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(54) **MEMORY MODULE WITH HEAT DISSIPATING APPARATUS**

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(57) **ABSTRACT**

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A memory module includes a plurality of memory cards and a heat dissipating apparatus. The heat dissipating apparatus is a continuously-bending metal sheet. The heat dissipating apparatus includes a plurality of thermal conductive portions arranged in a row and a plurality of connecting sheets locating in between the thermal conductive portions respectively and configured to connect with the two adjacent thermal conductive portions. Each of the thermal conductive portions includes a top plate, a front side plate, and a rear side plate, the front and rear side plates extend from two opposite sides of the top plate respectively. The front and rear side plates of each of the thermal conductive portions are configured to snugly clip to one of the memory cards and are in contact with heat sources on two opposite sides of the corresponding memory card.

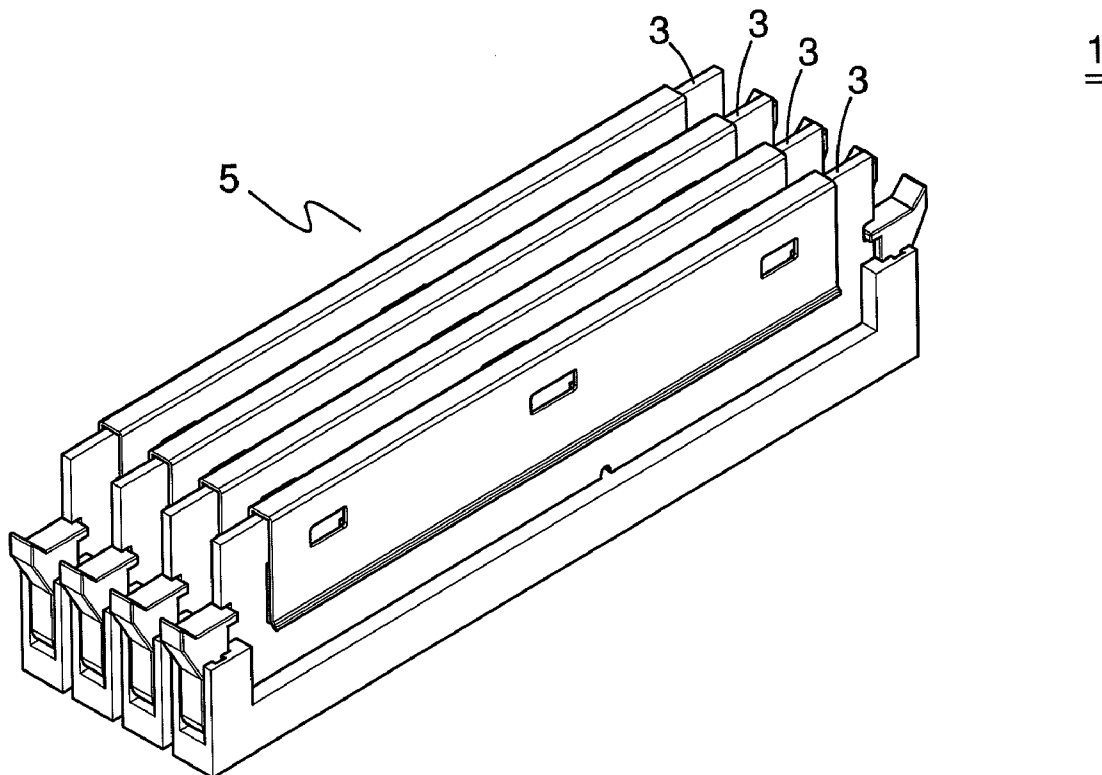
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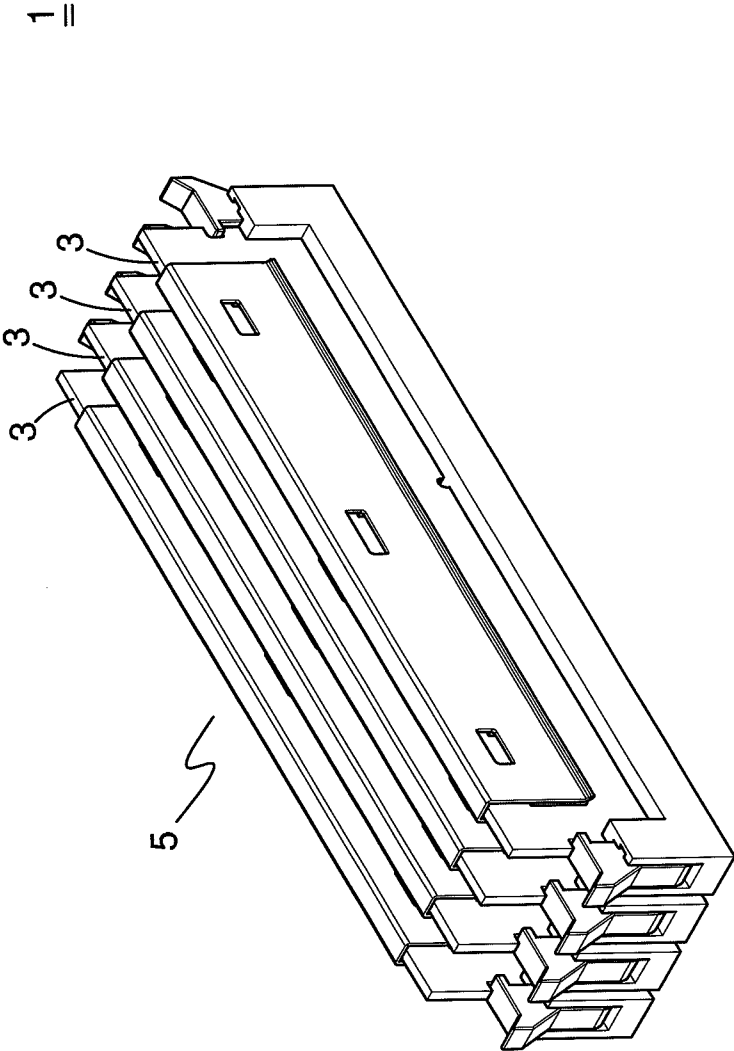


