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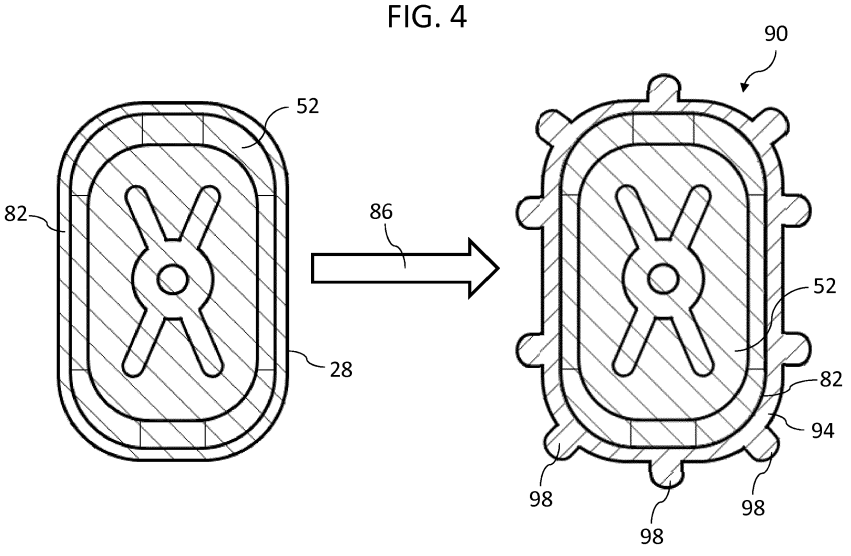
(54) **Method for manufacturing the cabinet of a household appliance and such a cabinet**

(57) The invention is related to a method of manufacturing a rear part (6) of a cabinet (10) of a household appliance provided with a back opening (56) and a back panel (90) for closing said back opening (56), the method comprising the following steps: a) providing a metal sheet (2) adapted to form said rear part (6); b) providing an opening (56) in said metal sheet (2) by removing an inner portion (52) of the latter; c) deforming said metal sheet (2) so as to form said rear part (6), in such a way that in the deformed condition of said metal sheet (2), said opening (56) defines said back opening (56); d) fixing a frame (94) made of plastic material along at least a part of the peripheral edge (82) of said removed inner portion (52) or another metal sheet with essentially the same dimensions, so as to form said back panel (90). The invention is also related to a cabinet (10) for a household appliance comprising a rear part (6) having a back opening (56) and a back panel (90) for closing said back opening (56), said back panel (90) comprising an inner portion (52) made of metal which at its peripheral edge (82) is at least partially encompassed by a frame (94) made of a plastic material.

FIG. 4



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Description

Background Art

[0001] In known household appliances such as laundry washing machines or tumble dryers, a cabinet is provided to protect the mechanical and electrical components of the machine. On top of the machine, usually a work top is mounted.

[0002] The term laundry washing machine includes washing machines as such but also combined washing/drying machines that can incorporate both functionalities. Also the terms laundry washing machine and washing machine are used interchangeably. The laundry machine can be designed as a front-loading laundry washing machine as well as a top-loading laundry washing machine

[0003] The cabinet usually is made of sheet metal or carbon steel. The sheet metal of the cabinet is often made by shearing and other typical and related processes. Particularly, a back opening for maintenance, closable by a removable back panel is made in the cabinet by shearing or other known processes.

[0004] As mentioned above, the cabinet usually comprises a removable back panel. It is removed for maintenance and/or assembly of the components inside the cabinet. In conventional laundry machines, the back panel is made of plastic material or is built as a metal sheet. The shearing process can generate wrinkling, burr and clearance. Usually the metal sheet obtained from the shearing process represents a scrap and thus leads to additional costs. Alternatively, the back panel can be made of plastic material, usually polypropylene (PP) or recycled PP.

[0005] The scrap can be used to obtain the back panel as a metal sheet: the scrap can be crushed and then stretched in such a way that a component with the desired dimensions is produced.

[0006] Since the back cover has to cover fully or completely the back opening, in case screws are used for its fixation to the peripheral border of the opening, the scrap has to be stretched in order to obtain an overlapping region.

[0007] This procedure of crushing and stretching leads to a reduction of the thickness of the metal sheet and usually also produces internal tensions. A back panel made of a metal sheet is usually assembled to the cabinet by screws, which puts limitations on the design of the back panel.

[0008] There are basically two methods to obtain a back panel:

1. Shearing of a metal sheet leading to scrap, whereby by the process of injection moulding a back panel made of plastic material is produced.
2. Shearing of a metal sheet leading to scrap, which is crushed and flattened, resulting in a back panel made of metal.

[0009] In the first case, a new process and a new component are necessary to re-place the scrap. In the second case, the stretching or flattening process can generate more scrap, reduction of thickness, internal tensions and constrains the cabinet design.

[0010] It is the aim of the present invention to provide a method for manufacturing a rear part of a household appliance which eliminates the disadvantages of a metal panel while at the same time reduce the needed amount of plastic material.

[0011] It is another aim of the present invention to provide a cabinet of a household appliance.

[0012] It is still another aim of the present invention to provide a household appliance with such a cabinet.

Disclosure of Invention

[0013] Referring to the method, this aim is solved by a method of manufacturing a rear part of a cabinet of a household appliance provided with a back opening and a back panel for closing said back opening,
the method comprising the following steps:

a) providing a metal sheet adapted to form said rear part;
b) providing an opening in said metal sheet by removing an inner portion of the latter;
c) deforming said metal sheet so as to form said rear part, in such a way that in the deformed condition of said metal sheet, said opening defines said back opening;
with the further step of
d) fixing a frame made of plastic material along at least a part of the peripheral edge of said removed inner portion or another metal sheet with same dimensions, so as to form said back panel.

[0014] Preferred embodiments of the invention are described in relation to the dependent claims and the description in relation to the enclosed drawings.

[0015] The invention is based on the consideration that in regular design choices of rear parts of cabinets of household appliances and corresponding back panels, there is presently a conflict of objectives with respect to the used materials. If, on the one hand, a back panel is made completely of plastic material, the metal scrap available from the part removed from the rear part to form an opening for the back panel to be inserted is basically lost, and the plastic material is additionally needed. If the back panel, on the other hand, is made of the metal scrap, in order to be able to be attached to the rear part by screws or similar fixing means, it has to be stretched and flattened, leading to reduced thickness and internal tensions.

[0016] Applicant has found that by realizing the back panel in a hybrid design, this conflict of aims can be solved or at least essentially reduced. By using the scrap for the interior part of the back panel which is framed by

a plastic frame, the dimensions of the back panel are reached in such a way that stretching procedure is not necessary since the plastic frame is adapted to allow the insertion and detachable fixing of the back panel in the rear part. Since plastic material is only used for the frame, the amount of needed material is quite low compared to cases where the entire back panel would be made of plastic.

[0017] The rear part of the cabinet hereby denotes the back wall which has adjacent pieces that - in a folded state - build the side walls of the cabinet. It does not comprise the front part or the bottom or top parts of casing of the household appliance.

[0018] Preferably, the method comprises a further step of e) fixing a back panel obtained according to steps a) to d) to close the back opening of a rear part of a cabinet of a household appliance obtained according to steps a) to c). With this additional step, a complete rear part of a cabinet is obtained.

