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(54) **LED lighting device capable of uniformly dissipating heat**

(57) An LED lighting device (1) with a heat dissipating structure is disclosed. The LED lighting device (1) includes a lamp base (20) coupled with a top cover (10) to form an accommodating space (100) for accommodating a first heat dissipating module (30) and a second heat dissipating module (40). The first heat dissipating module (30) includes a first heat-conducting plate (31), a first heat pipe (32a) and a first heat dissipater (33a). An LED lighting module (50) is connected with the first heat-conducting plate (31), in which an evaporator section (321a) of the first heat pipe (32a) is disposed thereon. The first heat dissipater (33a) is arranged on a condenser section (322a) of the first heat pipe (32a), and the second heat dissipating module (40) includes a second heat-conducting plate (41) and a second heat pipe (42a). The second heat-conducting plate (41) paralleling to the first heat-conducting plate (31) is connected with the LED lighting module (50). An evaporator section (421a) of the second heat pipe (42a) is disposed on the second heat-conducting plate (41), and whose condenser section (422a) is connected with an inner surface (101) of the top cover (10). Whereby, the heat generated from the

LED lighting module (50) can be dissipated uniformly and rapidly.

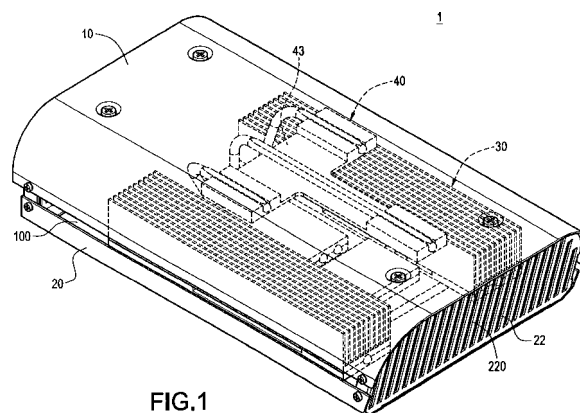


FIG.1

Description

BACKGROUND OF THE INVENTION

1. Field of the Invention

[0001] The present invention generally relates to an LED lighting device, and more particularly to an LED streetlamp having a heat dissipating structure.

2. Description of Prior Art

[0002] For a conventional mercury-vapor streetlamp, the high heat resulting from overnight use always makes its service life limited. Because of its high power consuming and environmental pollution, it trends toward being replaced by a light emitting diode (LED) lighting device having advantages of high intensity, power saving and long service life, etc. However, the heat generated from the LED will have disadvantageous influence on its service life. Therefore, the LED streetlamps usually employ heat dissipating devices.

[0003] A conventional LED streetlamp is provided with a lamp base and a transparent cover, in which a plurality of LEDs are accommodated therebetween. A heat dissipating device comprising a heat-conducting plate and plural heat dissipating fins disposed thereon is arranged in the streetlamp, wherein the heat-conducting plate is connected with the LEDs. The heat generated from the LEDs will be dissipated by the heat dissipating fins, and an additional heat dissipating fan is required for blowing the heated air.

[0004] In above structure, the heated air is dissipated by the heat dissipating fan. But the fan requires consuming extra electricity when operated, which contradicts the conception of power saving and environment protecting. In addition, the fan installed outdoors may be damaged easily.

SUMMARY OF THE INVENTION

[0005] It is a primary object of the invention to provide an LED lighting device, which conducts the heat generated from the LED lighting modules to both heat dissipating fins and a top cover uniformly and rapidly.

[0006] To achieve the object, the present invention provides an LED lighting device comprising a top cover, a lamp base, a first heat dissipating module and a second heat dissipating module, wherein the lamp base is covered with the top cover to form an accommodating space for accommodating the first heat dissipating module and the second heat dissipating module. The first heat dissipating module comprises a first heat-conducting plate, a first heat pipe and a first heat dissipater. An LED lighting module is connected with the first heat-conducting plate in which an evaporator section of the first heat pipe is disposed. A condenser section of the first heat pipe is arranged on the first heat dissipater. The second heat

dissipating module comprises a second heat-conducting plate and a second heat pipe. The second heat-conducting plate paralleling to the first heat-conducting plate is connected with the LED lighting module. An evaporator section of the second heat pipe is disposed on the second heat-conducting plate, and whose condenser section is connected with an inner surface of the top cover.

[0007] In comparison with the conventional LED lighting device, the present invention is provided with two heat dissipating modules, in which one heat dissipating module transfers the heat to the dissipaters by a heat-conducting plate and heat pipes, and the other heat dissipating module concurrently transfers the heat to the top cover. The two heat dissipating modules are lined on the LED lighting modules for transferring the heat uniformly and rapidly. Because the heat pipe has advantages of high thermal conductivity, light weight, simple structure and long service time, it has an excellent heat conducting efficiency without consuming extra electricity, which make economical and practical utility be improved.

BRIEF DESCRIPTION OF DRAWINGS

[0008]

FIG. 1 is a perspective view of the present invention;
FIG. 2 is a schematic view showing the top cover assembly of the present invention;
FIG. 3 is a schematic view showing the first and the second heat dissipating module assembly of the present invention;
FIG. 4 is an exploded view of the first heat dissipating module of the present invention;
FIG. 5 is an exploded view of the second heat dissipating module of the present invention;
FIG. 6 is a sectional view showing assembly of the present invention;
FIG. 7 is a second embodiment of the second heat dissipating module
FIG. 8 is a third embodiment of the second heat dissipating module and
FIG. 9 is a second embodiment of the first heat dissipating module.

DETAILED DESCRIPTION OF THE INVENTION

[0009] The technical characteristics, features and advantages of the present invention will become apparent in the following detailed description of preferred embodiments with reference to the accompanied drawings, and the preferred embodiments are used for illustrating the present invention only, but not intended to limit the scope of the present invention.

[0010] With reference to FIG. 1, the present invention is a light-emitting diode (LED) lighting device 1. The lighting device 1 includes a top cover 10 and a lamp base 20. The lamp base 20 is coupled with the top cover 10 to form an accommodating space 100 for accommodating

a first heat dissipating module 30 and a second heat dissipating module 40. The first heat dissipating module 30 and the second heat dissipating module 40 are arranged inside the lamp base 20.

[0011] With further reference to FIG. 2, two corresponding ends of the lamp base 20 are provided with side plates 22 separately. There are a plurality of heat dissipating holes 220 in each of the side plates 22. The rear end of the lamp base 20 has a sleeve 23 for being inserted by a lamp pole (not shown).