FIG. 1

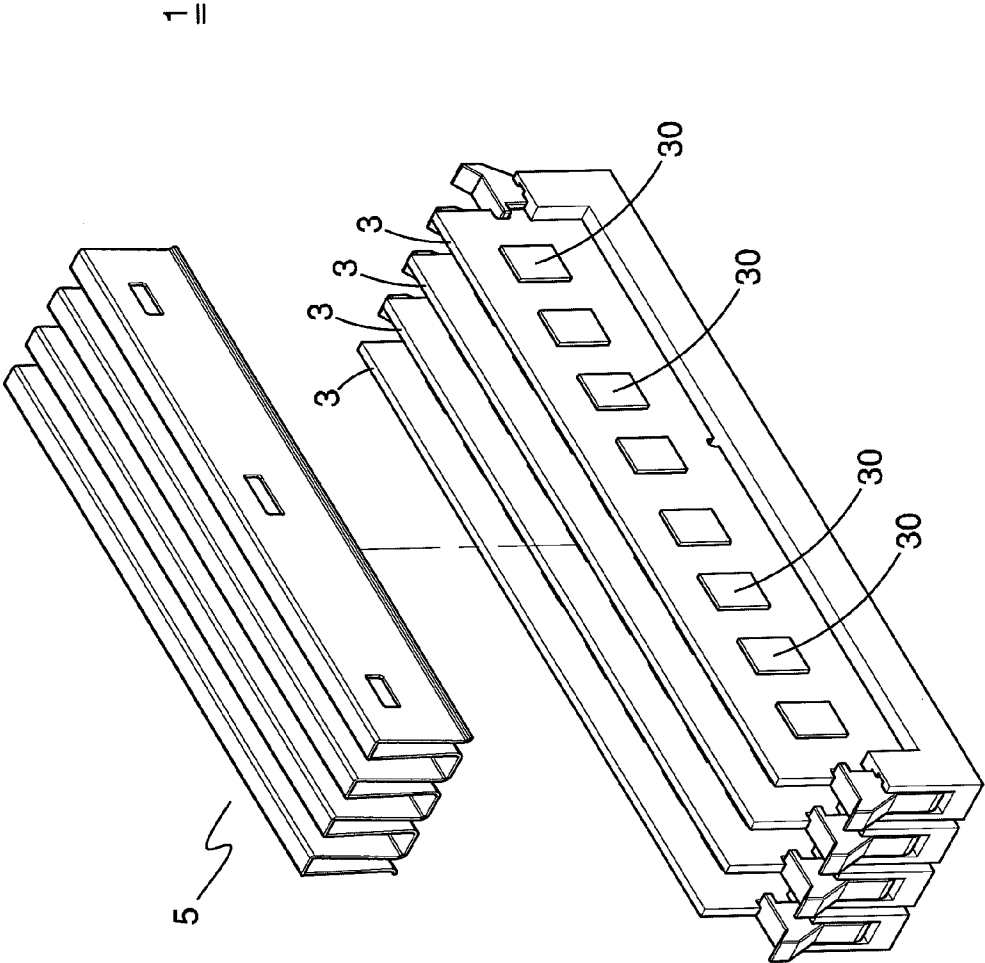
