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(54) **A COLLECTOR BOX FOR A HEAT EXCHANGER**

(57) A collector box 10 for a heat exchanger for a motor vehicle, comprising an elongated collector tank 11 with a fluid nozzle 12 and an opening 14 for receiving a header with heat exchange tubes, characterized in that it further comprises a plate arrangement 100 with a first distribution section 110 and a second distribution section 120, connected to the collector tank 11 so that a fluid passage is created between the nozzle 12 and the opening 13 through the distribution sections 110, 120, the first distribution section 110 being arranged closer to the nozzle 12 than the second distribution section 120, wherein the distribution sections 110, 120 are elongated in the same direction as the collector tank 11, and wherein the first distribution section 110 comprises distribution area which is smaller than distribution area of the second distribution section 120.

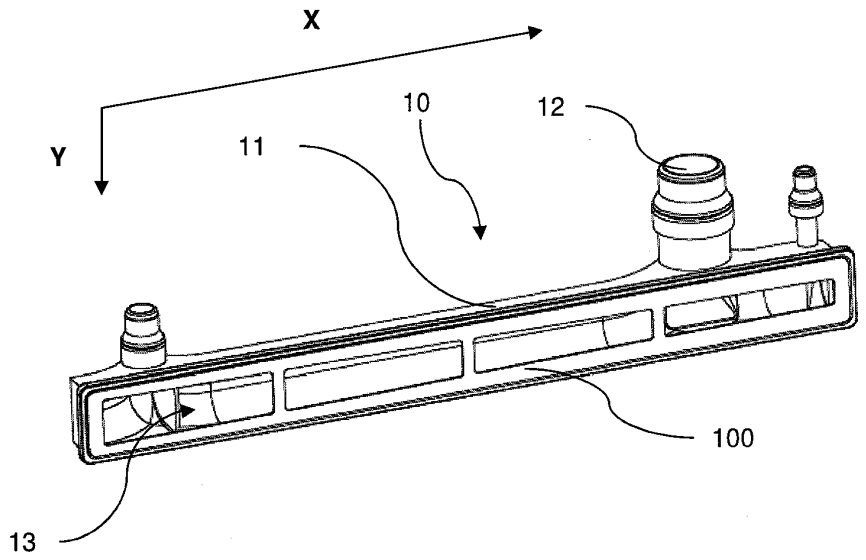

Fig. 3

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Description

FIELD OF THE INVENTION

[0001] The invention relates to a collector box for a heat exchanger for a motor vehicle. This may in particular involve radiators in which a heat-exchanging liquid circulates which serves for cooling of the engine of the vehicle and which is intended to be situated on the front face of said vehicle. However, the invention may also find application in other heat exchangers.

BACKGROUND OF THE INVENTION

[0002] There are known heat exchangers which enable heat exchange between a fluid circulating in a closed loop and the air. Such heat exchangers may have a bundle of tubes, connected on both ends in the tanks. In many instances, the tubes are placed in headers in rows parallel to each other, along the tank which preferably has an elongated shape to accommodate the header with tubes. The fluid travels between the tanks through the tubes. When the heat exchanger is subject to air moving around and between the tubes, the heat exchange between the air and the fluid flowing through the tubes and tanks takes place.

[0003] The tanks can have inlets and outlets for the fluid, located at various locations along the generally elongated structure of the tank. Consequently, the fluid flowing into the tank through the inlet has to travel within this tank to reach all of the tubes. In many cases, this may lead to uneven flow distribution through the heat exchanger, especially when the inlet or outlet is situated near the end of the elongated tank. In other words, the homogeneity of the fluid flow may be poor or below expected requirements. Poor homogeneity results in non-optimal heat exchange.

[0004] It is therefore the aim of this invention to improve heat exchange rate between the fluid flowing through the radiator and the air.

