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(71) Applicant: **Electrolux Home Products Corporation N.V.**
1930 Zaventem (BE)

(72) Inventor: **Uhov, Andrei**
St-Petersburg (RU)

(74) Representative: **Gonella, Mario**
Propria S.r.l.
P.O. Box 365
Via della Colonna, 35
33170 Pordenone (IT)

(54) **Household washing machine with induction heating**

(57) Household washing machine, both top- and front-loading, comprising: a rotating perforated drum (1), a tub (3) engaged to the cabinet of said machine, and made of dielectric material, and containing said drum rotating inside it, means apt to drive into rotation in a controlled way said drum, heating means, which can be selectively controlled, able of heating the liquor contained in said drum, and which comprises at least an induction

coil (5) placed outside said tub; said induction coil is oriented so as to make maximum the emitted electromagnetic field towards said drum.

The induction coil is preferably placed on the lower portion of the machine, and below said tub.

The machine is provided with control means able of activating said induction coil during and after the final spinning phase of the washing cycle.

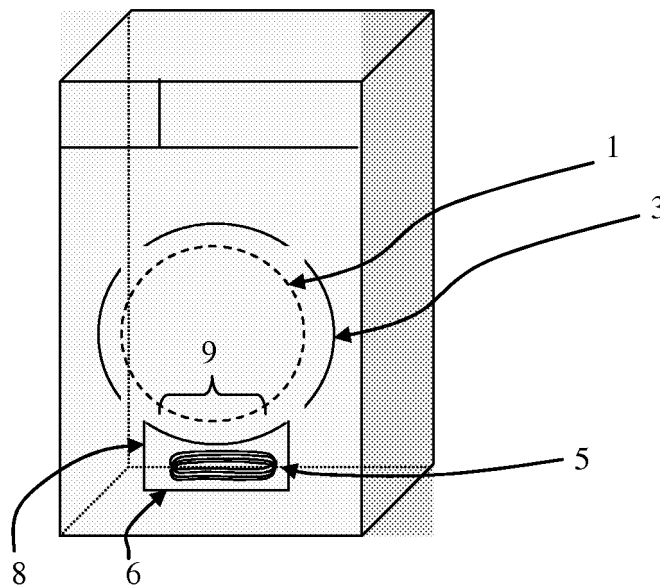


Fig. 2

Description

[0001] The invention refers to an improved type of washing machine, both front- and top loading, provided with a washing tub and a related drum rotating into it, and with heating means of the liquor contained in said tub and drum; said machine is particularly apt of performing washing cycles with very limited power consumption, and of avoiding in almost complete way the harmful effect of calcareous scaling on the conventional heating resistance of the washing bath.

[0002] Various heating means are well known which are apt of heating the washing bath in the household washing machines; one of such means is the using of induction bobbins which directly radiate and therefore heat metallic bodies, which in turn can heat the washing bath.

[0003] For instance from JP 9094377 it is known to place an induction coil, connected to an high frequency electric current, which is wound around a toroidal metallic body provided with a plurality of through holes into which the water flow, coming from the water mains, is forced.

[0004] Such solution offers the advantage of a constructive simplification, as said heating assembly is placed outside the machine, but just such feature obligates the mounting of the device outside the machine, as a mandatory device, and such circumstance is normally acceptable in the household washing machines, wherein the bulky size and the installation simplicity are among the basic requirements for the common user.

[0005] A simpler solution is divulged in the patent JP 6190188, where the induction coil is being wound directly around a stretch of the water inflow conduit and which is placed inside the machine, downstream the electrovalve; such a solution however shows the drawback that, as said coil is necessarily of limited size, the temperature increase, which is reached by the water flowing inside said conduit, turns to be too limited.

[0006] From EP 1657348 an house-hold washing machine is known, which is provided with a device of electromagnetic induction able of producing a flow of water vapour, which is then injected inside the rotating drum; even if such solution shows the unquestionable advantage of disposing of a jet of washing vapour at a very high temperature, and surely over 100 degrees C, however the final washing effect is not particularly appreciated in an average use, wherein the washing bath temperatures are often maintained at a level comprised between 40 and 60 degrees C, with very good washing results, and instead do require a very burdensome constructional and functional complexity.

[0007] From JP 2005177331 a top loading, vertical axis washing machine is known, which is provided with an induction coil able of irradiating the metallic bottom wall of the tub, which of course is being heated, so letting the so generated heat to the washing bath contained in it.