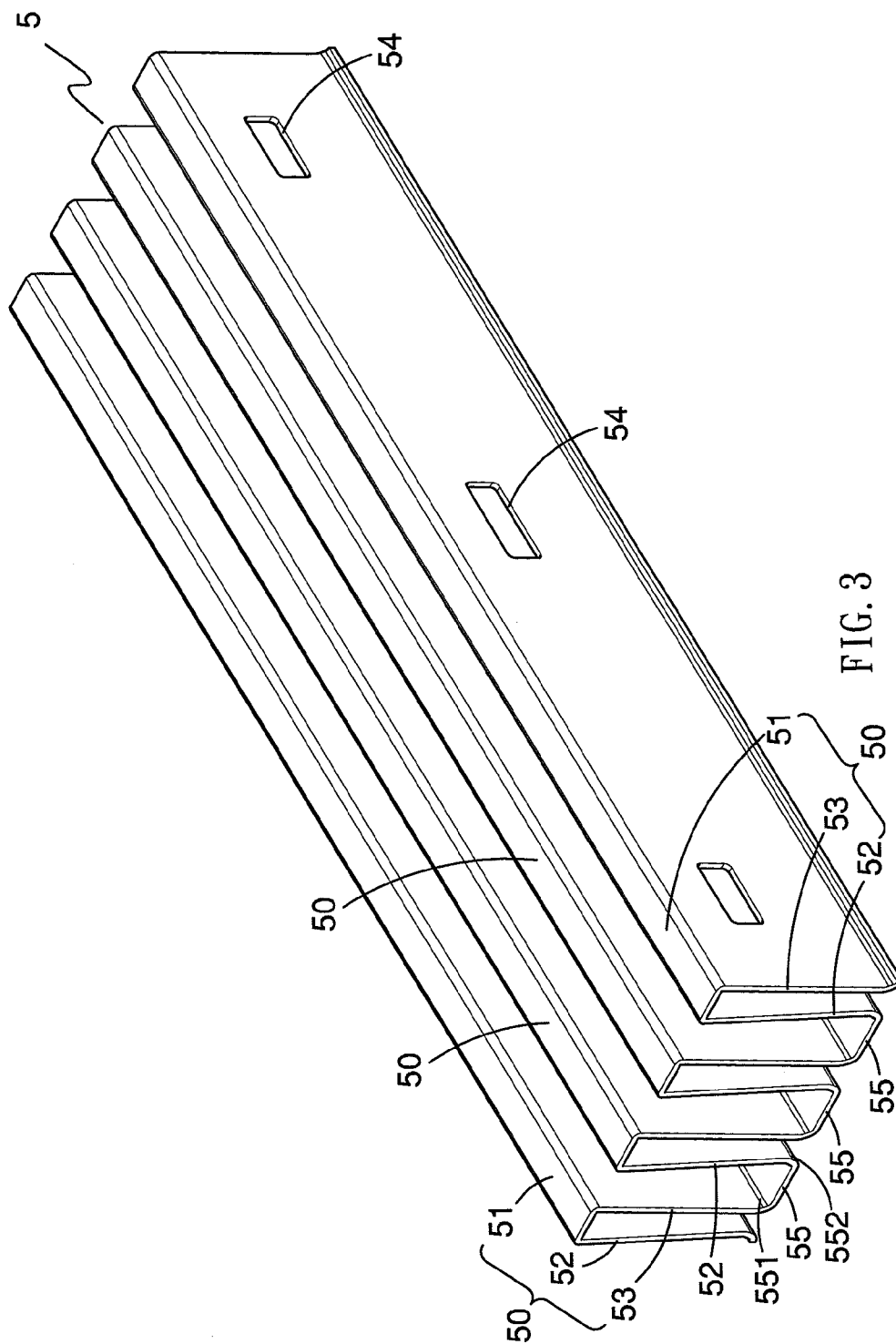


