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(54) **CLOTHES DRYER**

(57) The present invention discloses a clothes dryer, including a barrel 2 for containing clothes, a condenser 3 that is spatially in communication with the barrel, and a fan 4 that enables air to flow from the barrel 2 to the condenser 3, where the condenser 3 and the barrel 4 share a common wall 21, and the condenser 3 has an annular airflow passage 35. Because the condenser 3 is integrated with the barrel 2, space is more compact, and

the annular airflow passage 35 provides a longer heat exchange distance, so that condensation efficiency is improved. Swirling airflow forces condensed water to be thrown on a wall 21 of the annular airflow passage 35 under the action of centrifugal force; therefore, the condensed water is not easily brought into a fan 4 and an air heating apparatus by the airflow.

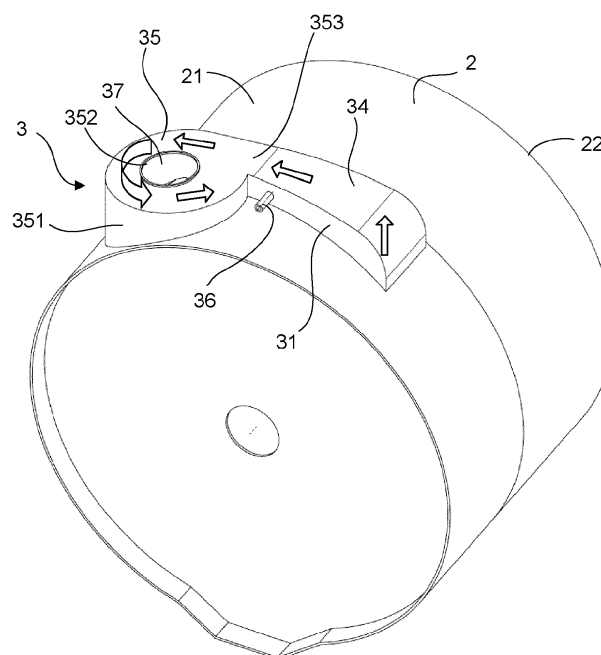


FIG. 1

Description

[0001] The present invention relates to a clothes dryer, and in particular, to a condensing apparatus of a clothes dryer.

[0002] Clothes dryers generally include machines having only a clothes drying function, and machines integrating a clothes washing function and a clothes drying function. A drying principle of the clothes dryer may be basically summarized as follows: With a heating apparatus, dry air is heated into dry hot air, then enters a clothes processing barrel to exchange heat with wet clothes, takes moisture away from the clothes, and becomes relatively wet hot air. The wet hot air subsequently passes through a condensing apparatus. By condensation of the condensing apparatus, moisture in the wet hot air is condensed into water and is discharged through a drainage tube. After the condensation, the air becomes relatively dry cold air, is guided into the heating apparatus again by a fan, becomes dry hot air after heating, and enters another circle. The circle repeats until a drying program ends.

[0003] The condensing apparatus may use various condensation methods. A common method is to use water as a cooling medium to exchange heat with drying air; thereby making moisture in hot air condensed and be separated from air. Such a condensing apparatus generally has a body in a passage shape, and a cooling water pipe is connected to the body. Wet hot drying air passes the inside of the condensing apparatus from the bottom up. During this period, cooling water flows out from the top down to exchange heat with wet hot air. Generally, due to the limit of space, that is, due to the limited height of the body of the condensing apparatus, the heat exchange distance between the wet hot air and the cooling water is short. In addition, the wet hot air ascending at a high speed blows away the water flow after meeting the cooling water, or even blows water droplets into the fan and an air heating apparatus. In addition, a condenser needs to occupy some space, and therefore, a clothes processing barrel has to be contained within limited space.

[0004] An objective of the present invention is to provide a clothes dryer in a compact structure, where a condenser also has better heat exchange performance and cooling water is not easily blown into a fan or an air heating apparatus.

[0005] To achieve the foregoing objective, a technical solution used in the present invention is as follows: A clothes dryer is provided, including a barrel for containing clothes, a condenser that is spatially in communication with the barrel, and a fan that enables air to flow from the barrel to the condenser, where the condenser and the barrel share a common wall, and the condenser has an annular airflow passage.

[0006] The clothes dryer may be various machines having a clothes drying function, for example, a machine used only to dry clothes, or a washer-dryer.

