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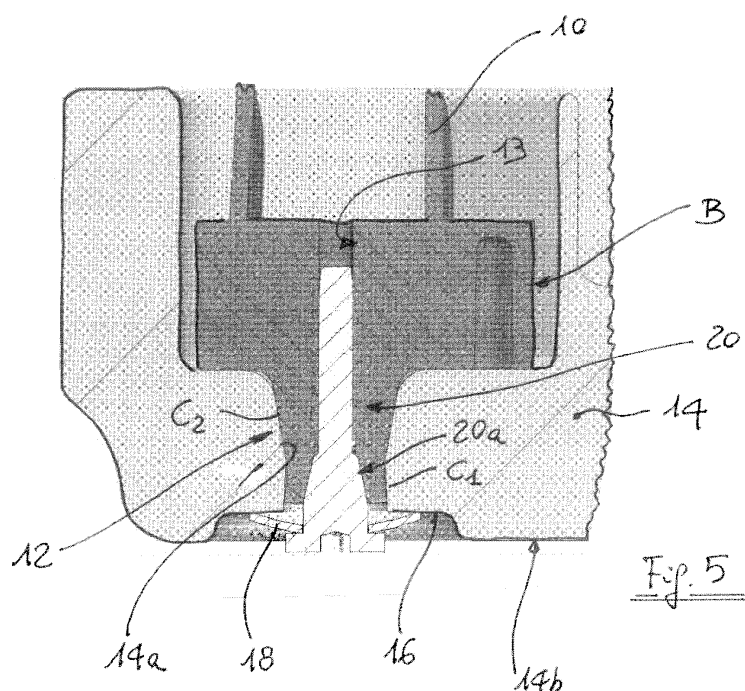
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(54) **Washing machine with a counterbalance weight fixing system**

(57) A washing machine has a tub (10) made of polymeric material and at least a counterbalance weight (14) attached thereto by means of detachable screw connections comprising pin-shaped protrusions (12) integral with the tub (10) and with a shape corresponding to through openings (14a) provided in the counterbalance weight (14). Each protrusion (12) has a central hole (13)

with longitudinal slots (12b) adapted to cooperate with a corresponding self-tapping screw (20) so that, when the counterbalance weight is fixed to the tub, a predetermined radial force is created between each protrusion and the corresponding opening of the counterbalance weight in order to obtain a combined axial and radial fastening between protrusions and openings.



Description

[0001] The present invention relates to a washing machine having a tub made of polymeric material and at least a counterbalance weight attached thereto by means of detachable screw connections comprising pin-shaped protrusions integral with the tub with a shape corresponding to through openings provided in the counterbalance weight.

[0002] A washing machine of this type is shown in DE-A-4238686 in which the force exerted between the protrusions and the bores in the ballast mass is predominantly an axial force. This is obtained by using, between each screw head and the ballast mass, a spring plate which has been curved concavely under pretension. Even if this known solution improves the fastening of the ballast masses, the use of the spring plates increases also the overall cost of the system.

[0003] EP-A-1659203 discloses an anchorage device for fastening a counterweight to a washing machine tub in which a concrete ballast is poured in a hollow plastic shell. For fixing such shell to the tub expansion cavities are used, in which self-tapping thread portions of screws are screwed. A part from the higher cost of ballast masses obtained by pouring concrete in a shell, such document does not provide any useful teaching for the kind of washing machines specified at the beginning of the description. Even if an expansion of threaded fastening means is disclosed, such expansion is only used for increasing the connection between the polymeric shell and the concrete ballast.

[0004] EP-A-798412 discloses an anchorage system in which the through openings provided in the concrete body have an internal shape with a diminishing diameter towards the washing machine tub. This solution, even if it can assure an axial and radial fixing system, does need the use of quite complex plastic inserts in the concrete body.

[0005] An object of the present invention is to provide a washing machine of the type specified above in which the connection between the counterbalance weight and the tub is highly improved without a corresponding increase of the overall cost of the machine.

[0006] According to the invention, such object is obtained thanks to the features specified in the attached claims.

[0007] Further advantages and features of a washing machine according to the invention will be more readily understood from the detailed description of one embodiment thereof, given by way of non limiting example, with reference to the accompanying drawings in which:

- Figure 1 is a perspective view of a front piece of a polymeric tub of a washing machine according to the invention;
- Figure 2 is a front view of a counterbalance weight adapted to be installed on the tub of figure 1;
- Figure 3 is a sectional view taken along line III-III of

figure 2;

- Figure 4 is a detail of figure 1; and
- Figure 5 is a cross sectional view of how the detail of figure 4 works for fastening the counterbalance weight to the tub.

