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(54) **HEAT-DISSIPATING MODULE**

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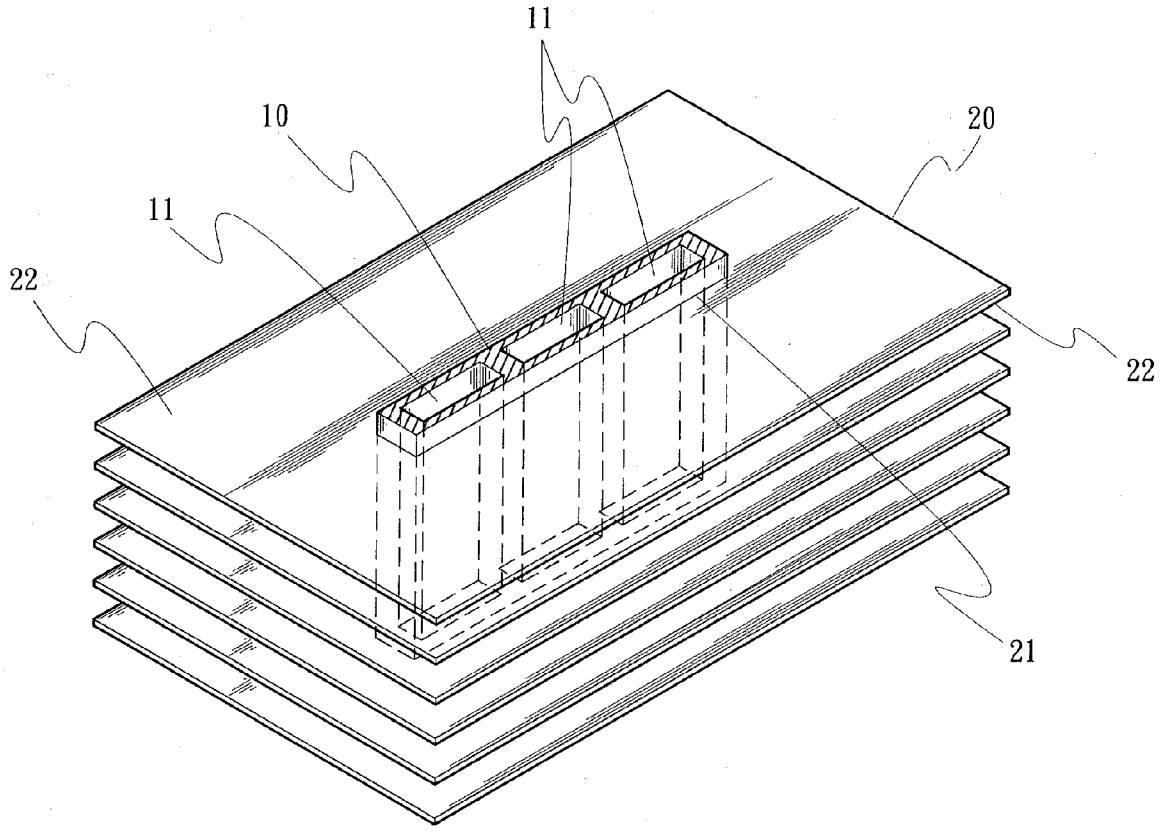
(57) **ABSTRACT**

A heat-dissipating module including a board-type heat-pipe and a heat-conductive construction connected therewith. The heat-conductive construction has a connecting end in contact with the board-type heat-pipe. Via the connecting end, the heat-conductive construction is connected to a predetermined section of the board-type heat-pipe. The other section of the heat-conductive construction forms an open end. The board-type heat-pipe is composed of multiple independent heat-pipe units not communicating with each other. The heat generated by a heat-generating element can be quickly and uniformly transferred through the heat-pipe units to the heat-conductive construction for dissipating the heat at high efficiency.