[0007] Compared with the prior art, because the condenser is integrated with the barrel, space is more compact, and the annular airflow passage provides a longer heat exchange distance, so that condensation efficiency is improved. Swirling airflow forces condensed water to be thrown on a wall of the annular airflow passage under the action of centrifugal force; therefore, the condensed water is not easily brought into a fan and an air heating apparatus by the airflow.

[0008] As a preferable improvement solution, the barrel includes a periphery wall that is substantially cylindrical; the barrel is substantially horizontally or obliquely disposed along an axis thereof; and the common wall that the condenser shares with the barrel is located on the periphery wall of the barrel, and is located above the axis of the barrel. Because the periphery wall of the barrel is cylindrical shaped, space that can be used exists between the periphery wall and a case body. This improvement solution maximizes, within limited space of the case body, the space between the barrel and the condenser by using this space.

[0009] As a possible improvement solution of the present invention, the annular airflow passage is located in a space that is formed by the arc-shaped periphery wall of the barrel and an outer wall of the condenser, and which space is located obliquely above the axis of the barrel and gradually increases in a perpendicular direction due to bending downwards of the periphery wall of the barrel. This space is generally vacant in the clothes dryer, or is rarely occupied by another component completely. Such design also finely uses the space. Moreover, this sink space provides relatively sufficient perpendicular space to the annular airflow passage, so that the airflow sufficiently descends within the annular airflow passage, and the longer heat exchange distance is achieved.

[0010] As a further improvement of the present invention, the condenser includes an air intake passage, which is in communication with the annular airflow passage, and is located at an upstream of the annular airflow passage; and the condenser includes a cooling water inlet which is located within the air intake passage. Therefore, cooling water is blown away within the air intake passage by an airflow and is mixed with the airflow, so that the heat exchange distance within the annular airflow passage can be used more sufficiently.

[0011] As a further improvement of the present invention, an air inlet of the air intake passage is provided on the periphery wall of the barrel, and the air inlet of the air intake passage and the cooling water inlet are respectively located at two sides of a corresponding barrel ridge that is located perpendicular above an axis of the barrel. In this way, it is not easy for the cooling water to enter the barrel from the air inlet to wet clothes in the barrel.

[0012] As a further improvement of the present invention, the condenser includes an air intake passage, which is in communication with the annular airflow passage, and is located at an upstream of the annular airflow pas-

sage, and a flow cross-section of the air intake passage gradually decreases along an air flowing direction. Such an air intake passage can increase a speed at which the airflow enters the annular airflow passage, and enhance heat exchange performance.

[0013] As a further improvement of the present invention, the condenser includes a cooling water inlet, which is close to a narrowest position of the flow cross-section of the air intake passage. The cooling water inlet is located near an area with a highest airflow speed, which helps to blow the cooling water into water droplets and better mix the cooling water with the airflow. Moreover, a relatively high airflow speed results in relatively great centrifugal force within the annular airflow passage, so that condensed water is separated from air to attach to a passage wall, and is prevented from entering the fan.

[0014] As a further improvement of the present invention, the air intake passage extends substantially horizontally.

[0015] As a further improvement of the present invention, a straight airflow passage is provided in the middle of the annular airflow passage, where a wall of the straight airflow passage forms an inner wall of the annular airflow passage; an inlet of the straight airflow passage is located at the bottom thereof, and is in communication with the annular airflow passage; and an outlet of the straight airflow passage is located at the top thereof, and is in communication with the fan. After swirling along the annular airflow passage, the airflow descends to reach the bottom and enter the straight airflow passage. Such a circuitous airflow path further limits or even prevents the condensed water from entering the fan, and also achieves more sufficient condensation.

[0016] As a further improvement of the present invention, the wall of the straight airflow passage is cylindrical shaped, so that the airflow swirls in the annular airflow passage more smoothly.

[0017] As a further improvement of the present invention, an inlet of the annular airflow passage is close to the top of the annular airflow passage. After entering the annular airflow passage from a relatively high position, the airflow finally enters the straight airflow passage from the bottom. The airflow swirls down; therefore, heat exchange increases, and condensation performance is improved.

[0018] As a further improvement of the present invention, the inlet of the annular airflow passage is provided in a tangent direction of the annular airflow passage. High speed airflow from the tangent direction helps to form a swirling airflow within the annular airflow passage, and reduce resistance.

[0019] As a further improvement of the present invention, a condensed water outlet is provided on a barrel wall that is at the bottom of the annular airflow passage. Such design prevents water accumulation, and the condensed water is discharged out of the barrel by using a drainage apparatus.

