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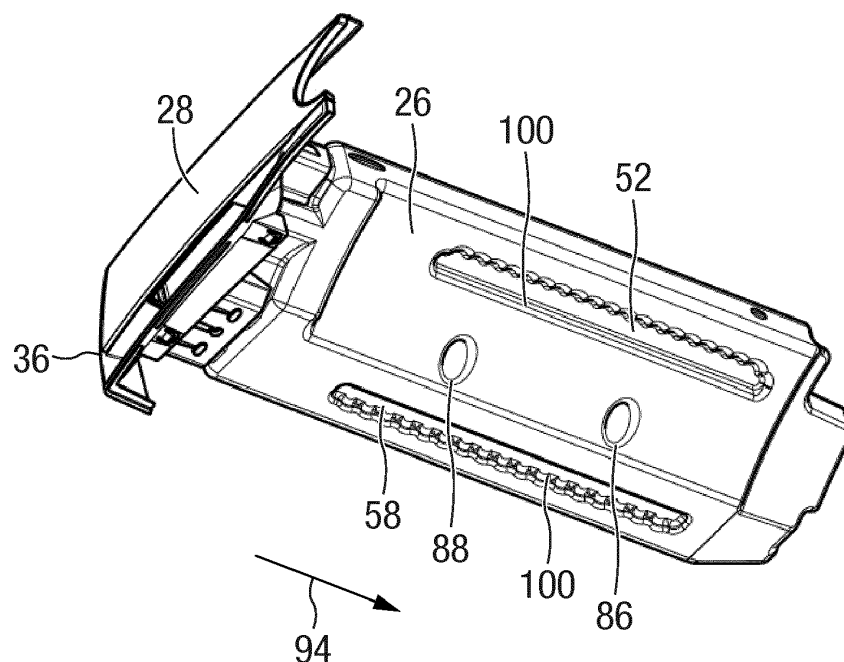
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(54) **LAUNDRY DRYER WITH A TANK AND MANUFACTURING METHOD FOR A TANK**

(57) Laundry dryer (2), especially of the condensation type, comprising a housing (10) in which a chamber for receiving laundry is arranged, said dryer (2) further comprising a removable tank (26) for containing a liquid to be circulated within the dryer (2), said tank (26) comprising a handle (28) with a graspable portion for a user,

whereby said tank (26) comprises at least one recess (52, 58, 80, 82) for receiving at least partly a user's hand, wherein said at least one recess (52, 58, 80, 82) is provided with friction means (100) that are configured to provide at least partially between said recess (52, 58, 80, 82) and said user's hand.

FIG. 6



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Description

Field of technology

[0001] The present invention relates to a household appliance such as a laundry treating machine. In particular, the present invention relates to a household appliance suitable for drying clothes, i.e. a laundry dryer.

Background

[0002] Laundry dryers are household appliances built for drying clothes and comprise a drying chamber, for example in the form of a drum, into which the clothes to be dried are introduced. The drying chamber is rotatable supported within a cabinet / housing and made to rotate by means of a driving motor, typically consisting of an electric motor connected to the drying chamber via a belt. Operation of the dryer is controlled by the user through a control panel, typically situated on the front or upper panels of the cabinet. Laundry dryers having a stationary drying chamber where laundry is, in general, hanged on a support provided within the chamber, are also known,

[0003] Generally, laundry drying machines may be divided in two categories according to the air circuit type implemented therein with the purpose of managing air flow of drying air (process air). Laundry machines of a first category are denoted as vented dryers. In operation, vented dryers draw air from the outside into the laundry machine, heat it and then blow the heated air through the laundry to be dried and finally exhaust back outside such air together with moisture absorbed from the laundry. Laundry drying machines of the second category are denoted as condensation dryers. Condensation dryers are provided with a closed drying air circuit (process air circuit) comprising a moisture condensing unit - or simply condensing unit - adapted to condense moisture dispersed in process air. Therefore, there is no exhaustion of moisturized air from the laundry machine during operation, but drying air is recirculated cyclically through the drying chamber where laundry to be dried is placed.

[0004] Condensation dryers may be further subdivided in two subtypes according to the device used for condensing moisture from process air. The condensation dryers of the first subtype are provided with an air-air heat exchanger, which cools and demisturizes the process air by taking and then exhausting air from/to outside the dryer, thereby using ambient air as coolant. Conversely, the condensation dryers of the second subtype are provided with a heat pump system which has a refrigerant fluid evaporator portion for cooling and demisturizing the process air.

[0005] In dryers, especially condensation-type dryers, a liquid is circulated during the laundry drying routine and is collected in a removable tank. Moisture removed by the condensing device is collected or supplied to the tank which is required to be emptied when full of liquid. Such tank is removably placed in a housing, typically in a draw-

erlike manner. The tank is provided with a hole for pouring water. The same hole is typically used also to fill the tank with water when it is inserted in its housing during the machine operation. After the drying process, the tank has to be removed from the housing, grasped by both hands, has to be rotated and emptied by the user. It is then re-inserted and the dryer can perform the next laundry drying routine. A liquid can be circulated in a laundry dryer with the purpose of spraying or driving it onto laundry contained in the laundry chamber so as to carry out an article refreshing process, a deodorizing process, a conditioning process or the like. Such liquid can be water, a water containing substance or a chemical compound not containing water. Such liquid, which can be loaded into the appliance by the user, can be delivered to laundry by changing its physical status, i.e. in form of steam.

[0006] The European patent application EP 2 752 518 A1 discloses a laundry dryer with a laundry drying chamber rotatable mounted in a cabinet.

[0007] The European patent application EP 2 455 538 A1 discloses a condensate collecting tank having a first handle and a second handle. The second handle is built by a recess formed in the tank wall.

[0008] When the tank cannot be grasped safely and conveniently by a user, liquid can be spilled, leading to water leakage.

Objects of the disclosure

[0009] It is an object of the present disclosure to overcome at least some of the problems associated with the prior art.

[0010] A further object of the present invention is to provide a laundry dryer which allows a precise and convenient emptying of the tank.