[0008] With reference to the drawings, with 10 is shown a half shell of a plastic tub of a horizontal axis washing machine having three pin-shaped protrusions 12 substantially parallel to the axis of the tub 10. Each protrusion 12 (figure 4) presents a cylindrical base B, a central stem 12a, three longitudinal slots 12b provided in a free end T of the stem 12a and a plurality of tapered radial wings 12c which are integral with the stem 12a and present a bigger dimension towards the tub 10 of the washing machine. The central stem 12a presents a central bore 13.

[0009] The external shape and diameter of each protrusion 12 corresponds substantially to the shape and diameter of three through holes 14a provided in a counterbalance weight 14 (figures 2 and 3). Each hole 14a is so shaped in order to have an entry cone C1 (figure 5) and an exit cone C2 (with reference to the movement of a fixing screw) in which the exit cone C2 is higher than the entry cone C1, and the slightly tapered shape of the exit cone C2 corresponds also to the tapered shape of each protrusion 12 (figures 4 and 5).

[0010] The front face of the counterbalance weight 14, indicated in the drawings with reference number 14b, presents three lowered zones 16 coaxial with the holes 14a in order to cooperate with corresponding washers 18 of self-tapping screws 20 adapted to be screwed in the bores 13 of the protrusions 12. Each screw 20 has a not-threaded tapered portion 20a, near the head thereof.

[0011] As it is clear from figure 5, when the screw 20 rotates in the bore 13 of the protrusion 12, it reaches a position in which the tapered portion 20a enters the bore 13 of the protrusion, starting to cause a radial expansion of the end T of the stem 12a. This expansion assures that the counterbalance weight 14 is not only fixed to the tub 10 by the axial force between the washer 18 and the mass 14, but also by a radial force between each "expanded" protrusion and such mass. The shape of each protrusion 12, with its resilient end T and wings 12c helps in assuring the above radial force; of course other shape could be used for obtaining a similar effect.

[0012] Moreover, a predetermined ratio between the diameter of the self-tapping screw 20 and the diameter of the central bore 13 of each protrusion 12 can be used for having a predetermined radial expansion of the protrusion, either alone or in combination with the tapered portion of the self-tapping screw.

[0013] With the above solution it is possible to have a tolerance adaptation and enough surface contact to carry the dynamic load typical of modern washing machine. Moreover the combination of expansion and direct screwing increases surprisingly the reliability of the fastening system.

