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(54) **A tumble dryer with a humidity sensor system**

(57) The present invention regards a tumble dryer comprising:

- a laundry drum for loading/unloading the laundry;
- a humidity sensor system comprising at least one support for two or more electrodes, electrically insulated one another and positioned in such a way that the electrodes are placed into or face the internal of the laundry drum, so as to contact the laundry loaded into the latter, the

elec-trodes being electrically connected or connectable to a de-tection circuit and/or a control unit of the tumble dryer.

Advantageously the support comprises at least two seat or channels for receiving the electrodes; each seat or channel comprises at least one retaining element adapted for retaining a respective electrode into the seat or channel.

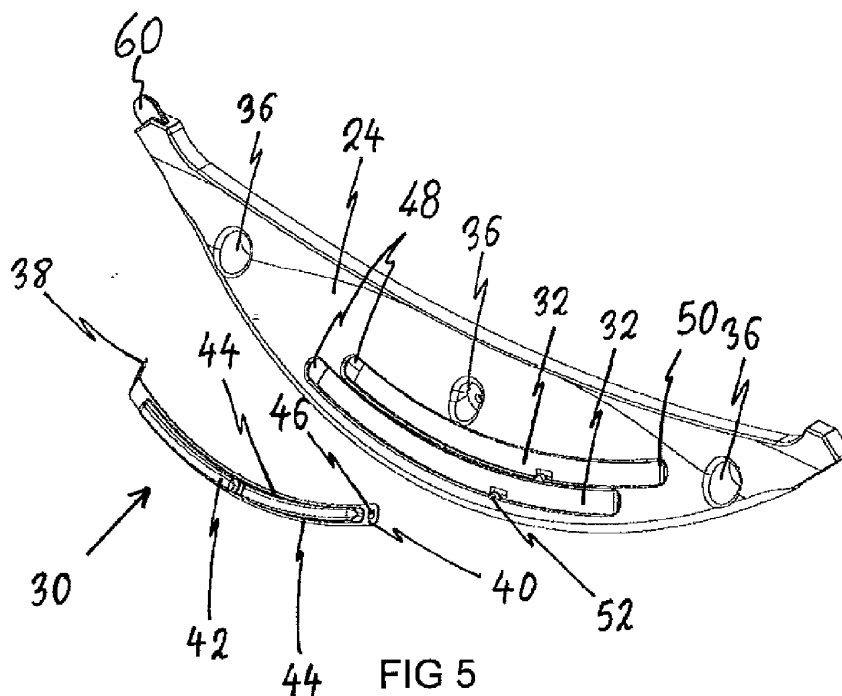


FIG 5

Description

[0001] The present invention relates to a tumble dryer with a humidity sensor system.

[0002] Tumble dryers and other domestic appliances, e.g. spinner-washers, require a humidity sensor in order to obtain information about the actual humidity of the laundry in the drum or of the air exiting the latter. This information is used for controlling the tumble dryer, e.g. for stopping the drying cycle when the detected humidity of the laundry is below a prefixed value.

[0003] DE 195 21 625 C1 discloses a humidity sensor for a tumble dryer. The humidity sensor includes a pair of contact stripes fastened at a plastic wall of the air channel. One end of the strip has a particular shape and forms a spring engaging a hole obtained in the wall. The costs of these electrodes are high, since elastic as well as conductive metal is required. Moreover, the thermal deformations of the electrodes due to the high variations of the temperature in the dryer may cause that the elasticity of the spring end is reduced. This results that the fastening of the electrode should be compromised.

[0004] US 3,593,571 discloses a dryness sensor assembly including a pair of electrodes. The fixation of the electrodes requires clip means. Thus, this dryness sensor assembly is relative expensive and the installation of this dryness sensor assembly is time-consuming.

[0005] US 4,899,464 discloses a moisture sensor for an automatic tumble dryer. Sensor strips are secured directly to the drum. The fastening of the sensor strips is less effective. The assembly of the sensor strips is quite difficult, since after placing the first end of the sensor strips in a corresponding aperture, the introducing of the second end in the corresponding aperture the sensor strip or at least its second end has to be bent with the risk of damaging it.

[0006] It is an object of the present invention to provide a tumble dryer with an improved humidity sensor system, which overcomes the above disadvantages.

[0007] The object of the present invention is achieved by the tumble dryer with the humidity sensor system according to claim 1.

[0008] According to the present invention the tumble dryer comprises:

- a laundry drum for loading/unloading the laundry;
- a humidity sensor system comprising at least one support for two or more electrodes, electrically insulated one another and positioned in such a way that the electrodes are placed into or face the internal of the laundry drum, so as to contact the laundry loaded into the latter, the electrodes being electrically connected or connectable to a detection circuit and/or a control unit of the tumble dryer.

[0009] Advantageously the support comprises at least two seats or channels for receiving the electrodes; each seat or channel comprises at least one retaining element

adapted for retaining a respective electrode into the seat or channel.

[0010] Advantageously, the at least one retaining element may be obtained in a single piece construction with the respective seat or channel.

[0011] Preferably the at least one retaining element protrudes from the side wall of the respective seat or channel towards the internal of the seat or channel.

[0012] Opportunely, the electrodes comprise a lateral border and the at least one retaining element is arranged in such a way to extend over the border of the respective electrode when the latter is placed into the respective seat or channel, so as to clamp the border and to fix the electrode into the seat or channel.

[0013] Preferably the electrodes comprise a first appendix or end inserted in or insertable into a first opening obtained in a portion of the respective seat or channel, so that the first appendix or end protrudes externally from the seat or channel.

[0014] Advantageously the first appendix or end is connected or connectable to electric connections for connecting the electrode to the detection circuit and/or control unit.

[0015] In a further embodiment, a second end of the electrodes is inserted in or insertable into a second opening obtained in the respective seat or channel.

[0016] Preferably the electrodes and the respective channels have an elongated shape.

[0017] Advantageously each electrode is moveable within a respective seat or channel about a predetermined length and along the common longitudinal axis of the electrode and seat or channel.

[0018] Preferably the electrode comprises a lateral border comprising at least one cut in order to overcome the at least one retaining element during inserting the electrode into the respective seat or channel.

[0019] Opportunely the cut is arranged at the border in such a way that, after inserting the electrode into the respective seat or channel, the at least one retaining element overlaps the border and keeps the electrode within the seat or channel after the electrode has been properly moved internally to the seat or channel.

[0020] Preferably the support is associated to, or associable to, or comprised into a front wall or flange or bulkhead associated to the casing of the tumble drier.

[0021] According to another aspect of the present invention the electrode is at least partially disappearing within the channel, wherein said electrode is clampable by the retaining element of the channel and the border of electrode. The electrode advantageously requires no material with special mechanical properties.

[0022] Advantageously, the electrode is moveable within the channel about a predetermined length and along the common longitudinal axis of the electrode and channel.

[0023] Preferably, at least one end of the electrode is inserted in or insertable into an opening in an end portion of the channel. In a similar way, both ends of the electrode

may preferably be inserted in or insertable into openings in the both end portions of the channel.

[0024] Advantageously, at least one end of the electrode is longer than the predetermined length defining the movability of the electrode within the channel along the common longitudinal axis. At first the longer electrode is inserted into the corresponding opening. Then the other electrode is inserted into the opposite opening. At last, the electrode is moved into the direction of said other electrode.

[0025] According to a preferred embodiment of the present invention, the retaining element extends from the longitudinal side wall of the channel inside said seat or channel and perpendicular to the longitudinal axis of the seat or channel.

[0026] Additionally, the seat or channel may comprise at least one recess corresponding with the retaining element, so that the border of the electrode is clampable between the retaining element and said recess.

[0027] Further, the border of the electrode may comprise at least one cut in order to overcome the retaining element during inserting said electrode into the channel. The cut simplifies the inserting of the electrode into the channel.

[0028] Preferably, the cut is arranged at the border, so that the retaining element supports the border and keeps the electrode within the seat or channel after the electrode has been moved about the predetermined length and along the common longitudinal axis. This is an efficient latching mechanism.

[0029] Preferably, a main part of the electrode is formed as a U-shaped profile section. This contributes to an increased stability and allows that a substantial part of the electrode is exposed to the contact with the laundry loaded into the drum.

[0030] In a further aspect, the invention relates to a tumble dryer comprising:

- a laundry drum for loading/unloading the laundry;
- a humidity sensor system comprising at least one support for two or more electrodes, electrically insulated one another and positioned in such a way that the electrodes are placed into or face the internal of the laundry drum, so as to contact the laundry loaded into the latter, the electrodes being electrically connected or connectable to a detection circuit and/or a control unit of the tumble dryer.

[0031] Advantageously the support is attached or attachable at a seat arranged in an inner side wall or flange or bulkhead comprised or contained in the casing of the tumble drier; at least one hole is advantageously arranged in the inner side wall or flange or bulkhead for conducting electric cables connecting the electrodes to the detection circuit and/or control unit; the support comprises at least one appendix or wing for covering at least partially the hole.

[0032] Preferably the appendix or wing is formed as a

protruding sheet.

[0033] Opportunely the seat is complementary to the support, so that the support is form-locking within the inner side wall or flange or bulkhead.

5 **[0034]** According to another aspect of the invention, the support is attached or attachable at a seat arranged in an inner side wall of the air stream channel, at least one hole is arranged in the inner side wall of the air stream channel for conducting electric cables connecting the electrodes to the detection circuit and/or control unit of the tumble dryer, and the support comprises at least one wing for covering at least partially this hole.

10 **[0035]** The wing is provided to obstruct at least partially a clearance between the hole and the support in order to prevent that moisture enters said clearance. This reduces the risk of damage the electronic components arranged downstream the hole.

15 **[0036]** Preferably, the wing is formed as a protruding sheet.

20 **[0037]** Further, the seat is complementary to the support, so that the support is form-locking within the inner side wall of an air stream channel.

25 **[0038]** Advantageously, the support may be attached or attachable at a flange enclosing an opening of the tumble dryer.

[0039] The novel and inventive features believed to be the characteristic of the present invention are set forth in the appended claims.