[0019] Advantageously, the frame is fixed to the removed inner portion by the steps of:

d1) positioning the inner portion in a mould, and
d2) within this mould, injecting a melted plastic material on at least a part of the peripheral edge of the inner portion. The process of injection moulding is especially suited for attaching a frame to the metal sheet, since it allows for the plastic material to seamlessly surround the peripheral edge of the metal sheet.

[0020] In a preferred embodiment, the injected material is polypropylene. Other suitable materials are polyamide, polyester, polyphenylsulfide (PPS), and also their filled and reinforced compounds.

[0021] The mould advantageously comprises a core and a cavity, wherein the core comprises at least one positioning element for positioning the inner portion. The metal sheet then is positioned in a mould cavity which is formed between cavity and core, and after closing, melted plastic material can be injected.

[0022] The positioning element advantageously comprises at least one magnetic plate. Alternatively or in combination thereto, the positioning element or position means can comprise cams or racks extruding from the core of the mould.

[0023] Advantageously, the cavity and the core comprise at least one recess configured for inserting the melted material and for allowing the material to encompass the at least a part of the edge of the inner portion.

[0024] In a preferred embodiment, the frame totally encompasses the peripheral edge of the inner portion. With such a design, the frame connects to the border of the opening in the rear part. Additionally, the sharp edge of the metal sheet is fully covered by the frame which improves the handling of the back panel.

[0025] Referring to the cabinet, the aim is solved by cabinet for a household appliance comprising a rear part having a back opening and a back panel for closing said back opening, wherein the back panel comprises an inner portion made of metal which at its peripheral edge is at least partially encompassed by a frame made of a plastic material.

[0026] This partial encompassing is preferably achieved in a sandwiched manner, where the peripheral part is surrounded by the frame on both sides by side parts which are connected by a border piece. This leads to an integrally built single-piece design of the frame.

[0027] In a preferred embodiment, the frame is fixed to the inner portion by injection moulding the frame on at least a part of the peripheral edge of the inner portion.

[0028] Preferably, the frame is removably fixable to the inner portion, allowing its replacement in case of malfunction or damage.

[0029] In order to provide a stable and long-lasting configuration, advantageously a form-locking connection is provided between the inner portion and the frame. This form-locking connection is preferably realized by an undercut. Preferably, the frame is made of polypropylene.

[0030] In a preferred embodiment of the cabinet, the frame totally encompasses the peripheral edge of the inner portion.

[0031] Referring to the household appliance, the aim is solved by a household appliance comprising a cabinet described above or comprising a cabinet having a rear part manufactured according to the method described above.

[0032] In a preferred embodiment, the household appliance is a laundry washing machine or a tumble drier or a laundry washer-drier.

[0033] The advantages of the invention are especially as follows. Due to the hybrid design of the back panel, a recovery of the cabinet scrap and a reduction of plastic material consumption are achieved, which can result in a considerable reduction of costs. Into the plastic frame, features such as snaps, clips holes etc. can be integrated. During the injection moulding process, operations on the metal sheet such a shearing or punching can be performed. Metal sheet and frame can be seamlessly integrated and connected.

[0034] The hybrid design of the back panel reduces design constraints for the rear part of the cabinet. Also, a pre-assembly of the back panel is possible. The resulting back panel is especially easy and convenient to handle since due to an attached plastic frame no sharp edges of the metal sheet are accessible.

Brief description of the Drawings

[0035] Further characteristics and advantages of the present invention will be highlighted in greater detail in the following detailed description of some of its preferred embodiments, provided with reference to the enclosed drawings. In said drawings:

FIG. 1 shows a metal sheet for building the rear part

of a cabinet with several structures formed in a preferred embodiment;

FIG. 2 the metal sheet according to FIG. 1 with an inner portion removed;

FIG. 3 the metal sheet according to FIG. 2 with its outer portions bend or folded to build a cabinet;

FIG. 4 the inner portion after being removed and after being framed with a plastic profile made by injection moulding;

FIG. 5 the inner portion with a plastic frame as it is inserted into the back opening of the rear part;

FIG. 6 a metal sheet in a second preferred embodiment;

FIG. 7 the metal sheet of FIG. 6 in a cross-sectional view;

FIG. 8 a back panel comprising the metal sheet according to FIG. 6 framed with a plastic frame to obtain a back panel;

FIG. 9 the back panel of FIG. 8 in a cross-sectional view;

FIG. 10 a mould in an open state with a cavity and a core and a filling system and a magnetic plate in a preferred embodiment for manufacturing a back panel;

FIG. 11 the mould according to FIG.8 in an open state with the metal sheet being inserted;

FIG. 12 the mould according to FIG. 11 in a closed state;

FIG. 13 the mould according to FIG. 12 with plastic material being injected;

FIG. 14 the mould according to FIG. 13 in an open state with the back panel being extracted;

FIG. 15 a magnified close sectional view of the rim of the back panel.

[0036] Identical parts are labelled with the same reference numerals.

Detailed Description of the Invention

[0037] With reference to FIG. 1, a metal sheet 2 is shown which is used to build a rear part 6 of a cabinet 10 of a household appliance. In the metal sheet 2, several structures have been formed by the process of shearing or punching, such as ribs 14, holes 20, and contours 24, 28, 32, 36, 40.

[0038] As shown in FIG. 2, close to contour 28, several holes 44 are punched into metal sheet 2. Along contour 28, metal sheet 2 is cut, and, as indicated by an arrow 48, an inner portion 52 which is essentially a scrap metal sheet 54 is removed from metal sheet 2 which leaves an opening 56 for later insertion of a back panel. Edges 60, 64 are formed into metal sheet 2 around which metal sheet 2 will be bended or folded by angles of 90°, respectively. In such a way, rear part 2 comprises a back part 70 or back wall and two side parts 74, 78 or side walls.

[0039] With reference now to FIG. 3, metal sheet 2 has been bent around edges 74, 78, leading to a cabinet with three adjacent parts 74, 70, 78 which essentially form three sides of a cuboid.

[0040] FIG. 4 on its left side shows inner portion 52 of metal sheet 2 before it is framed at its periphery 82 or peripheral edge by a plastic frame. After a process of building this plastic frame or profile of polypropylene (PP) material by injection moulding, as indicated by arrow 86, a back panel 90 results which is shown on the right side. Around its entire periphery 82 or peripheral edge, a frame 94 or plastic material or plastic frame has been fixed. Frame 94 comprises preferably several ears 98 (10 ears in the present case), dimensioned and positioned in such a way to be able to be superimposed to holes 44, so as to allow their fixing to the latter, for example by screws, not illustrated.

[0041] In FIG 5, the process, indicated by arrow 100, of inserting back panel 90 as shown on the left into the opening 56 in metal sheet 2, which is shown in its folded state on the right side to build cabinet 10, is illustrated. Back panel 90 is inserted into opening 56 in such a way that parts of frame 94, especially ears 98, remain on the outside of opening 56 in its inserted state.

[0042] In FIG. 6, a scrap metal sheet 54 is shown in an alternative preferred embodiment. While inner portion 52 according to the previous figures has been symmetric with respect to two orthogonal symmetry axes, scrap in metal sheet 54 is not symmetric with respect to line A-A but is still symmetric with respect to an orthogonal line B-B. The present invention comprises inner portions 52 and scrap metal sheets 54 of any geometrical dimension or shape as long as they are adapted to serve as a component for a back panel 90 for a rear part 6 of a cabinet 10.