[0012] Please refer to FIGs. 3-5, the bottom of the lamp base 20 is provided with a block 60 with good thermal conductivity. The first heat dissipating module 30 and the second heat dissipating module 40 are arranged on the top surface of the block 60. The bottom side of the lamp base 20 connects an LED lighting module 50.

[0013] Referring to FIG. 4, the first heat dissipating module 30 comprises a first heat-conducting plate 31, a first heat pipe 32a, another first heat pipe 32b, a first heat dissipater 33a and a second heat dissipater 33b. The first heat-conducting plate 31 is mounted on the top surface of the block 60 for connecting a front end of the LED lighting module 50. The first heat-conducting plate 31 is composed of a first upper heat-conducting plate 31a and a first lower heat-conducting plate 31b. The first upper heat-conducting plate 31a defines a first upper groove 310a thereon, and the first lower heat-conducting plate 31b has a first lower groove 310b correspondingly. Both the first upper groove 310a and the first lower groove 310b are used for disposing an evaporator section 321a of the first heat pipe 32a and an evaporator section 321b of the another first heat pipe 32b.

[0014] The first heat pipe 32a having one evaporator section 321a and two condenser sections 322a, 322a' is formed in a U shape. The first heat dissipater 33a is arranged on the condenser section 322a of the first heat pipe 32a, and the second heat dissipater 33b is arranged on the other condenser section 322a'. The first heat dissipater 33a is defined by a group of heat dissipating fins, or it can be an aluminum-extruding typed heat dissipating fin. The bottom of the first heat dissipater 33a is provided with a first accommodating groove 330a for accommodating the condenser section 322a. By this manner, the contacting areas of the condenser section 322a with the first heat dissipater 33a can be increased. Similarly, a second accommodating groove 330b is provided on the bottom of the second heat dissipater 33b.

[0015] Moreover, a first lower plate 34a and a second lower plate 34b are disposed on two sides of the first heat-conducting plate 31 separately. A first embedding groove 340a and a second embedding groove 340b are defined on the first and the second lower plate 34a, 34b respectively for disposing the two condenser sections 322a, 322a'. That is, the two condenser sections 322a, 322a' are arranged between the first lower plate 34a and the first heat dissipater 33a. The first and the second lower plate 34a, 34b can preferably be heat conductors for transferring the heat of the condenser sections 322a,

322a' to the first and the second heat dissipater 33a, 33b.

[0016] The two condenser sections 322a, 322a' are arranged on the first and the second lower plate 34a, 34b separately. However, the another heat pipe 32b having one evaporator section 321b and two condenser sections 322b, 322b' is also in a U shape. The evaporator section 321b is disposed on the first heat-conducting plate 31, and the two condenser sections 322b, 322b' are disposed on the first and the second embedding groove 340a, 340b respectively. Therefore, the first heat pipe 32a, 32b of the first heat dissipating module 30 transfer the heat to the first and the second dissipater 33a, 33b. However, a skilled person in the art would know that the shape of the first heat pipe 32a, 32b is not constrained. The quantity of the first heat pipe and the dissipaters can be changed in accordance with demands, in which the quantity can be one. In addition, the first upper groove 310a, the first lower groove 310b, the first and second accommodating groove 330a, 330b, and the first and second embedding groove 340a, 340b can be coated with heat conducting materials such as heat conducting grease.

[0017] Please refer to FIG. 5, the second heat dissipating module 40 includes a second heat-conducting plate 41, a second heat pipe 42a and two another second heat pipes 42b, 42c. The second heat-conducting plate 41 is disposed on a top surface of the block 60 for connecting a rear end of the LED lighting module 50. The second heat-conducting plate 41 is composed of a second upper heat-conducting plate 41a and a second lower heat-conducting plate 41b. The second upper heat-conducting plate 41a and the second lower heat-conducting plate 41b define a second upper groove 410a and a second lower groove 410b respectively.

[0018] The second heat pipe 42a has one evaporator section 421a and one condenser section 422a, wherein the evaporator section 421a is disposed between the second upper groove 410 and the second lower groove 410b, and the condenser section 422a is connected with the interior surface 101 (see FIG. 2) of the top cover 10. The second heat dissipating module 40 further comprises an upper plate 43 with good thermal conductivity, which is fixed on the interior surface 101. A first to third accommodating groove 430a-430c are defined on the upper plate 43 for disposing condenser sections 422a-422c of the three second heat pipes 42a-42c. By increasing the contacting areas of the condenser sections 422a-422c with the upper plate 43, the heat of the second heat-conducting plate 41 can be conducted to the upper plate 43 and the top cover 10 more uniformly and rapidly. Two evaporator sections 421b, 421c of the two another second heat pipes 42b, 42c are parallel to the evaporator section 421a of the second heat pipe 42a, where in an interval between the two adjacent condenser sections 422a-422c is larger than that of evaporator sections 421a-421c thereof. It transversely conducts the heat in the second heat-conducting plate 41 to the top cover 10. Furthermore, the length of the condenser section 422a

of the second heat pipe 42a is longer than the length of the condenser sections 422b, 422c of the two another second heat pipe 42b, 42c. Thus, the heat in the second heat-conducting plate 41 can also be conducted to the top cover 10 in a longitudinal direction. The upper plate 43 can be configured in a T shape for reducing weight and costs. However, a skilled person in the art would know that the quantity of the second heat pipe 42a~42c can be changed in accordance with demands, in which the quantity can be one. Besides, the second upper groove 410a, the second lower groove 410b and the first to third accommodating groove 430a~430c can be coated with heat conducting materials such as heat conducting grease.

[0019] With reference to FIG. 6, one side of the block 60 is provided with a trough 61 for accommodating the LED lighting module 50 covered by a transparent cover 70. The heat generated from the LED lighting module 50 is conducted to the first heat-conducting plate 31 and the second heat-conducting plate 41 through the block 60. Then the heat is transferred to the first and second dissipater 33a, 33b by the first and second heat pipe 32a, 32b. At last, the heat will be dispersed to the outside through the heat dissipating holes 220. On the other hand, the three second heat pipes 42a~42c transfer the heat to the top cover 10, and the heat will be dispersed by the top cover 10.

[0020] Please refer to FIGs. 7, which shows a second embodiment of the second heat dissipating module 40, the second heat-conducting plate 41 only includes the second upper heat-conducting plate 41a whose bottom is provided with the second upper groove 410a for accommodating condenser sections of the three second heat pipes 42a~42c. Moreover, there are three discrete upper plate 43a~43c for accommodating condenser sections of the three second heat pipes 42a~42c respectively. In a third embodiment as shown in FIG. 8, the upper plate 43d is configured in a rectangular shape for disposing the condenser sections of three second heat pipe 42a~42c in equal length.