[0011] A further object of the invention is to improve the holding of the tank to make the pouring operation safer, avoiding any uncontrolled water leakage due to tank mishandling.

[0012] A further object of the invention is to provide a method for manufacturing a tank for a dryer.

Summary of the invention

[0013] According to the invention, in a first aspect, the present disclosure provides a laundry dryer, especially of the condensation type, comprising a housing in which a chamber for receiving laundry is arranged, the dryer further comprising a removable tank for containing a liquid to be circulated within the dryer, the tank comprising a handle with a graspable portion for a user, whereby said tank comprises at least one recess for receiving at least partly a user's hand, whereby the at least one recess is provided with friction means that are configured to provide friction at least partially between the recess and the user's hand.

[0014] Preferred embodiments of the invention are described in relation to the dependent claims and the de-

scription of the enclosed drawings.

[0015] The invention is based on the consideration that the operation for emptying the tank requires the user to grasp a handle and pull the tank out of its housing. In the last phase of tank extraction from its housing, the user has to further hold the tank with a second hand, because its weight can be around 2-5 kg due to liquid contained therein. In current designs, the user's hand can slip from a surface of the tank, leading to an unstable holding of the tank. Due to its weight, spilling of liquid can occur. It is therefore desirable to allow the user to get a better handling of tank and a reliable grip on the tank.

[0016] Applicant has found that the handling of the tank can be considerably improved by providing at least an additional recessed area / recess which provides additional friction for the user's hand. Due to the enhanced friction, it is less likely that the hand will slip from the tank, leading to an uncontrolled movement of the tank and possible leaking of liquid. The user has more control over the movement of the tank which is especially important due to its weight in its filled state which can be up to several kilograms.

[0017] The friction means provide especially friction by providing a surface which leads to friction between the surface and the skin of the user's hand when the user grasps the tank in the recess. In this sense, the roughness of the recess is enhanced by the friction means. Preferably, the friction is enhanced compared to adjacent surfaces. The user can in this way easily determine an optimized area for holding / grasping the tank.

[0018] The handle is preferably arranged at a frontal part of the tank, especially if the tank is built in a drawer-type design. The handle or front handle can be either a separate component which is fixed / attached to the tank or can be integrally built with the tank, especially during the same manufacturing process. The handle provides a grasping portion for the user.

[0019] The recess with friction means is different from the handle or a recess which is realized by the shape or position of the handle and is preferably arranged at a side wall and/or bottom and/or upper wall of the tank. The tank is a container for liquid, i.e. it is built and designed to collect liquid until it has reached its full state.

[0020] The laundry dryer, in a preferred version, is a laundry dryer or laundry drying appliance of the condensation type, comprising a moisture condensing device. It is preferably built as a tumble dryer, whereby the chamber for receiving laundry is built as a rotatable drum. It can also be built as a wardrobe-dryer. The liquid which is collected in the tank may be condensate and the tank may function as a condensate tank.

[0021] The water tank may be intended as a removable tank provided for supplying water to a water using device such as a steamer, a laundry conditioning device, a machine component cleaning device, i.e. an arrangement for periodically cleaning a laundry moisture condensing device or an air filtering device.

[0022] The laundry dryer according to the present in-

vention comprises types of laundry dryers in which the liquid is condensate which has been removed from the laundry to be treated, water intended to be delivered to laundry in the chamber / drum, and/or water intended to be delivered to a component of the dryer for washing / cleaning it.

[0023] Preferably, the friction means comprise at least one friction surface with a roughness which is larger than a roughness of at least one adjacent surface of the tank which is adjacent to the friction surface.

[0024] The roughness advantageously is provided by providing recesses / friction recesses on the friction surface, which are of micrometer to centimeter size. The friction recesses can all have essentially the same size. Alternatively, friction recesses with different sizes can be provided. It is possible to have friction recesses of different sizes combined. As an example, a first group of friction recesses can be built in centimeter size, whereby a second group of friction recesses is arranged at least partially in the friction recesses of the first group which add a further layer or roughness. The friction recesses are preferably built to receive at least partially fingertips.

[0025] In a preferred embodiment, a friction element is arranged in the recess which provides said roughness.

The friction element is for example a component / part, which is attached at least partly to the recess. It can, as way of example, be attached to the recess by a bi-adhesive / double-faced adhesive tape or glued to the recess. The friction element can especially be designed as a layer which is attached to the tank in the recess.

[0026] In a preferred embodiment, the respective recess is at least partly shaped as a peak-and-valley structure / texture which at least partially provides the friction means.

[0027] This structure / texture is preferably shaped to fit / receive human fingertips. The valleys are therefore preferably designed with a curvature which allows human finger tips to enter in such a way that in an inserted way the fingertips have a large contact surface with the recess. In this way, at the contact surface, a large friction between fingertip and the recess is provided.

[0028] The tank is advantageously built as a drawer which is arranged in a drawer housing arranged in the housing.

[0029] The housing preferably comprises a door which, in an open state, gives access to the tank.

[0030] The respective recess preferably extends along a longitudinal direction of said tank. In this way, a convenient angle of the user's hand can be realized when grasping or holding the tank.

[0031] In a preferred embodiment, two recesses are provided.

[0032] Preferably, a first and a second recess are provided on walls of said tank between which liquid can be received. In a preferred embodiment, a first recess is provided on a side wall of the tank, whereby a second recess is provided on a bottom wall-lower

[0033] In a preferred embodiment, the tank comprises

at least one recess on the upper and walls of the tank, wherein the respective recess is provided with means for increasing friction of user hand/fingers on the recess surfaces. Preferably recesses are formed as two couples of opposed recesses provided on the upper and lower walls of the tank.

[0034] In a preferred embodiment, the side surface on which the recess is provided is inclined with respect to the bottom surface at an angle larger than 90°.

[0035] The friction means in a preferred embodiment comprise a color different from areas of the tank adjacent to the recess. In this way, the user obtains a visual indication on where she /he can grasp the tank when emptying the liquid from the tank.