[0043] In Fig. 7, a section through line A-A of FIG. 6 is displayed. Metal sheet 54 comprises a body 102, preferably with two structures 106 on its first side 110 and five structures 114 on its opposite second side 118.

[0044] In FIG. 8, metal sheet 54 is shown with a frame 94 made preferably of PP material fixed around its periphery 82. Frame 94 comprises several recesses 120 and bores 124 which serve to fix back panel 90 to rear part 6 of a cabinet 10. Back panel 90 of FIG. 8 is shown in FIG. 9 in a section through line A-A in FIG. 8.

[0045] Frame 94 of back panel 90, in a preferred em-

bodiment, is manufactured by an injection moulding process which will be described in conjunction with the following FIGs.

[0046] In FIG. 10, a mould 130 is shown which allows an injection moulding process for producing or manufacturing frame 94. Mould 130 comprises preferentially essentially two components or building blocks, namely the cavity 132 and the core 134. Cavity 132 comprises a filling system 138 which permits filling at least one recess 140 in core 134 with the material to be injected. Recess 140 is filled with the material through an injection point 144 which essentially is an opening in cavity 132. The material in the preferred embodiment described here for frame 94 is polypropylene (PP). Other materials that can be used for frame 94 are polyamide, polyester, polyphenylsulfide (PPS), and also their filled and reinforced compounds.

[0047] In core 134, a, preferably magnetic, plate 148 is arranged and/or fixed which permits the positioning of metal sheet 54 and fix it so it won't change its position during the injection moulding process. Alternatively or in addition, other positioning means can be provided such as protrusion, projections, lugs, noses, or other, preferably magnetic, elements etc. that spatially fix metal sheet 54. Metal sheet 54 will be inserted and fixed in the way described above while mould 130 is open. When cavity 132 and core 134 are closed, they define a mould cavity 150 into which metal sheet 54 can be inserted.

[0048] In FIG. 11, mould 130 is displayed in an open state. Scrap in metal sheet 54 is positioned in mould 130. Magnetic plate 148 allows the desired and accurate positioning of metal sheet 54 in mould cavity 150.

[0049] In FIG. 12, mould 130 is displayed in a closed state. Cavity 132 and core 134 in closed configuration of mould 130 define the shape 154 or geometry enclosed by recess 140 or cavity in core 134. Metal sheet 54 is stopped or entirely held between cavity 132 and core 134 to avoid that the melted plastic material which enters mould cavity 150 via injection point 144 penetrates cavity 150 in such a way that is moves across or covers metal sheet 54. Thus, the melted material is only allowed to flow into recess 140. In the configuration shown, the plastic material can be injected into mould 130.

[0050] The injection process of plastic material 158 into mould 130 is illustrated in FIG. 13. Through filling system 138, which is preferably built as a hot runner, the melted plastic material 158 fills cavity or recess 140 by passing through injection point 44. This way, the plastic material assumes geometry or shape 154 which is defined by the outer contour or shape of recess 140 and thereby generates the profile or frame 94.

[0051] In Fig. 14, mould 130 is shown after the injection moulding process and after plastic material 158 has hardened and thus keeps its shape. Back panel 90 obtained in this way can now be extracted from mould 130. It is adapted for insertion into the back opening of cabinet 10.

[0052] A section through back panel 90 obtained by the injection moulding process described above is shown in FIG. 15. Frame 94 or profile made of plastic material blocks scrap in metal sheet 54 by means of an undercut 162. This way, a form-locking connection between frame 94 and metal sheet 54 is achieved, preventing components 54, 94 to loosen with respect to each other. Metal sheet 54 is surrounded on three sides by the plastic material. Such a firm connection is important since back panel 90 is temporarily inserted and removed from the opening in rear part 6 of cabinet 10 when needed, which puts stress on the connection between components 54, 94. The invention, however, is not limited to such type or design of form-locking connection. Other possibilities include, for instance, protrusions formed in metal sheet 54 and corresponding recesses in frame 94. The advantage of the solution presented is that no chemical compounds or glues are necessary. The present invention, however, also comprises such fixation means.

[0053] Frame 94 comprises an outer frame part 166 and an inner frame part 170.

Claims

1. Method of manufacturing a rear part (6) of a cabinet (10) of a household appliance provided with a back opening (56) and a back panel (90) for closing said back opening (56), the method comprising the following steps:

   a) providing a metal sheet (2) adapted to form said rear part (6);
   b) providing an opening (56) in said metal sheet (2) by removing an inner portion (52) of the latter;
   c) deforming said metal sheet (2) so as to form said rear part (6), in such a way that in the deformed condition of said metal sheet (2), said opening (56) defines said back opening (56);

   the method being **characterized by** comprising the step of:

   d) fixing a frame (94) made of plastic material along at least a part of the peripheral edge (82) of said removed inner portion (52) or another metal sheet with essentially the same dimensions, so as to form said back panel (90).

2. Method according to claim 1, comprising the further step of:

   e) fixing a back panel (90) obtained according to steps a) to d) of claim 1 to close the back opening (56) of a rear part (6) of a cabinet (10) of a household appliance obtained according to steps a) to c) of claim 1.

3. Method according to claim 1 or 2, wherein said frame (94) is fixed to said removed inner portion (52) by

the steps of:

d1) positioning said inner portion (52) in a mould (130),
and
d2) within said mould (130), injecting a melted plastic material (158) on said at least a part of the peripheral edge (82) of said inner portion (52).

4. Method according to claim 3, wherein said injected melted plastic material (158) is poly-propylene.

5. Method according to one or more of the previous claims, wherein said mould (130) comprises a core (134) and a cavity (132), wherein said core (134) comprises at least one positioning element (148) for positioning said inner portion (52).

6. Method according to one or more of the previous claims, wherein said cavity (132) and said core (134) comprises at least one recess (140) configured for inserting said melted material (158) and for allowing said material (158) to encompass said at least a part of the edge (82) of said inner portion (52).

7. Method according to one or more of the previous claims, wherein said frame (94) totally encompasses the peripheral edge (82) of said inner portion (52).

8. Cabinet (10) for a household appliance comprising a rear part (6) having a back opening (56) and a back panel (90) for closing said back opening (56),
characterized in that
said back panel (90) comprises an inner portion (52) made of metal which at its peripheral edge (82) is at least partially encompassed by a frame (94) made of a plastic material.

9. Cabinet (10) according to claim 8, wherein said frame (94) is fixed to said inner portion (52) by injection moulding said frame (94) on at least a part of said peripheral edge (82) of said inner portion (52).

10. Cabinet (10) according to claim 8 or 9, wherein said frame (94) is removably fixable to said inner portion (52).

11. Cabinet (10) according to one of the claims 8 to 10, wherein a form-locking connection is provided between said inner portion (52) and said frame (94).

12. Cabinet (10) according to one of the claims 8 to 11, wherein said frame (94) is made of polypropylene.

13. Cabinet (10) according to one of claims 8 to 12, wherein said frame (94) totally encompasses said peripheral edge (82) of said inner portion (52).

14. Household appliance comprising a cabinet (10) according to one of claims 8 to 13, or comprising a cabinet (10) having a rear part (6) manufactured according to the method of one of claims 1 to 7.

15. Household appliance according to claim 14, wherein said household appliance is a laundry washing machine or a tumble drier or a laundry washer-drier.