FIG. 2



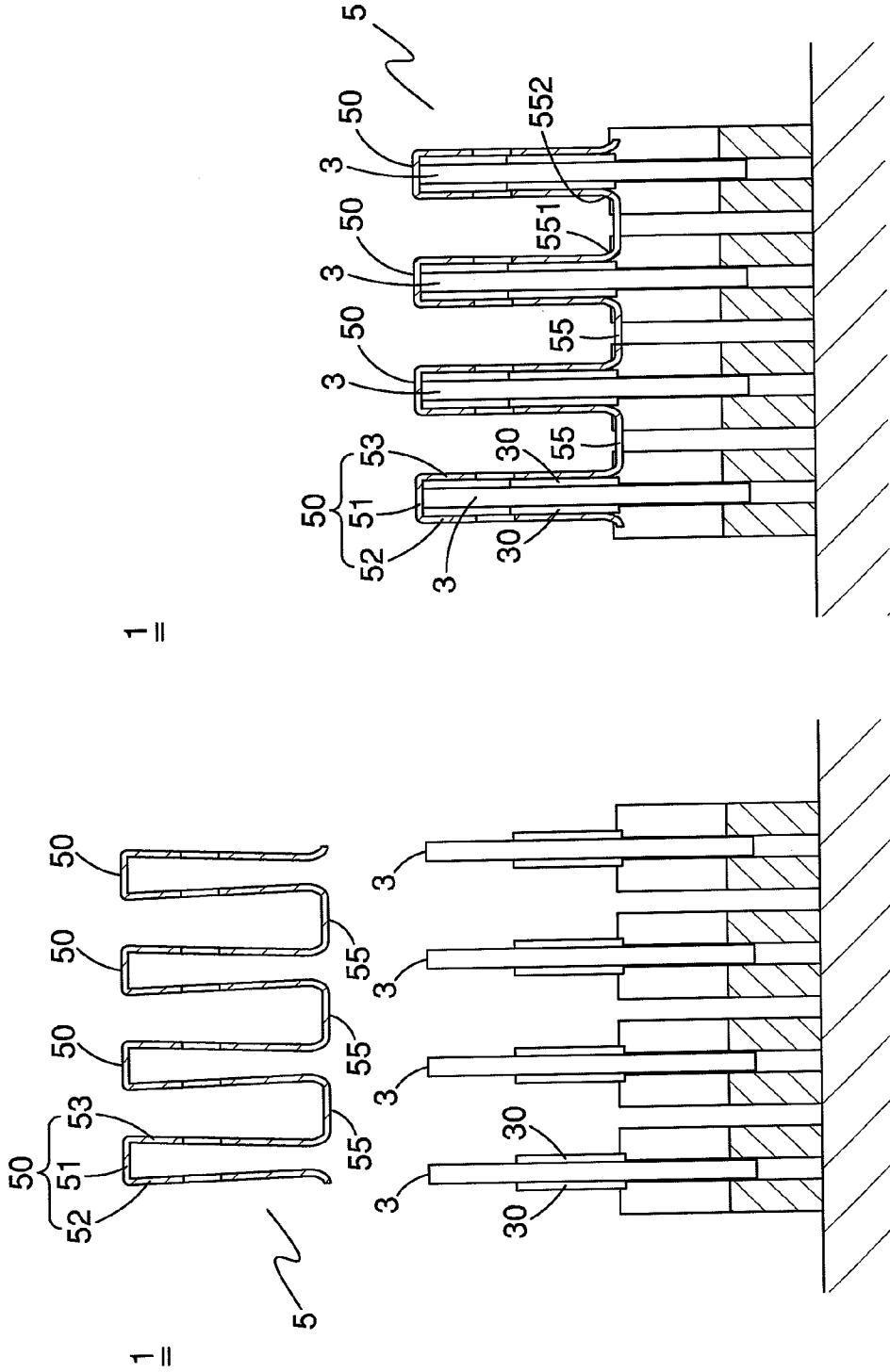


FIG. 5

FIG. 4

**MEMORY MODULE WITH HEAT DISSIPATING APPARATUS**

**BACKGROUND OF INVENTION**

**[0001]** 1. Field of Invention

**[0002]** The present invention relates to a heat dissipating apparatus, and in particular to a heat dissipating apparatus which is a continuously-bending metal sheet for assembling to a plurality of memory cards to dissipate heat generated therefrom.

**[0003]** 2. Related Prior Art

**[0004]** A heat dissipating apparatus for memory cards is disclosed in Taiwan Patent No. 1330517. The heat dissipating apparatus includes a heat dissipating plate and a plurality of thermal conductive portions. The heat dissipating plate defines a plurality of slits thereon. Each of the thermal conductive portions has a top plate and two side plates extending from two opposite ends of the top plate and through the slits of the heat dissipating plate to be in contact with two opposite sides of a memory card respectively for dissipating heat generated from chips on the memory card.

**[0005]** Another heat dissipating apparatus is disclosed in Taiwan Patent No. M246684. The heat dissipating apparatus is made of a continuously-bending metal sheet, and has a plurality of thermal conductive portions and connecting sheets which are interval arranged in a row. Each of the thermal conductive portions includes a top plate, and two side plates which extend from two opposite ends of the top plate respectively and are parallel to each other. Each of the connecting sheets connects with two bottom edges of two side plates of the two adjacent thermal conductive portions respectively.

**SUMMARY OF INVENTION**

**[0006]** The primary object of this invention is therefore to provide a memory module with an improved heat dissipating apparatus. The memory module includes a plurality of memory cards and the heat dissipating apparatus. Each of the memory cards has a plurality of heat sources on two opposite sides thereof, and the heat dissipating apparatus is assembled to the plurality of memory cards for dissipating heat generated from the heat sources on the opposite sides of the plurality of memory cards.