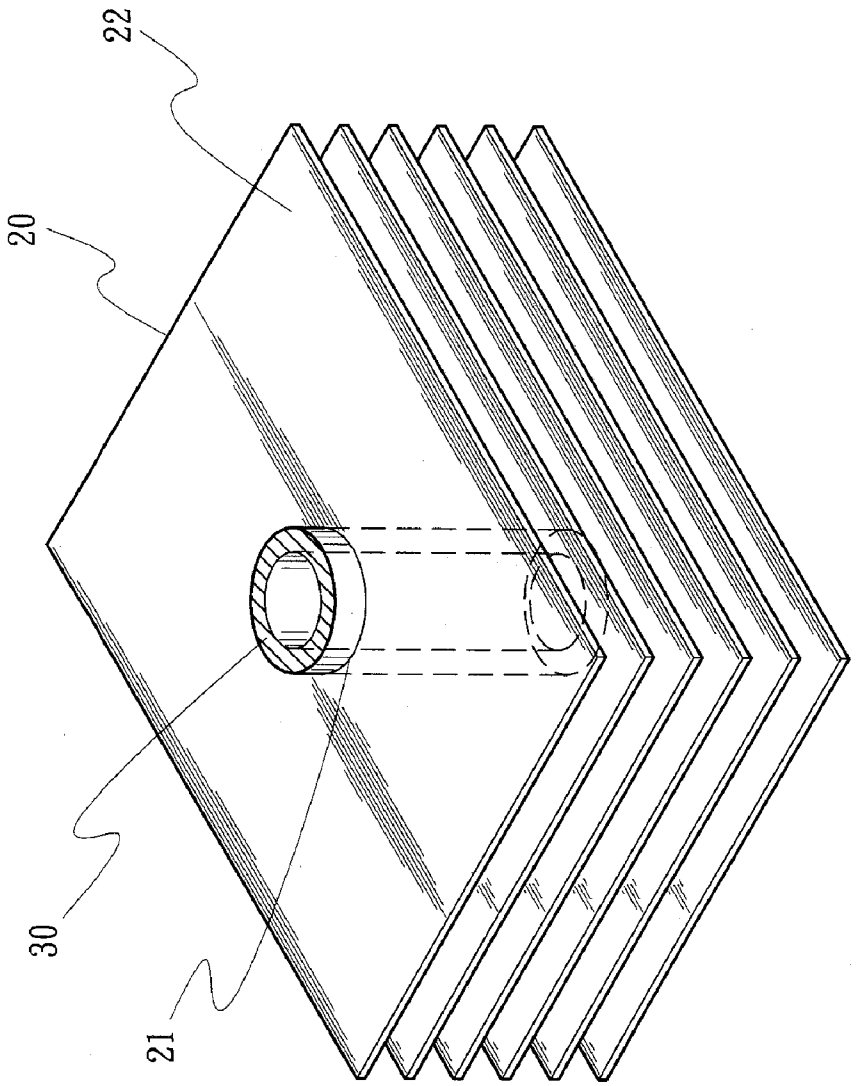


Fig. 1

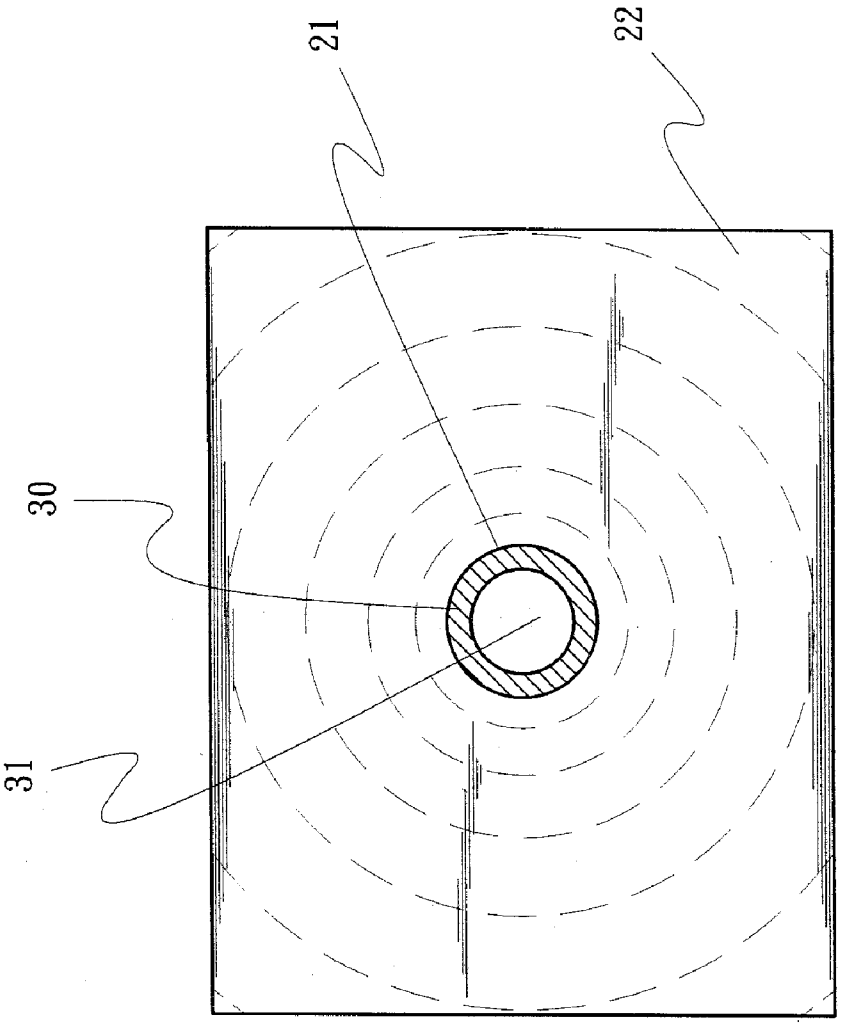


Fig. 2

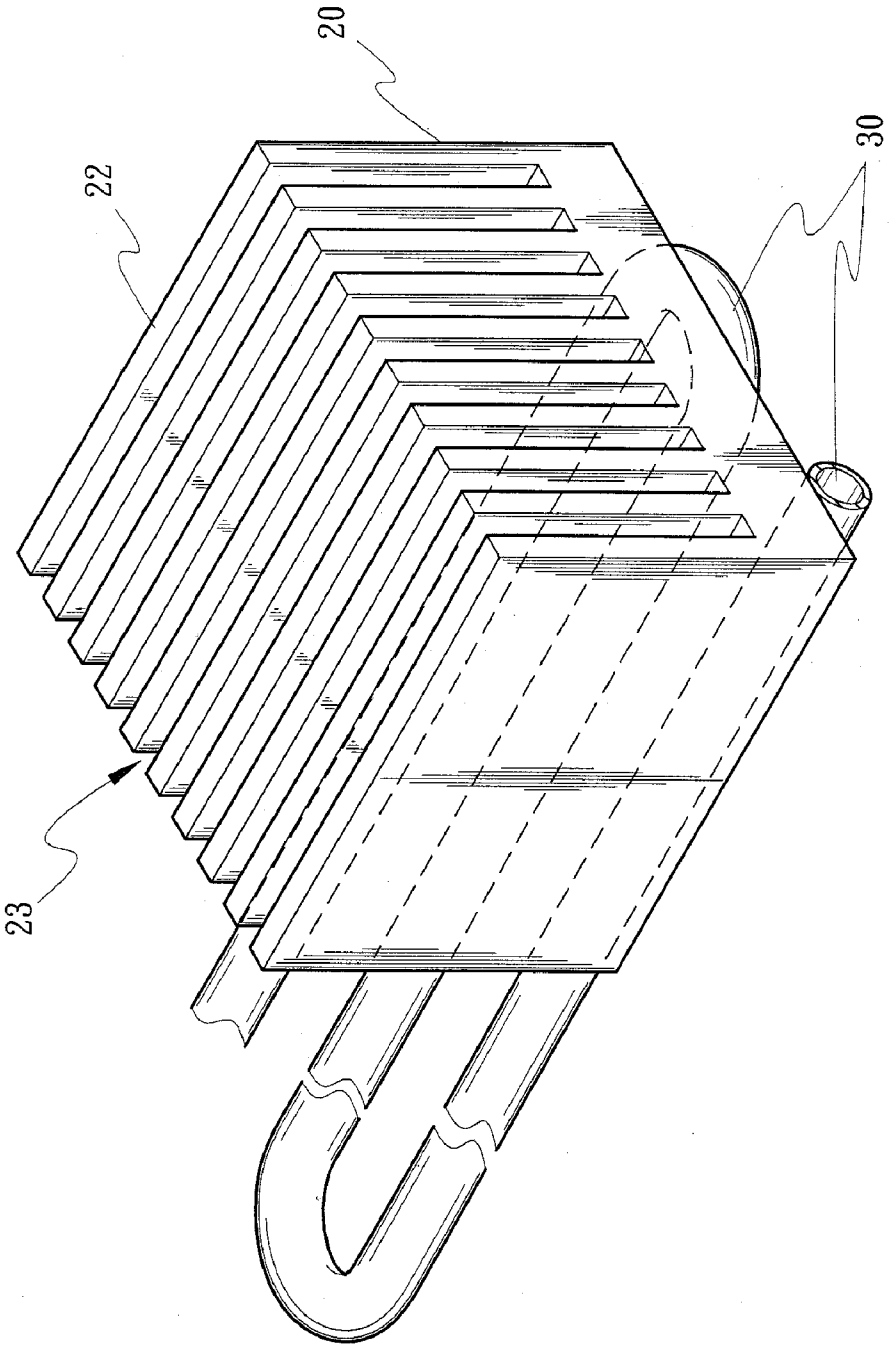


Fig. 3

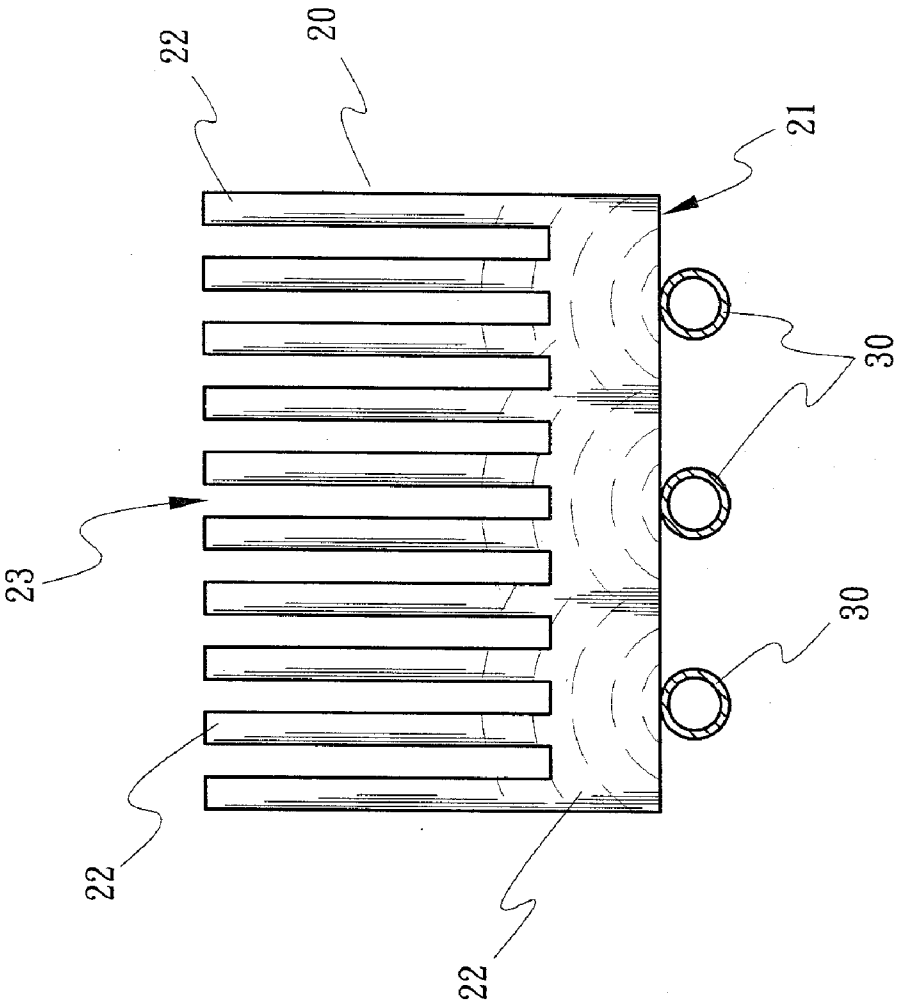


Fig. 4

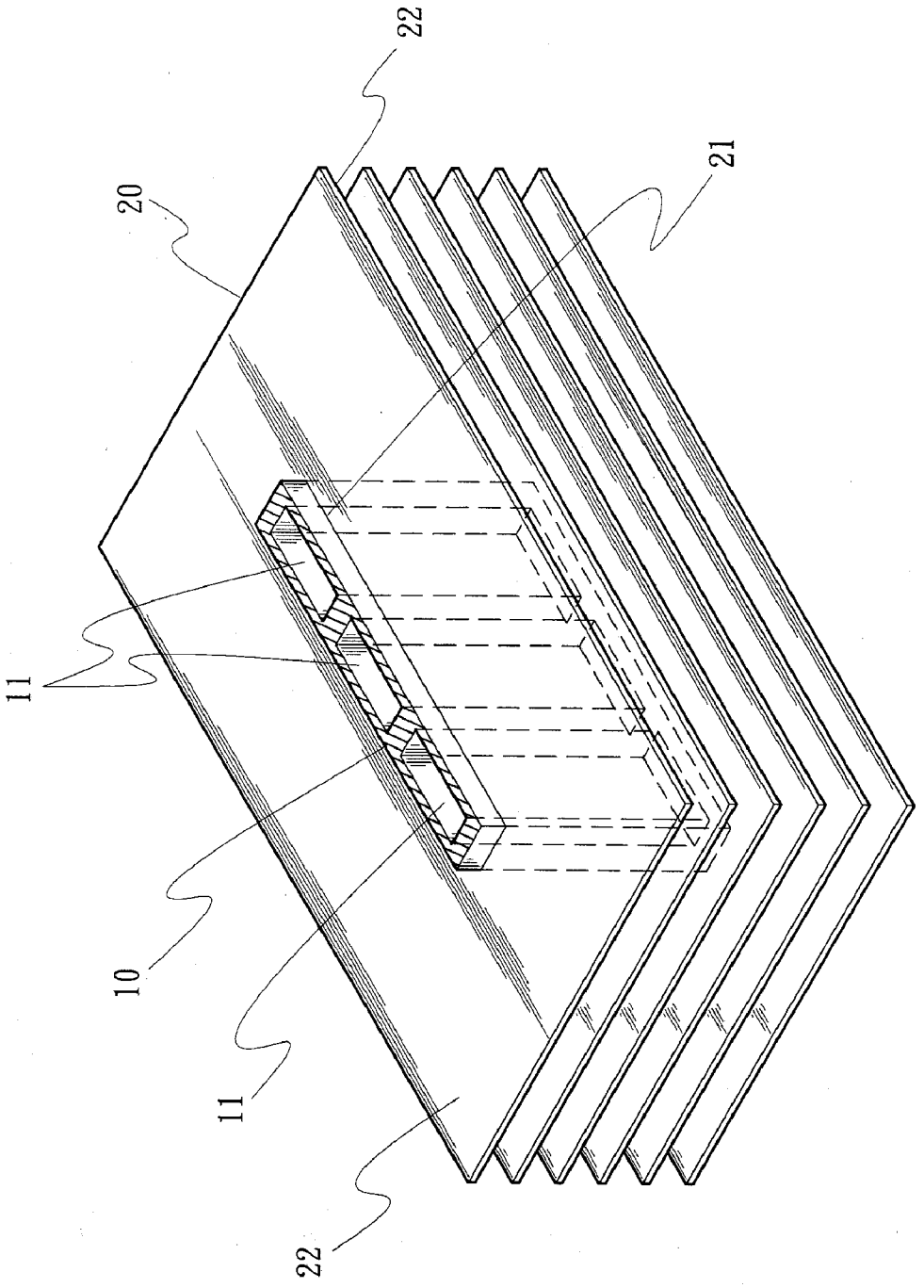


Fig. 5

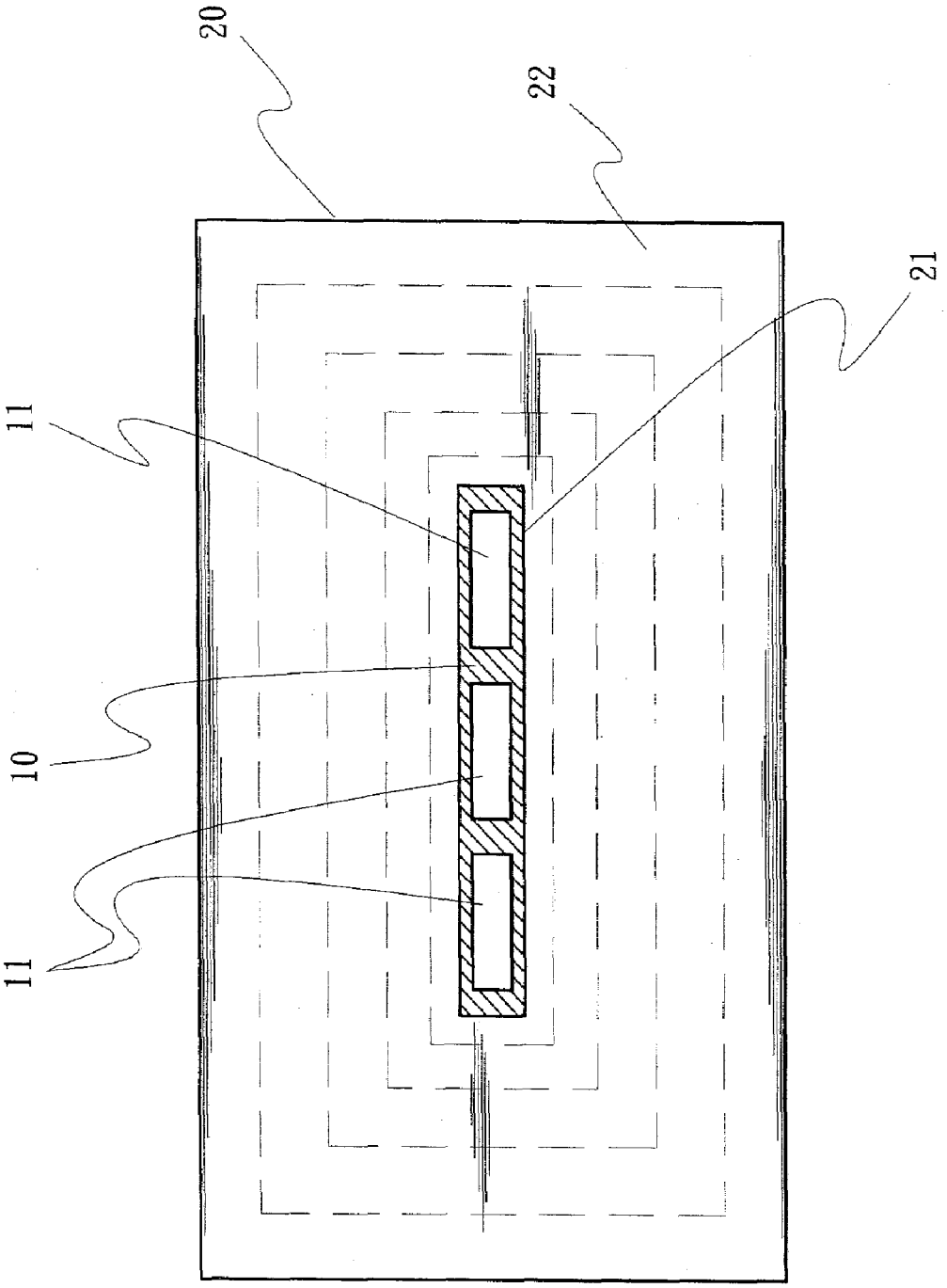


Fig. 6