SUMMARY OF THE INVENTION

[0005] The object of the invention is, among others, a collector box for a heat exchanger for a motor vehicle, comprising an elongated collector tank with a fluid nozzle and an opening for receiving a header with heat exchange tubes, characterized in that it further comprises a plate arrangement with a first distribution section and a second distribution section, connected to the collector tank so that a fluid passage is created between the nozzle and the opening through the distribution sections the first distribution section being arranged closer to the nozzle than the second distribution section, wherein the distribution sections are elongated in the same direction as the collector tank, and wherein the first distribution section comprises distribution area which is smaller than distribution area of the second distribution section.

[0006] Preferably, the first distribution section and/or the second distribution section comprises plurality of openings arranged in series.

[0007] Preferably, at least one of the distribution sections comprises an opening with a trapezoidal shape.

[0008] Preferably, at least one of the distribution sections comprises an opening with a rectangular shape.

[0009] Preferably, the distribution areas of consecutive openings of the first distribution section increase toward the second distribution section.

[0010] Preferably, the distribution areas of consecutive openings of the second distribution section decrease toward the first distribution section.

[0011] Preferably, at least part of the openings are separated from each other by a plate connection element.

[0012] Preferably, the plate arrangement is comprised of plurality of plates arranged in series.

[0013] Preferably, the plate arrangement comprises a mounting step.

[0014] Another object of the invention is a heat exchanger comprising a collector box as described above.

[0015] Another object of the invention is a heat exchanger a heat as described above, wherein a header with tubes is mounted in the opening.

BRIEF DESCRITPTION OF DRAWINGS

[0016] Examples of the invention will be apparent from and described in detail with reference to the accompanying drawings, in which:

Fig. 1 shows a heat exchanger;
Fig. 2 shows a collector box in a perspective view from above;
Fig. 3 shows a collector box in a perspective view from below;
Fig. 4 shows an example of plate arrangement for the collector box;
Fig. 5 shows another example of plate arrangement for the collector box;
Fig. 6 shows yet another example of plate arrangement for the collector box;
Fig. 7 shows yet another example of plate arrangement for the collector box.

DETAILED DESCRIPTION OF EMBODIMENTS

[0017] Fig. 1 shows a heat exchanger 1 in which a collector box 10 according to the invention can be implemented. The invention has applications in a heat exchanger 1 comprising tubes 20 which in this case form a bundle in which said tubes 20 are parallel to one another. Each tube 20 has two longitudinal ends connected in a fixed and sealed manner to collector boxes 10 for the circulation of a fluid, in particular cooling liquid or the like. Each collector box 10 comprises a nozzle 12, which can be either inlet or outlet for the fluid entering or exiting the heat exchanger.

[0018] Fig. 2 shows the collector box 10 in a perspective view from above. The collector box 10 comprises a collector tank 11. The collector tank 11 is elongated along the longitudinal axis X. The nozzle 12 is located at its side, near one of its side ends, for example near the first end of the collector tank 11. The placement of the nozzle 12 may vary, according to specific application.

[0019] Fig. 3 shows the collector tank 10 in a perspective view from below. The collector tank 11 comprises an opening 13 for receiving a header (not shown) with heat exchange tubes 20. Preferably, the opening 13 has a rectangular shape to accommodate a correspondingly shaped header, with a width along axis Y and length along axis X. The collector box 10 comprises a plate arrangement 100, connected to the collector tank 11. The plate arrangement 100 can be mounted in the collector tank 11 using clips, snap-fits, glue or other known connection methods. The general plane of the plate arrangement 100 is preferably parallel to the general plane of the opening 13.