[0036] In a second aspect, the present invention provides a method for manufacturing a tank for a laundry dryer, comprising the steps of

- a. forming a tank;
- b. providing at least one recess / recessed / graspable area on at least one wall of the tank;
- c. providing friction means for providing friction in the at least one recess.

[0037] Preferably, the steps b) and c) are performed at least partially overlapping in time with step a), whereby the surface of said recess is shaped during its forming in order to provide friction.

[0038] Preferably, step c) is performed after steps a) and b), whereby at least one surface of said recess is machined / deformed / finished to provide the friction means.

[0039] Advantageously, the tank is formed by molding, especially by blow-molding.

[0040] Advantageously, the surface is built with a greater roughness than adjacent surfaces of the tank.

[0041] The advantages of the invention are especially as follows. The friction means in the recess of the tank allow a safe and precise handling of the tank, thereby decreasing the risk of water spilling / pouring from the tank during handling. A design of the friction means as a peak-and-valley structure provides an especially convenient graspable area for the user.

Brief description of the drawings

[0042] Further features and advantages of the present invention shall become clearer from the following detailed description of some of its preferred embodiments, made with reference to the attached schematic drawings and given as an indication and not for limiting purposes.

[0043] While the invention is described in connection with preferred embodiments, it is not intended to limit the scope of the invention to the particular form set forth, but on the contrary, it is intended to cover such alternatives, modifications, and equivalents as may be included within the scope of the invention as defined by the appended claims. Even if the invention will be described here below

with reference to a condenser-type laundry dryer, the invention may be applied also in a vented-type laundry dryer.

[0044] In particular, the attached drawings are included to provide a further understanding of the invention and are incorporated in and constitute a part of this specification. The drawings together with the description explain the principles of the invention. In the drawings, corresponding characteristics and/or components are identified by the same reference numbers. In these drawings:

FIG. 1 shows a laundry dryer with a condensate tank in a perspective view;

FIG. 2 shows the laundry dryer of FIG. 1 in a second perspective view;

FIG. 3 shows the condensate tank in a perspective view;

FIG. 4 shows the condensate tank of FIG. 3 in a top view;

FIG. 5 shows the condensate tank of FIG. 3 in a cross-sectional view;

FIG. 6 shows the condensate tank of FIG. 3 in perspective view; and

FIG. 7 shows the condensate tank of FIG. 3 in another perspective view.

[0045] Same parts are labelled by identical reference numerals.

[0046] A laundry drying appliance or laundry dryer 2, shown in FIGs. 1 and 2 in a preferred embodiment, comprises a drum 6 which functions as a laundry drying chamber into which the clothes to be dried are introduced. Drum 6 can be closed by a door 8 and is rotatably supported within a casing or housing 10 which is preferably built as a cabinet 8. Drum 6 is made to rotate by means of a driving means, which, in the present case, comprises an electric motor which is connected to drum 6 via a drum driving belt and is housed in a motor housing or receptacle. Laundry dryer 2 further comprises a basement 4 which functions to cover and protect the interior components from outside influences. The housing 10 comprises a top plate 12, a back wall 14, and two side walls 16.

[0047] The electric motor preferably comprises a main motor shaft which is rigidly connected to a drying air fan which is placed in a drying air fan housing. The main motor shaft can also be built in a one-piece design with an axis of the drying air fan. Since the rotational speeds of the drying air fan and the drum 6 have to be quite different during operation, the drum is rotated by electric motor and a drum transmission system comprising a pulley, a transmission belt or secondary belt and a secondary shaft. The use of this drum transmission system al-

lows rotating both drum 6 and drying air fan by the same and identical electric motor.

[0048] Laundry dryer 2 comprises a front panel 20 on which a rotatable user interface 30 is arranged which preferably is built as a rotatable knob. The knob can also be built as a push-knob. Further user-interface elements are preferably provided on front panel 20 for selecting laundry treatment programs and/or options thereof as well as for displaying the current status of the machine.

[0049] Laundry dryer 2 is built as a condenser-type dryer with an air-air type heat exchanger or a heat pump system. Drying air from drum 6 is sucked in at a front side of laundry dryer 2 through a corridor by a drying air fan. At a rear side, drying air through a corridor is provided to drum 6. Before drying air is blown into drum 6, moisture is removed either by ambient air that cools heat exchanging surfaces of the air-air heat exchanger with the help of a condenser cooling air fan which is placed in a cooling fan housing or by means of a refrigerant evaporator of a heat pump system. Drying air is further heated up before being introduced in the drum 6 by means of an electric heater or a refrigerant condenser of the heat pump system.

[0050] During operation of the dryer, moisture is extracted from the laundry and collected in a condensate tank 26 which is built as a drawer with a front handle 28 which, on its right section, preferably has a cut-away 32 adjacent to rotatable element 30. The front handle 28 comprises a lower portion 36 into which, for pulling out the tank 26 from a drawer housing 40 arranged in housing 10 of laundry dryer 2, fingertips can be inserted as indicated by an arrow 34. On a bottom side 44, laundry dryer 2 can be mounted on a ground for operation.

[0051] During the laundry drying procedure, liquid which is extracted from the laundry is condensed and collected in condensate tank 26. After the treatment procedure, the condensate tank 26 needs to be emptied before a new procedure can be started. During the treatment procedure, several liters of condensate can be collected in the tank 26, leading to a weight of the filled tank 26 up to several kilograms.

[0052] The condensate tank 26 is configured to allow handling during its removal from the drawer housing 40. To this end, on a side wall 50 of condensate tank 26, a first recess 52 or recessed area is formed. On a bottom wall 56 of condensate tank 26, a second recess 58 or recessed area is formed. The recesses 52, 58 which are essentially built as wiggled gaps or slots are described in more detail in connection with FIG. 6.

[0053] As can be seen in FIG. 3, condensate tank 26 comprises an opening 64 which is formed as a hole in a casing 66 of condensate tank 26 into which a hollow extractable manifold 68 is inserted. During the laundry treatment procedure, the manifold 68 is inserted into opening 64, thereby allowing condensate removed from laundry to access the tank 26. For emptying the condensate tank 26, the manifold 68 can be extracted from the opening 64, while remaining attached to it, so as to drive the liquid

contained in condensate tank 26 to be poured out without leakage.