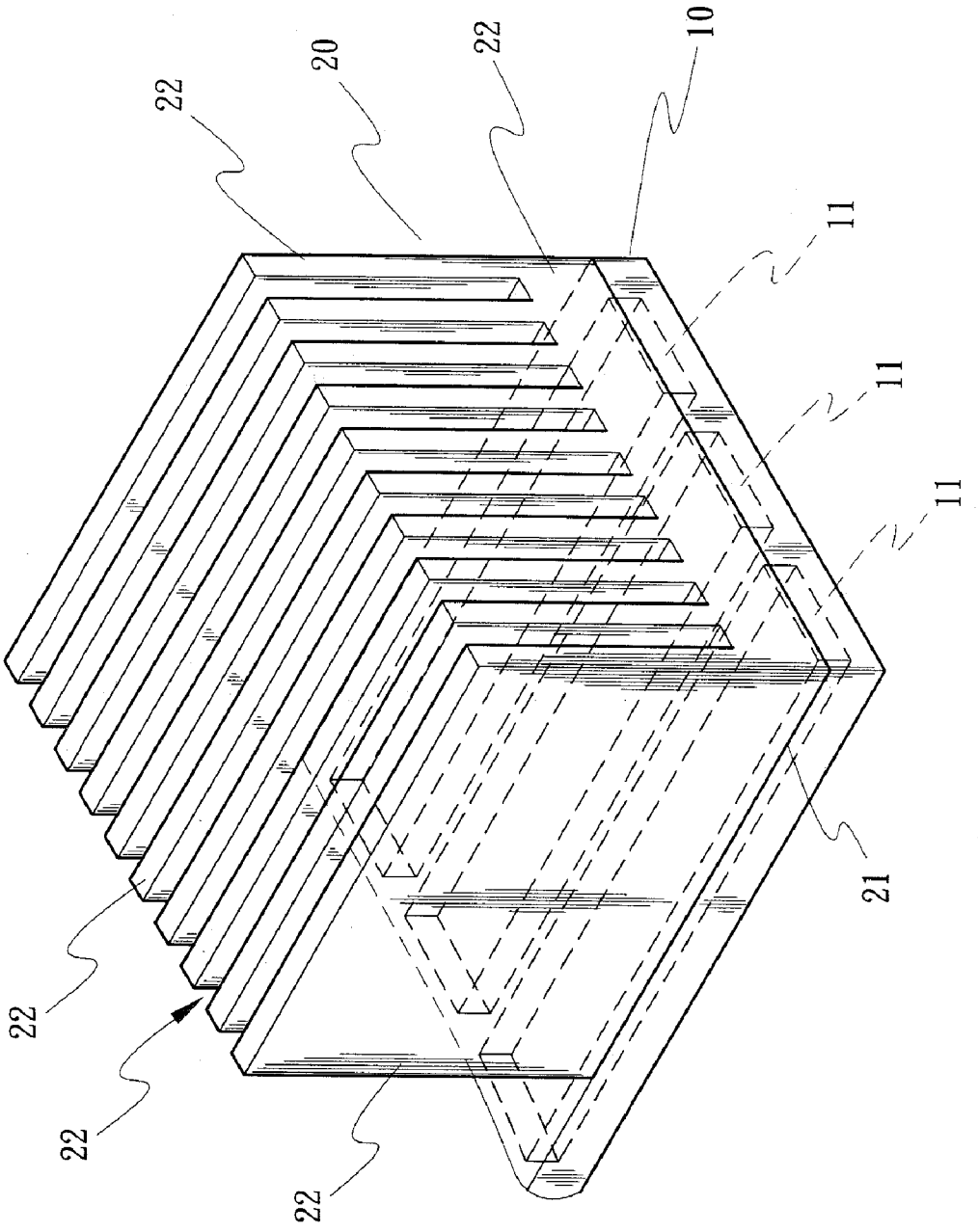


Fig. 7

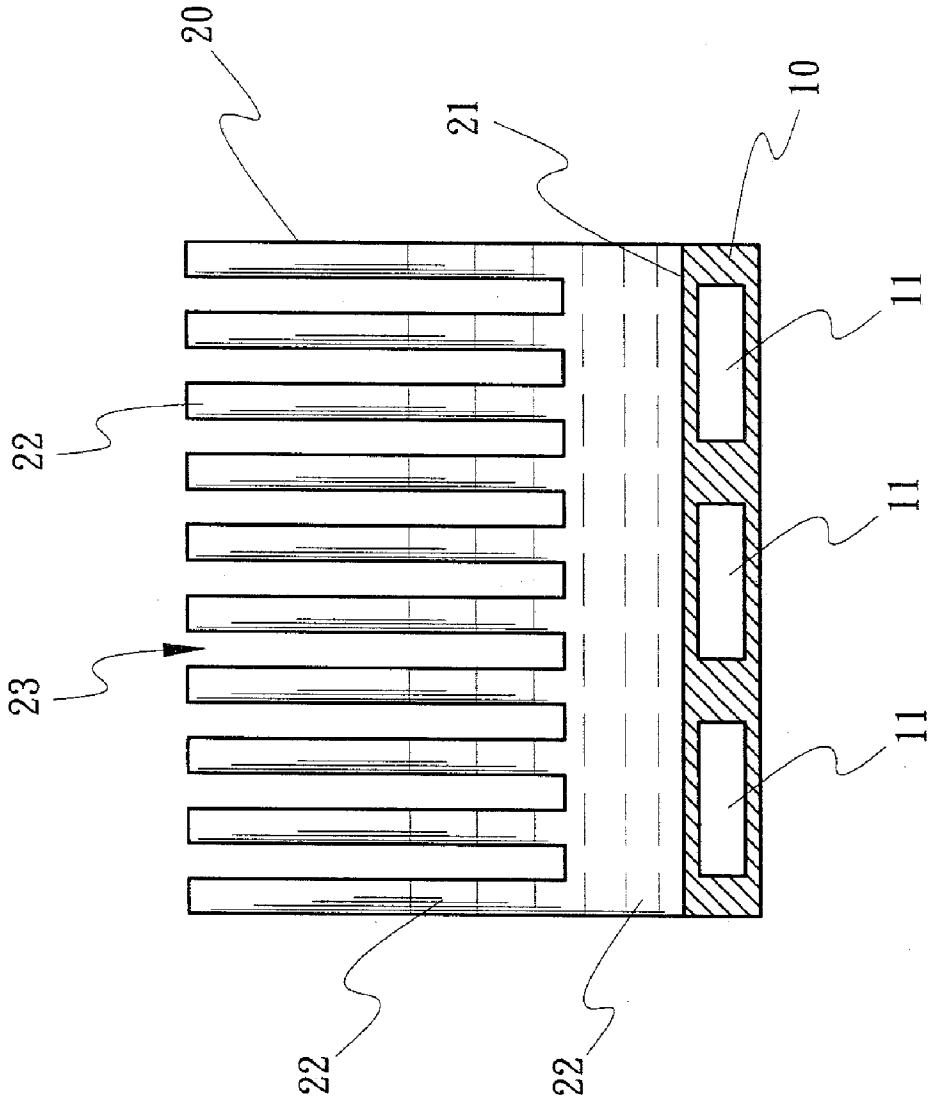


Fig. 8

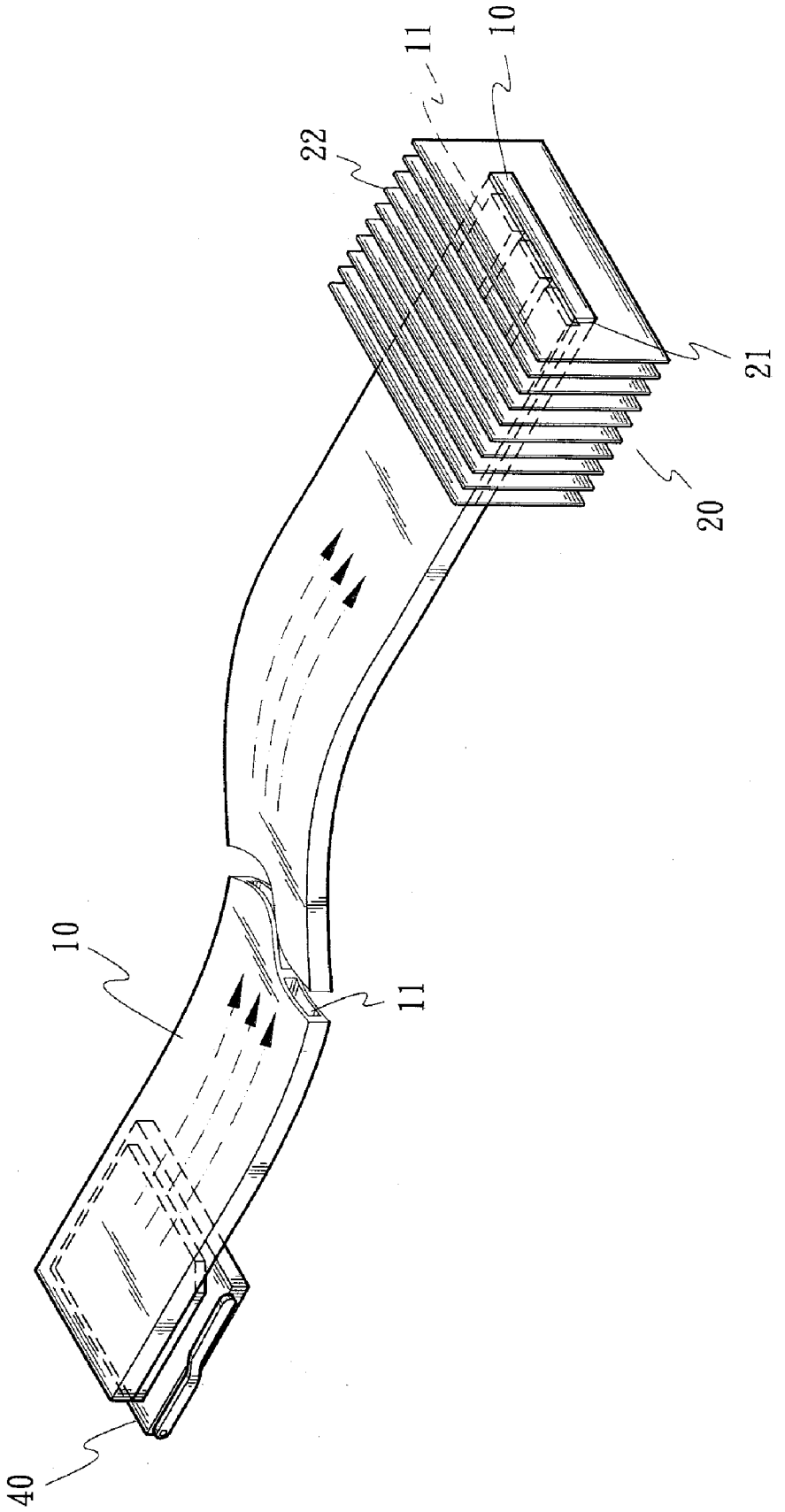


Fig. 9

HEAT-DISSIPATING MODULE

BACKGROUND OF THE INVENTION

[0001] The present invention is related to a heat-dissipating module, and more particularly to a heat-dissipating module including a board-type heat-pipe and a heat-conductive construction connected therewith. The board-type heat-pipe is composed of multiple independent heat-pipe units not communicating with each other for dissipating the heat at high efficiency.

[0002] There are various electric or electronic products which will generate heat when operating, such as refrigerators, air-conditioners, large-size electronic signs, high-speed electronic elements, etc. In general, a heat-radiating module is arranged for dissipating the heat so as to stabilize the operation of the device. An auxiliary unit with good heat-conductivity is often disposed on the heat-generating element, such as copper plates, aluminum boards, heat-pipes, etc. The heat-radiating module is attached to the surface of the heat-generating element. By means of convection, the heat is transferred to the heat-radiating module and dissipated from the other end of the heat-radiating module distal from the heat-generating element.

