Note: Within nine months of the publication of the mention of the grant of the European patent in the European Patent Bulletin, any person may give notice to the European Patent Office of opposition to that patent, in accordance with the Implementing Regulations. Notice of opposition shall not be deemed to have been filed until the opposition fee has been paid. (Art. 99(1) European Patent Convention).
Description

[0001] The invention relates to an improved type of washing machine with front or top loading, but with a horizontal or inclined axis, preferably of the domestic type, having a washing tub provided with a resistor for heating the washing bath, which may be assembled by means of a solely rectilinear movement parallel to the axis of the tub.

[0002] It is known that the washing tubs of clothes washing machines with a horizontal axis generally have in the bottom zone a resistor for heating the washing bath.

[0003] This resistor is usually inserted inside the tub by forming a small suitable opening in one of the two vertical circular walls which close laterally the cylindrical sleeve of the tub and introducing there said resistor in a suitable position, leaving outside obviously the power supply terminals; the opening is then closed using known hermetic fixing means.

[0004] The resistor assembly operation at present must be performed in a completely manual manner, since it is required to gain access inside the tub before completion thereof, namely with the associated half-shells still separated, in order to perform the necessary operations for positioning and fixing the resistor against at least one of said half-shells; typically the end result of assembly of the resistor inside the tub can be seen in the patent EP 0344549 (Fig. 2).

[0005] This operation does not pose any particular difficulties; however, if the general production program involves a completely automated sequence for assembly of the tub, then the operation of inserting and fixing the resistor inside the tub, since it requires manual intervention, causes an interruption in the production process and therefore a loss of production efficiency both because of the greater complexity of manual operation instead of automated processing, and because of the inevitable interruption in the automated production process, with evident slowing down of the latter and difficulties arising from handling of the tubs.

[0006] The patent EP 0,352,499 discloses arranging inside the tub of a washing machine a shaped plate on which a heating resistor formed as a thick film is deposited; this solution, however, does not solve the problem of automatability of the assembly method and, moreover, said resistor generally is not able to withstand for long periods the highly abrasive environment inside the washing tub - due to the temperature - of the moving liquid and detergent.

[0007] The patent EP 0,204,984 teaches keeping the resistor in position and in contact against the nearby tub wall, by means of a resilient device which acts on the outer terminals of the resistor; this solution, although it eliminates the need for internal fixing means, does not solve the problem of the automatability of the assembly operations.

[0008] Numerous other solutions where the resistor is arranged and fixed inside the tub by means of small fastening means, for example as described in DE 2739744 and US 5,364,051, are known.

[0009] Also known are solutions where the resistor is not arranged in a manner substantially parallel to the axis of the tub, but is arranged along one of the circular walls of the latter, as in US 2005/0279141 A1; this solution is applied selectively to a vertical-axis machine and therefore does not solve the present problem.

[0010] Furthermore a large category of washing machines is known where the resistors for heating the washing bath are arranged outside the tub, normally underneath the latter; e.g. the patents EP 0539917 B1 and EP 117758 B1 are cited.

[0011] Finally, some documents are known which disclose washing machines with resistors to be inserted in apertures of metallic tubs having retaining means to interact with resistor portions opposite to the tub apertures, see DE 197 49 958 A1, DE 198 44-568 C1, DE 41 12 230 A1 and UK 2 080 343 A.

[0012] It would be desirable, and this is the object of the present invention, to provide a washing machine with a horizontal-axis or inclined-axis cylindrical tub which has a heating resistor inserted inside the tub via a lateral and substantially vertical wall, assuming a position close to the cylindrical sleeve of the said tub and with an orientation parallel to the axis of the tub, so that the introduction of the resistor and the means for assembling and closing the latter may be performed by means of a sole rectilinear movement in a direction parallel to the axis of the said tub, and, therefore, in accordance with the ultimate object of the invention which consists in the possibility of assembling and disassembling the resistor without opening the tub and without the aid of additional pre-assembled supporting parts, which washing machine may also be provided with a tub made of thermoplastic material.

[0013] This object is achieved with a particular type of washing machine provided with a tub and with an associated heating resistor, described by way of a non-limiting example with reference to the accompanying drawings in which:

- Figures 1, 2 and 3 show, respectively, a partially transparent perspective view, cross-sectional view in a plane perpendicular to the axis and cross-sectional view in a plane passing along the axis of a first embodiment of a tub according to the invention;
- Figures 4, 5 and 6 show, respectively, a partially transparent perspective view, cross-sectional view in a plane perpendicular to the axis and cross-sectional view in a plane passing along the axis of a second embodiment of a tub according to the invention.
- Fig. 7 shows in a symbolic and schematic manner an improved embodiment of a heating resistor inside a tub according to the invention.