[0054] Condensate tank 26 comprises two recesses 80, 82 which essentially have a rectangular shape. The recesses 80, 82 are provided for grasping the tank 26 by a user and are configured with friction means 100 to provide a grasping region for a user's hand, especially the thumb, as will be described below.

[0055] Two columns 86, 88 (see also FIG. 6) are optionally provided supporting elements for providing additional stability to the tank 26 as will be described below. Columns 86, 88 are especially parts of are hollow cavities protruding within the tank 26 as to form a column-like structure in the tank volume containing liquid, such that the liquid is slowly driven towards the opening 64 when the tank 26 is emptied.

[0056] As can be seen in FIG. 4 and in the cross-sectional view in FIG. 5, the recesses 80, 82 are provided with friction means 100, which are built as a respective peak-and-valley structure 120. The respective peak-and-valley structure 120 is built with alternating projections and grooves, which are aligned in a longitudinal direction 122 of condensate tank 26. The respective protrusions and grooves have preferably a width, i.e. an extension in a direction perpendicular to longitudinal direction 122, which is below 1 mm. The peak-and-valley structure 120 serves to provide enhanced friction to a user's thumb when she or she grasps the tank and hinders the thumb from lateral sliding in the recess 80, 82, thereby providing a safe and precise grip of the tank 26.

[0057] As can also be seen in FIG. 5, one side wall 90 is inclined by an angle of 90° with respect to the bottom wall 56, while the other side wall 50 is inclined with respect to bottom wall 56 with an angle larger than 90°. In this way, the holding and the handling of the condensate tank 26 is more convenient compared to the case with two rectangular side walls.

[0058] As can be seen in FIG. 6, the two recesses 52, 58 are aligned in a longitudinal direction 94, which is parallel to an insertion direction in which the tank 26 is moved when inserted into drawer housing 40. Both recesses comprise friction means 100. The respective friction means 100 are built as peak-and-valley-structures, whereby the valley between peaks are dimensioned preferably with a width of approximately 8-12 mm such that a human fingertip can fit in. Preferably, a plurality of peaks and valleys is provided such that the user has a range of possible positions for her / his fingers to be placed in the corresponding recess 52, 58. Preferably, more than 10 peaks and valleys are provided. Preferably, the respective recess 52, 58 has the length of 5 centimeters or more, especially more than a typical width of a hand. It has preferably at least 4 peaks-and-valleys so that all four fingers of a hand can be entered. Most preferably, the respective recess 52, 58 extends over a length greater than half of the length of the tank 26 in direction 94. In this way, the user is given some flexibility and freedom where she /he would like to grasp the tank 26. The peak-

and-valley-structure of recesses 52, 58 is built to encompass user's fingertips and to provide friction between recess 52, 58 and the skin of the fingertip which allows to obtain a save and reliable grip of the condensate tank 26.

[0059] The recesses 52, 58, 80, 82 are preferably arranged at condensate tank 26 in order to provide the user a reliable handling of the tank which is performed preferably as follows. The tank will preferably be grasped by placing a right (left) hand on the drawer handle 36 and the left (right) hand placing to grasp the tank by engaging recess 80 (or 82) and 58 (or 52) respectively, whereby recess 80 (or 82) is engaged with the thumb and recess 58 (or 52) is engaged with the fingers.

[0060] Other preferred embodiments of the invention comprise only one recess 52, 58 or more than two recesses 52, 58. For instance, a further recess can be formed in the other sidewall 90 of the tank 26.

[0061] The container or tank 26 is preferably built by blow-molding. The respective recess 52, 58 is preferably formed during this process. Columns 86, 88 are also seen in FIG. 6. They comprise an optional supporting structure between the upper surface of tank 26 in which recesses 80, 82 are arranged and the side wall 50. Especially when the condensate tank 26 is manufactured by a blow-molding process, the respective column 86, 88 may serve to prevent collapsing of upper and lower surfaces of tank 26 when handled in a state filled with water. The aim of this supporting structure therefore is to support the upper and lower surface of condensate tank 26, avoiding them to collapse due to water weight. The structure is useful to slow down the water flow towards the manifold 68 when the tank is emptied. When liquid is poured out of the tank 26, the supporting structure slows down the flow of liquid. The supporting structure therefore provides a double function.

[0062] It will be appreciated that alternations and modifications may be made to the above without departing from the scope of the disclosure. Naturally, in order to satisfy local and specific requirements, a person skilled in the art may apply to the solution described above many modifications and alterations. Particularly, although the present disclosure has been described with a certain degree of particularity with reference to preferred embodiments thereof, it should be understood that various omissions, substitutions, and changes in the form and details as well as other embodiments are possible. Moreover, it is expressly intended that specific elements described in connection with any disclosed embodiment of the disclosure may be incorporated in any other embodiment as a general matter of design choice.

Claims

1. Laundry dryer (2), especially of the condensation type, comprising a housing (10) in which a chamber for receiving laundry is arranged, said dryer (2) further comprising a removable tank (26) for containing

a liquid to be circulated within the dryer (2), said tank (26) comprising a handle (28) with a graspable portion for a user, whereby said tank (26) comprises at least one recess (52, 58) for receiving at least partly a user's hand,

characterized in that

said at least one recess (52, 58, 80, 82) is provided with friction means (100) that are configured to provide friction at least partially between said recess (52, 58, 80, 82) and said user's hand.