[0003] In the case that the heat-radiating module is a heat-pipe structure, the heat-pipe is positioned at front end of the heat-radiating module. The heat is transferred from the heat-generating element to the heat-conductive material disposed in the heat-pipe. After absorbed by the heat-conductive material, the heat is transferred to a heat-dissipating end of the heat-radiating module. FIG. **1** shows the heat-dissipating end of the heat-radiating module. A heat-conductive construction **20** is arranged at the heat-dissipating end. The heat-conductive construction **20** has a connecting end **21** connected to the surface of the heat-pipe **30**. The other sections of the heat-conductive construction **20** serve as a heat-dissipating end **22**. In such conventional structure, the heat-conductive construction **20** includes multiple heat-radiating plates continuously arranged along the surface of the heat-pipe **30** in parallel to each other. As shown in FIG. **2**, the heat-pipe has a circular cross-section. The heat is radially transferred from the connecting sections **21** of the heat-conductive construction **20** to the open end **22** of the heat-conductive construction **20**.

[0004] FIG. **3** shows another type of heat-radiating structure. The heat-conductive element **20** is a metal block structure with channels **23**. The metal block is disposed on a winding heat-pipe **30**. Referring to FIG. **4**, the heat-conductive element **20** has a connecting section **21** in contact with the heat-pipe **30**. Similarly, the heat is radially transferred to the open end **22** of the heat-conductive element **20**. The heat-pipe **30** simply linearly contacts the heat-conductive element **20**. In order to achieve better heat-dissipating effect, it is necessary to enlarge the area of the heat-conductive element **20**. However, under such circumstance, the heat-conductive element **20** can still hardly provide good heat-dissipating effect.

[0005] It can be seen from FIGS. **2** and **4** that the heat is not uniformly transferred and spread by the heat-conductive construction **20**. The heat is more likely radially transferred in accordance with the circular profile of the heat-pipe **30**. Accordingly, the sections distal from the connecting end **21**, for example, the four corners of the heat-conductive construction **20**, can hardly effectively dissipate the heat. This is because during the transfer, most of the heat is concentrated on those sections close to the heat-pipe **30**. The sections distal from the heat-pipe can only absorb and dissipate little heat.

SUMMARY OF THE INVENTION

[0006] It is therefore a primary object of the present invention to provide an improved heat-dissipating module which is able to more effectively dissipate the heat generated by a heat-generating unit at high efficiency so as to keep the unit working at efficiency.

[0007] According to the above objects, the heat-dissipating module of the present invention includes a board-type heat-pipe and a heat-conductive construction connected therewith. The board-type heat-pipe is partially disposed on a heat-generating element for dissipating the heat. The heat-conductive construction has a connecting end in contact with the board-type heat-pipe. Via the connecting end, the heat-conductive construction is connected to a predetermined section of the board-type heat-pipe. The other section of the heat-conductive construction forms an open end. The board-type heat-pipe is composed of multiple independent heat-pipe units not communicating with each other. The heat generated by a heat-generating element can be quickly and uniformly transferred through the heat-pipe units to the heat-conductive construction for dissipating the heat at high efficiency.

[0008] The present invention can be best understood through the following description and accompanying drawings wherein:

BRIEF DESCRIPTION OF THE DRAWINGS

[0009] FIG. **1** is a perspective view of a conventional heat-dissipating module;

[0010] FIG. **2** is a sectional view according to FIG. **1**;

[0011] FIG. **3** is a perspective view of another conventional heat-dissipating module;

[0012] FIG. **4** is a sectional view according to FIG. **3**;

[0013] FIG. **5** is a perspective view of the heat-dissipating module of the present invention;

[0014] FIG. **6** is a sectional view according to FIG. **5**;

[0015] FIG. **7** is a perspective view of another embodiment of the heat-dissipating module of the present invention;

[0016] FIG. **8** is a sectional view according to FIG. **7**; and

[0017] FIG. **9** is a perspective view showing the heat-dissipating path of the present invention.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

[0018] Please refer to FIG. **5**. The present invention includes a board-type heat-pipe **10** and a heat-conductive construction **20**. The board-type heat-pipe **10** is partially disposed on a heat-generating element **40** (as shown in FIG. **9**) for dissipating the heat generated by the heat-generating element **40**. The heat-conductive construction **20** has a connecting end **21** for contacting or connecting with the board-type heat-pipe **10**. Via the connecting end **21**, the heat-conductive construction **20** is connected to a predetermined section of the board-type heat-pipe **10**. The other section of the heat-conductive construction **20** forms an open end **22**. In this embodiment, the heat-conductive construction **20** includes multiple heat-conductive plates arranged around the board-type heat-pipe **10**. The board-type heat-pipe **10** is composed of multiple independent heat-pipe units **11** not communicating with each other. Accordingly, the board-type heat-pipe **10** can quickly

and uniformly transfer the heat for heat exchange so as to enhance the heat-dissipating efficiency of the heat-radiating module.

[0019] Referring to FIG. **6**, the multiple heat-pipe units **11** of the board-type heat-pipe **10** are arranged side by side without communicating with each other. In practice, phase-changeable material is contained in the different heat-pipe units **11**, for example, pure water, coolant, organic solvent or a composition thereof. This can greatly enhance the heat-dissipating efficiency to several times of the heat-dissipating efficiency of the conventional uni-heat pipe structure. In addition, in this embodiment, the heat is uniformly transferred and spread to the open end **22** of the heat-conductive construction **20** as shown in FIG. **6**. The heat-dissipating areas of all the open ends **22** of the heat-conductive construction **20** serve to dissipate the heat at high efficiency.

[0020] FIGS. **7** and **8** show another embodiment of the present invention, in which the board-type heat-pipe **10** is equipped with a heat-conductive construction **20** as a metal block. The metal block is formed with multiple channels **23**. The connecting end **21** of the heat-conductive construction **20** connects with the surface of the board-type heat-pipe **10** by large area. In contrast to the conventional structure, such structure has larger heat-transferring area. Besides, the connecting section **21** contacts the board-type heat-pipe **10** by large area so that the heat in the board-type heat-pipe **10** can be quickly and uniformly transferred to the open end **22** of the heat-conductive construction **20** to quickly dissipate the heat as shown in FIG. **8**.