[0014] With reference to Figures 1, 2 and 3, a washing machine according to the invention comprises an approxi...
imately cylindrical tub 1 with the horizontal axis "X" and provided with a front opening 2 formed in one of the flat vertical walls 3 which form the two bases of the tub cylinder.

[0015] A heating resistor 20 with an elongated form is arranged on the bottom inner portion of the volume of the tub and in the vicinity of the bottom 4 of the latter; said resistor is formed in a conventional manner, i.e. with shape in the form of a very long U, so that one of its ends 5 reaches substantially a vertical wall 3, while the other end extends towards the opposite wall 8, without however touching it; for the sake of convenience of the description, in the remainder of the present document, the term "end 9" will be used and written also as "terminal portion 9".

[0016] One of said ends 5 is engaged with one of said walls 3 via an engaging means 6 of a type known per se, provided so as to close a respective hole 7 arranged in said wall 3.

[0017] A retaining part able to fix the opposite end 9 of said resistor is arranged on the opposite wall 8; according to Figs. 1 and 2 said retaining part is formed as a parallelepiped 10 fixed with only one side on the zone of said wall 8 which faces said hole 7; said part 10 has, on its outer wall 8 directed towards said hole 7, a recessed portion 13.

[0018] Moreover, an engaging device 16 able to fit inside said recessed portion 13 is mounted on said opposite end 9 of the resistor 20.

[0019] It is particularly useful if said device 16 is formed by a small spring or in any case by a resilient element such that, when it is inserted also with great precision towards said recessed portion 13, it is self-positioned inside the latter, while remaining fixed to said end 9.

[0020] The dimensions, geometry and relative configurations of the parts described must in any case be such that, when said resistor is introduced into the tub with a movement parallel to said axis "X", the end 9 of said resistor 20 does not come into contact with said parallelepiped part 10, but said spring 16 fits exactly inside said recessed portion 13, also and in particular as a result of its elasticity.

[0021] Essentially this achieves the object and also the teaching of the invention whereby assembly of the resistor, or replacement thereof, may be performed without it being necessary to open the half-shells or the different parts forming the tub, but simply by means of a rectilinear movement parallel to said axis "X" of said resistor and said engaging, support and closing means 6 so as to obtain the two main advantages of the invention, described above and for the sake of brevity not repeated here.

[0022] Moreover, in the case where use is made of a tub of thermoplastic material produced using any method such as injection, moulding or also casting, it is particularly advantageous if said retaining parts 10, 11 for the resistor 20, whatever their shape, are made as one piece with the said tub half-shell onto which they are mounted.

[0023] With reference to Figures 4 to 6, a second embodiment consists in mounting, on said opposite side 8, a flat bracket 11 in the form of a small metal flange having a laterally open incision 22 formed in its outer edge 21. [0024] Said flat bracket 11 is fixed onto the bottom of the tub so that the plane in which it extends is arranged vertically and passes along the axis "X" and said incision 22 is situated symmetrically opposite said engaging means 6 on the opposite wall 3 of the tub.

[0025] In this case the resistor 20, after it has been properly assembled, extends inside the tub and towards the opposite wall 8 with a length such that its U-curved end 9 fits precisely into said incision 22, being retained therein.

[0026] In this case also, the geometry and the relative dimensions of the parts described must be such as to achieve the object and also the teaching of the invention whereby assembly of the resistor, or replacement thereof, may be performed without it being necessary to open the half-shells or the different parts forming the tub, but simply by means of a rectilinear movement parallel to said axis "X" of said resistor and said engaging, support and closing means 6 so as to obtain the two main advantages of the invention, described above and for the sake of brevity not repeated here.

[0027] However, this second embodiment of the invention may pose a problem if the tub, and also said flat bracket 11, are made of thermoplastic material.

[0028] In fact it may happen that, owing to some fault occurring during the operating cycle of the machine, the resistor 20 is powered even when the tub is not filled with water and therefore said resistor 20 is not submerged; in this case its temperature increases very greatly, until it reaches a few hundreds of degrees, and since the resistor makes contact with said bracket 11, the latter may melt or even set fire to the plastic tub inside which it is inserted.