Claims

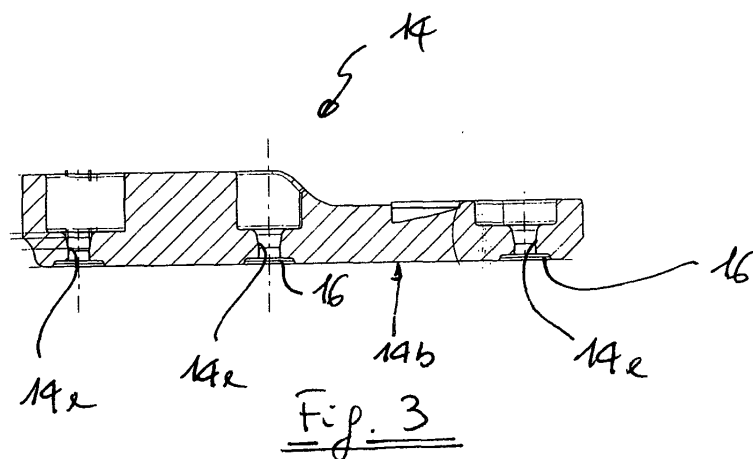
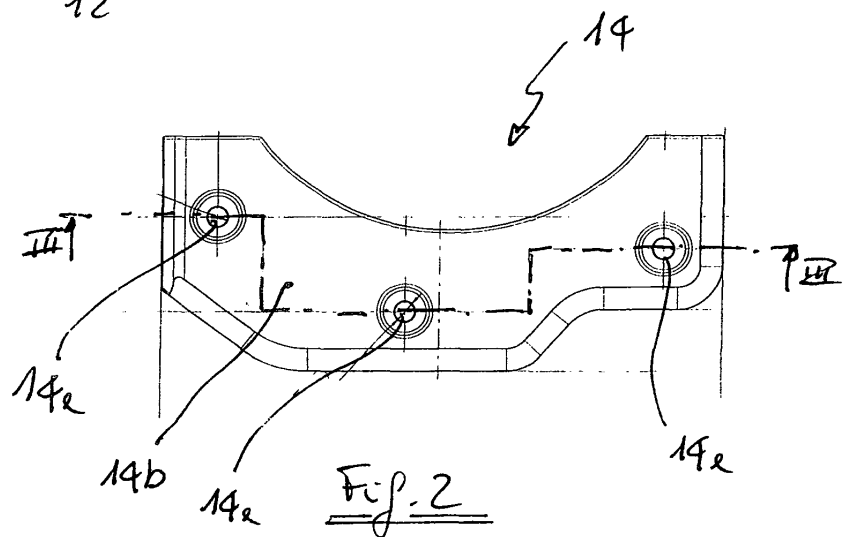
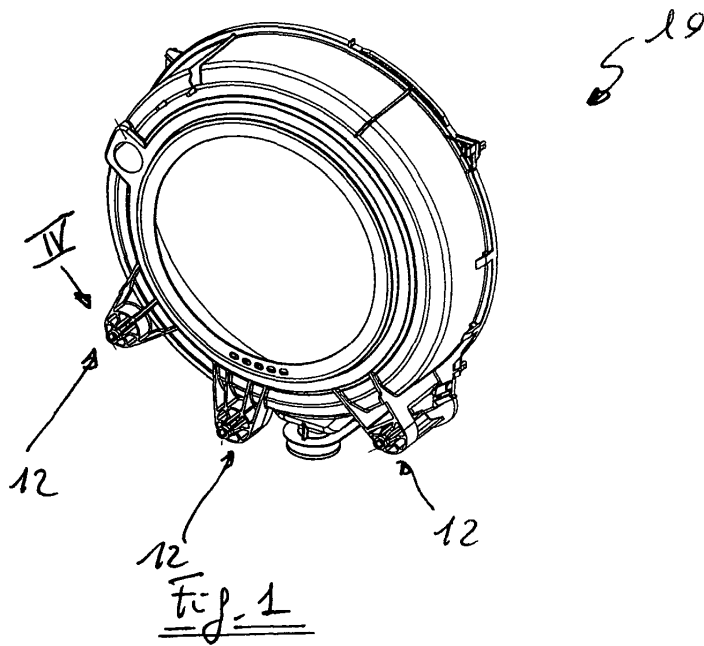
1. Washing machine having a tub (10) made of polymeric material and at least a counterbalance weight (14) attached thereto by means of detachable screw connections comprising pin-shaped protrusions (12) integral with the tub (10) and with a shape corresponding to through openings (14a) provided in the counterbalance weight (14), **characterised in that** each protrusion (12) has a central hole (13) adapted to cooperate with a corresponding self-tapping screw (20) so that, when the counterbalance weight (14) is fixed to the tub (10), a predetermined radial force is created between each protrusion (12) and the corresponding opening (14a) of the counterbalance weight (14) in order to obtain a combined axial and radial fastening between protrusions (12) and openings (14a).
2. Washing machine according to claim 1, **characterised in that** the self-tapping screw (20) presents an end tapered portion (20a) adapted to expand radially said protrusion (12).
3. Washing machine according to claim 1 or 2, wherein each protrusion (12) presents a stem portion (12a) having a free end (T) with longitudinal slots (12b) in order to guarantee a predetermined expansion of such stem portion (12a).
4. Washing machine according to claim 3, **characterised in that** each protrusion (12) presents radial wings (12c) integral with the stem portion (12a).
5. Washing machine according to claim 4, **characterised in that** the radial wings (12c) are tapered so as to present a bigger dimension towards the tub (10) of the washing machine.