**[0007]** In more detail, the heat dissipating apparatus is a continuously-bending metal sheet, and includes a plurality of thermal conductive portions arranged in a row and a plurality of connecting sheets locating in between the thermal conductive portions respectively. Each of thermal conductive portions includes a top plate, a front side plate, and a rear side plate. The front side plate and the rear side plate extend downwardly from two opposite ends of the top plate respectively, and the rear side plate faces the front side plate of another thermal conductive portion which is adjacent thereto. Each of the connecting sheets has a front edge and a rear edge, the front edge connects with a bottom end of the rear side plate of one of the thermal conductive portions, and the rear edge connects with a bottom end of the front side plate of another thermal conductive portion which is adjacent thereto. Each of the thermal conductive portions has a distance between the front side plate and the rear side plate such that the corresponding memory card can be snugly clip in between the front side plate and the rear side plate of the thermal conductive portion, and the front side plate and the rear side

plate are in contact with the heat sources on the two opposite sides of the corresponding memory card.

**[0008]** Preferably, the front side plate and the rear side plate of each of the thermal conductive portions of the heat dissipating apparatus define a plurality of air vents respectively in order to provide better heat dissipating effect.

**[0009]** In comparison with the prior art, the memory module of the present invention has the heat dissipating apparatus assembled to the plurality of memory cards at one time for dissipating heat generated from the heat sources on the plurality memory cards. Accordingly, the heat dissipating apparatus of the present invention has advantages of easy assembling, and time and labor cost saving during assembling process. Moreover, because of the front side plate and the rear side plate of each of the thermal conductive portions of the heat dissipating apparatus incline inwardly toward each other so as each of the thermal conductive portions of the heat dissipating apparatus can be snugly clip to the corresponding memory card and the front side plate and the rear side plate of the thermal conductive portion can be in tight contact with the heat sources on the opposite sides of the corresponding memory card.