30 **[0040]** The invention will be described in further detail with reference to the drawings, in which

FIG 1 illustrates a sectional side view of a tumble dryer including a humidity sensor system according to a first embodiment of the present invention,

FIG 2 illustrates a sectional side view of the humidity sensor system according to the first embodiment of the present invention,

FIG 3 illustrates a perspective rear view of a front wall for the tumble dryer including the humidity sensor system according to the first embodiment of the present invention,

FIG 4 illustrates a perspective view of a support of the humidity sensor system according to the first embodiment of the present invention,

FIG 5 illustrates a perspective view of the support and an electrode of the humidity sensor system according to the first embodiment of the present invention, in a condition in which the electrode is not associated to the support,

FIG 6 illustrates a further perspective view of the support and the electrode of the humidity sensor system of FIG 5,

FIG 7	illustrates a perspective view of the support and the partially inserted electrode of the humidity sensor system according to the first embodiment of the present invention,		FIG 15a	illustrates a perspective view of the support and the one inserted electrode of the humidity sensor system according to the second embodiment of the present invention,
FIG 8	illustrates a perspective rear view of the support and the partially inserted electrode of the humidity sensor system according to the first embodiment of the present invention,	5	FIG 17a	illustrates a perspective view of the support and one finally mounted electrode of the humidity sensor system according to the second embodiment of the present invention,
FIG 9	illustrates a perspective view of the support and the inserted electrode of the humidity sensor system according to the first embodiment of the present invention,	10	FIG 17b	illustrates a detailed perspective view of the support and the one finally mounted electrode of the humidity sensor system of FIG 15a according to the second embodiment of the present invention,
FIG 10	illustrates a perspective view of the support and the finally mounted electrode of the humidity sensor system according to the first embodiment of the present invention,	15	FIG 18	illustrates a sectional side view at line C-C in FIG 17a of the support and the one finally mounted electrode of the humidity sensor system according to the second embodiment of the present invention,
FIG 11	illustrates a perspective rear view of the support and the finally mounted electrode of the humidity sensor system according to the first embodiment of the present invention,	20	FIG 19	illustrates a perspective rear view of the front wall of the tumble dryer provided for the humidity sensor system according to an embodiment of the present invention,
FIG 12	illustrates a perspective view of the support and two finally mounted electrodes of the humidity sensor system according to the first embodiment of the present invention,	25	FIG 20	illustrates a perspective front view of the front wall of FIG 19,
FIG 13	illustrates a sectional side view at line A-A in FIG 12 of the support and the two finally mounted electrodes of the humidity sensor system according to the first embodiment of the present invention,	30	FIG 21	illustrates a perspective front view of a lower portion of the front wall of FIG 18,
FIG 14a	illustrates a perspective view of the electrode of the humidity sensor system according to a second embodiment of the present invention,	35	FIG 22	illustrates a perspective rear view of the front wall of FIG 19 with the humidity sensor system in a semi-mounted state,
FIG 14b	illustrates a detailed perspective view of the electrode of the humidity sensor system of FIG 14a according to the second embodiment of the present invention,	40	FIG 23	illustrates a perspective front view of the lower portion of the front of FIG 22 wall with the humidity sensor system in a semi-mounted state,
FIG 15a	illustrates a perspective view of the support and the one inserted electrode of the humidity sensor system according to the second embodiment of the present invention,	45	FIG 24	illustrates a perspective rear view of the lower portion of the front wall of FIG 19 with the humidity sensor system in a mounted state,
FIG 15b	illustrates a detailed perspective view of the support and the one inserted electrode of the humidity sensor system of FIG 15a according to the second embodiment of the present invention,	50	FIG 25	illustrates a perspective front view of the lower portion of the front wall of FIG 24,
FIG 16	illustrates a sectional side view at line B-B in	55	FIG 26	illustrates a front view of the front wall with the humidity sensor system in a mounted state,
			FIG 27	illustrates an enlarged detail of FIG 26,
			FIG 28	illustrates a rear view of the front wall with the humidity sensor system in a mounted state, and

FIG 29 illustrates a sectional view at line D-D in FIG 27.

[0041] FIG 1 illustrates a sectional side view of a tumble dryer 10 including a humidity sensor system according to a first embodiment of the present invention.

[0042] The tumble dryer 10 advantageously comprises a casing 12 with a loading/unloading opening preferably at its front side. This opening is closable by a door 16. A laundry drum 14 is rotatably arranged inside the casing 12. The open front side of the laundry drum 14 is advantageously sealed by a gasket 28 fixed preferably to a frontal wall or flange or bulkhead 26 which is associated to the casing 12, preferably frontally, and which preferably encloses the loading/unloading opening of the tumble dryer 10; advantageously the frontal edge of the laundry drum 14 is in contact to and slides on the gasket 28, so as to guarantee a rotatable airtight connection between the laundry drum 14 and the gasket 28.

[0043] The tumble drier 10 is arranged in such a way that an air stream 18 may circulate between the laundry drum 14 and an air stream channel 20. The air stream channel 20 extends preferably below and behind the laundry drum 14; advantageously the frontal wall or flange or bulkhead 26 is comprised in the air stream channel 20.

[0044] A condenser 22 is preferably arranged within the air stream channel 20, advantageously but not necessarily below the laundry drum 14.

[0045] During operation of the tumble drier, the air stream 18, advantageously heated before entering the laundry drum 14, circulates through the laundry drum 14 and the air stream channel 20, so as to remove the moisture from the laundry loaded into the laundry drum 14. The condenser 22 cools down the air stream 18 exiting from the laundry drum 14 and removes moisture from the air stream 18. After passing the condenser 22, the air stream 18 is heated up again within the air stream channel 20, for example by an electric heater or a heat pump system. Then, the air stream 18 is introduced into the laundry drum 14 again. Thus, the air stream 18 circulates within a closed loop.

[0046] Alternatively, the present invention may be applied to a vented tumble dryer, wherein the hot and humid air stream 18 exiting the laundry drum 14 is blown to the environment without recirculation.

[0047] As mentioned above, the loading/unloading opening of the tumble dryer 10 is enclosed (or surrounded) by a front wall or flange or bulkhead 26.

[0048] The tumble drier 10 comprises a support 24 for two or more electrodes 30, electrically insulated one another, which is positioned in such a way that the electrodes 30 are placed into or faces the internal of the laundry drum 14, so as to contact the laundry loaded into the latter.

[0049] Preferably the support 24 is attached at a lower portion of the front wall or flange or bulkhead 26. In this case the support 24 is arranged internally or in proximity

to laundry drum 14, preferably but not necessarily in correspondence to the inlet of the air stream channel 20. The support 24 is advantageously a part of the humidity sensor system. Advantageously, the support 24 may be obtained in a single piece construction with the front wall or flange or bulkhead 26 (i.e. it may be part of the front wall or flange or bulkhead 26); alternatively, the support 24 and the front wall or flange or bulkhead 26 may be advantageously obtained as a completely separate components, and they may be associated one another after their manufacture.

[0050] FIG 2 illustrates a sectional side view of the humidity sensor system according to the first embodiment of the present invention. The support 24 may be advantageously attached at the lower portion of the front wall or flange or bulkhead 26 (or in a further embodiment the support 24 and the front wall or flange or bulkhead 26 may be obtained in a single piece construction).

[0051] As mentioned above, two (or more) electrodes 30 are advantageously attached at the support 24; advantageously the electrodes 30 are electrically insulated one another. It is clear that in a further embodiment, not illustrated, the support 24 may be also defined as the part of the front wall or flange or bulkhead 26 to which the electrodes 30 are associated, and therefore they are not proper distinguish components as in the enclosed figures.

[0052] Advantageously the electrodes 30 are provided for detecting the humidity of the laundry loaded into the laundry drum 14; when a piece of laundry touches both the electrodes, the electrical impedance between the electrodes changes, and can be detected by a suitable detection circuit to which the electrodes are electrically connected. Advantageously the detection circuit detects the humidity of the laundry as a function of the electrical impedance (or of a quantity related to the impedance) between the electrodes 30.

[0053] The electrodes 30 advantageously have a predetermined distance from each other.

[0054] FIG 3 illustrates a perspective rear view of a front wall or flange or bulkhead 26 of the tumble dryer 10 including the humidity sensor system according to the first embodiment of the present invention. In particular, FIG 3 shows the flange 26 enclosing the opening of the tumble dryer 10. A light source 34 may preferably, but not necessarily, be arranged at the upper portion of the front wall or flange or bulkhead 26. The light source 34 is provided for illuminating the inner space of the laundry drum 14.

[0055] The support 24 is preferably attached at the lower portion of the flange 26, for example by screws. To this, the support 24 preferably comprises corresponding screw holes 36.

[0056] In FIG 3 one of the two electrodes 30 is shown. The support 24 comprises two seat or channels 32, having preferably an elongated shape, for receiving one electrode 30 in each case. The channel 32 is substantially complementary to at least part of the electrode 30. The

electrodes 30 as well as the channels 32 are preferably curved. The support 24 is preferably made of an electrically insulating material, so that the two electrodes 30 are electrically insulated from each other. For example, support 24 is made of plastics.

[0057] FIG 4 illustrates a perspective view of the support 24 of the humidity sensor system according to the first embodiment of the present invention; in FIG 4 the electrodes are not shown.

[0058] Each channel or seat 32 advantageously comprises a first opening 48 at one of its ends, and preferably, but not necessarily, also a second opening 50 at its other end.

[0059] Further, each seat or channel 32 preferably comprises at least a retaining element 52 adapted for retaining a respective electrode 30 into the seat or channel 32. Advantageously the retaining element 52 may be placed at a longitudinal side of the channel 32, preferably, but not necessarily, at a lower longitudinal side. The retaining element 52 preferably projects towards the internal of the channel 32.

[0060] FIG 5 illustrates a perspective view of the support 24 and the electrode 30 of the humidity sensor system according to the first embodiment of the present invention. FIG 5 clarifies the relationship between the electrode 30 and the corresponding channel 32.

[0061] The electrodes 30 may advantageously include a first appendix or end 38, a second appendix or end 40, a main part 42 and a lateral border 44.

[0062] Advantageously the first end 38 of the electrodes is adapted to be connected to suitable electric connections for connecting the electrode to a detection circuit or to the control unit of the tumble dryer.

[0063] The second end 40 may advantageously comprise a hole 46. The first end 38 is provided for an inserting into the first opening 48 of the channel 32. The second end 40 may be advantageously provided for a subsequent inserting into the second opening 48 (if the latter is provided) of the channel 32.

[0064] FIG 6 illustrates a further perspective view of the support 24 and the electrode 30 of the humidity sensor system according to the first embodiment of the present invention. FIG 6 clarifies the first step of insertion the electrode 30 into the channel 32. The first end 38 shall be inserted into the first opening 48 of the channel 32 of the support 24.

[0065] FIG 7 illustrates a perspective view of the support 24 and the partially inserted electrode 30 of the humidity sensor system according to the first embodiment of the present invention. In FIG 7 the first end 38 of the electrode 30 is inserted in the first opening 48 of the channel 32 of the support 24.

[0066] FIG 8 illustrates a perspective rear view of the support 24 and the partially inserted electrode 30 of the humidity sensor system according to the first embodiment of the present invention. FIG 8 shows the rear side of the support 24. FIG 8 clarifies that the first end 38 of the electrode 30 penetrates the first opening 48 of the

channel 32 of the support 24.

[0067] FIG 9 illustrates a perspective view of the support 24 and the inserted electrode 30 of the humidity sensor system according to the first embodiment of the present invention. In FIG 9 the electrode 30 is inserted in the channel 32, but the second end 40 of the electrode 30 is not yet inserted into the second opening 50 of the channel 32 (clearly the latter statement refers only to an embodiment, as the one illustrated in enclosed figures, in which the second opening 50 is provided).