[0008] Such a solution however cannot be implemented when plastic tubs are used, by obvious reasons; more-

over, in the cases where it cannot be employed, a serious drawback is encountered, that the so heated tub sends the heat both inwards and outwards, i. e., in the environment atmosphere air; the latter heat portion is obviously lost, with apparent serious worsening of the energy effectiveness.

[0009] It would be then desirable, this being the purpose of the present invention, of implementing a washing machine provided with heating means able of avoiding the use of a conventional heating resistance, and however without suffering the limitations and the above cited drawbacks.

[0010] This purpose will be described and obtained implementing a type washing machines provided with an induction coil according to the description that is given below by way of non-limiting example with reference to the accompanying drawings, in which:

- fig. 1 shows symbolically and in transparency a washing machine provided with a tub and a rotating drum inside it, generally in accordance with the invention,
- fig. 2 symbolically shows an improved embodiment of the tub of fig. 1.

[0011] Even if in the following of this description it will be referred to a front loading washing machine, it will be intended that the present invention can be identically applied to a top loading washing machine, both with horizontal or vertical axis.

[0012] A washing machine according to the prior art comprises:

- a perforated rotating drum 1 to contain and to wash the clothes to be washed,
- a tub 2 elastically engaged to the machine cabinet, and containing inside it said rotating drum,
- a motor assembled outside and connected to said drum. An induction coil 5 is placed outside said tub and is oriented so as to irradiate in the prevailing way a portion "P" of said drum.

Said coil is connected to an high frequency electric power supply, provided through conversion and amplification means well known, which therefore will be not be explained.

In order to heat only that portion "P" of said drum which is normally dipped in the washing/rinsing bath, a shield 6 is being associated to said induction coil 5, said shield being basically constituted by a metallic covering wrapped from the bottom and laterally said coil 5.

Preferably, and with reference to fig. 2, the cylindrical side wall 8 of said shield 6 is joined to the corresponding and overhanging portion of the tub lower portion 9, so as said shield and said tub lower portion 9 do constitute a closed lodging for said induction coil 5.

Obviously said tub 3 is made of dielectric material,

and preferably of thermoplastic material, which is well known in the prior art, as if the tub would be made of metallic material, it unavoidably would intercept the electromagnetic emitted radiation, so preventing its reaching of the drum.

It is well known, as explained in one of the above cited patents, that if said tub would be made of metal it would be heated in place of the drum, and therefore a portion of the generated heat would be transferred to the washing bath; however, as already explained, a part of the generated heat would be scattered in the outer room, so worsening the performance of energy efficiency.

[0013] A machine according to the just described invention may be used in a particularly advantageous way if one think that the induction coil may be connected to a power supply, the tub being empty of liquor; as a matter of facts in an improved embodiment the induction coil may be activated even after the tub has been emptied and during the final spinning phase.

[0014] In such a case the heat that can be developed in the drum wall is being transferred in the load to be spin, and therefore a controllable heating of the same washing load, even at the spinning end, may be achieved.

[0015] As already known, the water molecular cohesion is being reduced as its temperature is being increased, and this fact makes easy and improves the wringing effect due to the spinning, so that the water amount insisting in the washing load after the spinning turns to be reduced with respect to the water amount that would be remained without the present drum induction heating after the final spinning.

[0016] Moreover a further positive effect is achieved if the washing load is extracted at high temperature, as this circumstance speeds up the drying in the outer room , as well known.

[0017] A further advantage may be easily achieved if the induction coil is activated after the end of the final spinning phase; in the facts, in such a case, should the drum be rotated at the low speed, it may be heated in an effective and not expensive way only the washing load which contains a minimum water amount, avoiding of wasting a part of that energy used to dry that part of water still contained in the washing load during the finall spinning phase, and which would be in any case intended to be discharged for the sole spinning action.

- means apt to drive into rotation said drum in a controlled way,
- heating means which can be selectively controlled" able of heating the liquor contained in said drum,

characterized in that said heating means comprise at least an induction coil (5) placed outside said tub.