[0021] With refer to FIG. 9, which shows a second embodiment of the first heat dissipating module 30. The first heat-conducting plate 31 only includes the first upper heat-conducting plate 31a whose bottom is provided with the first upper groove 310a for accommodating the evaporator sections of the two first heat pipe 32a, 32b. Besides, there are no accommodating grooves defined on the bottoms of the first and second heat dissipater 33a, 33b. Each condenser section of the heat pipes 32a, 32b is formed with a flat surface connected with the first and second heat dissipaters 33a, 33b.

Claims

1. A light-emitting diode (LED) lighting device, comprising:

an LED lighting module (50);
a top cover (10);
a lamp base (20) covered with the top cover (10) to form an accommodating space (100), the LED lighting module (50) installed on outer of the lamp base (20);
a first heat dissipating module (30) in the accommodating space (100), comprising:

a first heat-conducting plate (31) connecting with the LED lighting module (50);
a first heat pipe (32a), whose evaporator section (321a) is secured in the first heat-conducting plate (31); and
a first heat dissipater (33a), connecting a condenser section (322a) of the first heat pipe (32a); and

a second heat dissipating module (40) in the accommodating space (100), comprising:

a second heat-conducting plate (41) attached to the LED light-emitting module (50); and
a second heat pipe (42a), whose evaporator section (421a) is secured in the second heat-conducting plate (41), and
a condenser section (422a) of the second heat pipe (42a) connecting to an inner surface (101) of the top cover (10).

2. The LED lighting device of claim 1, wherein the first heat dissipating module (30) further comprises a first lower plate (34a) having a first embedding groove (340a), and the first heat pipe (32a) is sandwiched between the first lower plate (34a) and the first dissipater (33a).
3. The LED lighting device of claim 2, wherein the first heat pipe (32a) having one evaporator section (321a) and two condenser sections (322a, 322a') is formed in a U shape, the first heat dissipating module (30) further comprises a second lower plate (34b), and the two condenser sections (322a, 322a') are secured on the first and the second lower plate (34a, 34b) separately.
4. The LED lighting device of claim 3, wherein the first heat dissipating module (30) further comprises a second heat dissipater (33b) connecting the other condenser section (322a') of the first heat pipe (32a).
5. The LED lighting device of claim 3, wherein the first and the second lower plate (34a, 34b) are thermo-conductors.
6. The LED lighting device of claim 3, wherein the first heat dissipating module (30) further comprises an

another first heat pipe (32b), the another first heat pipe (32b) having one evaporator section (321b) and two condenser sections (322b, 322b') is formed in a U shape, and the two condenser sections (322b, 322b') are secured on the first and the second lower plates (34a, 34b) separately.

7. The LED lighting device of claim 3, wherein one side of the first heat-conducting plate (31) has a first upper groove (310a) for accommodating the first heat pipe (32a). 5
8. The LED lighting device of claim 7, wherein the first heat-conducting plate (31) is composed of a first upper heat-conducting plate (31a) and a first lower heat-conducting plate (31b), the first upper groove (310a) is arranged on the first upper heat-conducting plate (31a), a first lower groove (310b) is correspondingly arranged on the first lower heat-conducting plate (31b), and the first heat pipe (32a) is sandwiched between the first upper and the first lower groove (310a,310b). 10 15 20
9. The LED lighting device of claim 7, wherein the second heat dissipating module (40) further comprises an upper plate (43) connected to the inner surface (101) of the top cover (10), and provided with a first accommodating groove (430a) for disposing the second heat pipe (42a). 25 30
10. The LED lighting device of claim 9, wherein the second heat dissipating module (40) further comprises two another second heat pipes (42b, 42c), whose evaporator sections (421b, 421 c) are parallel to the evaporator section (421a) of the second heat pipe (42a) and secured in the second heat-conducting plate (41). 35
11. The LED lighting device of claim 10, wherein an interval between the two adjacent condenser sections (422a~422c) of the three second heat pipes (42a~42c) is larger than that of evaporator sections (421a~422c) thereof. 40
12. The LED lighting device of claim 11, wherein the length of the condenser section (421a) of the second heat pipe (42a) is larger than that of the condenser sections (421b,421c) of the two another second heat pipe (42b,42c). 45 50
13. The LED lighting device of claim 12, wherein the upper plate (43) is formed in a T shape.
14. The LED lighting device of claim 12, wherein the second heat dissipating module (40) includes three separately upper plates (43a~43c) for disposing the condenser sections (422a~422c) of the three second heat pipes (42a~42c). 55
15. The LED lighting device of claim 9, wherein the upper plate (43a) is a thermo-conductor.