2. Laundry dryer (2) according to claim 1, whereby said friction means (100) comprise at least one friction surface with a roughness which is larger than a roughness of at least one adjacent surface of said tank (26) which is adjacent to said friction surface.
3. Laundry dryer (2) according to claim 2, whereby said roughness is provided by providing recesses on said friction surface which are of micrometer to centimeter size.
4. Laundry dryer (2) according to one of the claims 1 to 3, whereby a friction element is arranged in said recess (52, 58, 80, 82) which provides said roughness.
5. Laundry dryer (2) according to one of the claims 1 to 4, whereby said respective recess (52, 58, 80, 82) is at least partly shaped as a peak-and-valley structure (120) / texture which at least partially provides said friction means.
6. Laundry dryer (2) according to claim 5, whereby said structure / texture is shaped to fit / receive human fingertips.
7. Laundry dryer (2) according to one of the previous claims, whereby said tank (26) is built as a drawer which is arranged in a drawer housing (40) arranged in said housing (10).
8. Laundry dryer (2) according to claim 7, whereby said drawer housing (40) comprises a door which in an open state gives access to said tank (26).
9. Laundry dryer (2) according to one of the claims 1 to 8, whereby said respective recess (52, 58, 80, 82) extends along a longitudinal direction (94) of said tank (26).
10. Laundry dryer (2) according to one of the claims 1 to 9, whereby two recesses (52, 58, 80, 82) are provided.
11. Laundry dryer (2) according to claim 10, whereby a first (80, 82) and a second recess (52, 58) are provided on walls (50, 56) of said tank (26) between

which liquid can be received.

- 12.** Method for manufacturing a tank (26) for a laundry dryer (2), comprising the steps of
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- a. forming a tank (26);
 - b. providing at least one recess (52, 58, 80, 82) on at least one wall (50, 56) of said tank (26);
 - c. providing friction means (100) for providing friction in said at least one recess (52, 58, 80, 82).
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- 13.** Method according to claim 14, whereby steps b) and c) are performed at least partially overlapping in time with step a), and whereby the surface of said recess (52, 58, 80, 82) is shaped during its forming in order to provide friction.
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- 14.** Method according to claim 14, whereby step c) is performed after steps a) and b), and whereby at least one surface of said recess (52, 58, 80, 82) is machined / deformed / finished to provide said friction means (100).
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- 15.** Method according to claim 15 or 16, whereby said surface is built with a greater roughness than adjacent surfaces of said tank (26).
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FIG. 1