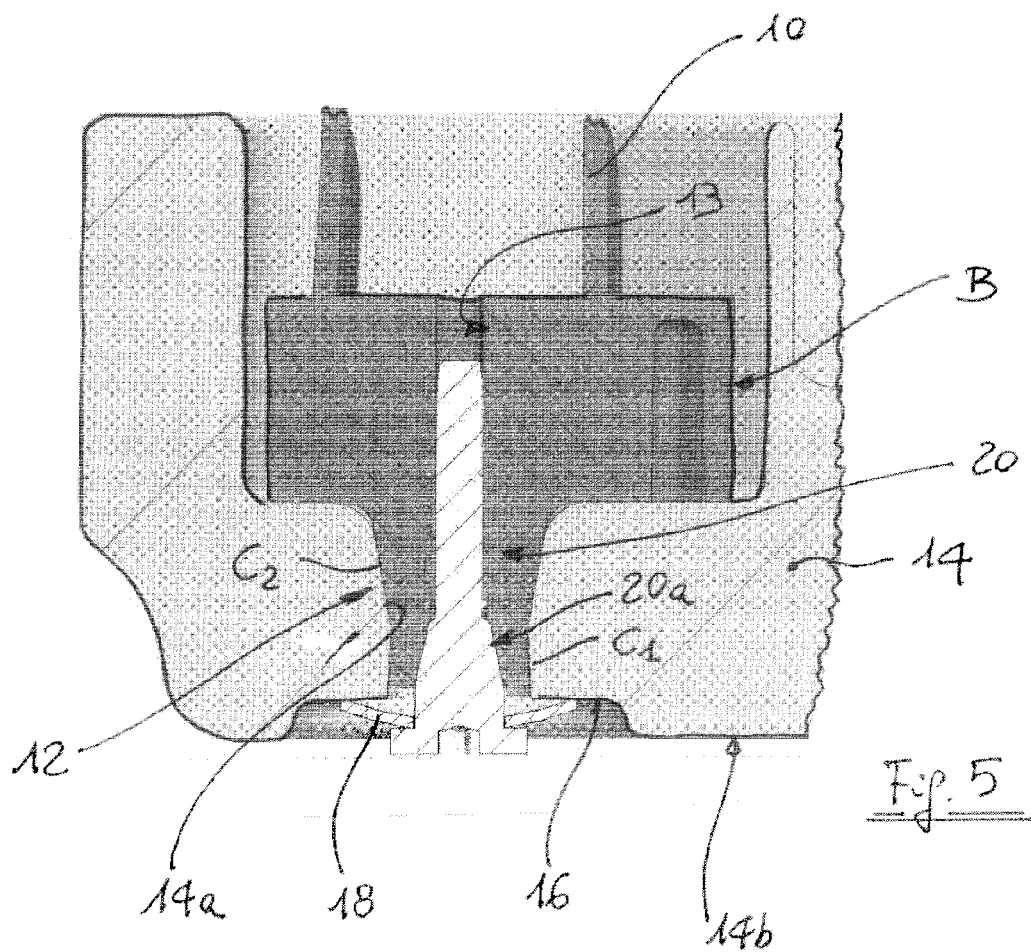
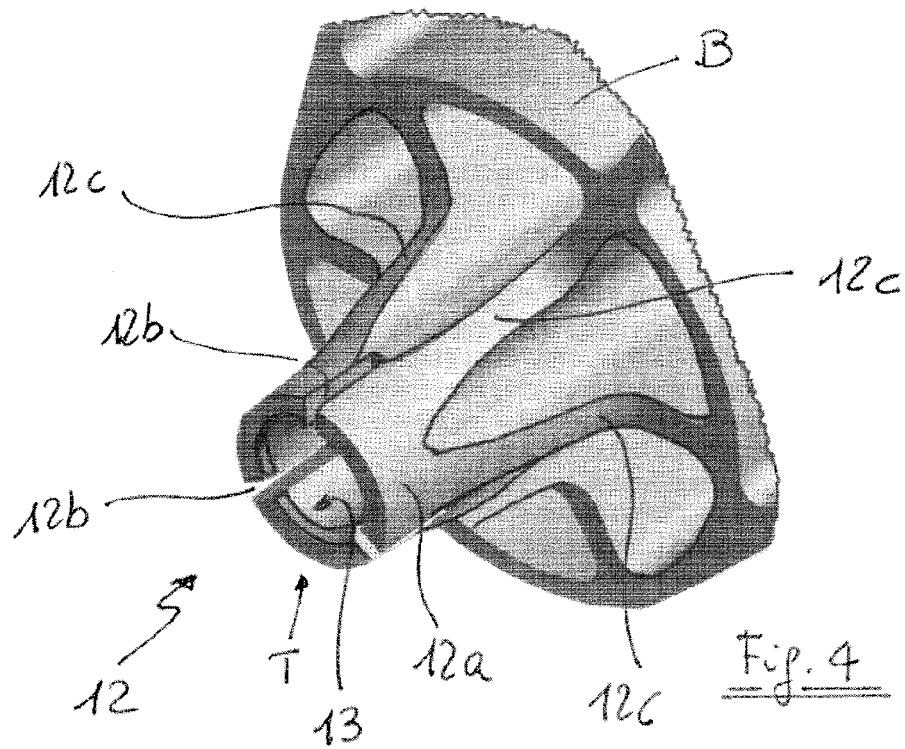
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Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
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X	EP 0 965 676 A1 (BALAY SA [ES]) 22 December 1999 (1999-12-22) * paragraph [0023] - paragraph [0032]; figures 1-3 *	1,2,4,5	
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			TECHNICAL FIELDS SEARCHED (IPC)
			D06F
The present search report has been drawn up for all claims			
Place of search Munich		Date of completion of the search 5 July 2007	Examiner Hannam, Martin
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
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EP 07 10 2912

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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- EP 1659203 A [0003]
- EP 798412 A [0004]