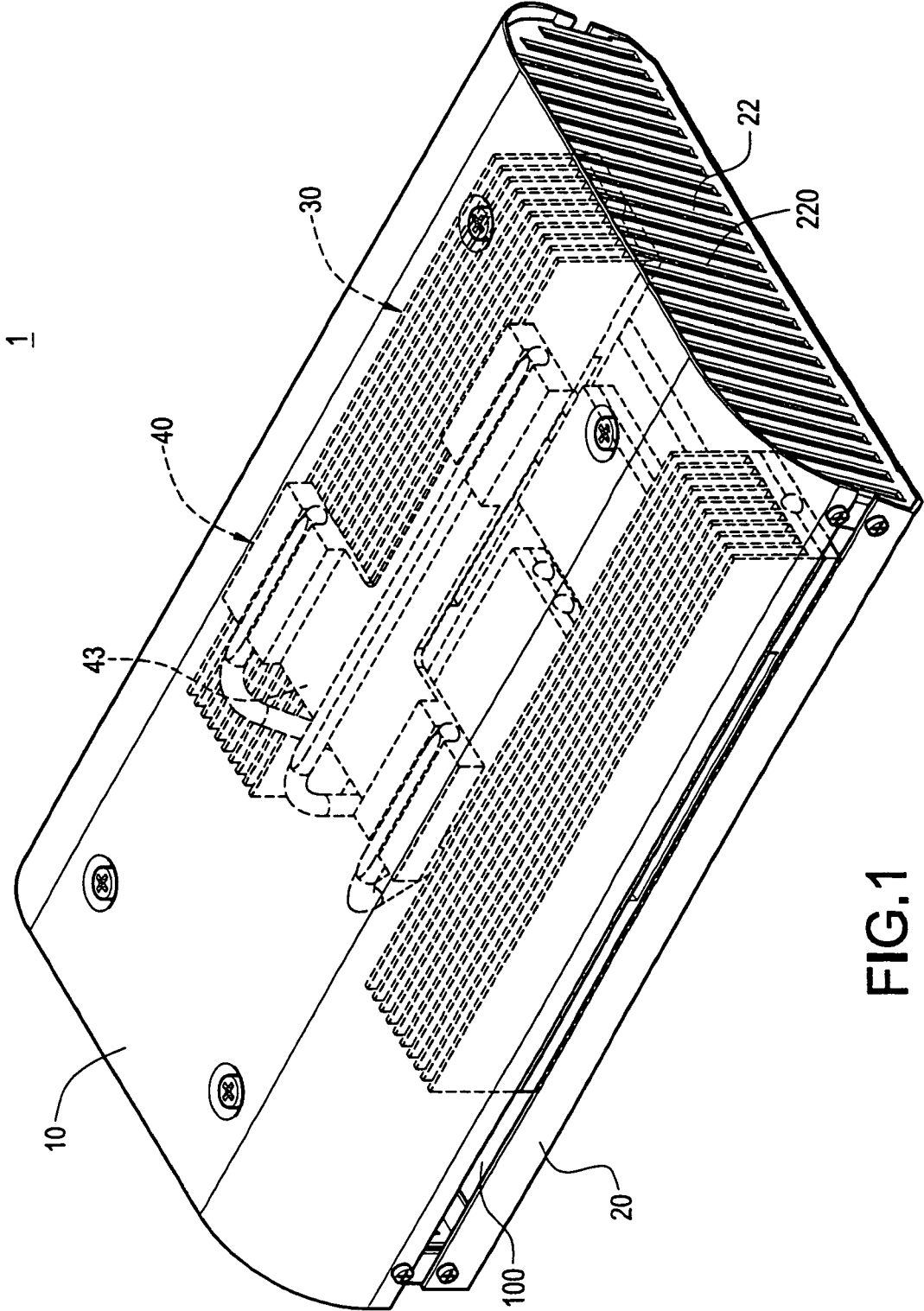


FIG.1

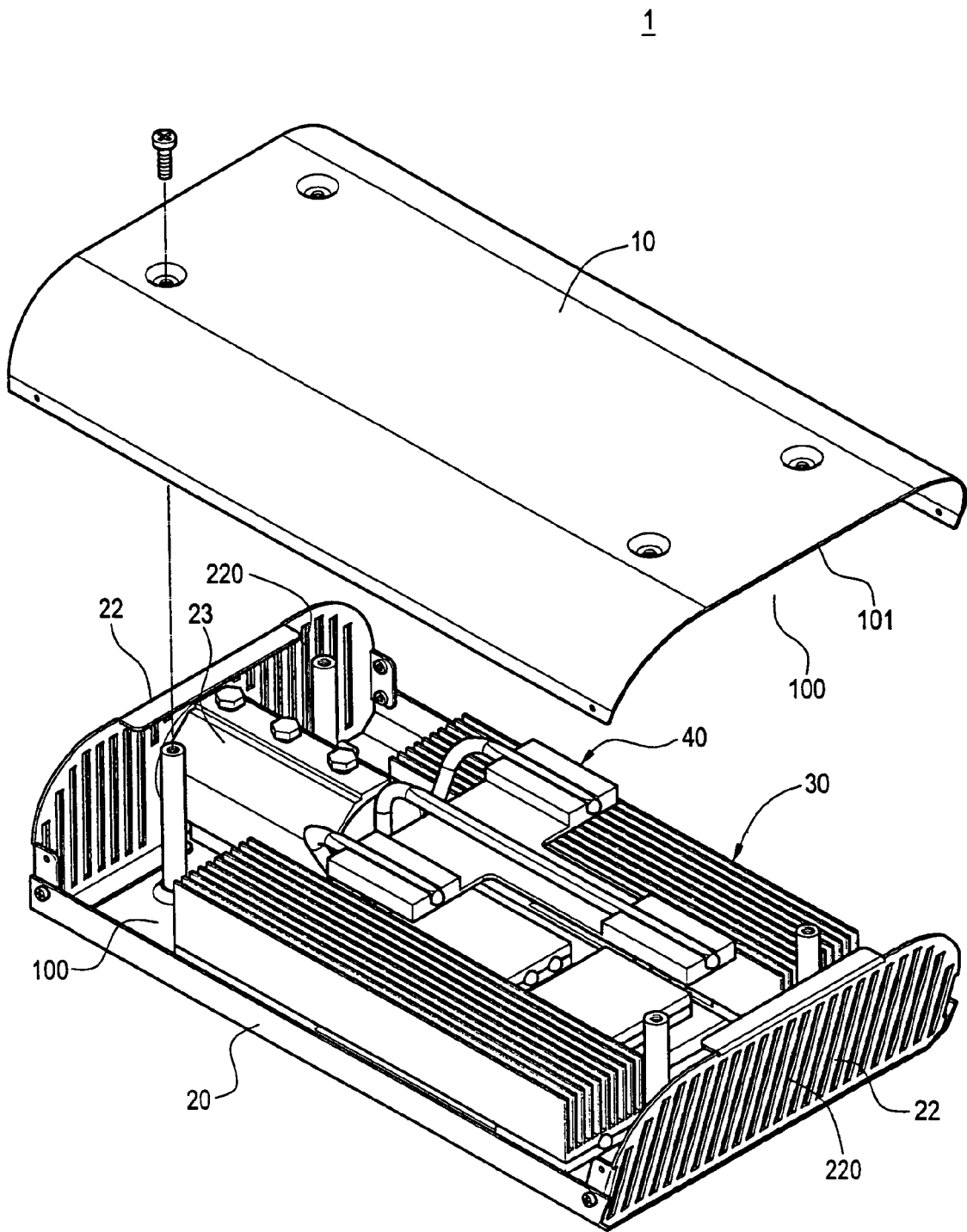


FIG.2

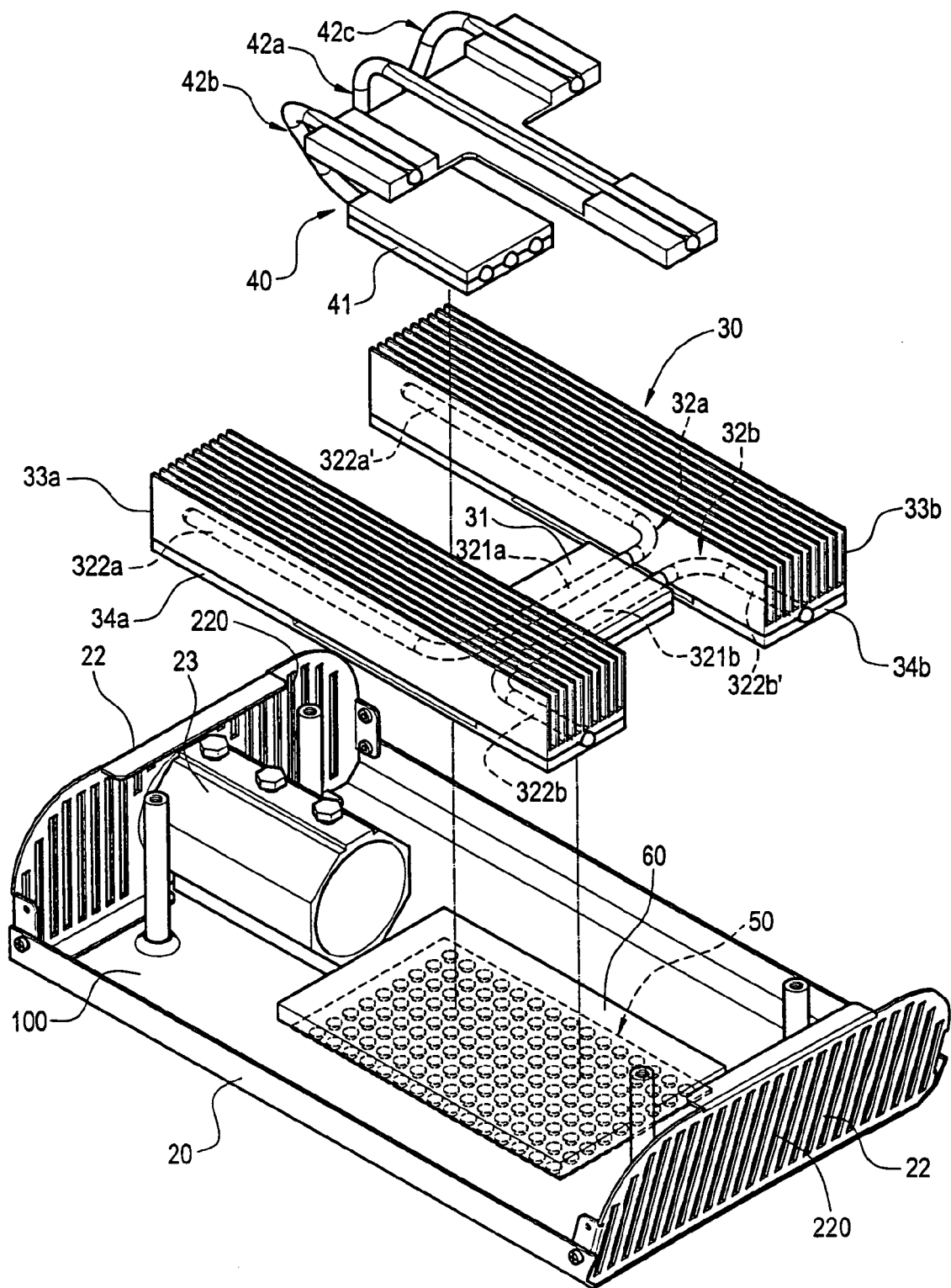


FIG.3

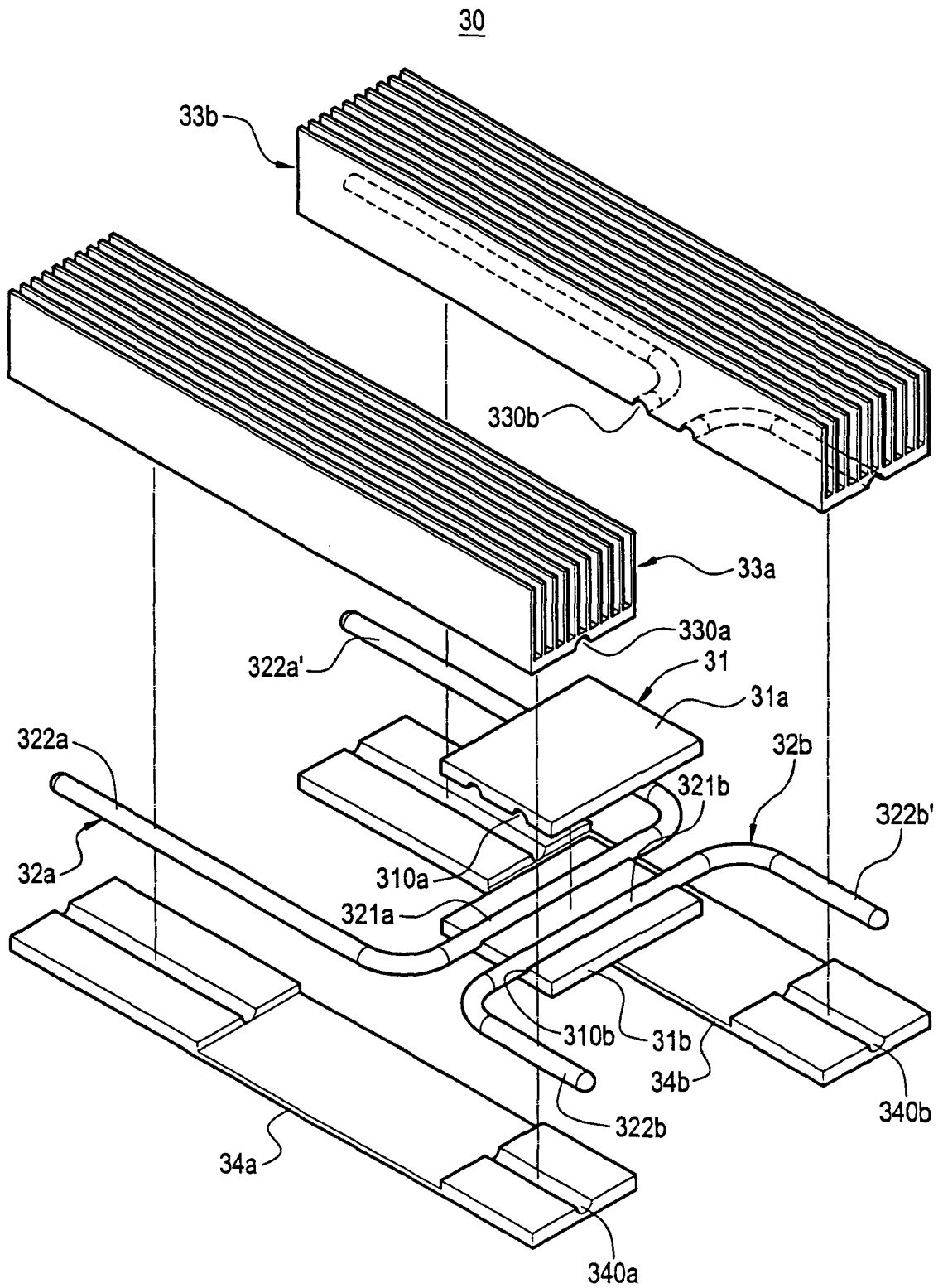


FIG.4

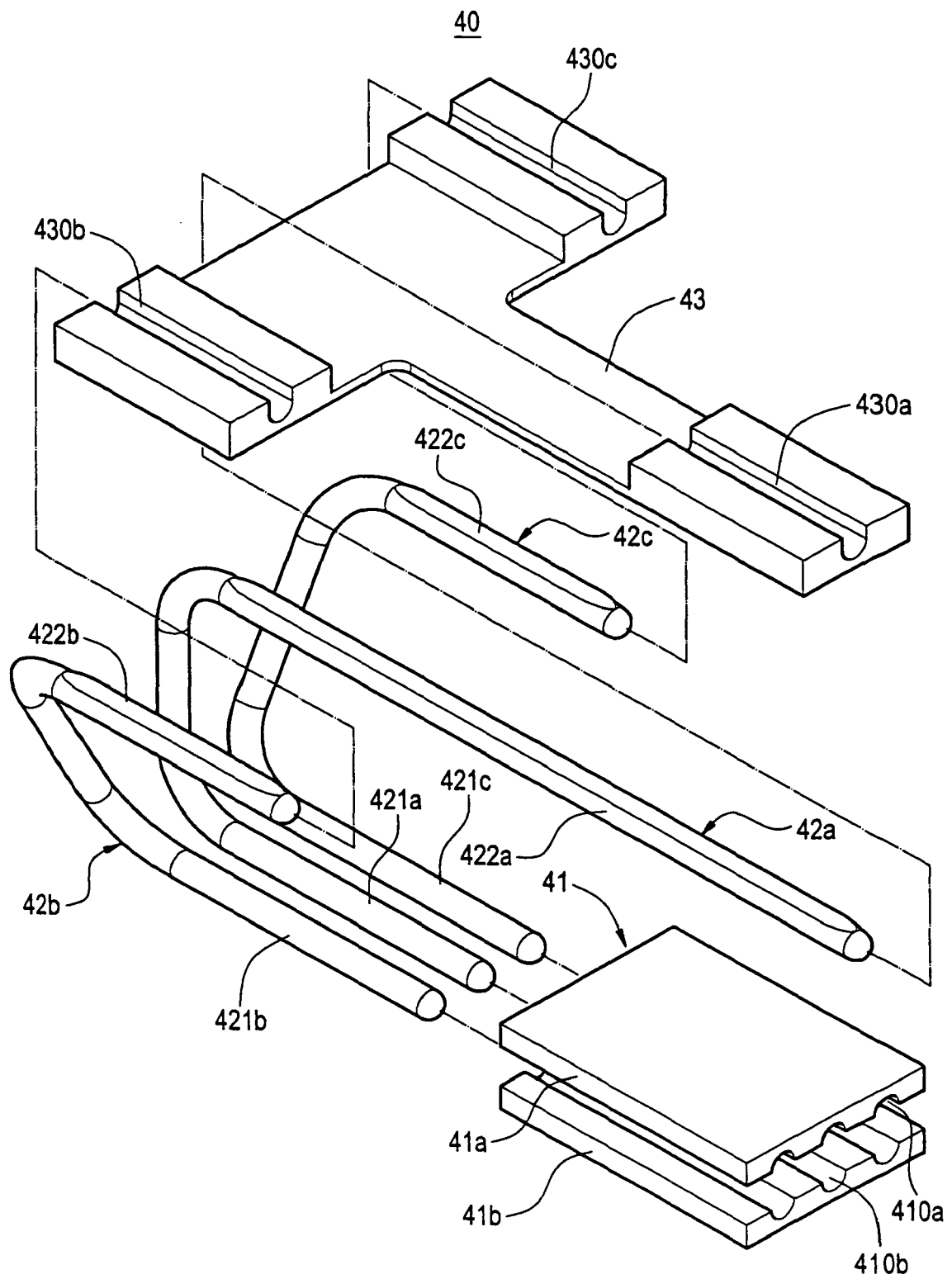


FIG.5

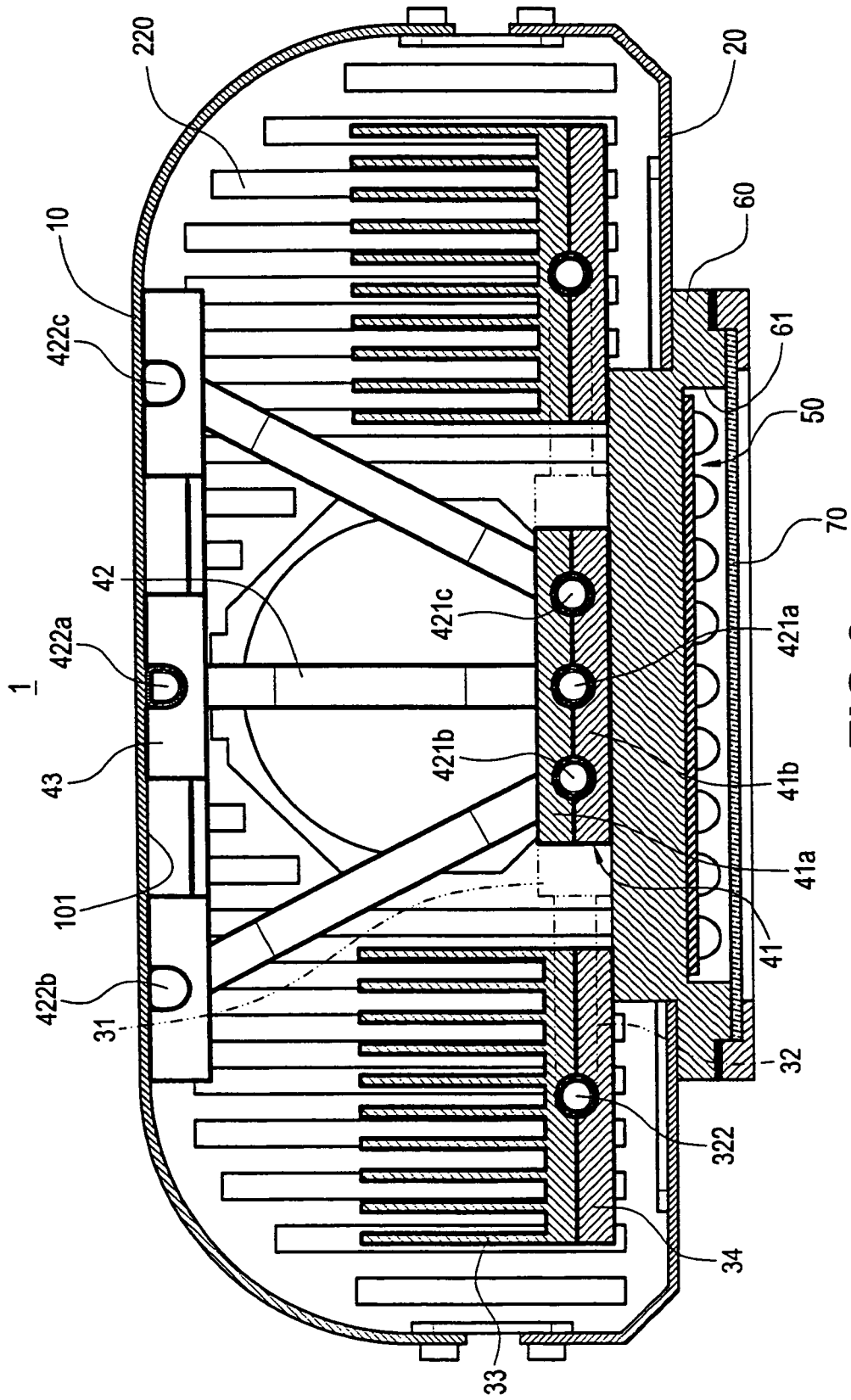


FIG. 6