**[0010]** Further benefits and advantages of the present invention will become clear as the description proceeds.

**BRIEF DESCRIPTION OF DRAWINGS**

**[0011]** The invention will now be elucidated with reference to the following description and accompanying drawings where:

**[0012]** FIG. 1 is a perspective view of a memory module according to one preferred embodiment to the present invention;

**[0013]** FIG. 2 is an exploded view of FIG. 1;

**[0014]** FIG. 3 is a perspective view of a heat dissipating apparatus of the memory module of the preferred embodiment;

**[0015]** FIG. 4 is a lateral cross-sectional view of FIG. 2; and

**[0016]** FIG. 5 is a lateral cross-sectional view of FIG. 1.

**DETAILED DESCRIPTION OF EMBODIMENTS**

**[0017]** FIGS. 1 and 2 are schematic views of a memory module in accordance with a preferred embodiment of the present invention. The memory module 1 comprises a plurality of memory cards 3 and a heat dissipating apparatus 5 assembled to the plurality of memory cards 3 for dissipating heat generated from the plurality of memory cards 3. Each of memory cards 3 has a plurality of heat sources 30 on two opposite sides thereof, respectively, as shown in FIG. 2. Preferably, the heat sources 30 can be a plurality of chips on the memory card according to the preferred embodiment of the invention.

**[0018]** Referring to FIG. 3, the heat dissipating apparatus 5 is a continuously-bending metal sheet which is preferably made of a flexible heat-conductive metal sheet. The heat dissipating apparatus 5 comprises a plurality of thermal conductive portions 50 arranged in a row and a plurality of connecting sheets 55 locating in between the thermal conductive portions 50 respectively. Each of the thermal conductive portions 50 includes a top plate 51, a front side plate 52, and a rear side plate 53. The front side plate 52 and the rear side plate 53 extend downwardly from two opposite ends of the top plate 51, and incline inwardly toward each other. The rear side plate 53 of one of the thermal conductive portions 50

faces the front side plate **52** of another thermal conductive portion **50** which is adjacent thereto. Besides, each of the connecting sheets **55** has a front edge **551** and a rear edge **552**, the front edge **551** connects with a bottom end of the rear side plate **53** of one of the thermal conductive portions **50**, and the rear edge **552** connects with a bottom end of the front side plate **52** of another thermal conductive portion **50** which is adjacent thereto.

**[0019]** Preferably, the front side plate **52** and the rear side plate **53** of each of the thermal conductive portions **50** define a plurality of air vents **54** thereof, respectively, in order to provide better heat dissipating effect.

**[0020]** With reference to FIGS. **4** and **5**, the heat dissipating apparatus **5** is assembled to the plurality of memory cards **3**, and each of thermal conductive portions **50** of the heat dissipating apparatus **5** clips to one of the memory cards. Each of the thermal conductive portions **50** has a distance between the front side plate **52** and the rear side plate **53** to snugly clip the corresponding memory card **3**, and the front side plate **52** and the rear side plate **53** of the thermal conductive portion **50** are in contact with the heat sources **30** on two opposite sides of the corresponding memory card **3** with referring to FIG. **5** for dissipating heat generated from said heat sources **30** thereon.

**[0021]** It is noted that, as shown in FIG. **4**, the front side plate **52** and the rear side plate **53** of each of the thermal conductive portions **50** of the heat dissipating apparatus **5** incline inwardly originally, and a maximum distance between the front side plate **52** and the rear side plate **53** is generally equal to a thickness of each of the memory cards **3**. Therefore, the front side plate **52** and the rear side plate **53** of each of the thermal conductive portions **50** are stretched outwardly by the corresponding memory card **3** during assembling process so as the front side plate **52** and the rear side plate **53** are turn from an original situation of incline inwardly to a parallel situation. In this manner, the front side plate **52** and the rear side plate **53** of each of the thermal conductive portions **50** are in tight contact with the heat sources **30** on two opposite sides of the corresponding memory card **3** while the heat dissipating apparatus **5** and the plurality of memory cards **5** are assembled. Besides, each of the connecting sheets **55** has a distance between the front edge **551** and the rear edge **552** which is equal to a distance between the two adjacent memory cards **3**.