[0068] FIG 10 illustrates a perspective view of the support 24 and the finally mounted electrode 32 of the humidity sensor system according to the first embodiment of the present invention. In FIG 10 the electrode 30 has been moved rightward with reference to FIG 9, so that the second end 40 of the electrode 30 is inserted in the second opening 50 of the channel 32. In this situation, the first end 38 of the electrode 30 is still inserted in the first opening 48 of the channel 32.

[0069] FIG 11 illustrates a perspective rear view of the support 24 and the finally mounted electrode 30 of the humidity sensor system according to the first embodiment of the present invention. FIG 11 clarifies that in this embodiment the first end 38 of the electrode 30 is inserted in the first opening 48 of the channel 32 and at the same time the second end 40 of the electrode 30 is inserted in the second opening 50 of the channel 32.

[0070] FIG 12 illustrates a perspective view of the support 24 and two finally mounted electrodes 30 of the humidity sensor system according to the first embodiment of the present invention. In FIG 12 both electrodes 30 are inserted in the corresponding channels 32. Further, both electrodes 30 have been moved rightward within the corresponding channels 32, so that their second ends 40 are inserted in the second opening 50 of the respective channel 32.

[0071] FIG 13 illustrates a sectional side view at line A-A in FIG 12 of the support 24 and the two finally mounted electrodes 30 of the humidity sensor system according to the first embodiment of the present invention. FIG 13 clarifies that at last the retaining element 52 effects the fixation of the electrodes 30 within the channels 32.

[0072] FIG 14a illustrates a perspective view of the electrode 30 of the humidity sensor system according to a second embodiment of the present invention. The electrodes 30 of the second embodiment have substantially the same properties as those of the first embodiment.

[0073] Additionally, the electrode 30 of the second embodiment comprises at least one cut 54 in their border 44. The cut 54 corresponds with the retaining element 52 insofar, as this cut 54 overcomes the retaining element 52 during inserting the electrode 30 into the channel 32. In the first embodiment the retaining element 52 forms a small barrier for the lower border 44 of the electrode 30. Clearly, more than one retaining element 52 may be provided for each channel 32; in this case more than one cuts 54 (or also one or more cuts adapted to overcome more than one retaining element 52) may be correspond-

ently provided in each electrode 30.

[0074] With reference to the second embodiment disclosed in FIGS 14a to 18, the electrode 30 can be inserted in a simple way into the channel 32. The position of the cut 54 is substantially the same as that of the retaining element 52, when the first end 38 of the electrode 30 is completely inserted in the first opening 48 of the channel 32. The electrode may be afterwards moved (for example rightward with reference to figure 15a), until the retaining element 52 supports (overlaps) the border 44.

[0075] FIG 14b illustrates a detailed perspective view of the electrode 30 of the humidity sensor system of FIG 14a according to the second embodiment of the present invention. FIG 14b clarifies a possible geometric structure of the cut 54.

[0076] FIG 15a illustrates a perspective view of the support 24 and one inserted electrode 30 of the humidity sensor system according to the second embodiment of the present invention. The electrode 30 is inserted in the channel 32, and the first end 38 is completely inserted in the first opening 48 of the channel 32. In this situation, the cut 54 and the retaining element 52 are at the same position. FIG 15a clarifies that in this condition the cut 54 overcomes the retaining element 52.

[0077] FIG 15b illustrates a detailed perspective view of the support 24 and the one inserted electrode 30 of the humidity sensor system according to symbol X in FIG 15a. The size of the cut 54 preferably substantially corresponds with the size of the retaining element 52. More in general, the size of the cut 54 is such that the retaining element 52 may at least partially enter the cut 54.

[0078] FIG 16 illustrates a sectional side view at line B-B in FIG 15a of the support 24 and the one inserted electrode 30 of the humidity sensor system according to the second embodiment of the present invention. The retaining element 52 may have for example the form of a tooth.

[0079] FIG 17a illustrates a perspective view of the support 24 and the finally mounted electrode 30 of the humidity sensor system according to the second embodiment of the present invention. FIG 17a is different from FIG 15a in that the electrode 30 has been moved rightward. In this condition the retaining element 52 overlaps the border 44 of the electrode 30, so as to retain the latter into the channel 32.

[0080] FIG 17b illustrates a detailed perspective view of the support 24 and the one finally mounted electrode 30 of the humidity sensor system according to symbol Y in FIG 17a. FIG 17b clarifies that the cut 54 has been moved rightward and the retaining element overlaps the lower border 44 of the electrode 30.

[0081] FIG 18 illustrates a sectional side view at line C-C in FIG 17a of the support 24 and the one finally mounted electrode 30 of the humidity sensor system according to the second embodiment of the present invention. In FIG 18 the lower border 44 of the electrode 30 is arranged below the retaining element 52.

[0082] FIG 19 illustrates a perspective rear view of the

front wall or flange or bulkhead 26 of the tumble dryer 10 provided for the humidity sensor system according to a further embodiment of the present invention. This embodiment of the present invention may be preferably but not necessarily combined with the first embodiment as well as with the second embodiment of the present invention. Alternatively, also a different humidity sensor system (in which for example the electrodes are fixed to the support by gluing or by welding) may be used with the embodiment illustrated in FIGs 19 to 29.

[0083] The front wall or flange or bulkhead 26 preferably comprises a seat 56 provided for fastening the support 24, which is not shown in FIG 19. The seat 56 advantageously includes a hole 58 for the passage of the electric cables 62 which connects the electrodes 30 to the detection circuit or control unit of the tumble dryer.

[0084] FIG 20 illustrates a perspective front view of the front wall or flange or bulkhead 26. FIG 20 shows the other side of the front wall or flange or bulkhead 26 with respect to FIG 19.

[0085] FIG 21 illustrates a perspective front view of a portion of the front wall or flange or bulkhead 26 provided for a humidity sensor system. The electric cables 62 advantageously penetrate the hole 58.

[0086] FIG 22 illustrates a perspective rear view of the front wall or flange or bulkhead 26 with the semi-mounted support 24 of the humidity sensor system. The seat 56 is adapted to lodge the support 24.

[0087] FIG 23 illustrates a perspective front view of the portion of the front wall or flange or bulkhead 26 illustrated in Fig 22.

[0088] The support 24 preferably includes an appendix or wing 60 (illustrated also in Figures 4, 5, 6, 7, 8, 9, 10, 11, 12, 15a, 17a) protruding from a distal end of the support 24. In the mounted state of the support 24, the appendix or wing 60 is placed in the hole 58. The wing 60 obstructs at least partially the clearance between the hole 58 and the support 24 in order to prevent that moisture enters this clearance. This reduces the risk of damage the electronic components arranged downstream the hole 58.

[0089] At first the electric cables 62 are fixed to the electrodes 30. Then the wing 60 is inserted into the hole 58, and finally the support 24 is rotated so as to place it into the seat 56. At last, the support 24 is fixed to the wall or flange or bulkhead 26, for example by screws in the screw holes 36.

[0090] FIG 24 illustrates a perspective rear view of the lower portion of the front wall or flange or bulkhead 26 with the support 24 mounted.

[0091] FIG 25 illustrates a perspective front view of the lower portion of the front wall or flange or bulkhead 26 with the support 24 mounted. FIG 25 is the opposite side with respect to FIG 24.

[0092] FIG 26 illustrates a front view of the front wall or flange or bulkhead 26 with the support 24 mounted. The wing 60 is recognizable from the front side.

[0093] FIG 27 illustrates a detail of FIG 26.

[0094] FIG 28 illustrates a rear view of the front wall or flange or bulkhead 26 with the support 24 mounted.

[0095] FIG 29 illustrates a sectional view at line D-D in FIG 27. FIG 29 clarifies the arrangement of the support 24 and the wing 60 with respect to the flange 26.

[0096] Although the present invention relates to a tumble dryer, the humidity sensor system may be also applied to other domestic appliances like washer-drier or a spinner-washer.

[0097] Although illustrative embodiments of the present invention has been described herein with reference to the accompanying drawings, it is to be understood that the present invention is not limited to those precise embodiments, and that various other changes and modifications may be affected therein by one skilled in the art without departing from the scope or spirit of the invention. All such changes and modifications are intended to be included within the scope of the invention as defined by the appended claims.

Claims

1. A tumble dryer (10) comprising:

- a laundry drum (14) for loading/unloading the laundry;
- a humidity sensor system comprising at least one support (24) for two or more electrodes (30), electrically insulated one another and positioned in such a way that said electrodes (30) are placed into or face the internal of said laundry drum (14), so as to contact the laundry loaded into the latter, said electrodes (30) being electrically connected or connectable to a detection circuit and/or a control unit of the tumble dryer (10),

characterized in that

- said support (24) comprises at least two seat or channels (32) for receiving said electrodes (30),
 - each seat or channel (32) comprises at least one retaining element (52) adapted for retaining a respective electrode (30) into said seat or channel (32).
2. The tumble dryer according to claim 1, wherein said at least one retaining element (52) is obtained in a single piece construction with the respective seat or channel (32).
3. The tumble dryer according to claim 1 or 2, wherein said at least one retaining element (52) protrudes from the side wall of the respective seat channel (32) towards the internal of said seat channel (32).

4. The tumble dryer according to any one of the preceding claims, wherein said electrodes (30) comprise a lateral border (44) and wherein said at least one retaining element (52) is arranged in such a way to extend over the border (44) of the respective electrode (30) when the latter is placed into the respective seat or channel (52), so as to clamp said border (44) and to fix said electrode (30) into said seat or channel (32).
5. The tumble dryer according to any one of the preceding claims, wherein said electrodes comprise a first appendix or end (38) inserted in or insertable into a first opening (48) obtained in a portion of the respective seat or channel (32), so that said first appendix or end (38) protrudes externally from said seat or channel (32).
6. The tumble dryer according to claim 5, wherein said first appendix or end (38) is connected or connectable to electric connections for connecting said electrode (30) to said detection circuit and/or control unit.
7. The tumble dryer according to any one of the preceding claims, wherein a second end (40) of said electrodes (30) is inserted in or insertable into a second opening (50) obtained in the respective seat or channel (32).
8. The tumble dryer according one or more of the preceding claims, wherein said electrodes (30) and said respective channels (32) have an elongated shape.
9. The tumble dryer according to claim 8, wherein each electrode (30) is moveable within a respective channel (32) about a predetermined length and along the common longitudinal axis of the electrode (30) and channel (32).
10. The tumble dryer according to any one of the preceding claims, wherein said electrode comprises a lateral border (44) comprising at least one cut (54) in order to overcome said at least one retaining element (52) during inserting said electrode (30) into the respective seat or channel (32).
11. The tumble dryer according to claim 10, wherein the cut (54) is arranged at the border (44) in such a way that, after inserting said electrode (30) into the respective seat or channel (32), said at least one retaining element (52) overlaps said border (44) and keeps the electrode (30) within the seat or channel (32) after the electrode (30) has been properly moved internally to said seat or channel (32).
12. The tumble dryer (10) according to one or more of the previous claims, wherein said support (24) is associated to, or associable to, or comprised into a

front wall or flange or bulkhead (26) associated to the casing (12) of said tumble drier (10).

