The present invention relates to a washing machine tank (1), of the type provided with a basically cylindrical structure obtained by moulding plastic materials, designed to house a rotary metal drum, characterised in that it is provided with a smooth bottom wall (2) with central hole, against which a circular cap (3) is exactly engaged and permanently fixed with concavity facing the bottom wall, with a cylindrical nozzle in central position designed to be perfectly aligned with the central hole of the bottom wall.
WASHING MACHINE TANK PROVIDED WITH EXTERNAL REINFORCING CAP ON BOTTOM WALL

[0001] The present patent application for industrial invention relates to a washing machine tank provided with an external reinforcing cap on the bottom wall.

[0002] As it is known, the washing unit of washing machines or dryer/washer combos comprises a basically cylindrical drum designed to be loaded with laundry, which rotates inside a tank obtained by moulding plastic materials.

[0003] A similar tank is frontally provided with a large opening for the laundry, while the bottom wall of the tank contains a central hole that ends in a rear cylindrical nozzle, where the shaft protruding from the bottom wall of the drum contained in the tank is exactly inserted, with the interposition of a bearing support.

[0004] In particular, the shaft slightly protrudes outside the tank in order to be coupled with the electrical motor designed to drive it into rotation.

[0005] In some cases, the electrical motor is mounted in peripheral position with respect to the bottom wall of the cylindrical tank; in such a case, a drive belt is provided to ensure the joint rotation of the shaft of the electrical motor and the shaft of the drum, which are both suitably provided with corresponding pulleys.

[0006] In other cases, the so-called “direct drive” technology is used, according to which the stator of the electrical motor is mounted in the centre of the bottom wall of the tank in such a way that the rotor is directly splined to the shaft of the drum.

[0007] In both cases, however, the bottom wall of the washing machine tank must be characterised by high structural rigidity in order to withstand without damages the high mechanical stress induced by the centrifugal force generated by the mass of the laundry contained in the rotating drum.

[0008] So far, the said rigidity of the bottom wall has been guaranteed by means of a network of stiffening ribs provided on the outside of the tank.

[0009] When the presence of the said ribs is not sufficient, the bottom wall of the tank is given an “omega” profile in which some sections of the wall protrude inwards.

[0010] In fact, such a configuration gives the bottom wall of the tank a high inertia momentum.

[0011] A careful examination of the state of the art has identified several critical aspects.

[0012] In particular, the formation of the external stiffening ribs requires a large use of moulding material and sophisticated expensive moulds, with very long moulding time especially due to the need to cool down the ribs.

[0013] By considering that the market offers different models of washing machines in terms of rotation speed of the drums (from 400 to 1,600 rpm.), it is clear that each model of washing machine must be provided with a tank with specific mechanical resistance characteristics according to the different stress imposed by the rotation speed of the drum.

[0014] In view of this, a manufacturer of washing machine tanks must produce at least five different models of tanks, each of them with different rigidity and resistance according to the rotation speed of the specific appliance.

[0015] Moreover, the tanks with bottom wall provided with “omega” profile are impaired by the fact that they create considerable turbulence in the water mass contained inside the tank, with consequent high noise level inside the appliance, formation of foam that requires more rinsing water, and considerable washing residues in the concave areas of the bottom wall that are not removed by the rinsing water.

[0016] The washing residues originate the so-called “biofilm”, which is considered detrimental because it favours the proliferation of bacteria and consequent production of bad odours.

[0017] The purpose of the present invention is to find a solution to the aforementioned problems of the prior technique, in order to reduce production costs and improve technical-functional efficiency and versatility considerably.

[0018] The inventive idea of the present invention consists in a special composite structure of the bottom wall of a washing machine tank.

[0019] More precisely, the tank of the invention is provided with a bottom wall with a smooth surface both internally and externally.

[0020] This allows to eliminate the traditional stiffening ribs that protrude outwards and the raised areas with that protrude inwards, of the type used in the bottom wall of tanks provided with “omega” profile.

[0021] In this case the task to give the necessary rigidity and resistance to mechanical stress is entrusted to a circular cap designed to be exactly fitted against the external side of the bottom wall of the tank.

[0022] The plastic moulded cap is preferably provided with a plurality of spokes, being otherwise defined as cross-piece.

[0023] Considering that the spokes of the cap are externally hollow, it appears evident that, in cooperation with the external side of the flat bottom of the tank of the invention, the spokes originate a box-shaped structure with multiple spokes, which is effectively able to guarantee a considerable inertia momentum both with respect to flexural and torsional stress.

[0024] If considered individually, both the smooth bottom wall of the tank and the cap have modest inertia values due to reduced thickness.

[0025] Their stable coupling, however, allows to create the box-shaped structure effectively provided with mechanical characteristics compatible with the correct operation of a washing machine.

[0026] The advantages of the invention appear evident from first description.

[0027] First of all, the presence of a perfectly smooth bottom wall ensures better practical and economic characteristics with reference to moulding, not only because of the lower complexity of the moulds, but also because of the lower quantity of plastic material used.