[0020] As a further improvement of the present inven-

tion, the annular airflow passage includes a cylindrical outer wall and a cylindrical inner wall. An annular passage located between the cylindrical outer wall and the cylindrical inner wall has small resistance to airflow passing through the annular passage.

[0021] A preferred embodiment of the present invention is now further described as follows with reference to the accompanying drawing, wherein:

FIG. 1 is a schematic diagram of a barrel and a condenser of a clothes dryer;

FIG. 2 is a cross sectional schematic view of the barrel, the condenser, and a fan of the clothes dryer; and

FIG. 3 is a sectional view along an A-A direction of FIG. 2.

[0022] As shown in FIG. 1 to FIG. 3, a clothes dryer has a drum 1 and a barrel 2 that are coaxial and are spatially communicated. The drum 1 is rotatably installed in the barrel 2. Clothes to be dried are contained in the drum 1, and are gradually dried under the action of hot air that enters the barrel 2.

[0023] The drum 1 and the barrel 2 are substantially horizontally installed along their axial direction. A condenser 3 is disposed on a periphery wall 21 that is on the top of the barrel 2. A fan 4 and an air heating passage 5 are sequentially connected to a downstream of the condenser 3. An outlet air of the air heating passage 5 is in communication with a front opening 20 of the barrel 2. Therefore, an air circulation path is formed in the barrel 2, the condenser 3, the fan 4, and the air heating passage 5.

[0024] The condenser 3 includes an outer wall 31. The outer wall 31 together with the substantially cylindrical periphery wall 21 of the barrel forms a condensing passage 32. The condensing passage 32 includes an air intake passage 34, and an annular airflow passage 35 located at a downstream of the air intake passage 34. The air intake passage 34 is in communication with the annular airflow passage 35.

[0025] The annular airflow passage 35 is located in a space that is formed by the arc-shaped periphery wall 21 of the barrel and the outer wall 31 of the condenser, and which space is located obliquely above an axis 22 of the barrel 2 and gradually increases in a perpendicular direction due to bending downwards of the periphery wall 21 of the barrel.

[0026] As shown in FIG. 1 and FIG. 2, the air intake passage 34 extends substantially horizontally, and a flow cross-section of the air intake passage gradually decreases along an air flowing direction. A cooling water inlet 36 is located within the air intake passage 34, and is close to a narrowest position of the flow cross-section of the air intake passage 34. An air inlet 33 of the air intake passage 34 is provided on the periphery wall 21

of the barrel, and the air inlet 33 of the air intake passage and the cooling water inlet 36 are respectively located at two sides of a corresponding barrel ridge 23 that is located perpendicular above the axis 22 of the barrel 2.

[0027] An annular passage 35 includes a cylindrical outer wall 351 and a cylindrical inner wall 352, where the outer wall 351 is a part of the outer wall 31 of the condenser, and a straight airflow passage 37 is formed within the inner wall 352. An inlet 371 of the straight airflow passage 37 is located at the bottom thereof, and is in communication with the annular airflow passage 35; and an outlet 372 of the straight airflow passage is located at the top thereof, and is in communication with the fan 4. An inlet 353 of the annular airflow passage 35 is close to the top of the annular airflow passage, and is provided towards a tangent direction of the annular airflow passage 35. The inlet 353 of the annular airflow passage 353 is connected to the air intake passage 34.

[0028] A condensed water outlet 38 is provided at the bottom of the annular airflow passage 35 and on the periphery wall 21 of the barrel. Therefore, condensed water is discharged from the condensed water outlet 38 into the barrel 2.

[0029] Various specific embodiments described in the foregoing and shown in accompanying drawings are only used for illustrating the present invention, and are not regarded as the entirety of the present invention. Within the scope of the basic technical thought of the present invention, any types of modifications to the present invention made by persons ordinarily skilled in the art fall within the protection scope of the present invention.