13. A tumble dryer (10) comprising:

- a laundry drum (14) for loading/unloading the laundry;
- a humidity sensor system comprising at least one support (24) for two or more electrodes (30), electrically insulated one another and positioned in such a way that said electrodes (30) are placed into or face the internal of said laundry drum (14), so as to contact the laundry loaded into the latter, said electrodes (30) being electrically connected or connectable to a detection circuit and/or a control unit of the tumble dryer (10),

characterized in, that

- the support (24) is attached or attachable at a seat (56) arranged in an inner side wall or flange or bulkhead (26) comprised or contained in the casing (12) of said tumble drier (10),
- at least one hole (58) is arranged in the inner side wall or flange or bulkhead (26) for conducting electric cables (62) connecting the electrodes (30) to said detection circuit and/or control unit, and
- said support (24) comprises at least one appendix or wing (60) for covering at least partially said hole (58).

14. The tumble dryer according to claim 13, wherein said appendix wing (60) is formed as a protruding sheet.

15. The tumble dryer according to claim 14, wherein said seat (56) is complementary to said support (24), so that said support (24) is form-locking within the inner side wall or flange or bulkhead (26) of an air stream channel (20).

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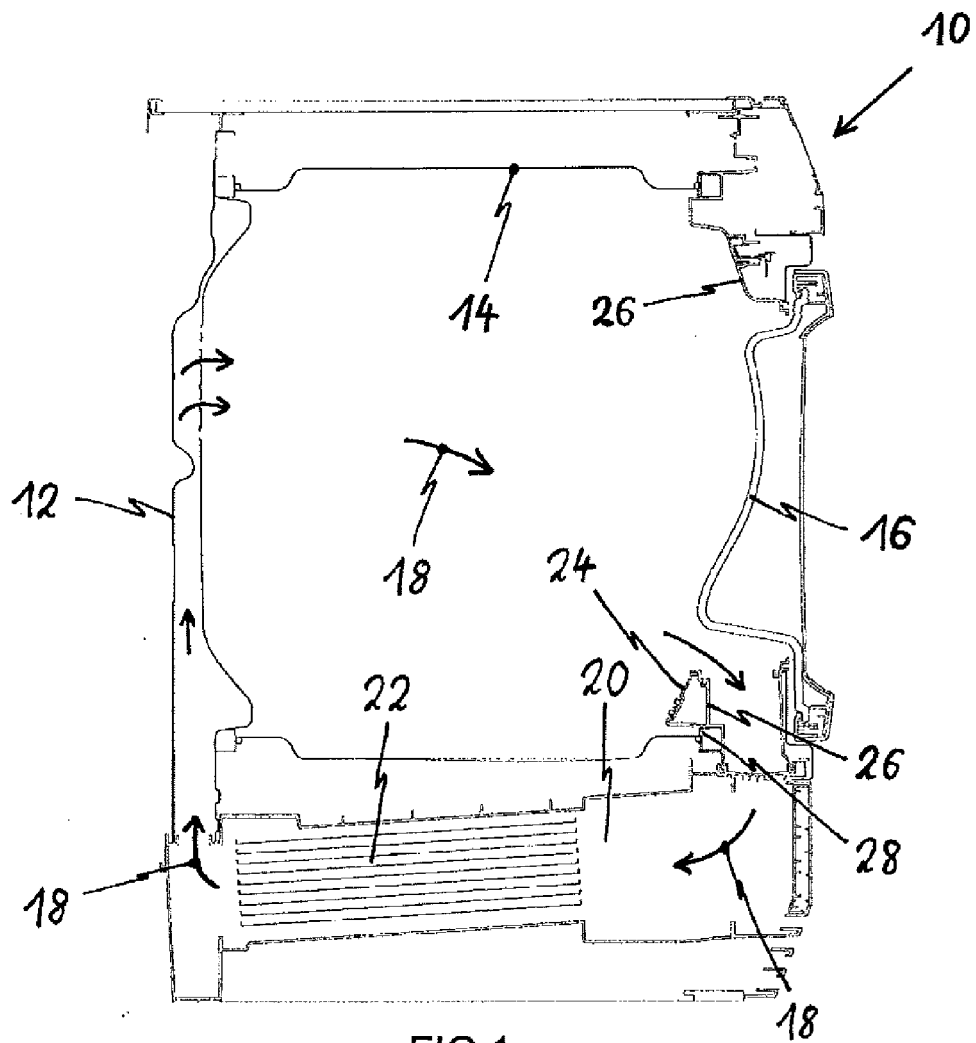


FIG 1

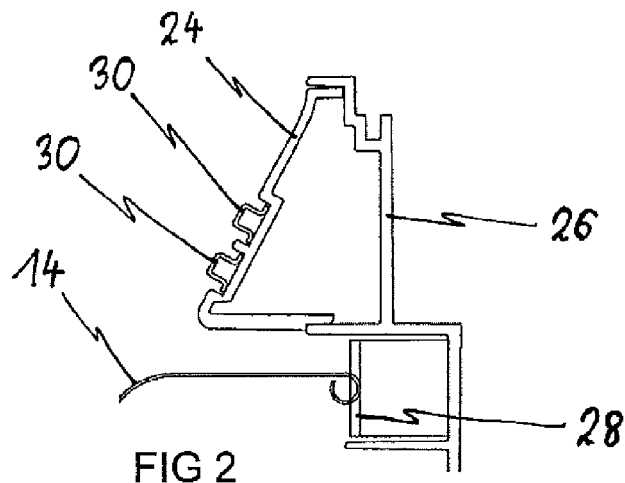


FIG 2

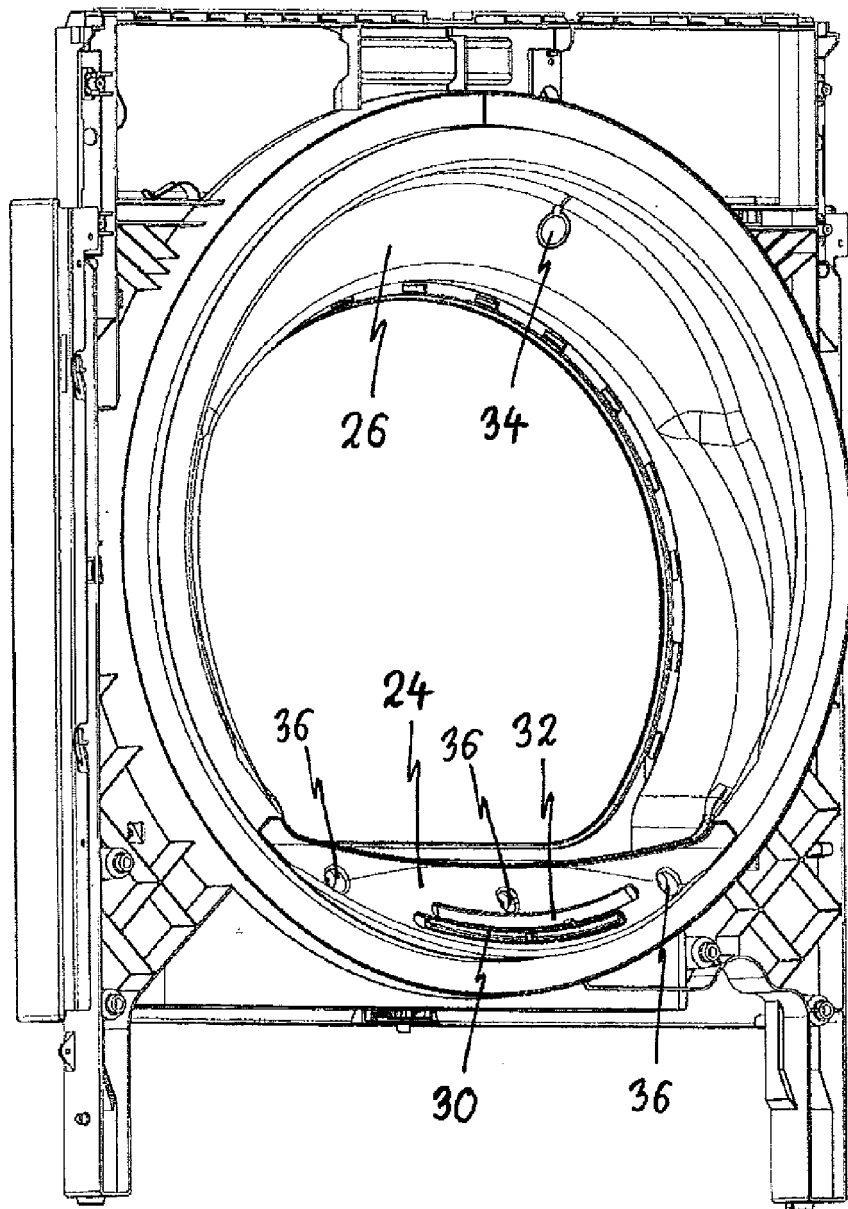
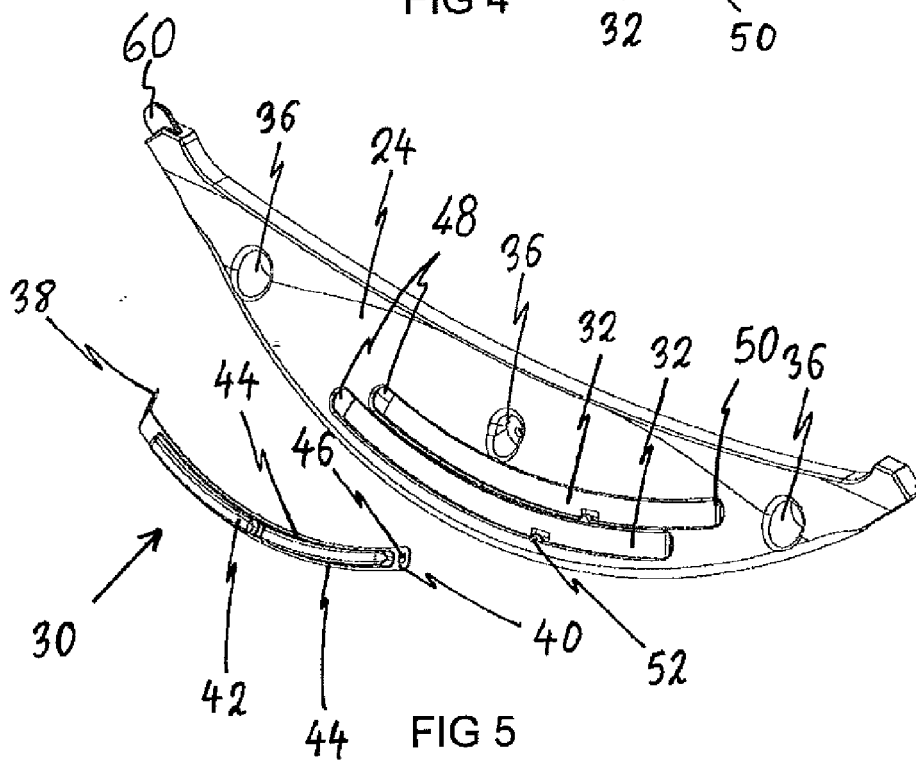
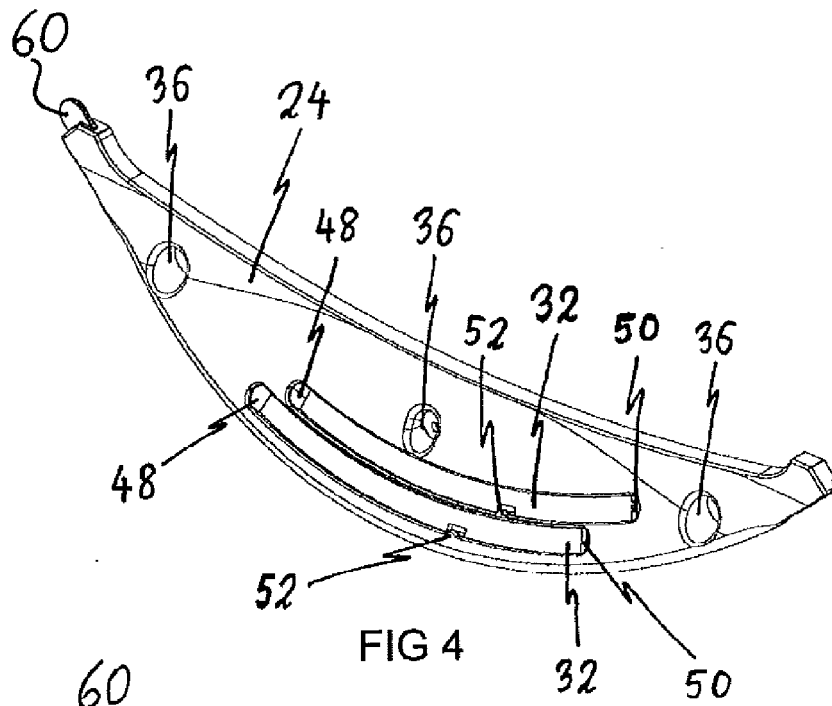