FIG. 1

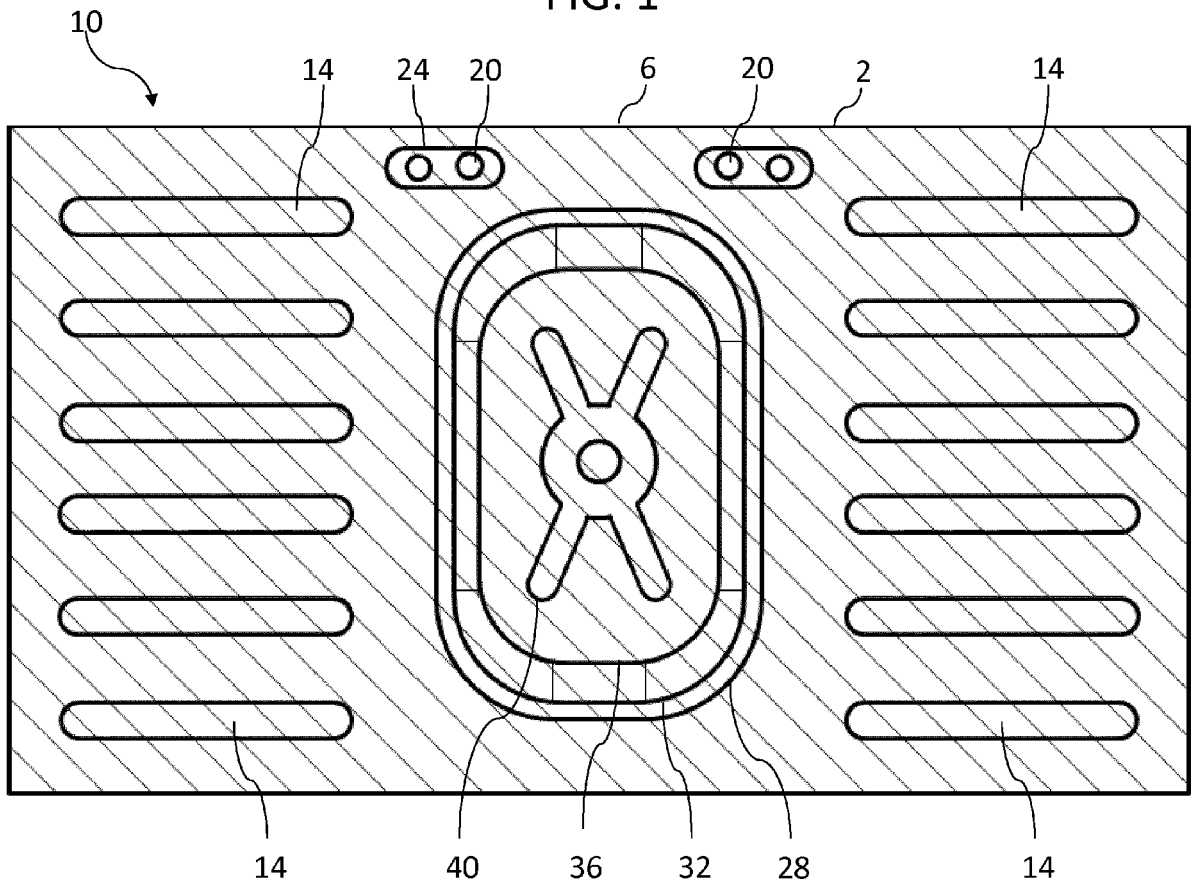


FIG. 2

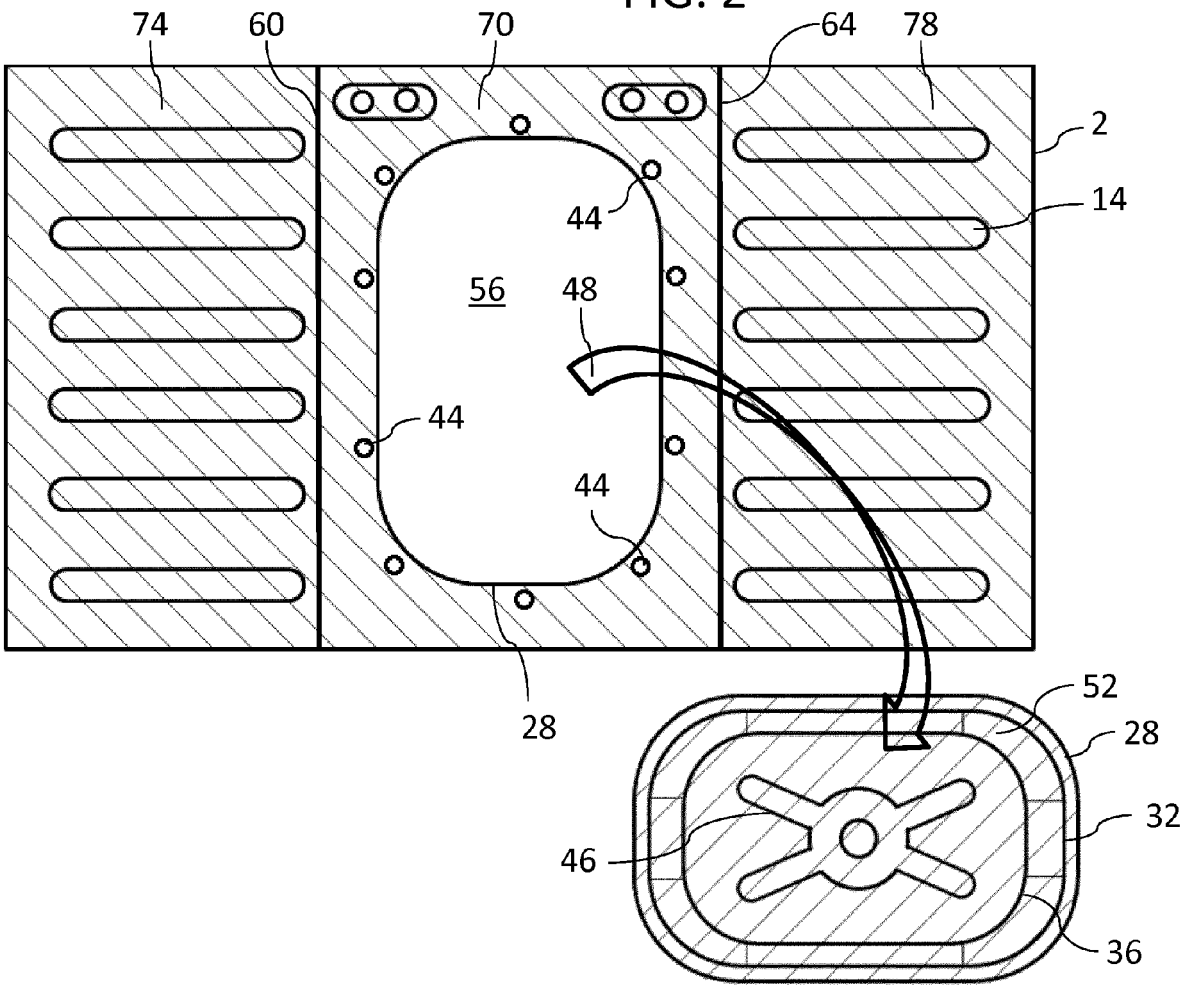


FIG. 3

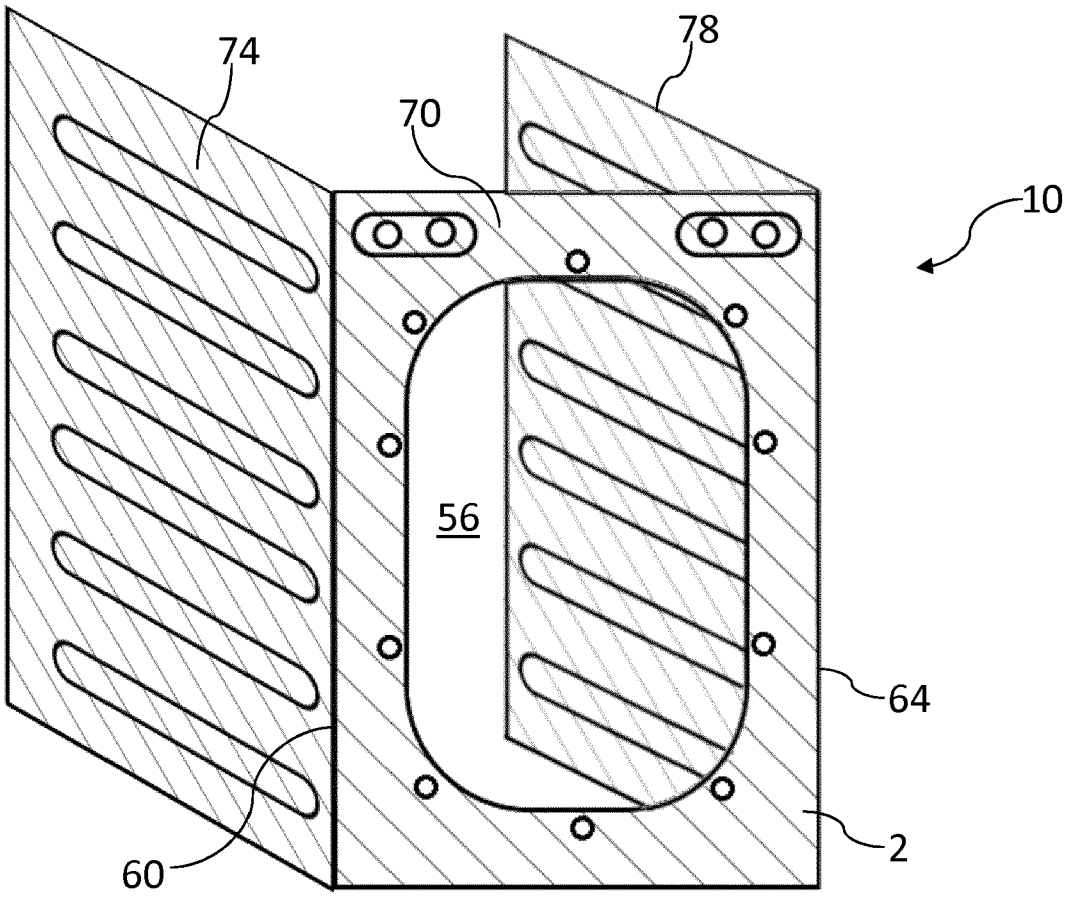


FIG. 4

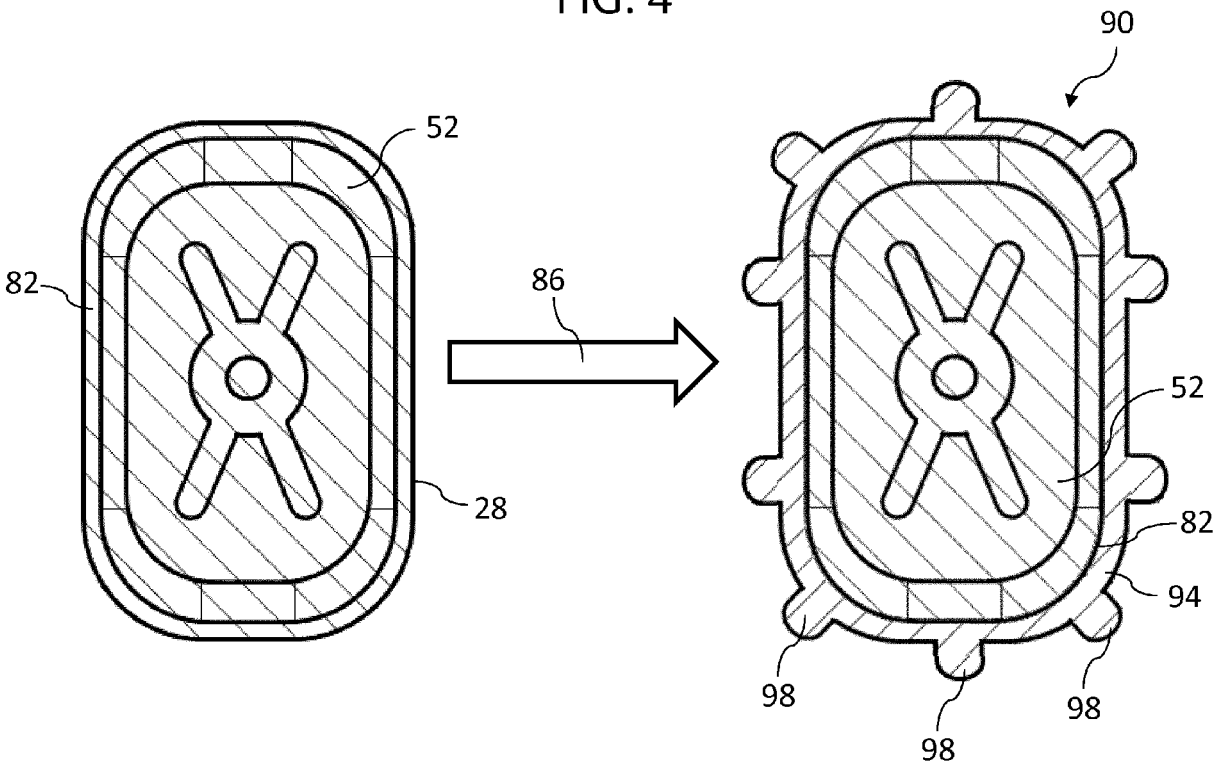


FIG. 5

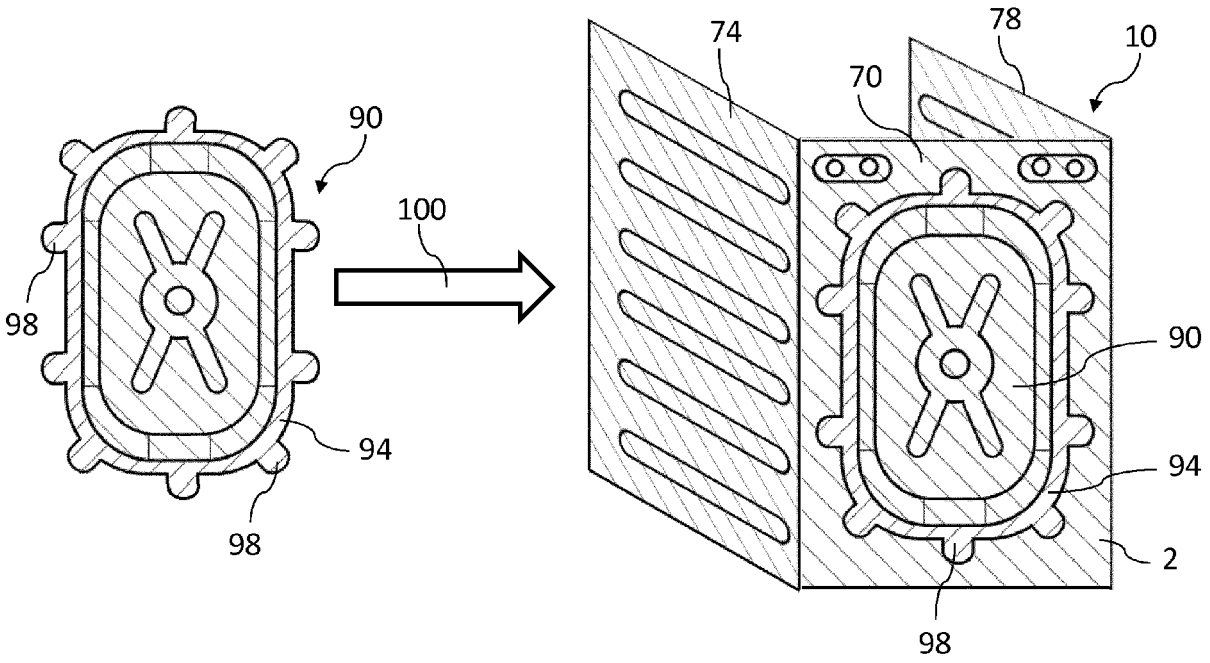


FIG. 6

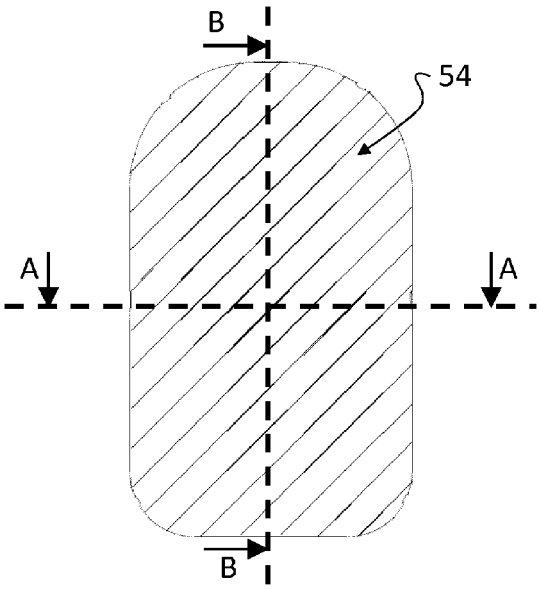


