A compound heat-dissipating device includes a conductive base and a heat-dissipating body. The conductive base has a first bottom surface, a first top surface, and a plurality of combining portions protruded from the first top surface. Each combining portion has a bottom end connected with the first bottom surface and a top end extended from the bottom end integrally. The top end has a cross-sectional area bigger than that of the bottom end. The heat-dissipating body has a second bottom surface and a second top surface. The second bottom surface has a pair of concave portions corresponding to a contour of the conductive base, and a plurality of combining grooves formed in the concave portion. The shape of the combining grooves is corresponding to that of the combining portions, and the combining portions are correspondingly combined with the combining grooves.
COMPOUND HEAT-DISSIPATING DEVICE
BACKGROUND OF THE INSTANT DISCLOSURE

1. Field of the Instant Disclosure

The instant disclosure relates to a heat-dissipating device for dissipating heat from a heat-generating device, particularly to a compound heat-dissipating device combining two different metallic elements for enhancing the heat-conductive effectiveness.

2. Description of Related Art

In order to release the heat generated by the heat-generating electronic devices, such as a central processing unit (CPU) or a chip, a heat-dissipating device is generally used to achieve the object. Further, to improve heat-conductive effect of a contacting part of heat-dissipating device which is contacted with the heat-generating device, a conventional heat-dissipating structure compounded of two metallic materials is developed.

The conventional heat-dissipating structure usually has a heat-dissipating unit made of aluminum and a heat-conductive base made of copper, and both have a contacting surface combined to each other by concave-convex fitting engagement, such as sawtooth-shaped or wavy-shaped structure. However, this kind of combining way is still not so firm. The heat-dissipating unit of the heat-dissipating structure for dissipating heat is easily to separate from the heat-conductive base.

SUMMARY OF THE INSTANT DISCLOSURE

The object of the instant disclosure is to provide a compound heat-dissipating device, for firmly combining a heat-dissipating body and a conductive base to avoid separation happened between both, and further for well and uniformly conducting heat from the conductive base to the heat-dissipating body.

In order to achieve the aforementioned objectives, according to an embodiment of the instant disclosure, a compound heat-dissipating device includes a conductive base and a heat-dissipating body. The conductive base has a first bottom surface and a first top surface. The first top surface has a plurality of combining portions protruded therefrom. Each combining portion has a bottom end connected to the first bottom surface, and a top end integrally extending upward from the bottom end. The top end has a cross-sectional area bigger than that of the bottom end. The heat-dissipating body has a second bottom surface and a second top surface. The second bottom surface has a pair of concave portions corresponding to a contour of the conductive base, and a plurality of combining grooves formed in the concave portion. The shape of the combining grooves is corresponding to that of the combining portions, and the combining portions are correspondingly combined with the combining grooves.

Based on the above, the instant disclosure has at least the following advantages, that the conductive base of the present disclosure can be firmly combined with the heat-dissipating body. Therefore, by such kind of mutual combination structure, the combining area and the conductive area are enlarged, and the efficiency of heat-dissipating is enhanced.

In order to further appreciate the characteristics and technical contents of the instant disclosure, references are hereunder made to the detailed descriptions and appended drawings in connection with the instant disclosure. However, the appended drawings are merely shown for exemplary purposes, rather than being used to restrict the scope of the instant disclosure.

BRIEF DESCRIPTION OF THE DRAWINGS

Fig. 1 shows a perspective exploded view of a compound heat-dissipating device according to a first embodiment of the instant disclosure;

Fig. 2 shows another perspective exploded view of the compound heat-dissipating device according to the instant disclosure;

Fig. 3 shows a perspective assembled view of the compound heat-dissipating device according to the instant disclosure;

Fig. 4A shows a cross-sectional view of the compound heat-dissipating device according to the instant disclosure;

Fig. 4B shows another cross-sectional view of a compound heat-dissipating device according to the instant disclosure;

Fig. 5 shows a perspective exploded view of a compound heat-dissipating device according to second embodiment of the instant disclosure;

Fig. 6 shows another perspective exploded view of a compound heat-dissipating device according to second embodiment of the instant disclosure;