FIG 3



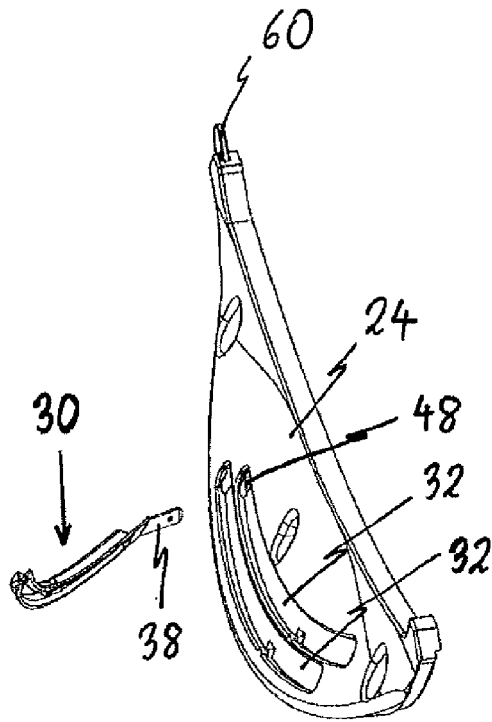


FIG 6

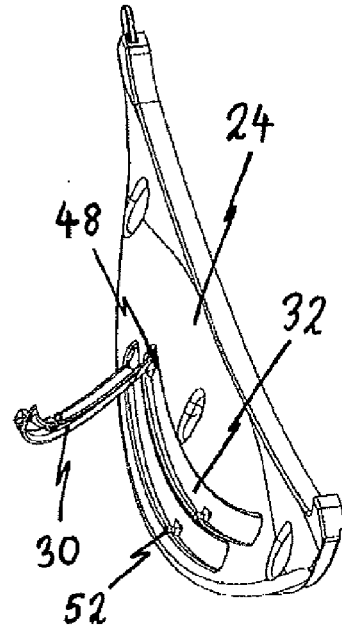


FIG 7

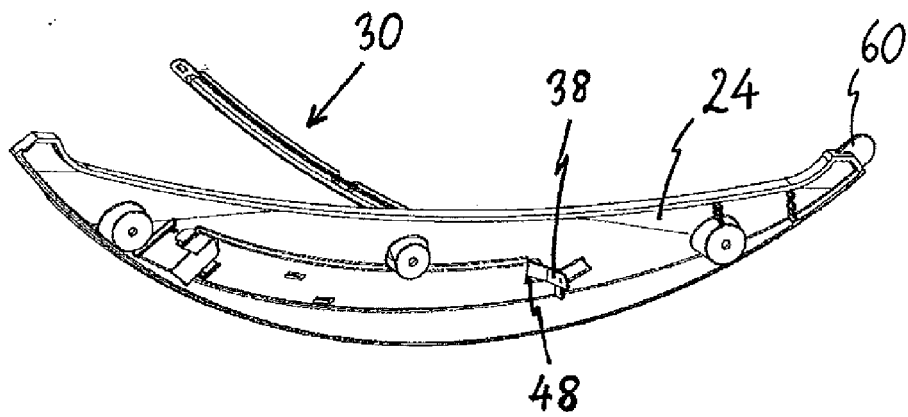
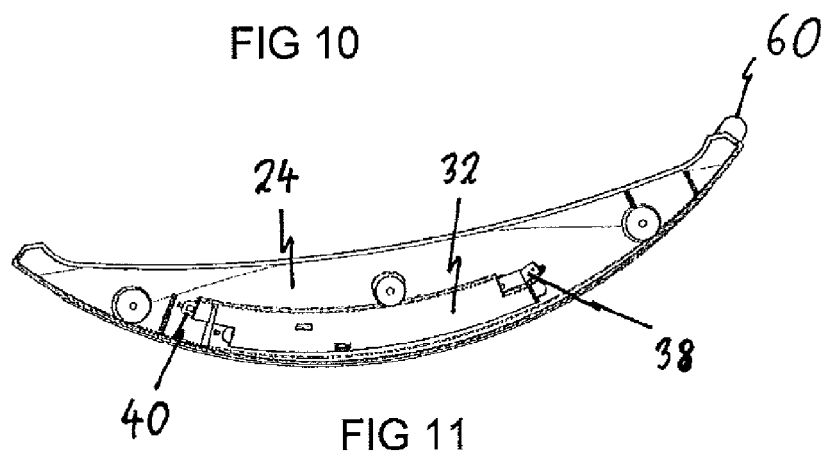
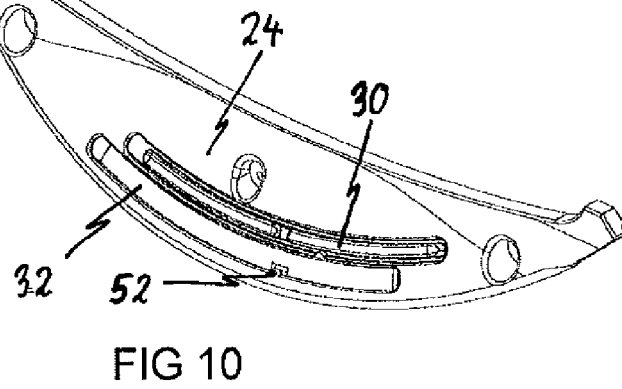
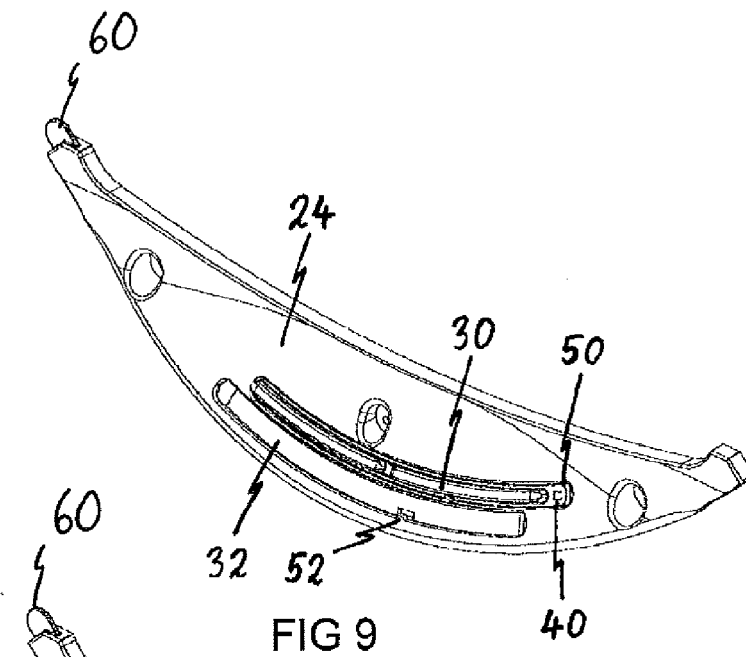