[0029] In order to eliminate said drawback and with reference to Fig. 7, the U-shaped terminal portion 9 of said resistor is constructed so that it has parts with a very low specific resistivity in said terminal portion 9; basically the resistive elements 30 are arranged only along the extension of the resistor defined by the length "S" in Fig. 7, while the U-shaped terminal portion 9 has a very low resistivity conductor 31 passing through it.

[0030] Therefore, said terminal portion 9 is never heated to a significant degree and therefore, even in the event that the situation described above should occur, its temperature never reaches a level such as to compromise the integral condition of the tub or the safety conditions in general.

[0031] Moreover, in the case where use is made of a tub of thermoplastic material produced using any method such as injection, moulding or also casting, it is particularly advantageous if said retaining parts 10, 11 for the resistor 20, whatever their shape, are made as one piece with the said tub half-shell onto which they are mounted.
Claims

1. Domestic washing machine, of the front-loading type, comprising a substantially cylindrical shaped tub with a horizontal axis "X", having:

- an opening (2) for access inside it, arranged in one of the flat vertical side faces (3);
- a heating resistor (20) arranged at a small distance from the bottom portion (4) of said tub and engaged at one of its ends (5) by an engaging means (6) mounted inside a hole (7) formed in one of the flat side faces (3);
- fixing means able to engage with the opposite end (9) of said resistor (20), relative to said tub, wherein that said fixing means comprise at least one retaining part, arranged on the side face of said tub opposite the face (3) in which said hole (7) is formed and positioned substantially facing said hole (7),

characterized in that said retaining part is formed as a thick flat bracket (11) and has, on its edge (21) directed towards said hole (7), a laterally open incision (22) projecting towards said hole (7) with the end (9), opposite said end (5) engaged inside said incision (22) when said resistor is mounted on said tub, wherein the terminal portion or end (9), opposite said end (5) engaged inside said hole (7), of said resistor (20), is substantially devoid of resistive heating elements.

2. Machine according to Claim 1, characterized in that said resistor (20) is shaped in the form of a U or a very long open ring and in that said thick flat bracket (11) is arranged in a plane substantially perpendicular to the plane of said "U".

3. Machine according to Claim 1 or 2, characterized in that said tub (1) is made of thermoplastic material and said retaining parts (10, 11) are formed as one piece with said tub.

Patentansprüche

1. Haushaltswaschmaschine vom Frontladertyp, die einen im Wesentlichen zylindrischen Laugenbehälter mit einer horizontalen X-Achse umfasst, welche folgende Elemente aufweist:

- eine Öffnung (2) für den Zugriff auf den Innenbereich, welche an einer der flachen, vertikalen Seitenflächen (3) angeordnet ist;
- einen Heizwiderstand (20), der in einem kleinen Abstand vom unteren Abschnitt (4) des Laugenbehälters angeordnet ist und an einem sei-
- des moyens de fixation aptes à venir en prise avec l'extrémité opposée (9) de ladite résistance (20), relativement à ladite cuve, où lesdits moyens de fixation comprennent au moins une partie de retenue agencée sur la face latérale de ladite cuve opposée à la face (3) dans laquelle le ledit trou (7) est formé et positionné sensiblement en face dudit trou (7),

caractérisée en ce que ladite partie de retenue est réalisée comme un support épais plat (11) et possède, sur son bord (21) dirigé vers ledit trou (7), une incision latéralement ouverte (22), faisant saillie vers ledit trou (7) avec l'extrémité (9), opposée à ladite extrémité (5) engagée dans ledit trou (7) de ladite résistance (20) apte à s'engager à l'intérieur de ladite incision (22) lorsque ladite résistance est montée sur ladite cuve, où la portion terminale ou extrémité (9), opposée à ladite extrémité (5) engagée à l'intérieur dudit trou (7) de ladite résistance (20), est sensiblement exempte d'éléments chauffants résistifs.

2. Mécanisme selon la revendication 1, caractérisé en ce que ladite résistance (20) est configurée sous la forme d’un U ou d’une baguette ouverte très longue, et en ce que ledit support épais plat (11) est agencé dans un plan sensiblement perpendiculaire au plan dudit "U".

3. Machine selon la revendication 1 ou 2, caractérisée en ce que ladite cuve (1) est réalisée en matériau thermoplastique, et lesdites parties de retenue (10, 11) sont formées en une pièce avec ladite cuve.
REFERENCES CITED IN THE DESCRIPTION

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