2. Household washing machine according to claim 1, **characterized in that** said induction coil is placed on the lower portion of said machine, and below said tub.
3. Household washing machine according to claims 2, **characterized in that** said induction coil is lodged inside a metallic shield (6) placed laterally of and below it.
4. Household washing machine according to claim 3, **characterized in that** said metallic shield (6) is provided of a side wall (8) whose upper edges are joined to a lower portion (9) of said tub.
5. Household washing machine according to one of the preceding claims, **characterized in that** it is able of selectively performing fully washing cycles, including the final spinning phases, wherein the operation of said induction coil, at least during a part of said final spinning phases, is activated.
6. Washing machine according to claim 3, **characterized in that** it is able of selectively performing complete washing cycles, including the final spinning phases, wherein the operation of said induction coil, after the end of said final spinning phases, is activated.
7. Household washing machine according to any of the preceding claims, **characterized in that** said tub (3), containing said drum, is made of dielectric material, and preferably of thermoplastic material.

Claims

1. Household washing machine, both top and front loading, comprising:

- a perforated rotating drum (1),
- a tub (3) engaged to the cabinet of said machine, and containing said drum (1) rotating into it,

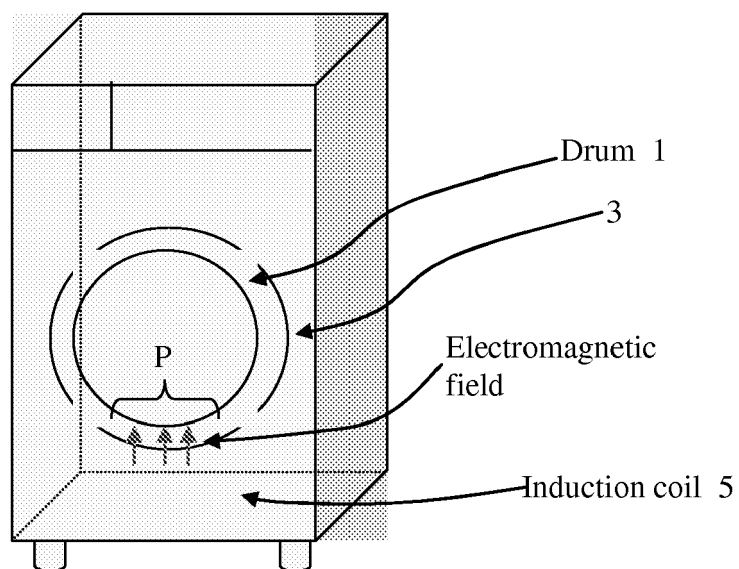


Fig. 1

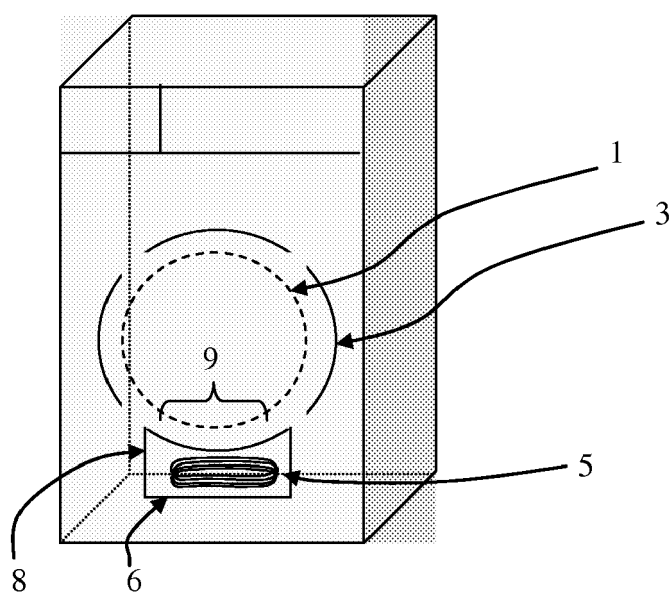


Fig. 2



European Patent
Office

EUROPEAN SEARCH REPORT

Application Number
EP 06 12 2607

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Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
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The present search report has been drawn up for all claims			TECHNICAL FIELDS SEARCHED (IPC)
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Place of search		Date of completion of the search	Examiner
Munich		14 March 2007	DIAZ, M
CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document			

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EPO FORM 1503 03.82 (P04C01)

**ANNEX TO THE EUROPEAN SEARCH REPORT
ON EUROPEAN PATENT APPLICATION NO.**

EP 06 12 2607

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report.
The members are as contained in the European Patent Office EDP file on
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14-03-2007

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- JP 6190188 B [0005]
- EP 1657348 A [0006]
- JP 2005177331 A [0007]