[0021] Please refer to FIG. **9**. One end of the board-type heat-pipe **10** is partially attached to a heat-generating element **40** such as an operating CUP. The end of the board-type heat-pipe **10** is directly or indirectly (via a heat-dissipating plate or a thermoelectric couple) attached to the heat-generating element **40**. Under such circumstance, the heat can be quickly transferred through the heat-pipe units **11** to the heat-conductive construction **20** in a direction of the arrows. Even if the board-type heat-pipe **10** is damaged by external force, only one single or few heat-pipe units **11** will be affected. The other heat-pipe units **11** can still work to dissipate the heat and keep the device normally operating. Accordingly, a serviceman will have longer time to repair the board-type heat-pipe **10** so as to ensure that the operation of the device will not be affected.

[0022] In conclusion, the heat-dissipating module of the present invention is able to quickly dissipate the heat generated by a heat-generating element. The board-type heat-pipe **10** composed of multiple independent heat-pipe units **11** tightly contacts the heat-conductive construction **20** by large area to quickly transfer the heat so as to enhance the heat-dissipating efficiency. Moreover, the heat-dissipating module of the present invention is applicable to various fields such as minitype chip module and thinned electronic sign.

[0023] The above embodiments are only used to illustrate the present invention, not intended to limit the scope thereof. Many modifications of the above embodiments can be made without departing from the spirit of the present invention.

What is claimed is:

1. A heat-dissipating module comprising a board-type heat-pipe and a heat-conductive construction connected therewith, the heat-conductive construction having a connecting end in contact with the board-type heat-pipe, via the connecting end, the heat-conductive construction being disposed on a predetermined section of the board-type heat-pipe, the other section of the heat-conductive construction forming an open end, the board-type heat-pipe being composed of multiple independent heat-pipe units not communicating with each other.

2. The heat-dissipating module as claimed in claim **1**, wherein the multiple heat-pipe units are arranged side by side.

3. The heat-dissipating module as claimed in claim **1**, wherein phase-changeable material is contained in the heat-pipe units.

4. The heat-dissipating module as claimed in claim **2**, wherein phase-changeable material is contained in the heat-pipe units.

5. The heat-dissipating module as claimed in claim **3**, wherein the phase-changeable material is pure water, coolant, organic solvent or a composition thereof.

6. The heat-dissipating module as claimed in claim **4**, wherein the phase-changeable material is pure water, coolant, organic solvent or a composition thereof.

7. The heat-dissipating module as claimed in claim **1**, wherein the heat-conductive construction includes multiple heat-conductive plates arranged around the board-type heat-pipe.

8. The heat-dissipating module as claimed in claim **2**, wherein the heat-conductive construction includes multiple heat-conductive plates arranged around the board-type heat-pipe.

9. The heat-dissipating module as claimed in claim **3**, wherein the heat-conductive construction includes multiple heat-conductive plates arranged around the board-type heat-pipe.

10. The heat-dissipating module as claimed in claim **5**, wherein the heat-conductive construction includes multiple heat-conductive plates arranged around the board-type heat-pipe.

11. The heat-dissipating module as claimed in claim **1**, wherein the heat-conductive construction is a metal block formed with multiple channels.

12. The heat-dissipating module as claimed in claim **2**, wherein the heat-conductive construction is a metal block formed with multiple channels.

13. The heat-dissipating module as claimed in claim **3**, wherein the heat-conductive construction is a metal block formed with multiple channels.

14. The heat-dissipating module as claimed in claim **5**, wherein the heat-conductive construction is a metal block formed with multiple channels.

15. The heat-dissipating module as claimed in claim **7**, wherein the heat-conductive construction is a metal block formed with multiple channels.

16. The heat-dissipating module as claimed in claim **9**, wherein the heat-conductive construction is a metal block formed with multiple channels.

17. The heat-dissipating module as claimed in claim **10**, wherein the heat-conductive construction is a metal block formed with multiple channels.

18. The heat-dissipating module as claimed in claim **1**, wherein the surface of one end of the board-type heat-pipe partially contacts a heat-generating element directly or indirectly.

19. The heat-dissipating module as claimed in claim **2**, wherein the surface of one end of the board-type heat-pipe partially contacts a heat-generating element directly or indirectly.

20. The heat-dissipating module as claimed in claim **3**, wherein the surface of one end of the board-type heat-pipe partially contacts a heat-generating element directly or indirectly.

21. The heat-dissipating module as claimed in claim **5**, wherein the surface of one end of the board-type heat-pipe partially contacts a heat-generating element directly or indirectly.

22. The heat-dissipating module as claimed in claim **7**, wherein the surface of one end of the board-type heat-pipe partially contacts a heat-generating element directly or indirectly.

23. The heat-dissipating module as claimed in claim **9**, wherein the surface of one end of the board-type heat-pipe partially contacts a heat-generating element directly or indirectly.

24. The heat-dissipating module as claimed in claim **10**, wherein the surface of one end of the board-type heat-pipe partially contacts a heat-generating element directly or indirectly.

25. The heat-dissipating module as claimed in claim **11**, wherein the surface of one end of the board-type heat-pipe partially contacts a heat-generating element directly or indirectly.

26. The heat-dissipating module as claimed in claim **13**, wherein the surface of one end of the board-type heat-pipe partially contacts a heat-generating element directly or indirectly.

27. The heat-dissipating module as claimed in claim **14**, wherein the surface of one end of the board-type heat-pipe partially contacts a heat-generating element directly or indirectly.

28. The heat-dissipating module as claimed in claim **15**, wherein the surface of one end of the board-type heat-pipe partially contacts a heat-generating element directly or indirectly.

29. The heat-dissipating module as claimed in claim **16**, wherein the surface of one end of the board-type heat-pipe partially contacts a heat-generating element directly or indirectly.

30. The heat-dissipating module as claimed in claim **17**, wherein the surface of one end of the board-type heat-pipe partially contacts a heat-generating element directly or indirectly.

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