Claims

1. A clothes dryer, comprising a barrel (2) for containing clothes, a condenser (3) that is spatially in communication with the barrel, and a fan (4) that enables air to flow from the barrel to the condenser, **characterized in that:** the condenser (3) and the barrel (2) share a common wall (21), and the condenser (3) has an annular airflow passage (35).
2. The clothes dryer according to claim 1, **characterized in that:** the barrel (2) comprises a periphery wall (21) that is substantially cylindrical; the barrel (2) is substantially horizontally or obliquely disposed along an axis (22) thereof; and the common wall (21) that the condenser (3) shares with the barrel (2) is located on the periphery wall (21) of the barrel, and is located above the axis (22) of the barrel.
3. The clothes dryer according to claim 2, **characterized in that:** the annular airflow passage (35) is located in a space that is formed by the arc-shaped periphery wall (21) of the barrel and an outer wall (31) of the condenser, and which space is located obliquely above the axis (22) of the barrel and grad-

ually increases in a perpendicular direction due to bending downwards of the periphery wall (21) of the barrel.

4. The clothes dryer according to claim 1, **characterized in that:** the condenser (3) comprises an air intake passage (34), which is in communication with the annular airflow passage (35), and is located at an upstream of the annular airflow passage; and the condenser comprises a cooling water inlet (36) which (36) is located within the air intake passage (34).
5. The clothes dryer according to claim 4, **characterized in that:** an air inlet (33) of the air intake passage (34) is provided on the periphery wall (21) of the barrel, and the air inlet (33) of the air intake passage and the cooling water inlet (36) are respectively located at two sides of a corresponding barrel ridge (23) that is located perpendicular above an axis (22) of the barrel (2).
6. The clothes dryer according to claim 1, **characterized in that:** the condenser (3) comprises an air intake passage (34), which is in communication with the annular airflow passage (35), and is located at an upstream of the annular airflow passage (35), and a flow cross-section of the air intake passage (34) gradually decreases along an air flowing direction.
7. The clothes dryer according to claim 6, **characterized in that:** the condenser (3) comprises a cooling water inlet (36), which is close to a narrowest position of the flow cross-section of the air intake passage (34).
8. The clothes dryer according to any one of claims 4 to 7, **characterized in that:** the air intake passage (34) extends substantially horizontally.
9. The clothes dryer according to claim 1, **characterized in that:** a straight airflow passage (37) is provided in the middle of the annular airflow passage (35), wherein a wall (352) of the straight airflow passage forms an inner wall (352) of the annular airflow passage; an inlet (371) of the straight airflow passage is located at the bottom thereof, and is in communication with the annular airflow passage (35); and an outlet (372) of the straight airflow passage is located at the top thereof, and is in communication with the fan (4).
10. The clothes dryer according to claim 9, **characterized in that:** the wall (352) of the straight airflow passage (37) is cylindrical shaped.
11. The clothes dryer according to claim 9, **characterized in that:** an inlet (353) of the annular airflow passage (35) is close to the top of the annular airflow

passage (35).

12. The clothes dryer according to claim 11, **characterized in that:** the inlet (353) of the annular airflow passage (35) is provided in a tangent direction of the annular airflow passage (35). 5
13. The clothes dryer according to claim 1, **characterized in that:** a condensed water outlet (38) is provided on a barrel wall (21) that is at the bottom of the annular airflow passage (35). 10
14. The clothes dryer according to claim 1, **characterized in that:** the annular airflow passage (35) comprises a cylindrical outer wall (351) and a cylindrical inner wall (352). 15