[0028] The elimination of the inward protruding sections that are typical of tanks with “omega” bottom completely prevents the formation of the undesirable biofilm.

[0029] The presence of the smooth bottom wall of the tank of the invention generates an excellent distribution of the surface tension that tend to be created in a totally non-uniform way in the more complicated structures of the pre-existing tanks, impairing the mechanical characteristics of the same tanks.

[0030] Moreover, the composite structure of the bottom wall of the tank of the invention ensures practical and economic characteristics also with reference to the production of different models of tanks for washing machines with different rotation speeds.

[0031] As mentioned earlier, according to the prior technique, each specific type of washing machine requires a spe-
specific tank with specific rigidity and mechanical resistance properties according to the maximum rotation speed.

[0032] Because of the present invention, all different types of washing machines use the same type of tanks, being provided that the task to guarantee the correct index of mechanical resistance to the bottom wall of the tank is entrusted to the cap with multiple spokes.

[0033] In view of the above, a manufacturer that makes use of the technology of the invention will produce a single model of tank, which will be adapted to each specific model of washing machine by means of a diversified production of caps (according to the different thickness and profile of the caps).

[0034] The need to produce a different range of caps is certainly more practical and cost-effective compared to the current need to produce a different range of tanks.

[0035] Finally, it must be noted that the favourable weight/performance ratio determined in the tank of the invention because of the assembly between the bottom wall of the tank and the cap contributes to optimise the traditional appendices provided on the perimeter of washing machine tanks.

[0036] Reference is made to the appendices designed to favour the assembly in peripheral position of the electrical motor designed to drive the internal drum into rotation, and also to the appendices used to apply fixing means used to join the tank to the bearing case of the household appliance during packaging and transport operations (when the tank, which is usually mounted on elastic elements; is subjected to undesired dangerous shocks).

[0037] For clarity purposes the description of the invention continues with reference to the enclosed drawings, which only have an illustrative, not limiting purpose, whereby:

[0038] FIG. 1 is an axonometric view of the tank of the invention, without the reinforcing cap;

[0039] FIG. 2 is an axonometric external view of the said cap;

[0040] FIG. 3 is an axonometric internal view of the said cap;

[0041] FIG. 4 is an axonometric view of the aforementioned components one in front of the other one, without permanent fixing;

[0042] FIG. 5 is an axonometric view of the tank in assembled condition;

[0043] FIG. 6 is an axonometric exploded view of the tank, in the embodiment designed to be associated with the corresponding electrical motor according to the direct drive technology.

[0044] With reference to FIG. 1, the tank of the invention (1) is usually composed of a plastic moulded cylindrical structure and designed to be frontally closed with a circular flange (not shown in the enclosed figures) provided with a large opening used to load laundry inside the traditional rotary drum (not shown in the enclosed figures) housed in the tank.

[0045] As mentioned earlier, the peculiarity of the new tank (1) consists in the presence of a smooth bottom wall (2) without stiffening ribs or inward projecting areas.

[0046] The wall (2) is provided with a central hole (2a) that receives the shaft of the drum housed in the tank (1).

[0047] With reference to FIGS. 2 and 3, the second component of the tank (1) consists in a sort of circular cap (3) provided with a plurality of internally hollow spokes (3a) obtained by moulding plastic materials.

[0048] In particular, the spokes (3a) protrude from a central cylindrical nozzle (3b) and are joined at the peripheral ends with the internally hollow annular border (3c) of the cap (3).

[0049] As shown in FIGS. 2 and 3, the central nozzle (3b) is considerably longer than the thickness of the annular perimeter border (3c); because of this, the spokes (3a) have a section with decreasing height from the centre to the peripheral area.

[0050] The cylindrical nozzle (3b) is designed to house a metal bearing support (SP) that receives exactly the shaft of the drum after passing through the hole (2a) of the bottom wall (2) of the tank (1); reference is made to FIG. 2 that shows the said support (SP) in an exploded view.

[0051] The bearing support (SP) is preferably co-moulded with the cap (3).

[0052] In any case, the cap (3) is designed to be fixed in external position on the flat bottom wall (2) of the tank (1), with the concave side facing the flat wall (2).

[0053] In order to guarantee the mutual coupling between the two components, the cap (3) has a basically identical diameter as the bottom wall (2) of the tank (1) and the central nozzle (3b) of the cap (3) is perfectly aligned with the hole (2a) obtained in the bottom wall (2).

[0054] The cooperation between the cap (3) and the bottom wall (2) of the tank (1) allows to obtain a box-shaped structure on the back of the tank, which is composed of a series of radial compartments (V1), each of them is bordered by one of the spokes (3a) of the cap (3), and an annular compartment (V2) bordered by the annular border (3c) of the cap (3).

[0055] The presence of the box-shaped structure allows the bottom wall (2) to acquire the necessary resistance to withstand without damages the mechanical stress transmitted by the rotations of the shaft of the drum full with wet laundry.

[0056] The stable fixing of the cap (3) against the bottom wall (2) of the tank (1) can be obtained according to different suitable modes, such as gluing, welding or screwing.