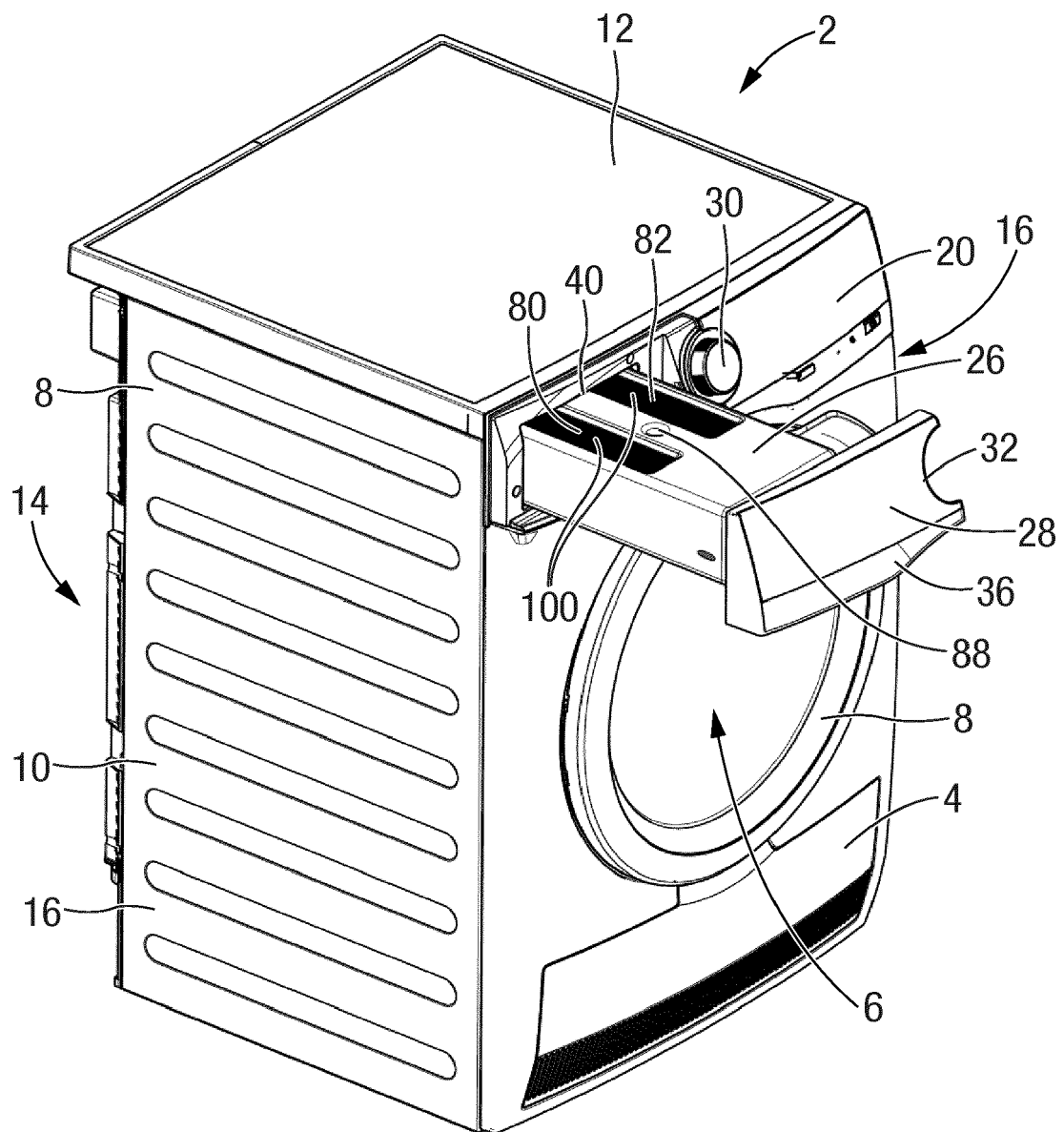


FIG. 2

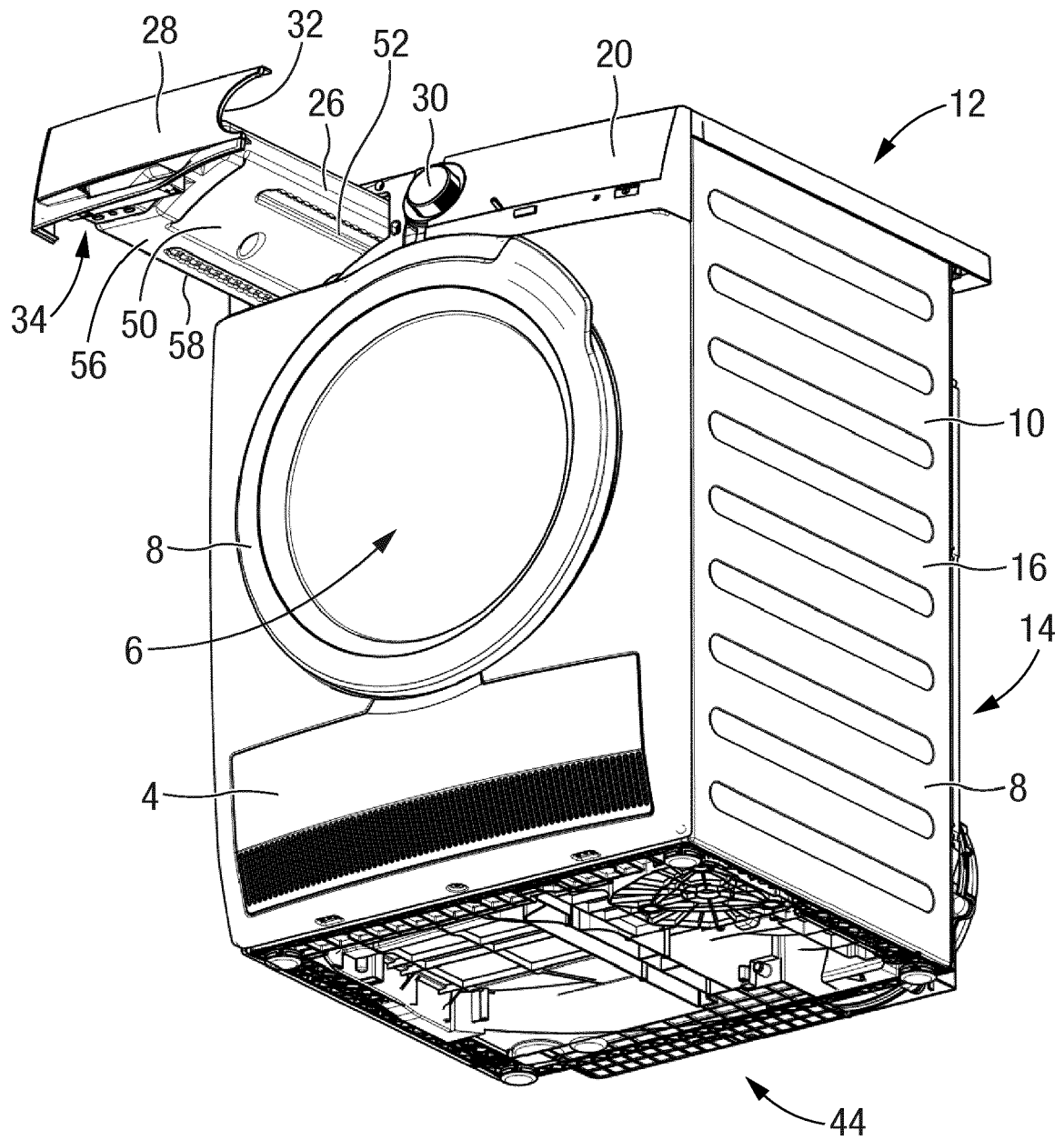