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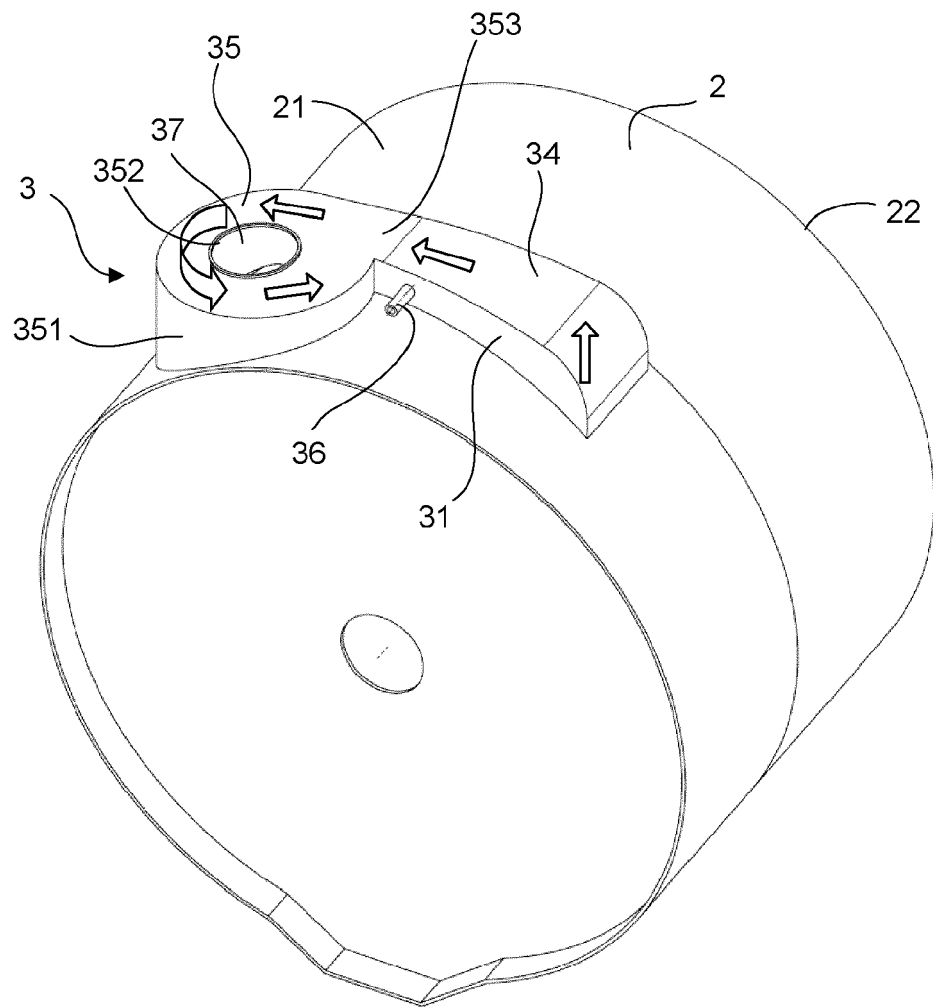