[0020] Fig. 4 shows an example of plate arrangement 100. The plate arrangement 100 is defined by length along the longitudinal axis X and width along the axis Y. The plate arrangement 100 comprises a first distribution section 110 and a second distribution section 120. The first distribution section 110 and the second distribution section 120 are adapted to distribute fluid along the longitudinal axis X by comprising openings 111, 112, 121, 122 with length bigger than width, so that each opening can supply fluid to plurality of tubes 20. The distribution sections 110, 120 preferably are carried out in form of through-holes, which allow for flow of the fluid between the first side of the plate arrangement 100 and its second side. The plate arrangement 100 is connected to the collector tank 11 so that a fluid passage is created between the inlet 12 and the opening 13 through the distribution sections 110, 120, preferably exclusively through the distribution sections 110, 120. The exclusive fluid passage can be provide through sealing of the plate arrangement 100 with respect to the collector tank 11. The first distribution section 110 is arranged to be closer to the nozzle 12 than the second distribution section 120. In particular, in order to improve homogeneity of fluid flow between the collector tank 11 and the tubes 20 of the heat exchanger 1, the first distribution section 110 comprises distribution area which is bigger than distribution area of the second distribution section 120. By a distribution area it is meant for example the area of the through-hole constituting given distribution section 110, 120, through which the fluid will flow. The distribution sections 110, 120 in this example are adjacent to each other. In this example, the distribution section 110 comprises an opening 111, while the distribution section 120 comprises an opening 121. The openings 111, 121 have a rectangular shape. They are arranged in series. In particular, they are arranged in series sharing a side (with width dimension). In other words, there is no material barrier between the distribution sections 110, 120 and the between their openings 111, 121.

[0021] Fig. 5 shows another example of plate arrangement 100. It differs from the plate arrangement shown in Fig. 4 in that one of the distribution sections, in this case the second distribution section 120, has a trapezoidal shape. In particular, the opening 121 of the second distribution section 120 has trapezoidal shape. Preferably, the longitudinal sides of the openings 121 are arranged so that the distance between them is decreasing in the direction of the nozzle 12. It can be however also envisaged that the openings 111 of the first distribution section 110 have a correspondingly arranged shape.

[0022] Fig. 6 shows yet another example of plate arrangement 100. In this example, the first distribution section 110 and the second distribution section 120 comprise plurality of openings 111, 112, 121, 122 arranged in series. In particular, the first distribution section 110 comprises openings 111, 112, while the second distribution section 120 comprises openings 121, 122. In this example, the distribution areas of consecutive openings 111, 112 of the first distribution section 110 increase toward the second distribution section 120. Also, the distribution areas of consecutive openings 121, 122 of the second distribution section 120 decrease toward the first distribution section 110. This allows to further control and improve the homogeneity of the fluid flow.

[0023] Fig. 7 shows yet another example of plate arrangement 100. In this example, the first distribution section 110 comprises openings 111, 112, where both of them have the same shape and distribution area. Further, the second distribution section 120 comprises openings 121, 122 of trapezoidal shape, and the distribution areas of them decrease toward the first distribution section 110. The openings 111, 112, 121, 122 are separated from each other by a plate connection element 130. This provides an improved strength of the plate arrangement 100, which may be needed due to demanding operation conditions such as sudden pressure and temperature changes. Another cause for improving strength of the plate arrangement 100 may be the need to reduce deformation risk during the assembly.

[0024] It is to be noted that the plate connection elements 130 as described for example depicted in Fig. 7 can be applied to any of other examples pertaining to this invention. They can be placed between the distribution sections 110, 120 i.e. between the openings 111, 112, 121, 122. Further, the connection elements 130 can be placed between all the openings 111, 112, 121, 122 or between only part of them.

[0025] Analogously, if a trapezoidal shape is applied to any of the openings 111, 112, 121, 122, the longitudinal sides of these openings can arranged so that the distance between them is decreasing in the direction of the nozzle 12.

[0026] It is to be noted that although the examples disclose plate arrangements with two or four openings, the invention can envisage any different number of them, for example three, five etc., and still ensure corresponding

advantageous technical effect.

[0027] Preferably, the collector box 10 is configured so that upon connecting the header with tubes 4 to the collector box 10, the ends of the tubes 4 are distanced from the plate arrangement 100, for example by 1 mm.

[0028] According to one example, the plate arrangement 100 can be comprised of plurality of plates arranged in series, wherein at least part of them comprise opening 111, 112, 121, 122. The advantage of such configuration may be that the manufacturing process can be simplified, i.e. the shortcomings of stamping, moulding or machining can be avoided, especially in case of long tanks.