FIG. 3

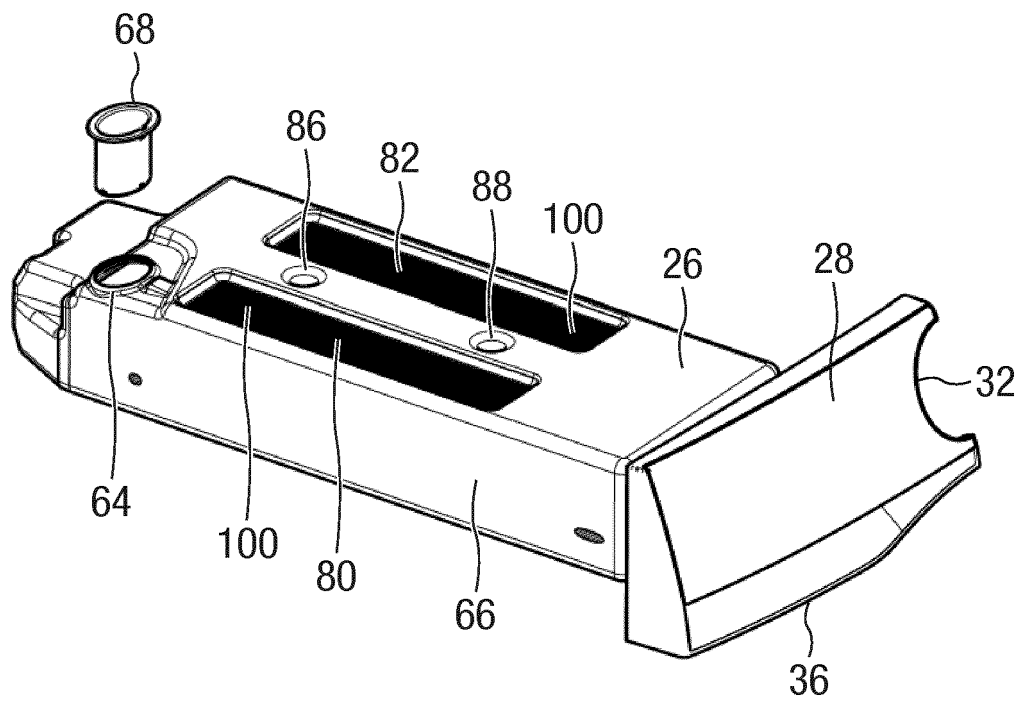
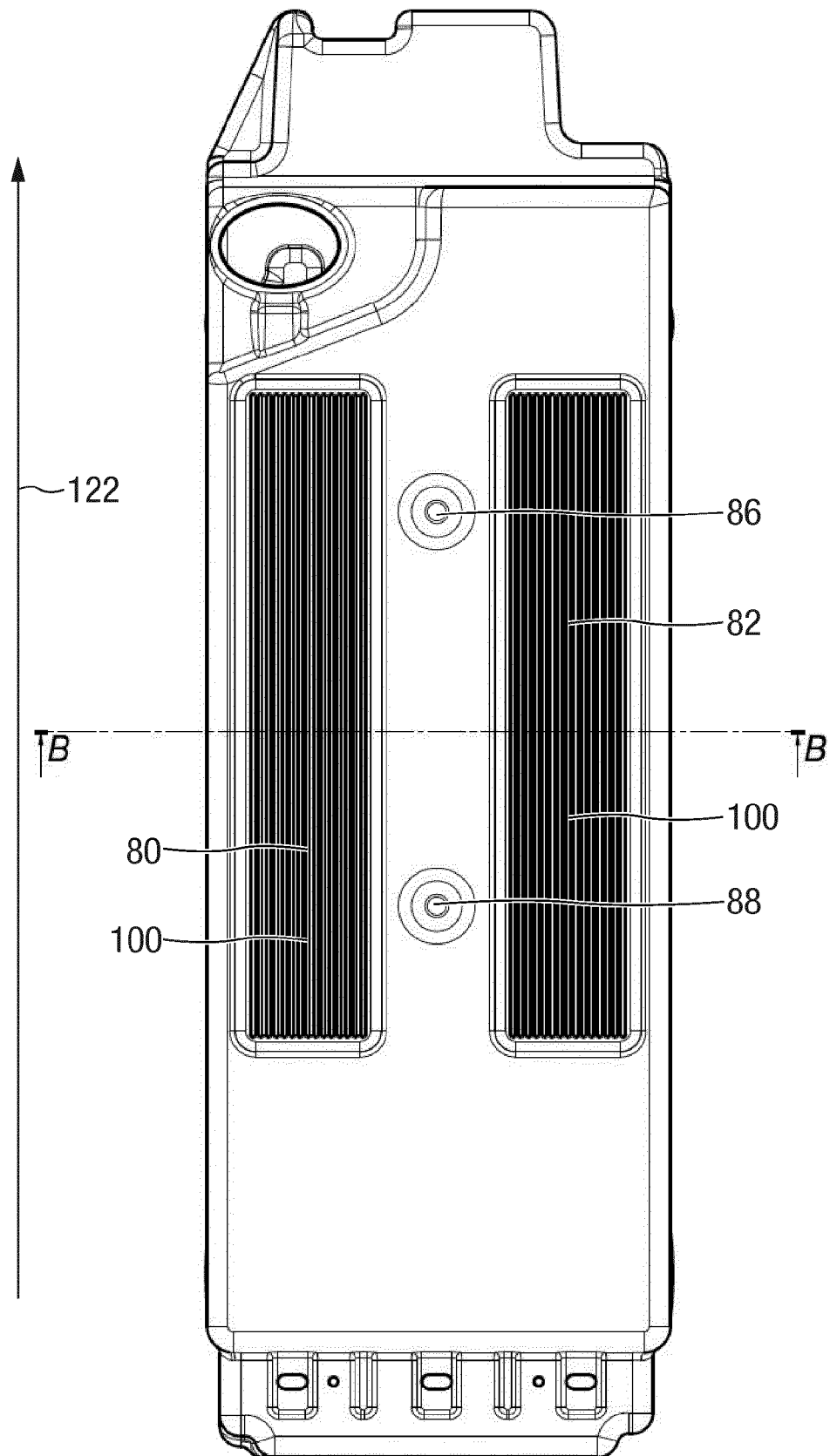