FIG. 1

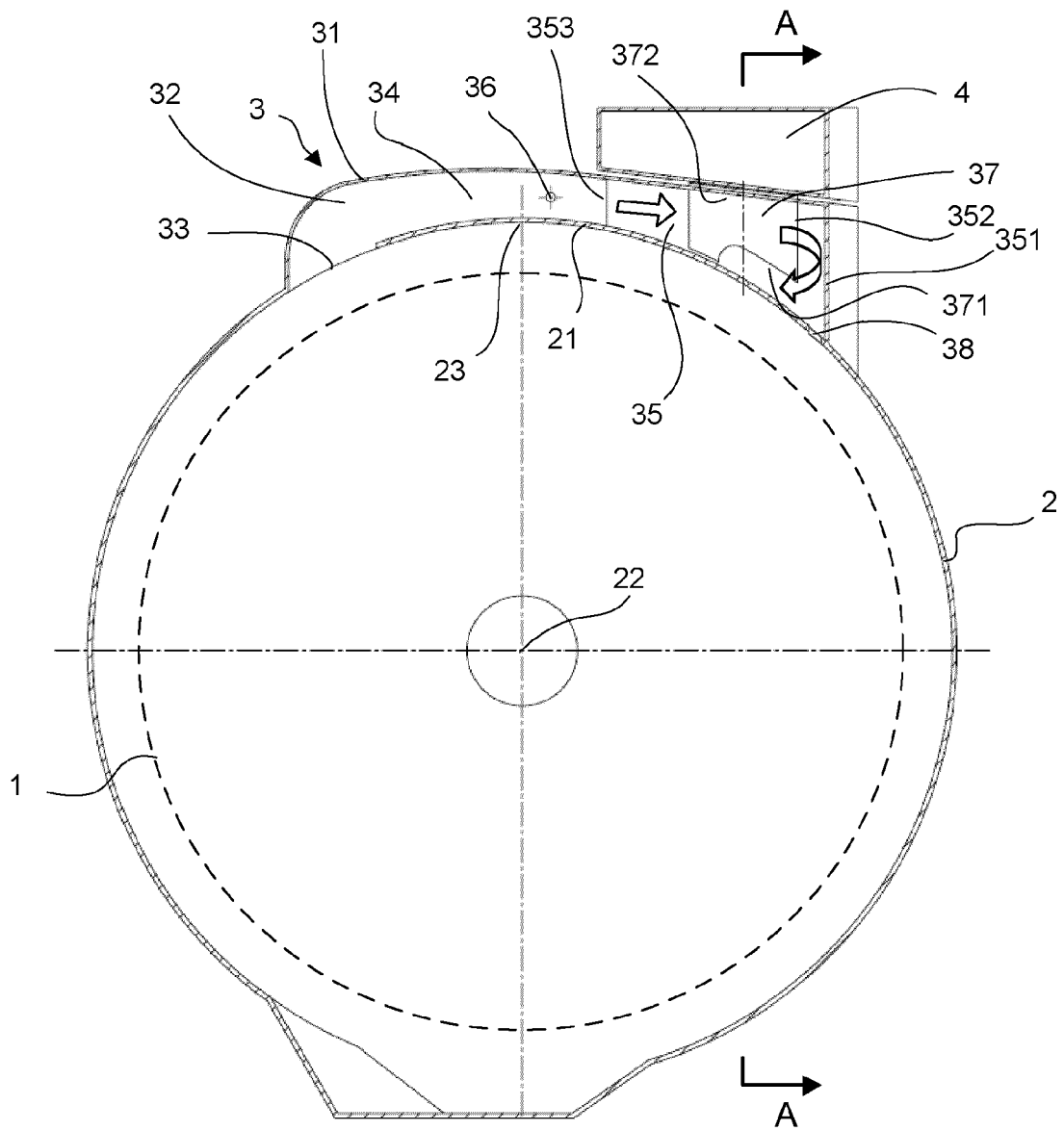


FIG. 2

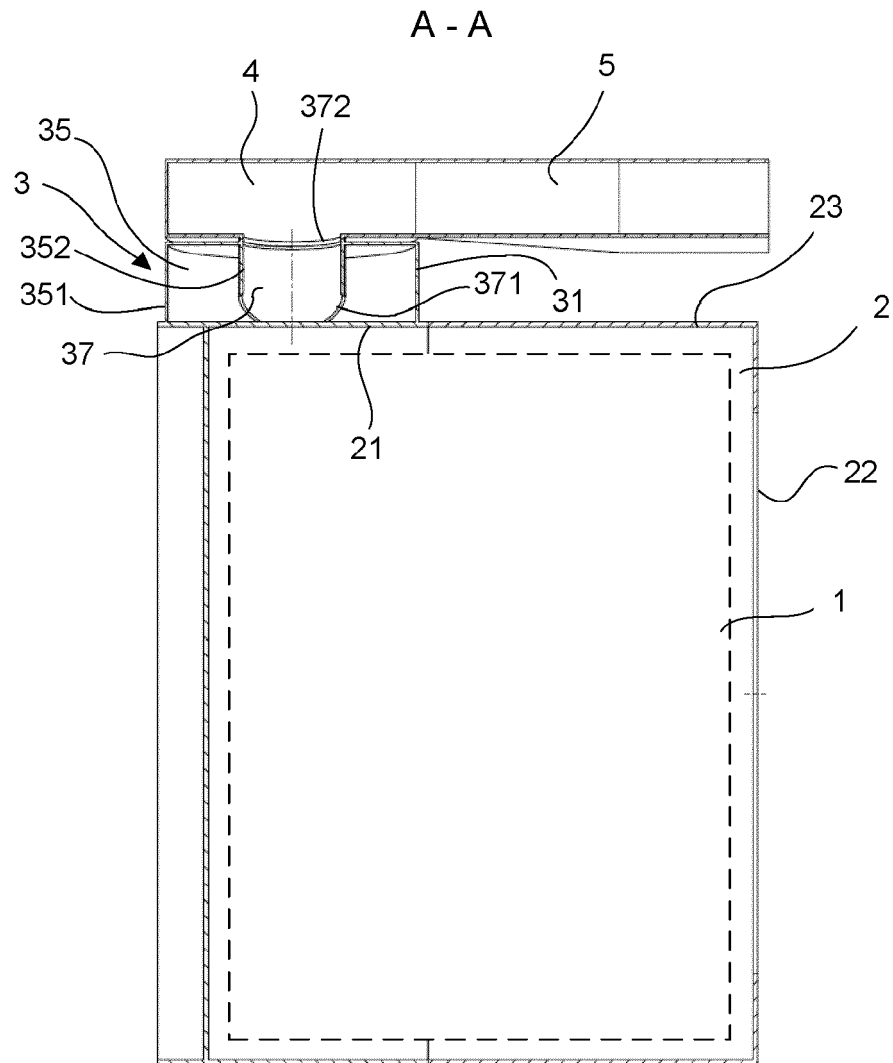


FIG. 3



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Application Number
EP 16 16 3120

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Place of search Munich		Date of completion of the search 1 August 2016	Examiner Bermejo, Marco
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