[0029] The plate arrangement 100 can be made from aluminum, plastic or other material resistant to glycols.

[0030] The collector box 10 provides internal pressure drop reduction. In particular, internal pressure drop reduction is obtained due to reduction of spiral shape flow of coolant within the tank and more homogenous flow through the heat exchanger core made of tubes 4. The plate arrangement 100 cooperates with the tank 11 to improve guiding of the fluid stream.

[0031] The invention can reduce thermal shock stress level within the heat exchanger, normally occurring due to different temperature levels at the extremities, as the fluid flow speed differences within the whole cross-sections of the exchanger will be decreased. This is achieved by decreasing the flow between the inlet/outlet and the tubes in selected sections, determined by the inlet/outlet placement, and increasing the flow in the remaining sections.

[0032] Other variations to the disclosed embodiments can be understood and effected by those skilled in the art in practicing the claimed invention, from a study of drawings, the disclosure, and the appended claims. The mere fact that certain measures are recited in mutually different dependent claims does not indicate that a combination of these measures cannot be used to the advantage.

Claims

1. A collector box 10 for a heat exchanger for a motor vehicle, comprising an elongated collector tank 11 with a fluid nozzle 12 and an opening 14 for receiving a header with heat exchange tubes, **characterized in that** it further comprises a plate arrangement 100 with a first distribution section 110 and a second distribution section 120, connected to the collector tank 11 so that a fluid passage is created between the nozzle 12 and the opening 13 through the distribution sections 110, 120, the first distribution section 110 being arranged closer to the nozzle 12 than the second distribution section 120, wherein the distribution sections 110, 120 are elongated in the same direction as the collector tank 11, and wherein the first distribution section 110 comprises distribution area which is smaller than distribution area of the second distribution section 120.

2. A collector box 10 according to claim 1, wherein the first distribution section 110 and/or the second distribution section 120 comprises plurality of openings 111, 112, 121, 122 arranged in series.

3. A collector box 10 according to any preceding claim, wherein at least one of the distribution sections 110, 120 comprises an opening 111, 112, 121, 122 with a trapezoidal shape.

4. A collector box 10 according to any preceding claim, wherein at least one of the distribution sections 110, 120 comprises an opening 111, 112, 121, 122 with a rectangular shape.

5. A collector box 10 according to any of claims 2-4, wherein the distribution areas of consecutive openings 111, 112 of the first distribution section 110 increase toward the second distribution section 120.

6. A collector box 10 according to any of claims 2-5, wherein the distribution areas of consecutive openings 121, 122 of the second distribution section 120 decrease toward the first distribution section 110.

7. A collector box 10 according to any preceding claims, wherein at least part of the openings 111, 112, 121, 122 are separated from each other by a plate connection element 130.

8. A collector box 10 according to any preceding claim, wherein the plate arrangement 100 is comprised of plurality of plates arranged in series.