**[0022]** Furthermore, since that the heat dissipating apparatus **5** is made of a flexible metal sheet, the front side plate **52** and the rear side plate **53** can store an elastic force of inwardly clipping while the front side plate **52** and the rear side plate **53** are stretched outwardly by the corresponding memory card **3**. Therefore, each of the thermal conductive portions **50** of the heat dissipating apparatus **5** can tightly clip to the corresponding memory cards **3** by said elastic force generated from the front side plate **52** and the rear side plate **53** of each of the thermal conductive portions **50**.

**[0023]** Compare to the prior art, the memory module of the present invention has the heat dissipating apparatus assembled to the plurality of memory cards at one time for dissipating heat generated from the heat sources of the plurality of memory cards. Accordingly, the memory module of the present invention has advantages of easy assembling, and time and labor cost saving during assembling process. Moreover, because of the front side and rear side plates of the heat dissipating apparatus of the present invention incline inwardly toward each other so as the thermal conductive portions of the heat dissipating apparatus can be snugly clip to

the plurality of memory cards respectively, and the front side plate and the rear side plate of each of the thermal conductive portions can be in tight contact with the heat sources on the opposite sides of the corresponding memory card.

**[0024]** Numerous characteristics and advantages of the invention have been set forth in the foregoing description. The disclosure, however, is illustrative only, and changes may be made in detail within the principle of the invention, to the full extent indicated by the broad general meaning of the terms in which the appended claims are expressed.

The invention claimed is:

**1.** A heat dissipating apparatus being a continuously-bending metal sheet for dissipating heat generated from a plurality of devices, wherein two opposite sides of each of the devices have a plurality of heat sources respectively, the heat dissipating apparatus comprising:

a plurality of thermal conductive portions arranged in a row, each of the thermal conductive portions having a top plate, a front side plate and a rear side plate, the front and the rear side plates respectively extending downwardly from two opposite ends of the top plate and incline inwardly toward each other, the rear side plate facing the front side plate of another conductive portion which is adjacent thereto; and wherein each of the thermal conductive portions has a distance between the front side plate and the rear side plate to be configured to snugly clip to one of the devices, and the front side and rear side plates of each of the thermal conductive portions are in contact with the heat sources on opposite sides of the corresponding device; and

a plurality of connecting sheets respectively located in between the thermal conductive portions, each of the connecting sheets having a front edge and a rear edge, the front edge connecting with a bottom end of the rear side plate of one of the thermal conductive portions, the rear edge connecting with a bottom end of the front side plate of another thermal conductive portion which is adjacent thereto.

**2.** The heat dissipating apparatus of claim **1**, wherein the front side plate and the rear side plate of each of the thermal conductive portions define a plurality of air vents thereon respectively.

**3.** A memory module comprising:

a plurality of memory cards, each of the memory cards having a plurality of heat sources on two opposite sides thereof respectively; and

a heat dissipating apparatus assembled to the memory cards, the heat dissipating apparatus being a continuously-bending metal sheet and including a plurality of thermal conductive portions arranged in row and a plurality of connecting sheets locating in between the thermal conductive portions respectively; wherein each of the thermal conductive portions has a top plate, a front side plate and a rear side plate, the front side plate and the rear side plate respectively extend downwardly from two opposite ends of the top plate, and the rear side plate faces the front side plate of another thermal conductive portion which is adjacent thereto; wherein each of the connecting sheets has a front edge and a rear edge, the front edge connects with a bottom end of the rear side plate of one of the thermal conductive portions, and the rear edge connects with a bottom end of the front side plate of another thermal conductive portion which is adjacent thereto; and wherein the front side plate and the

rear side plate of each of the thermal conductive portions snugly clip to one of the memory cards and are in contact with the heat sources on the two opposite sides of the corresponding memory card.

4. The memory module of claim 3, wherein the front side plate and the rear side plate of each of the thermal conductive portions of the heat dissipating apparatus define a plurality of air vents thereon respectively.

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