FIG. 7

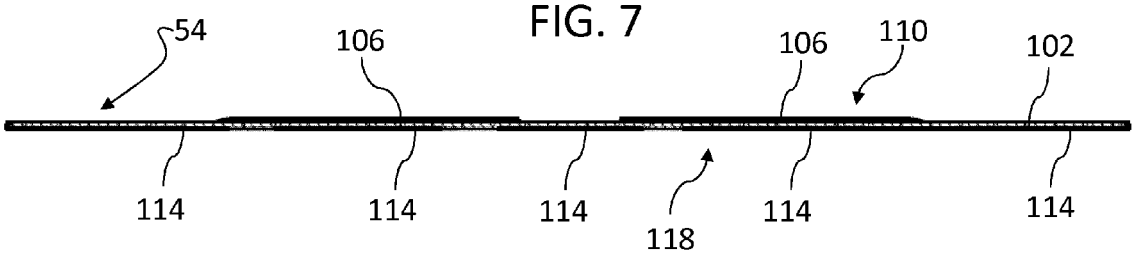


FIG. 8

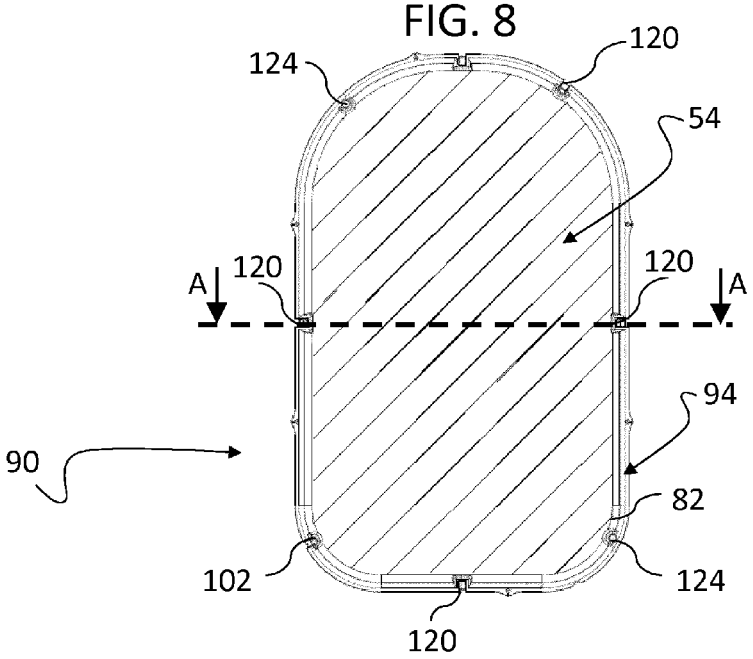


FIG. 9

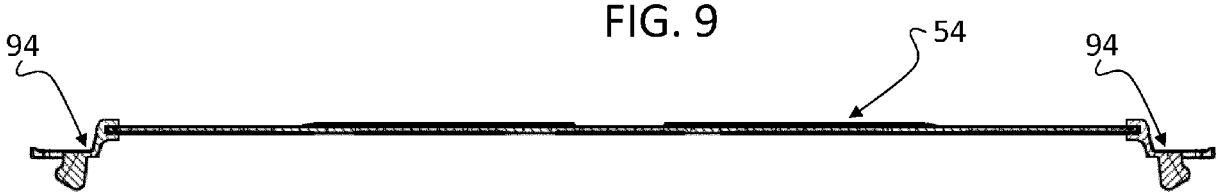


FIG. 10

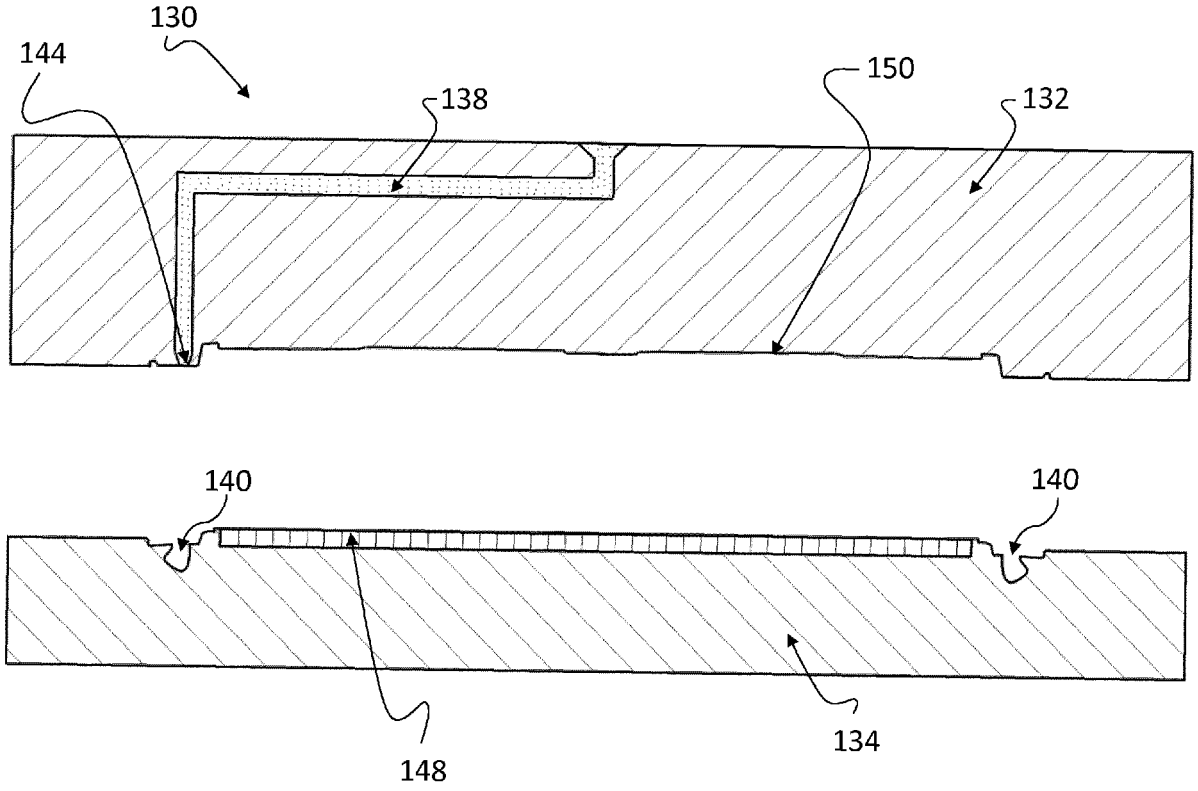


FIG. 11

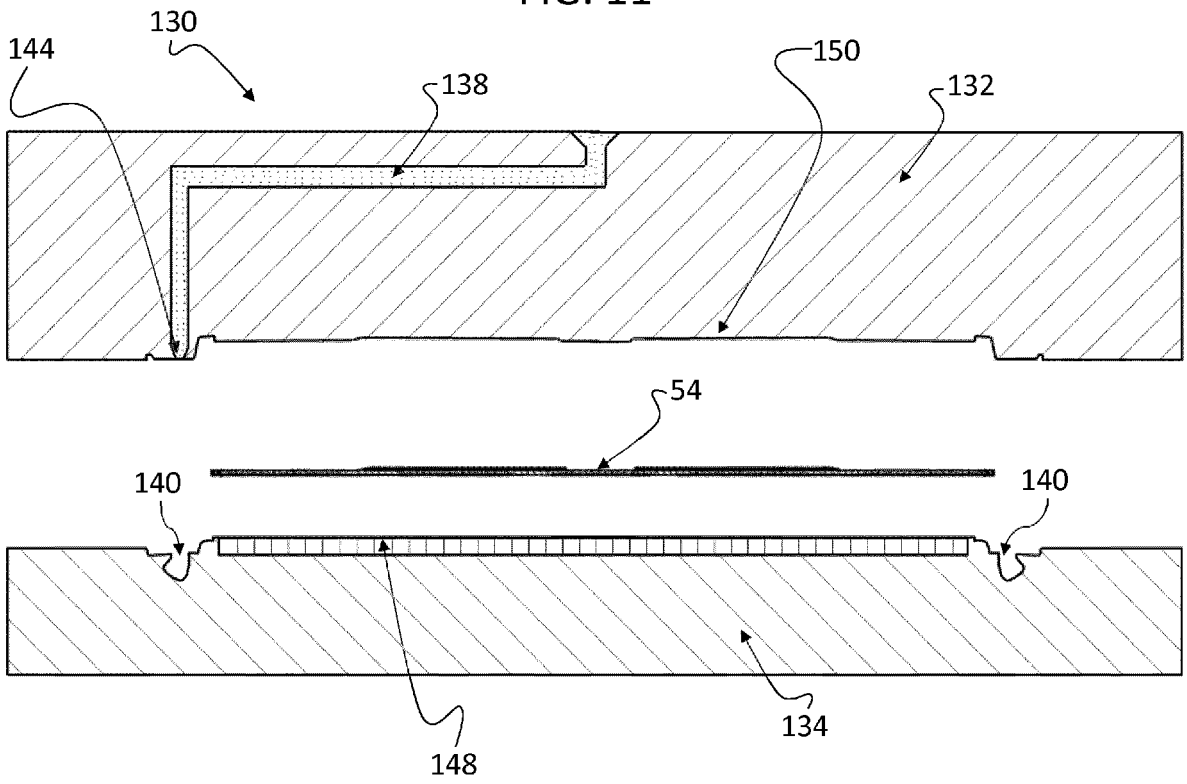


FIG. 12