FIG 8



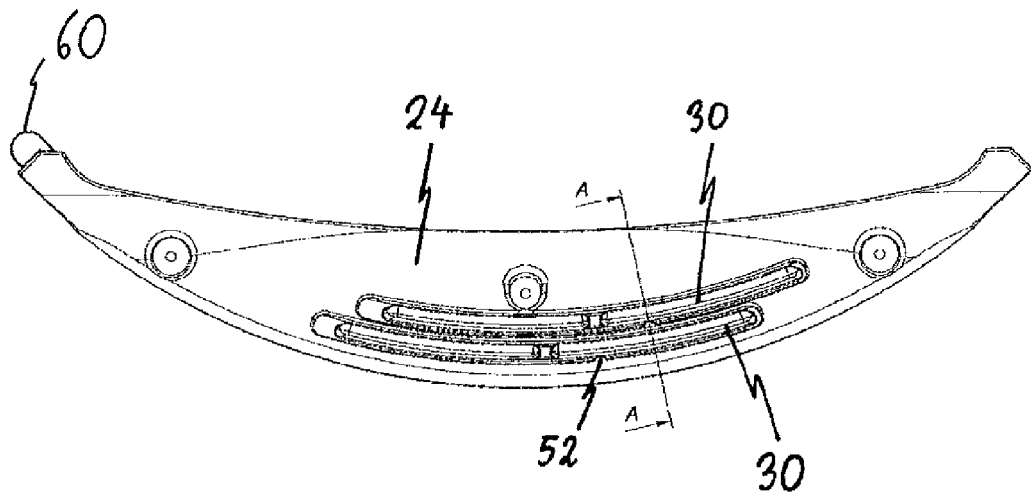


FIG 12

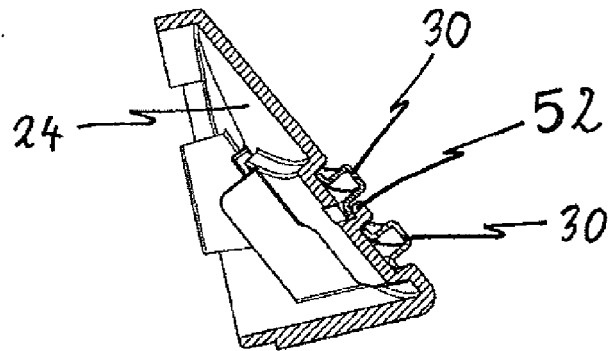


FIG 13

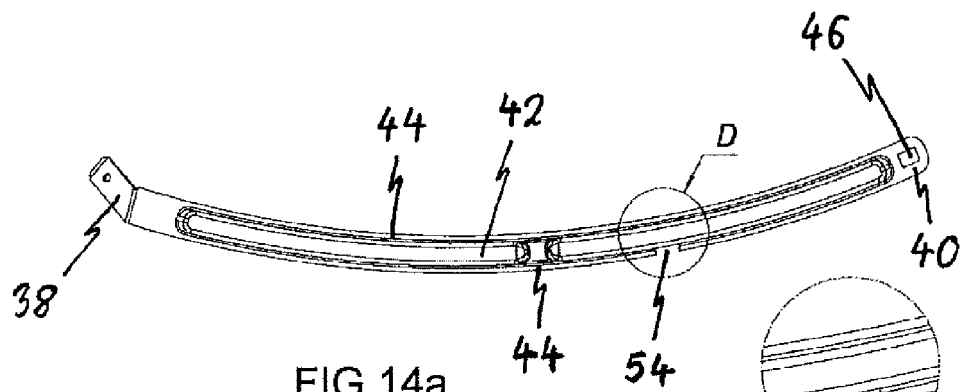


FIG 14a

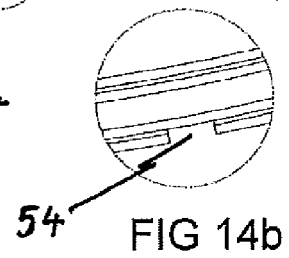
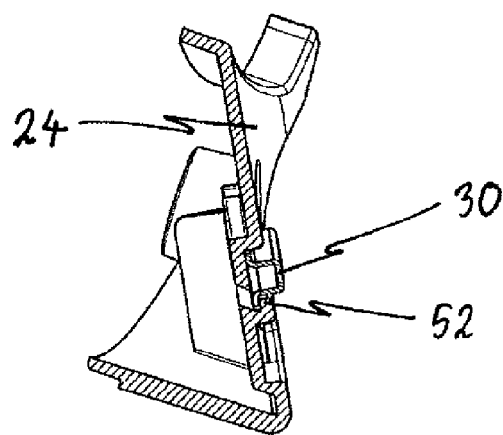
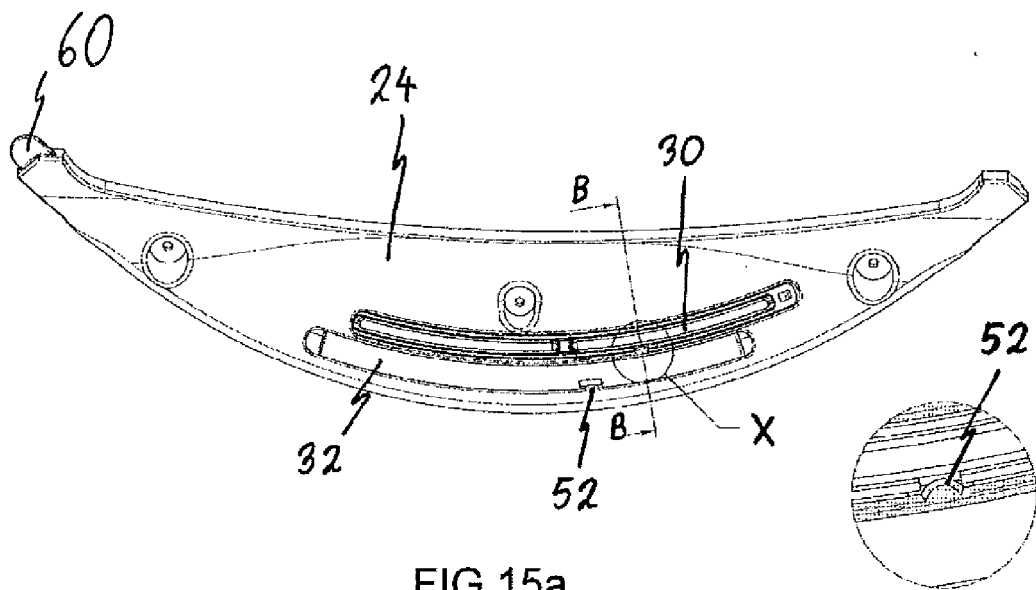


FIG 14b



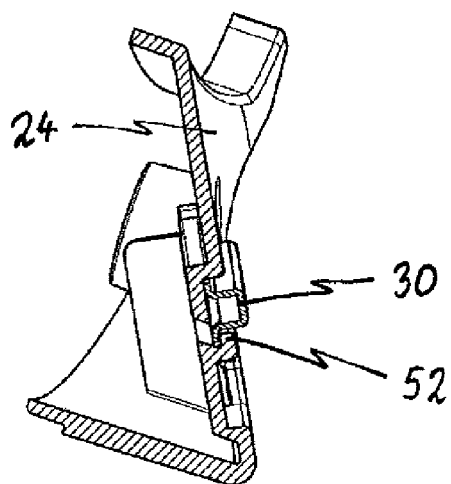
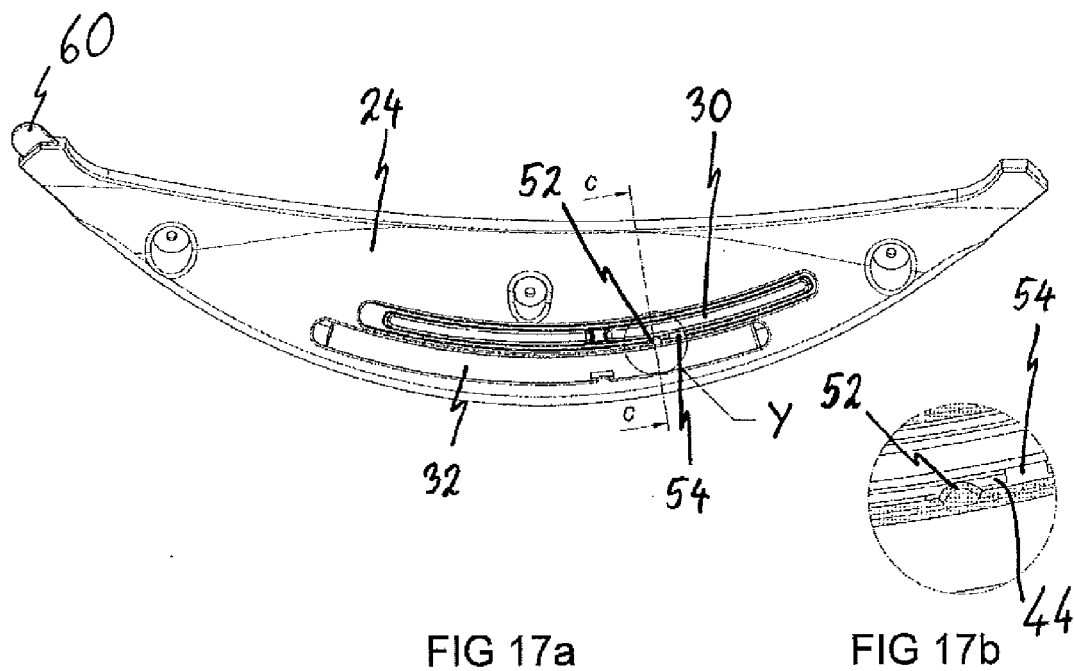