[0057] The cap (3) can be also provided on the external side with basically cylindrical appendices (4, 5) obtained during the same process and with the same moulding material used for the cap (3).

[0058] The appendices (4, 5) have a parallel position to the central nozzle (3b) and are designed to favour the application of the means used to ensure the stable fixing of the entire tank (1) to the bearing structure of the washing machine during packaging and transportation.

[0059] To that end, each appendix (4, 5) is frontally provided with a corresponding axial hole (4a, 5a) used to screw a corresponding screw.

[0060] In particular, in the embodiment of the cap (3) shown in the enclosed figures, a first opposite pair (4) of appendices is provided at a higher height directly protruding from the annular border (3c), and a second pair (5) of appendices is provided at a lower height protruding on the front of corresponding small hollow arms (5b) that protrude radially from the annular border (3c).

[0061] Finally, a third pair (6) of similar appendices is provided between the two appendices of the second pair (6), protruding on the front of corresponding small hollow arms (6b), designed to be used to fix the electrical motor that drives into rotation the shaft of the drum housed inside the cylindrical nozzle (3b) of the cap (3) by means of a drive belt.

[0062] Also the appendices (6) of the third pair are frontally provided with axial holes (6a) for suitable fixing screws.
The small radial arms (5a, 6a) are provided with corresponding internal cavities designed to be exactly covered, when the cap (3) is engaged to the bottom wall (2) of the tank (1), by corresponding ears (50a, 60a) that protrude from the border of the bottom wall (2) of the tank (1) to generate relevant box-shaped structures.

Finally, FIG. 6 shows the embodiment of the cap (3) designed to mount the electrical motor according to the direct drive technology.

In such a case, the external surface of the cap (3) is provided with three fixing holes (3d) for the stator (ST), with a corresponding rotor (RT) that rotates outside it splined to the shaft of the drum that partially protrudes from the cylindrical nozzle (3b) of the cap (3).

1. Washing machine tank comprising:
   a basically cylindrical structure (1) obtained by moulding plastic materials, designed to house a rotary metal drum, said cylindrical structure (1) being provided with a smooth bottom wall (2) with a central hole (2a) and a cap (3) exactly engaged and permanently fixed to said bottom wall (2) of the cylindrical structure (1), said cap (3) having a cylindrical nozzle (3b) in central position designed to be perfectly aligned with the central hole (2a) of the bottom wall (2), wherein said cap (3) is obtained by moulding plastic materials, said cap (3) being fixed in external position, against to said bottom wall (2) of the cylindrical structure (1) by means of gluing, welding or screwing, said cap (3) having a concave side facing the smooth bottom wall (2) of said cylindrical structure (1).

2. Washing machine tank as claimed in claim 1, wherein the nozzle (3b) of the cap (3) houses a metal bearing support (SP).

3. Washing machine tank as claimed in claim 1 wherein the cap (3) is provided with a series of spokes (3a) starting from the central nozzle (3b) with corresponding cavities facing the bottom wall (2) of the tank (1).

4. Washing machine tank as claimed in claim 3, wherein the spokes (3a) of the cap (3) are coupled at the ends with an annular border (3c) with cavity facing the bottom wall (2) of the cylindrical structure (1).

5. Washing machine tank as claimed on claim 4, characterised in that the central nozzle (3b) of the cap (3) is longer than the height of the annular border (3c) and, consequently, the spokes (3a) have a decreasing height from the centre to the peripheral area.

6. Washing machine tank as claimed in claim 4, wherein the annular border (3c) of the cap (3) is provided with appendixes (4, 5, 6) used to mount the fixing means to the bearing structure of the washing machine and the electrical motor.

7. Washing machine tank as claimed in claim 5, wherein the appendixes (4, 5, 6) have a basically cylindrical structure parallel to the central nozzle (3b) of the cap (3) and are provided with relevant axial holes (4a, 5a, 6a) used to insert screws or similar fixing means.

8. Washing machine tank as claimed in one or more of the claims 4, wherein a first opposite pair (4) of appendixes designed to receive the fixing means of the bearing structure of the washing machine protrude directly from the annular border (3c) of the cap (3) and a second opposite pair (5) of appendixes protrudes at a lower height protruding on the front of corresponding small arms (5b) that protrude radially from the annular border (3c).

9. Washing machine tank as claimed in claim 5, wherein the appendixes (6) designed to favour the mounting of an electrical motor protrude from corresponding small arms (6b) that protrude radially from the annular border (3c) of the cap (3).

10. Washing machine tank as claimed in claim 1, wherein the small radial arms (5a, 6a) (50, 60) protruding from the cap (3) are provided with internal cavities facing the bottom wall (2) of the cylindrical structure (1) of the tank designed to engage exactly against corresponding ears (50a, 60a) protruding from the border of the bottom wall (2).

11. Washing machine tank as claimed in claim 1, wherein the cap (3) is frontally provided with holes (3d) for direct mounting of a stator (ST) of an electrical motor, with rotor (RT) splined to the shaft of the drum that protrudes slightly from the nozzle (3b).

* * * * *