FIG. 4



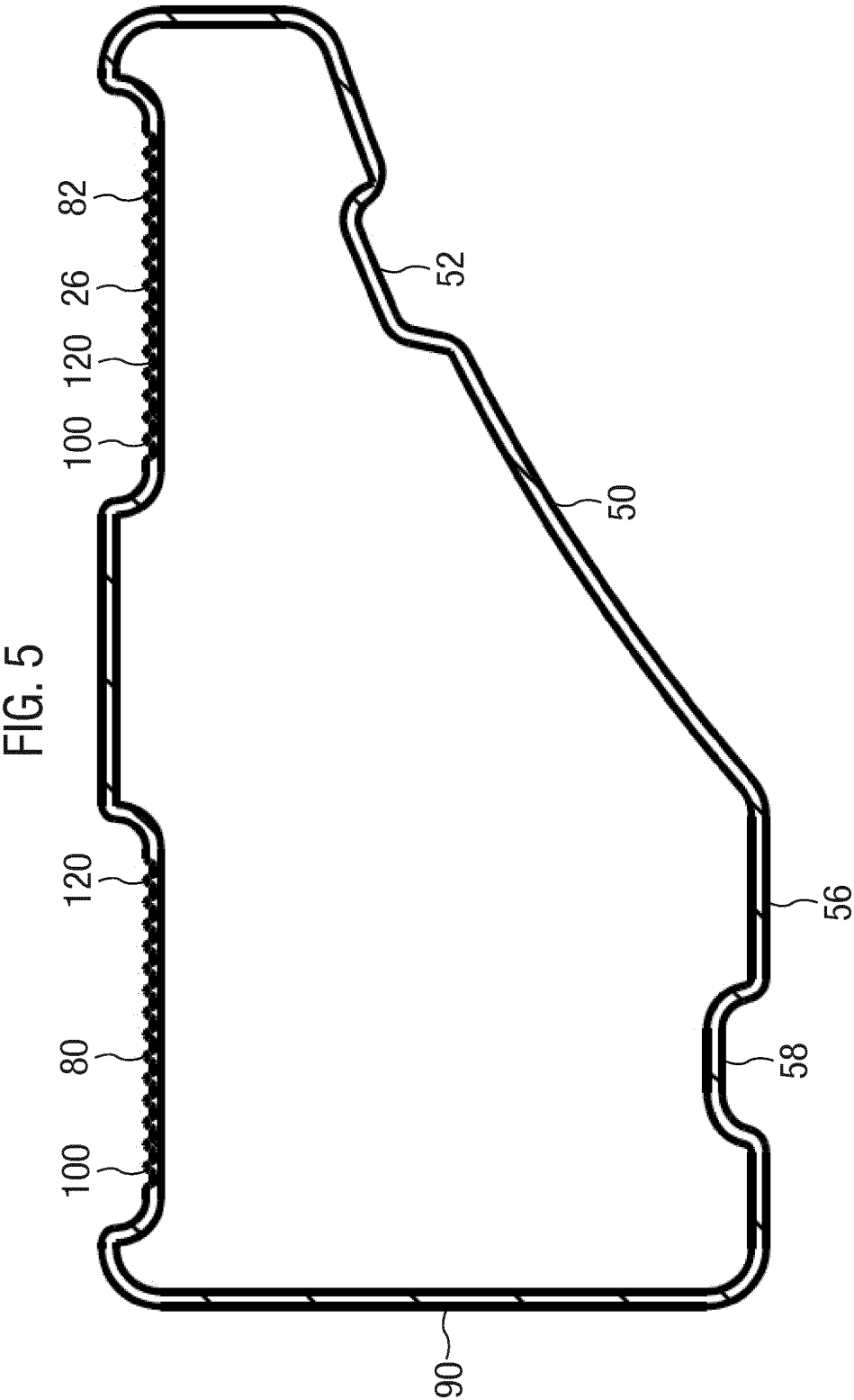


FIG. 6

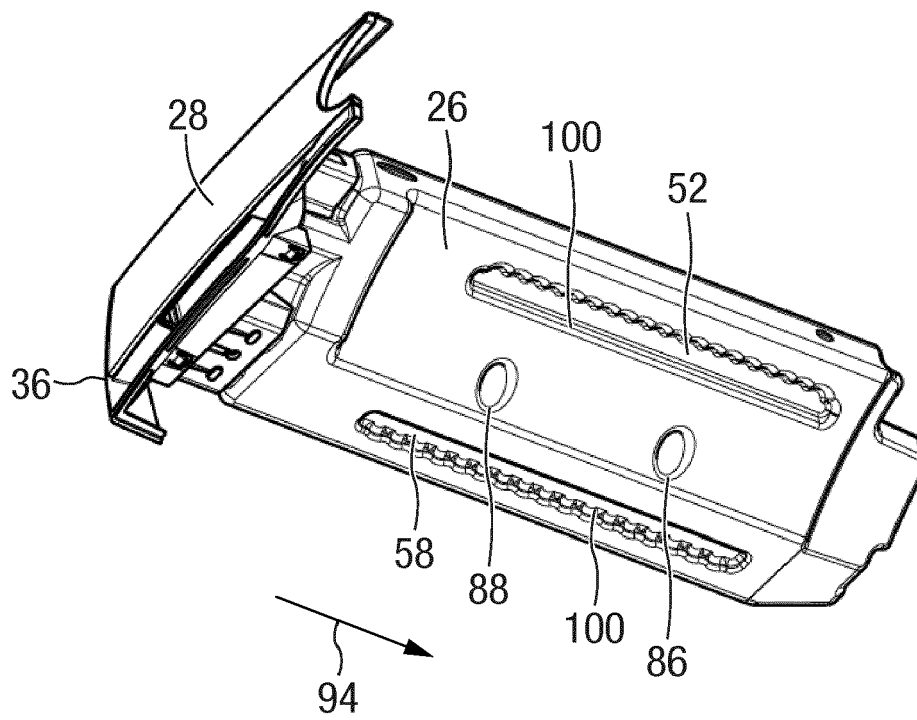
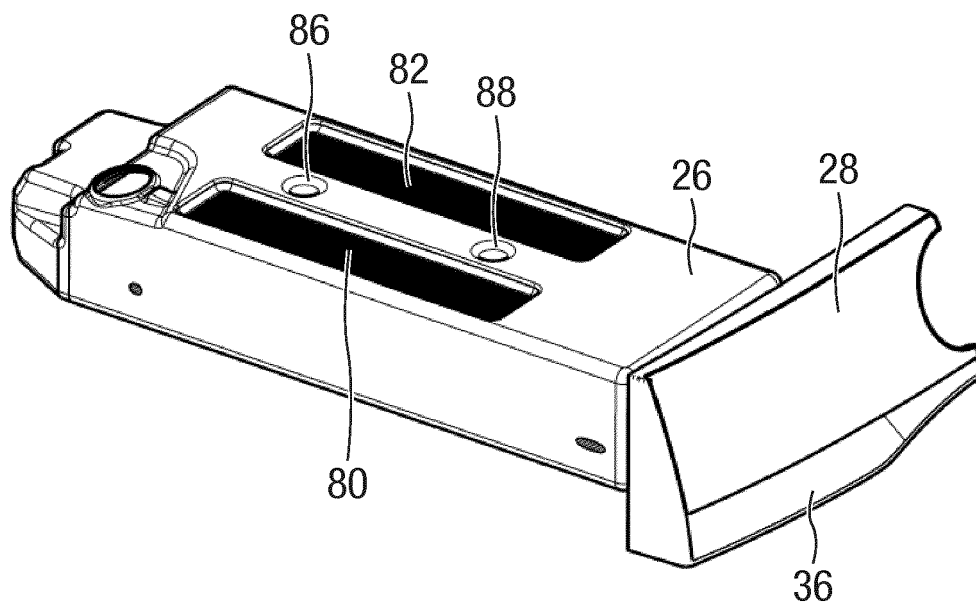


FIG. 7





EUROPEAN SEARCH REPORT

Application Number
EP 17 19 5905

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