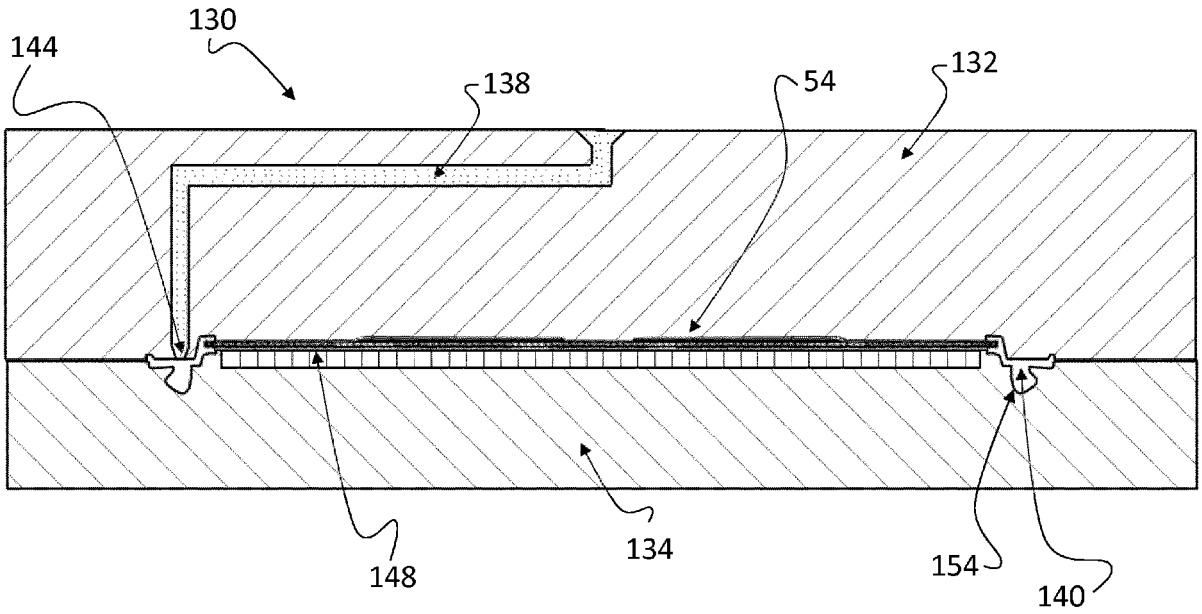


FIG. 13

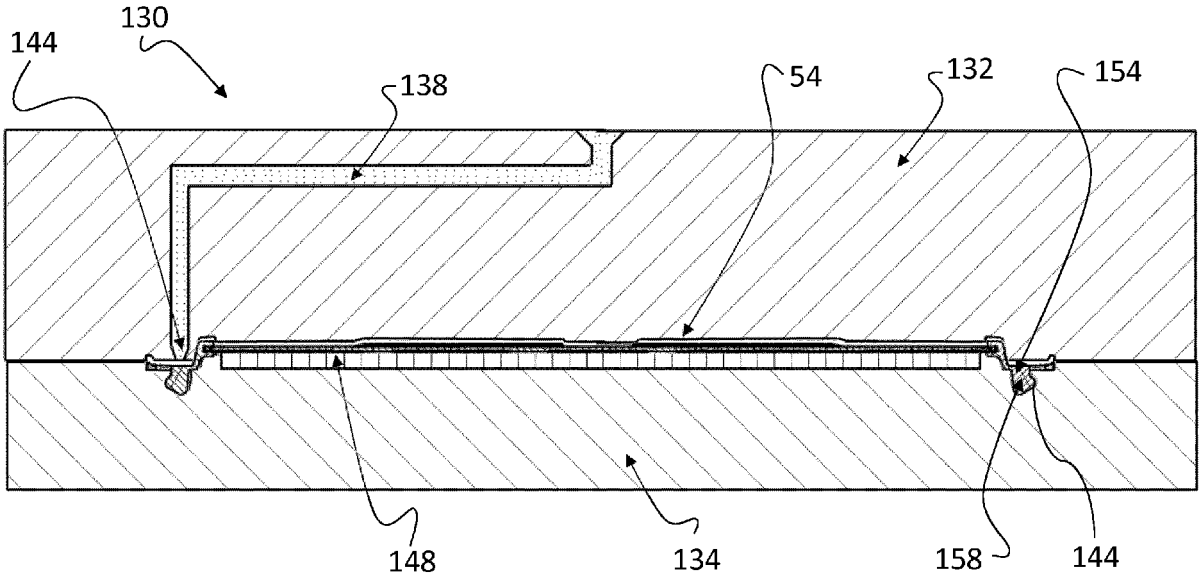


FIG. 14

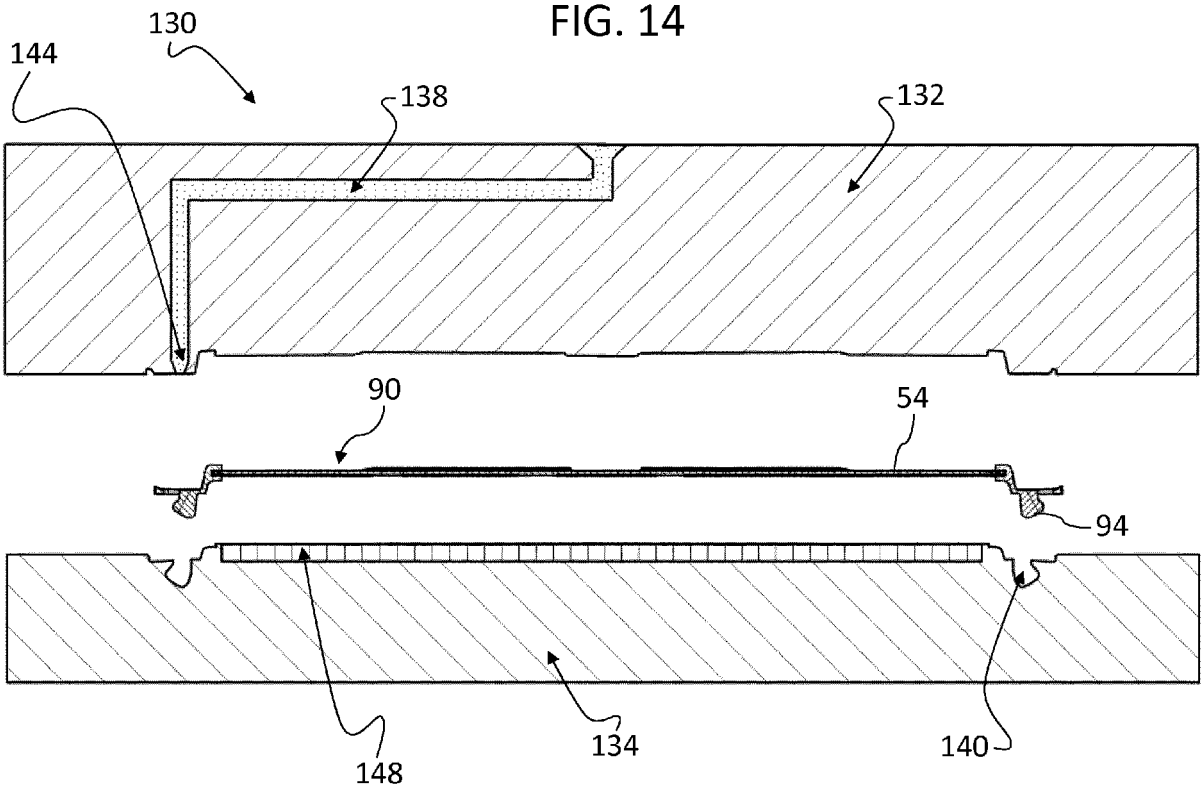
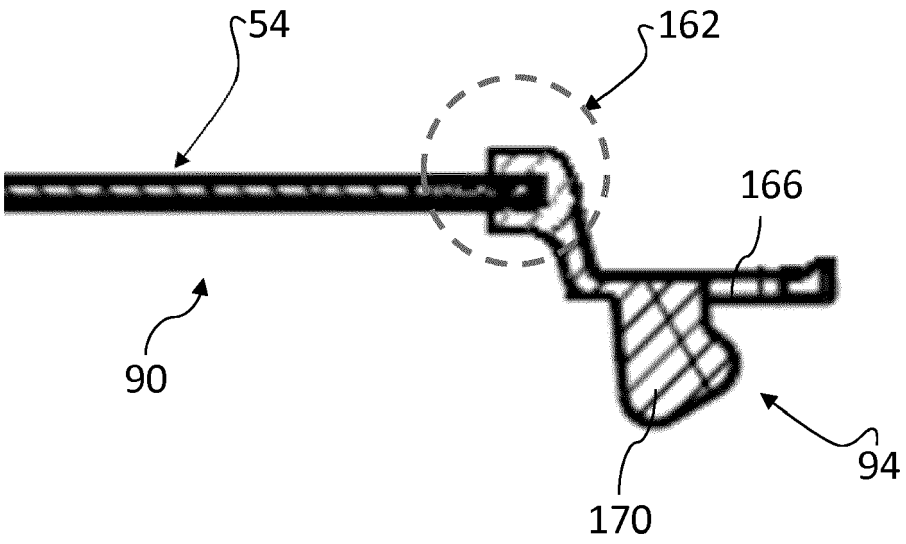


FIG. 15



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EUROPEAN SEARCH REPORT

Application Number
EP 14 17 7372

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X	EP 0 561 201 A1 (ZANUSSI ELETTRODOMESTICI [IT] ELECTROLUX ZANUSSI ELETTRODOME [IT]) 22 September 1993 (1993-09-22) * abstract * * column 4, line 36 - column 6, line 24; claims 1-6; figures 1-4 *	8,9, 11-15	INV. D06F39/12
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Place of search	Date of completion of the search	Examiner
Munich	14 January 2015	Prosig, Christina

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X : particularly relevant if taken alone
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