FIG 18

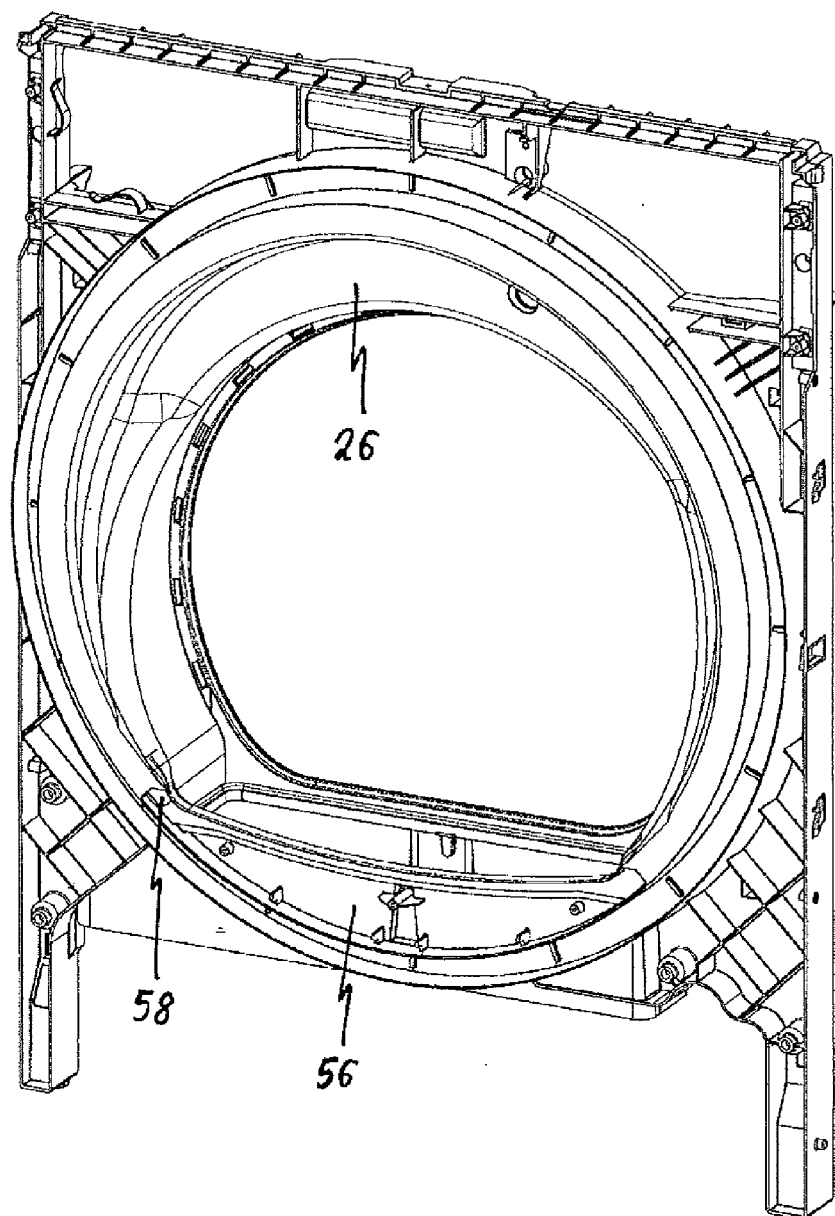


FIG 19

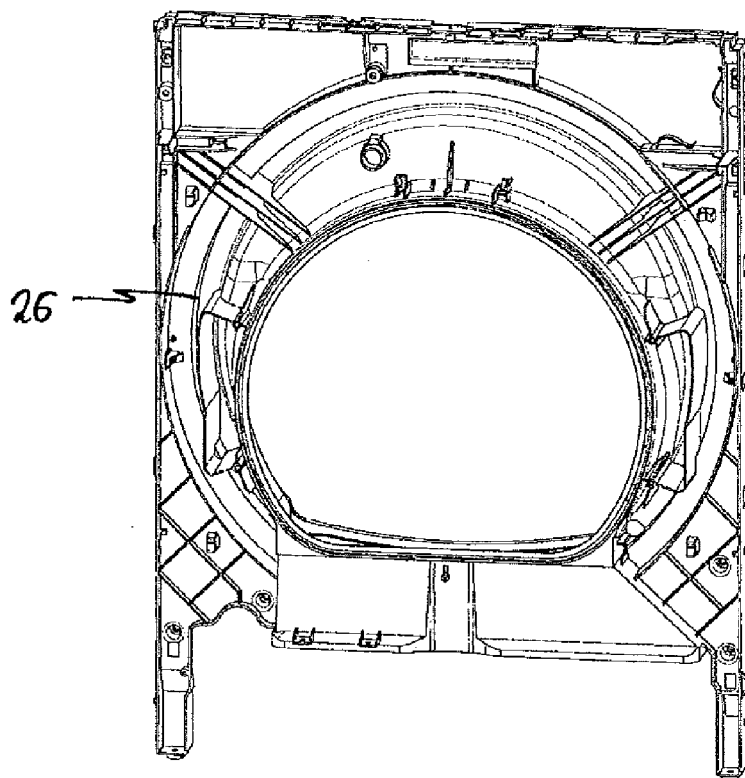


FIG 20

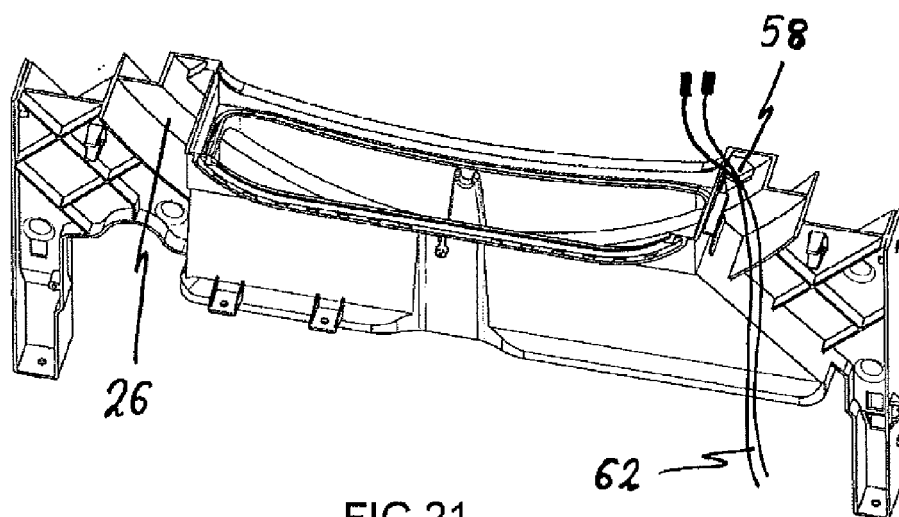


FIG 21

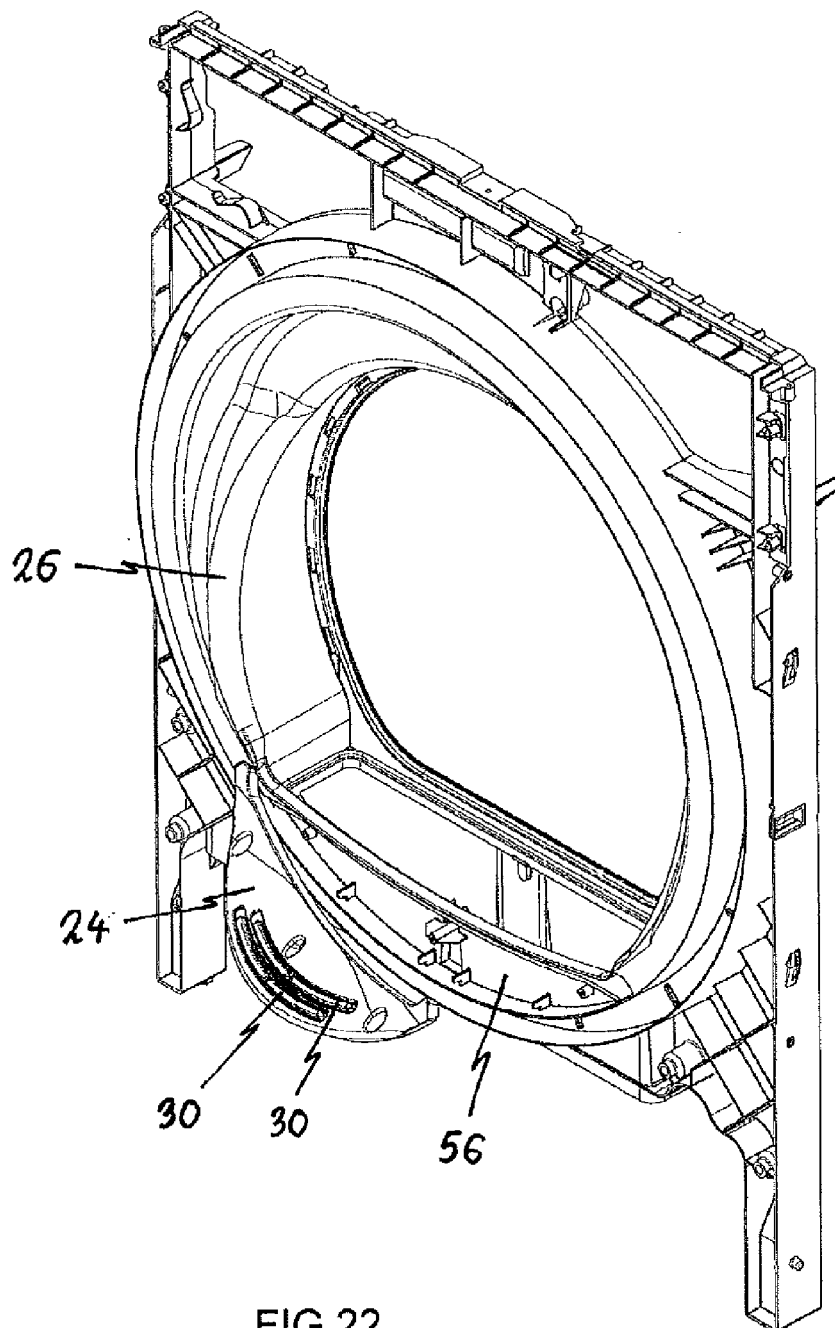


FIG 22

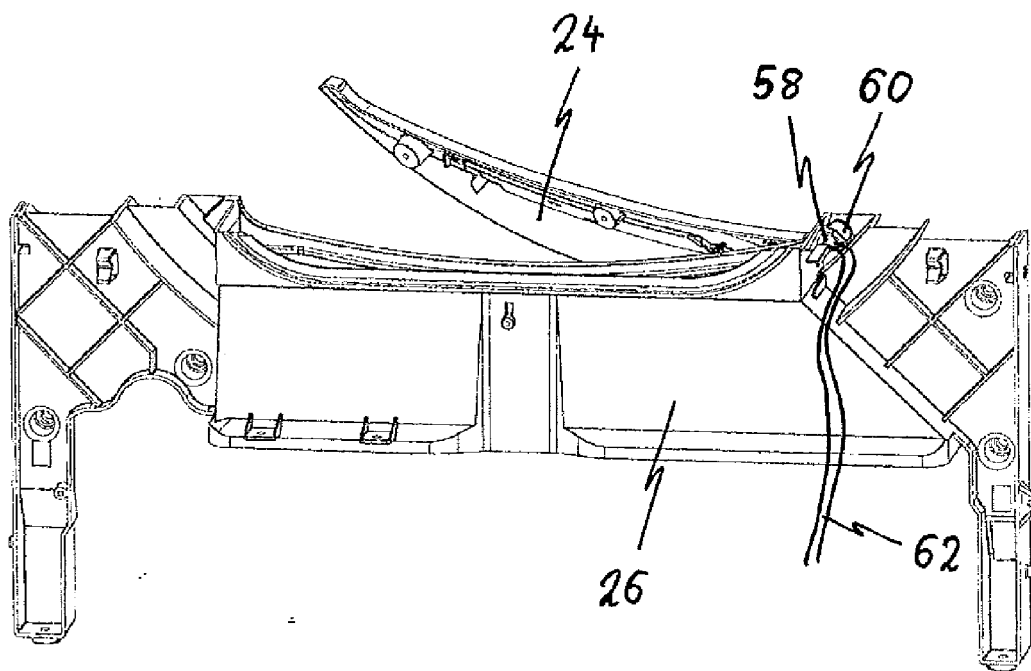
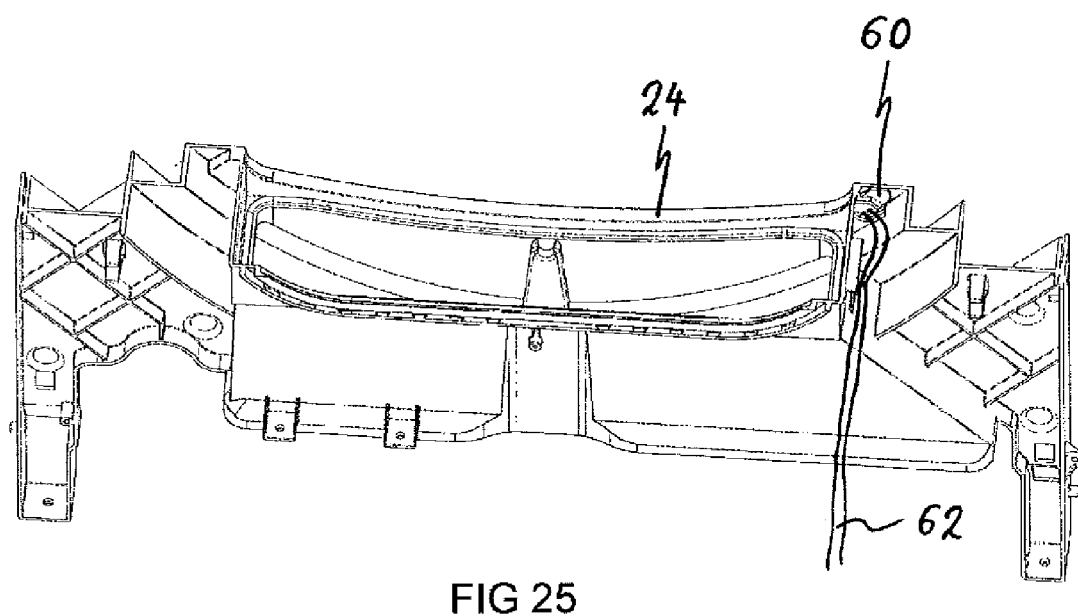
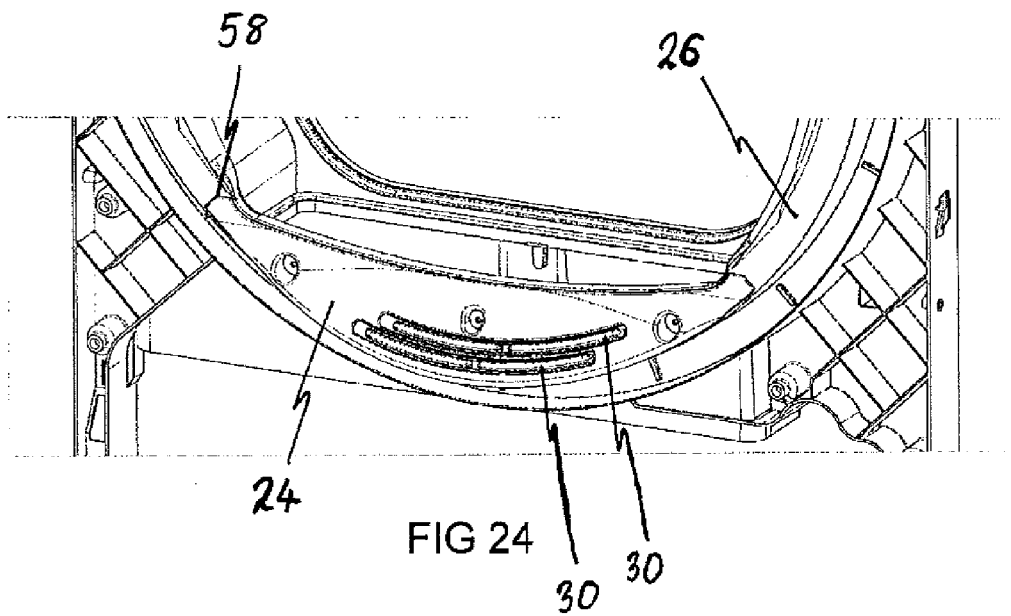