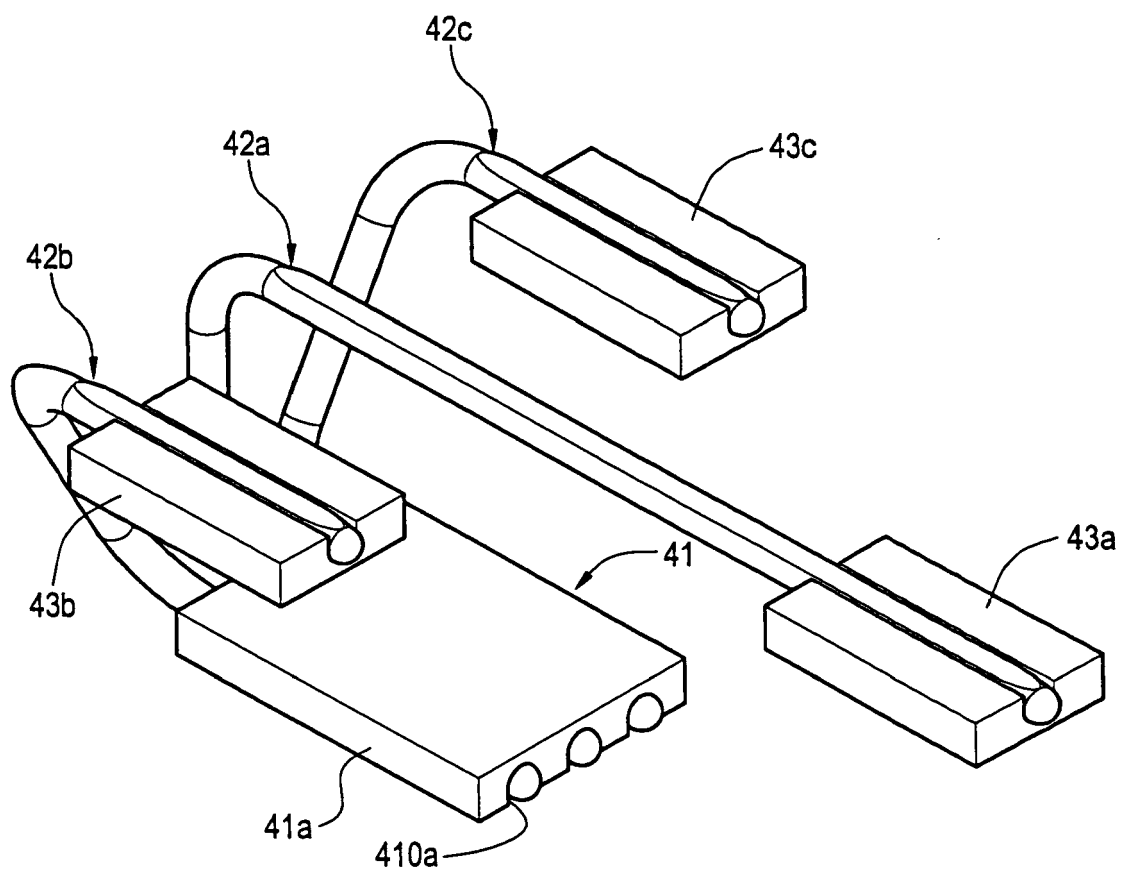


FIG.7

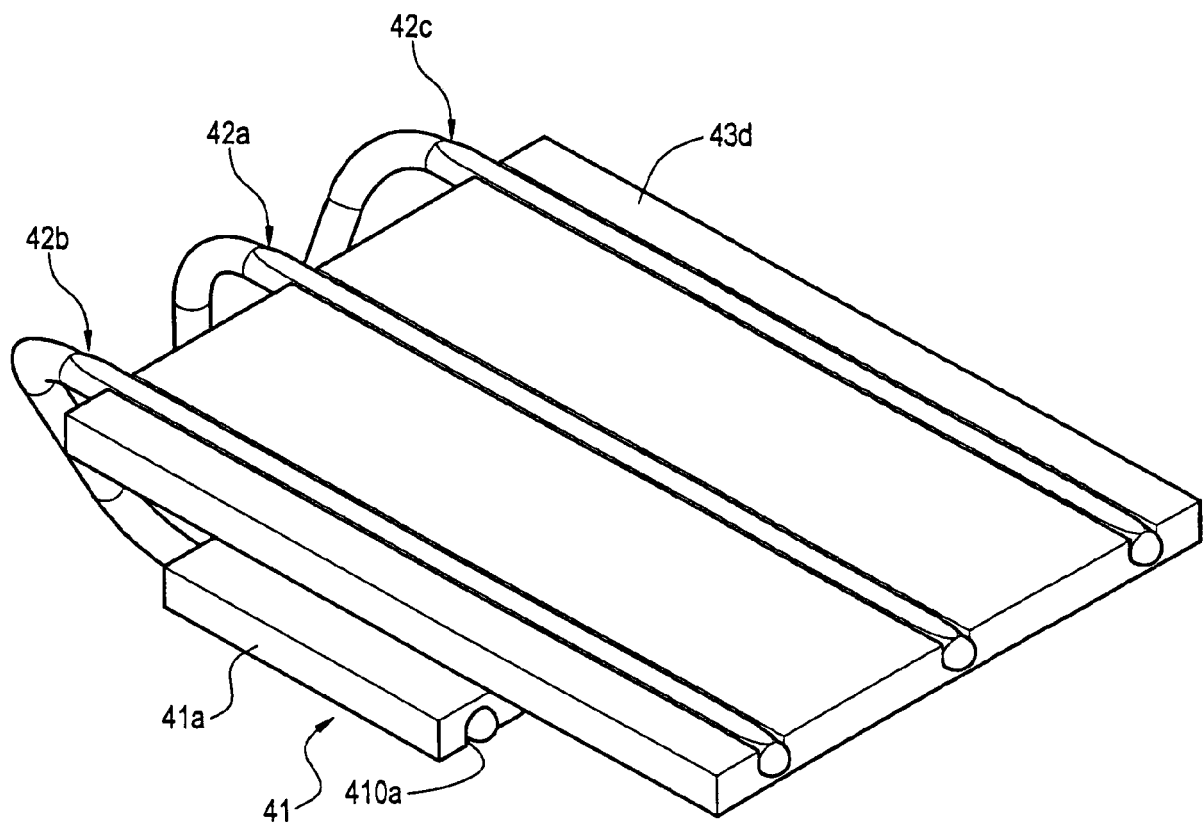


FIG.8

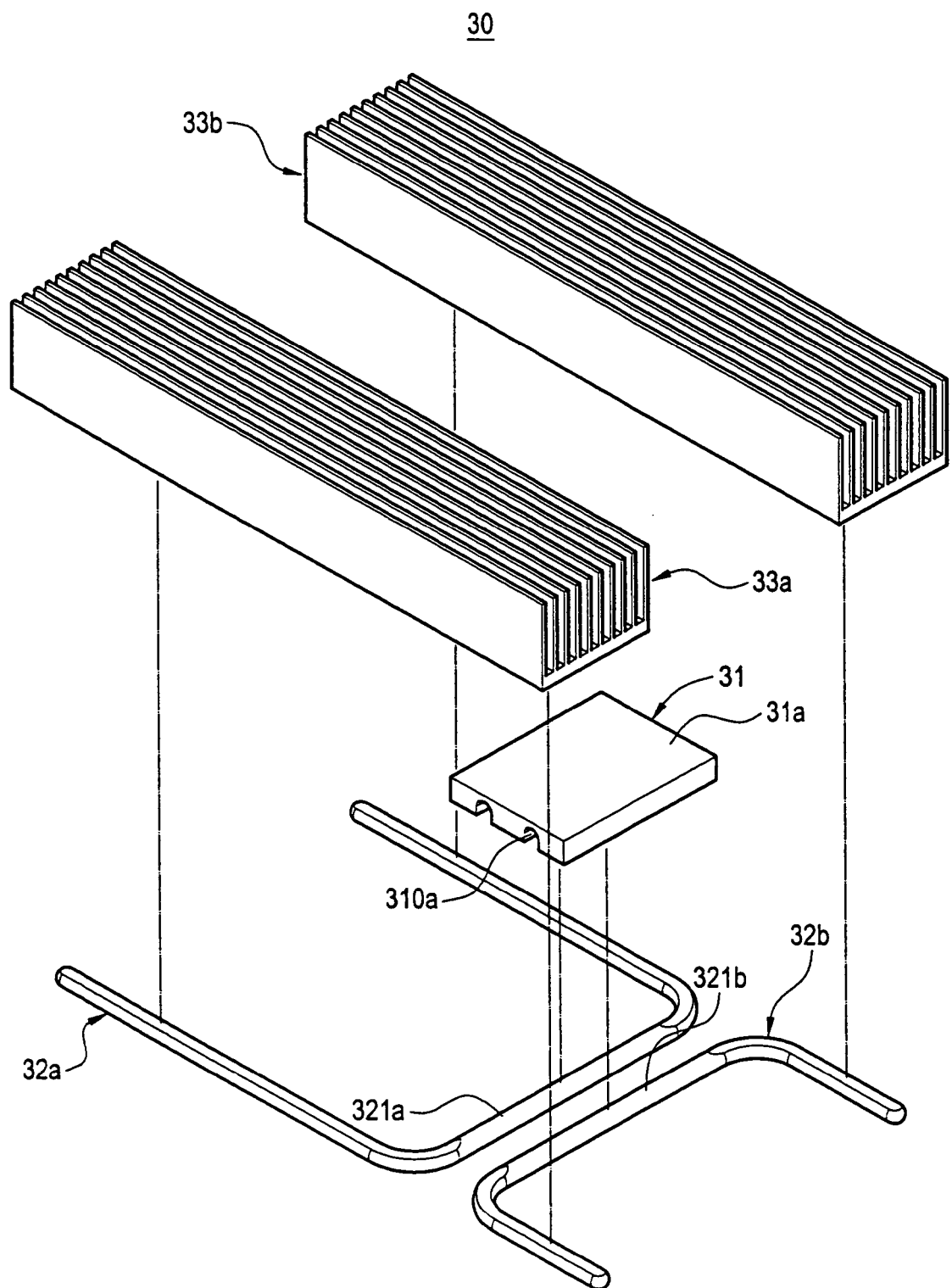


FIG.9



EUROPEAN SEARCH REPORT

Application Number
EP 09 00 5729

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
Y	US 7 488 093 B1 (HUANG CHUNG-YUAN [US]; KUO JER-HAUR [TW]; ZHA XIN-XIANG [CN]; YU YE-FE) 10 February 2009 (2009-02-10) * column 2, line 8 - column 4, line 8 * * figures 1-5 *	1-15	INV. F21S8/08 F21V29/00 ADD. F21Y101/02
Y	US 7 338 186 B1 (WU CHUNG [TW]; HUANG MENG-CHENG [TW]; HSU ZU-CHAO [TW]) 4 March 2008 (2008-03-04) * column 2, line 11 - column 3, line 30 * * figures 1-4 *	1-15	
			TECHNICAL FIELDS SEARCHED (IPC)
			F21S F21V
The present search report has been drawn up for all claims			
Place of search The Hague		Date of completion of the search 2 October 2009	Examiner Blokland, Russell
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EPO FORM 1503 03.82 (P04C01)

**ANNEX TO THE EUROPEAN SEARCH REPORT
ON EUROPEAN PATENT APPLICATION NO.**

EP 09 00 5729

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report.
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02-10-2009

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