9. A collector box 10 according to any preceding claim, wherein the plate arrangement comprises a mounting step 10.

10. A heat exchanger 1 comprising a collector box according to any preceding claims.

11. A heat exchanger 1 according to claim 10, wherein a header with tubes 4 is mounted in the opening 13.

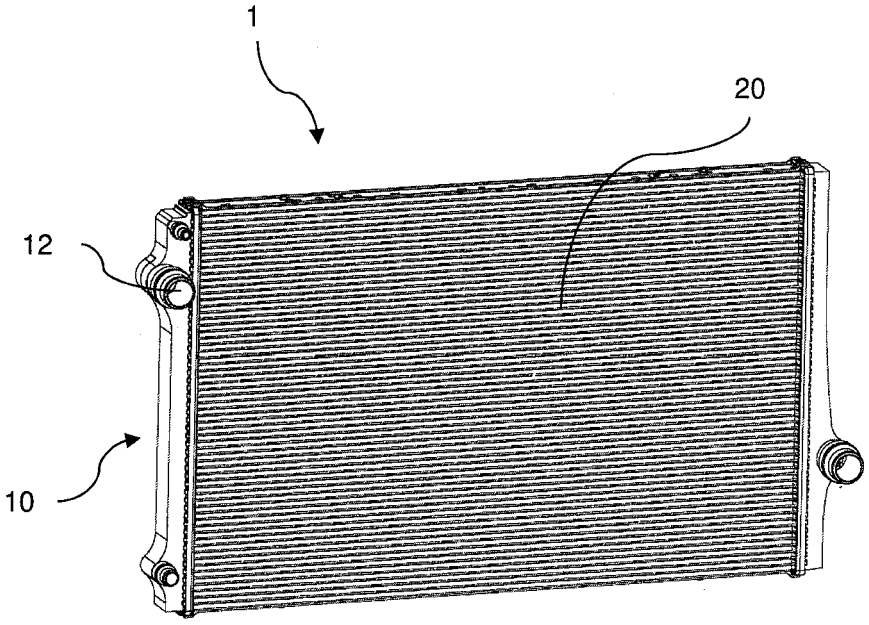

Fig. 1

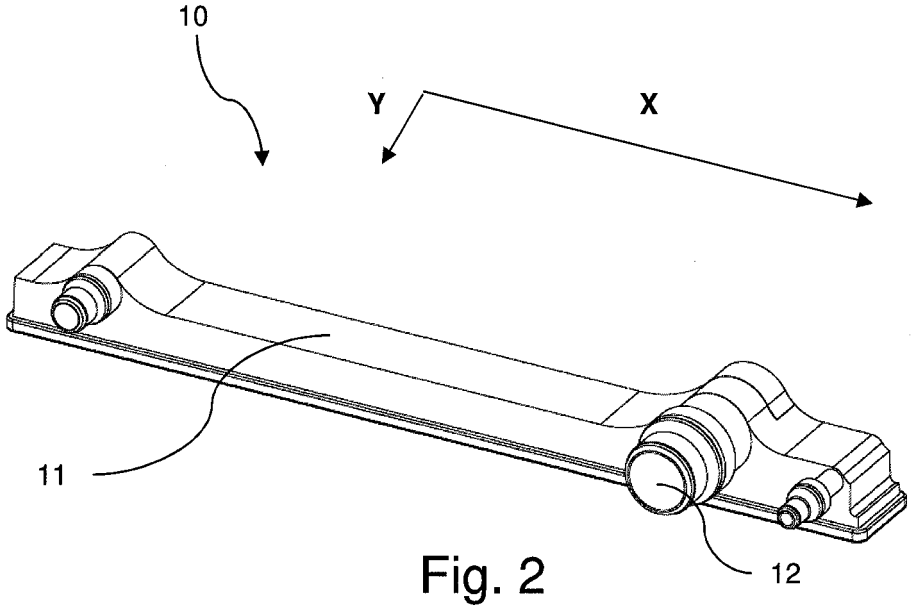

Fig. 2