FIG 23



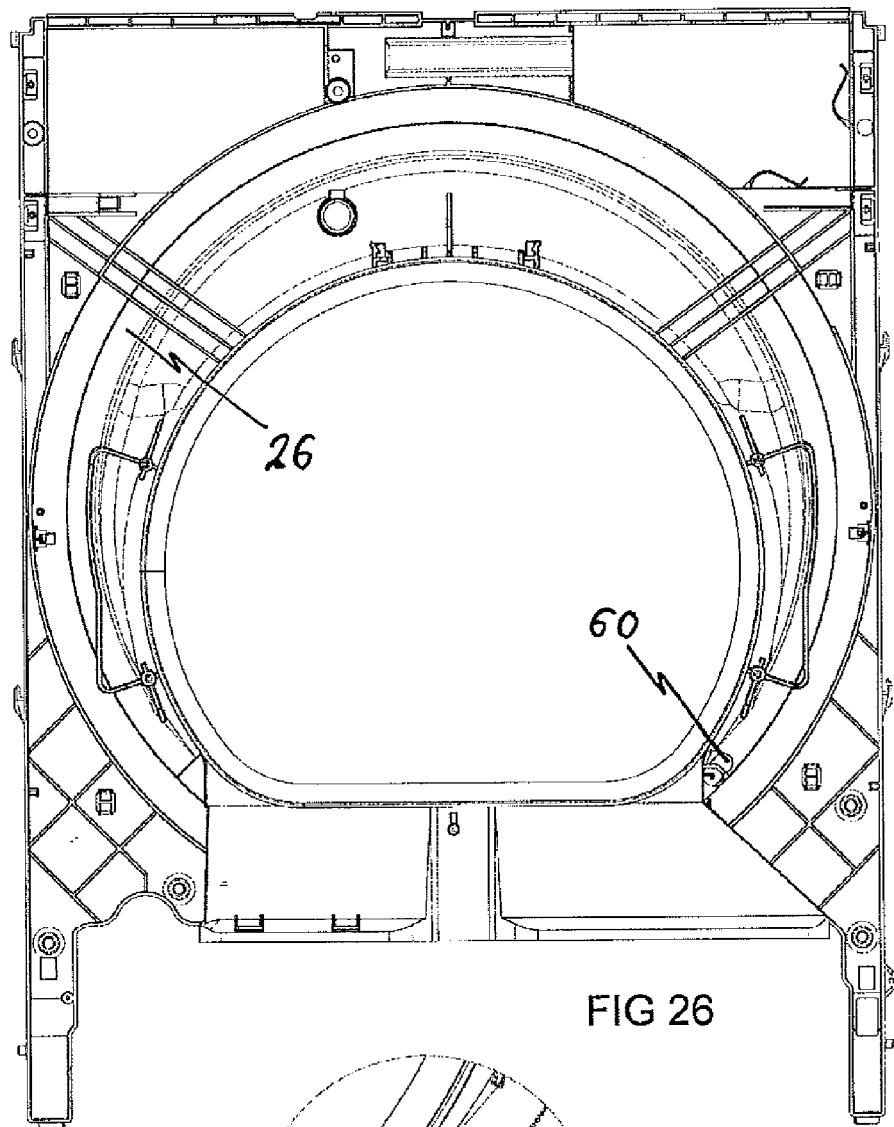


FIG 26

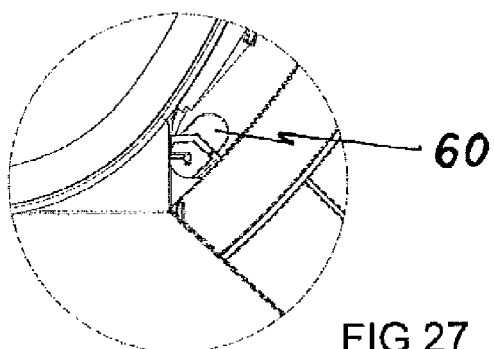
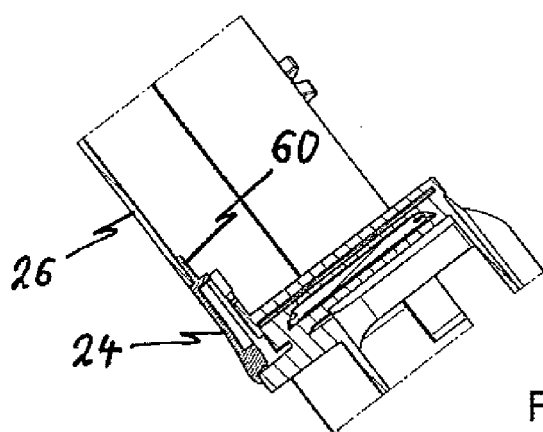
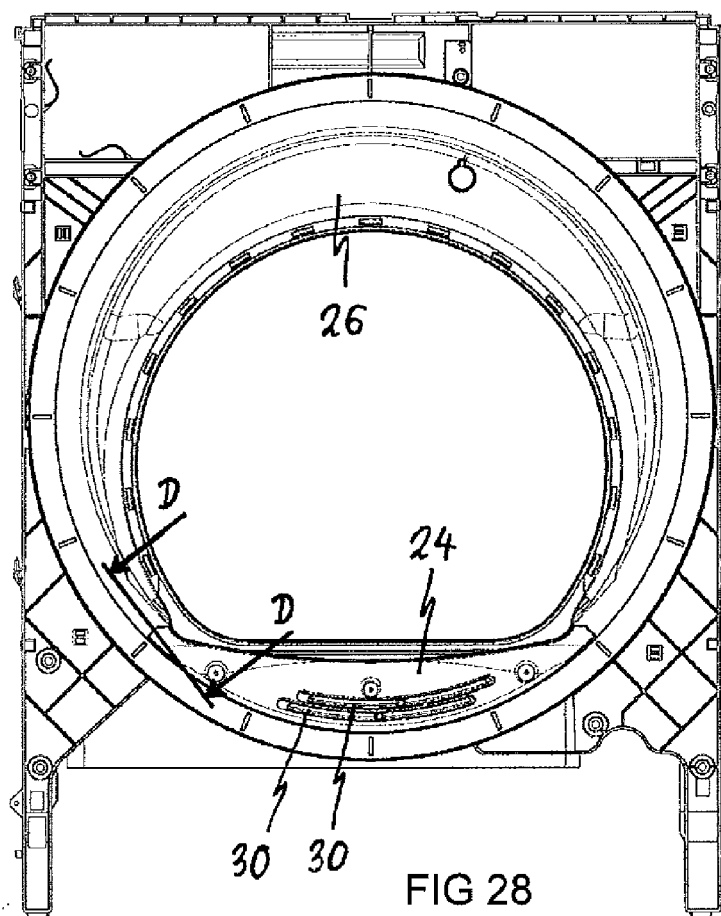


FIG 27





EUROPEAN SEARCH REPORT

Application Number
EP 10 19 2892

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Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X	EP 1 473 402 A1 (LG ELECTRONICS INC [KR]) 3 November 2004 (2004-11-03) * paragraphs [0030], [0 48], [0 49]; figure 9 *	1,2,8, 12,13,15	INV. D06F58/28
X	DE 10 2006 023955 A1 (LG ELECTRONICS INC [KR]) 28 December 2006 (2006-12-28) * paragraphs [0037], [0 38], [0 65], [0 77]; figure 4 *	1,9	
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A	WO 2010/076132 A1 (ARCELIK AS [TR]; CINAR LEVENT [TR]; GULBAY UMIT [TR]) 8 July 2010 (2010-07-08) * paragraph [0021] - paragraph [0024]; figures 3, 4 *	1-15	
The present search report has been drawn up for all claims			TECHNICAL FIELDS SEARCHED (IPC)
			D06F G01N
Place of search		Date of completion of the search	Examiner
Munich		25 May 2011	Westermayer, Wilhelm
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			

1
EPO FORM 1503 03.02 (P04C01)

**ANNEX TO THE EUROPEAN SEARCH REPORT
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EP 10 19 2892

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25-05-2011

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