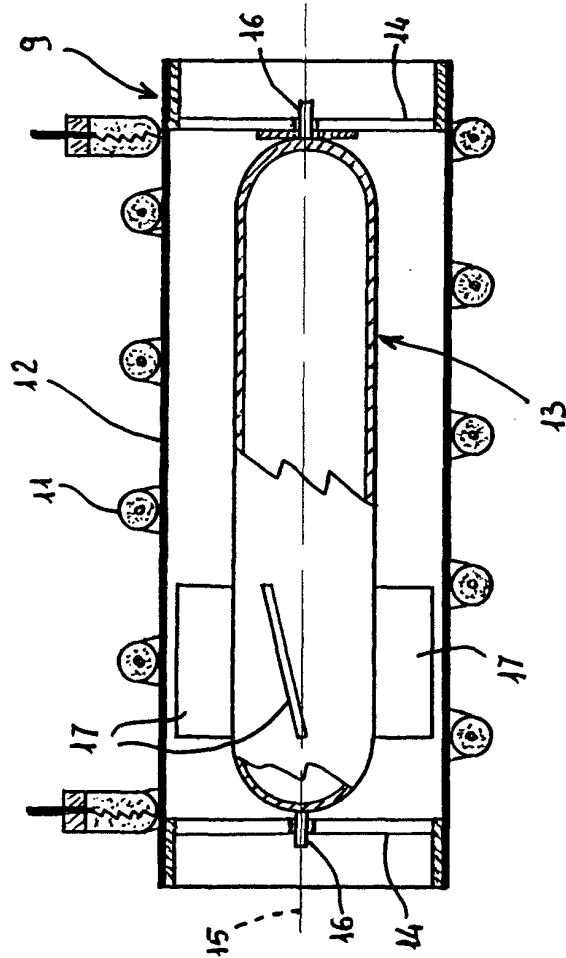


Fig. 2