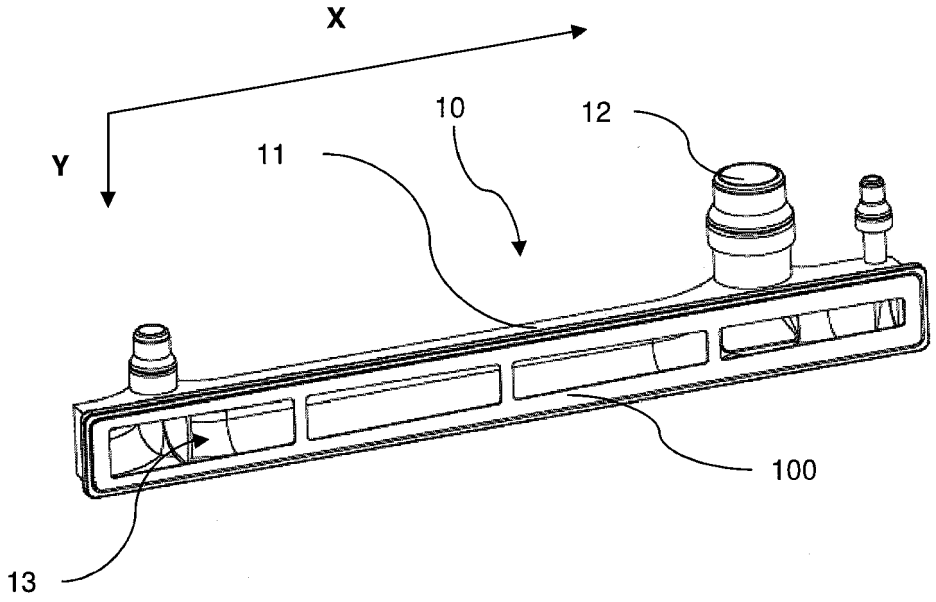

Fig. 3

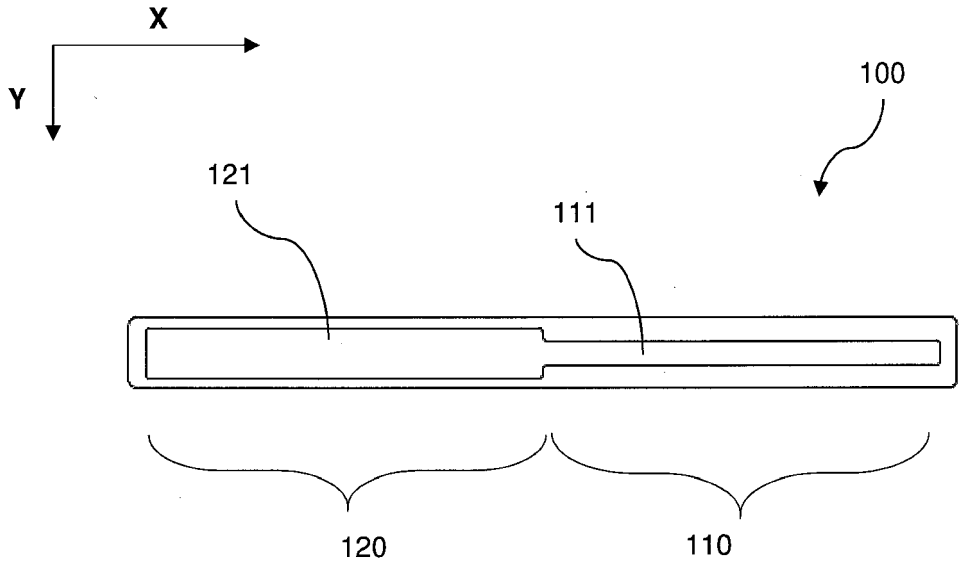

Fig. 4

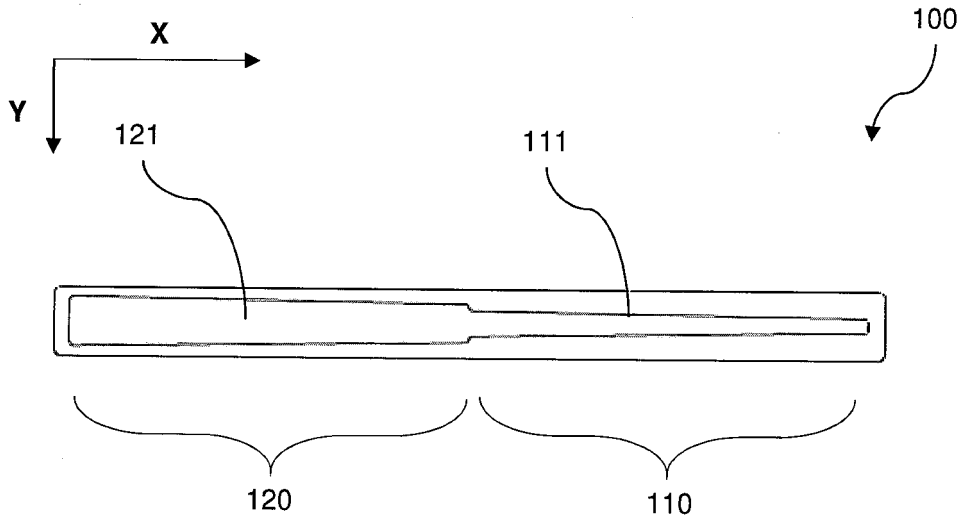

Fig. 5

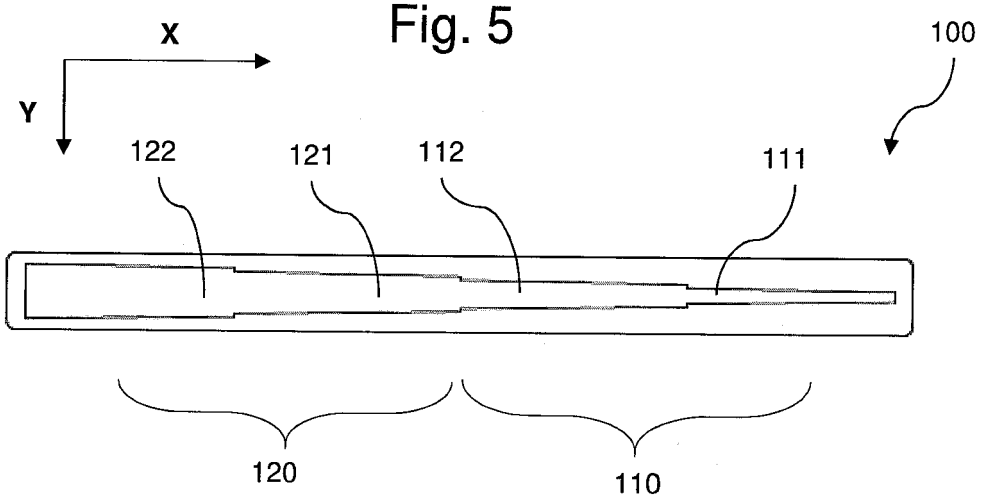

Fig. 6

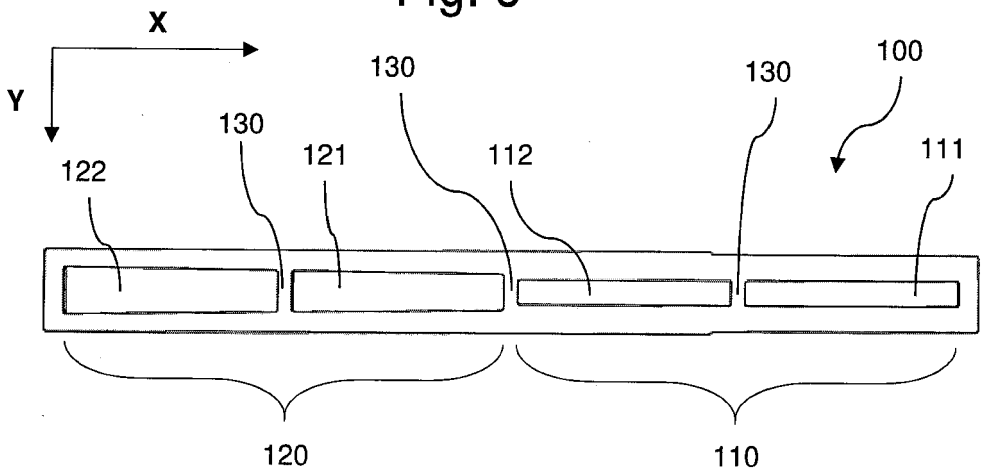

Fig. 7

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EUROPEAN SEARCH REPORT

Application Number
EP 18 46 1603

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X	WO 02/103263 A1 (SHOWA DENDO K K [JP]; HORIUCHI HIROFUMI [JP]; HOSHINO RYOICHI [JP]; OG) 27 December 2002 (2002-12-27) * figure 11 * -----	1,2,5-7, 9-11	
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The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
Munich	30 January 2019	Delaitre, Maxime

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
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