Fig. 7 shows a perspective assembled view of the compound heat-dissipating device according to second embodiment of the instant disclosure;

Fig. 8 shows a cross-sectional view of the compound heat-dissipating device according to second embodiment of the instant disclosure.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

The aforementioned illustrations and following detailed descriptions are exemplary for the purpose of further explaining the scope of the instant disclosure. Other objectives and advantages related to the instant disclosure will be illustrated in the subsequent descriptions and appended drawings. Besides, in the following description, when it comes to the number or the like, unless specifically described, the instant disclosure is not limited to the number mentioned. Throughout the present specification, expression of relative position such as “top”, “bottom”, “left”, “right”, “front”, “rear” etc, are used solely for convenience and clarity as oriented in the drawings. They are in no way intended to be limited as to the orientation of use of the instant disclosure described.

First Embodiment

Please refer to FIGS. 1 and 2, which are perspective exploded views of a compound heat-dissipating device according to the instant disclosure. The instant disclosure provides a compound heat-dissipating device 100, which includes a conductive base 10 and a heat-dissipating body 20. The conductive base 10 is embedded with a bottom of the heat-dissipating body 20. For a preferable embodiment of material arrangement, the conductive base 10 can be made of copper, and the heat-dissipating body 20 can be made of aluminum. Such arrangement utilizes copper which has higher heat-conductive coefficient for conducting with a sur-
face of the heat-generating device and transferring to the heat-dissipating body 20 to dissipate heat. The copper material of conductive base could be copper or copper alloy. However, the instant disclosure is not limited thereto, it can be an assembly of different metals such as aluminum, copper, steel, or alloy thereof. Further, the manufacturing method can be Metal Injection Molding, power metallurgy casting, metal forging, squeeze casting, die casting... etc. FIGS. 1 and 2 are exemplified for illustrating the detailed structure of the conductive base 10 and the heat-dissipating body 20, which are not express the combining process.

[0021] The conductive base 10 has a first bottom surface 11 and a first top surface 12. A plurality of protruded-shaped combining portions 14 is protruded from the first top surface 12. Each combining portion 14 has a bottom end 141 connected with the first bottom surface 11 and a top end 142 integrally extended from the bottom end 141 upward. The top end 142 has a cross-sectional area bigger than that of the bottom end 141. From a side view, the combining portion 14 is substantially wedge-shaped. In another view, those combining portions 14 are trapezoid-shaped in cross-section. Each top end 142 of the combining portions 14 is rectangular-shaped, and there is a pair of inclined surfaces 144 are inwardly shrank from the top end 142 gradually and connected to the first top surface 12 of the conductive base 10. In this embodiment, because the top end 142 is bigger than the bottom end 141, the conductive base 10 can be firmly combined with the heat-dissipating body 20 to avoid a split between both. From another point, the combining portions 14 of this embodiment have four sides which are shrank from the top end 142 toward the bottom end 141, such combining way is very stable not only parallel to or perpendicular to the conductive base 10 without lateral sliding.

[0022] In this embodiment, those combining portions 14 are uniformly distributed on the first top surface 12 of the conductive base 10, which is benefit for conducting heat uniformly to the heat-dissipating body 20. Besides, those combining portions 14 of the conductive base 10 are arranged in many rows along a longitudinal direction. The odd rows of the combining portions 14 in longitudinal direction are aligned to each other, and the even rows of the combining portions 14 in longitudinal direction are aligned to each other. However, the combining portions 14 can be arranged in a matrix manner.

[0023] The heat-dissipating body 20 has a second bottom surface 21 and a second top surface 22. The second bottom surface 21 has a concave portion 210 corresponding to a contour of the conductive base 10, and a plurality of combining grooves 212 formed in the concave portion 210. Those combining grooves 212 are shaped corresponding to that of the combining portions 14, so that the combining portions 14 are combined to the combining grooves 212 correspondingly. In other words, the combining groove 212 has structure characteristics that having a narrow inlet and a wide inner portion. A noticeable point, all the top ends 142 of the combining portion 14 are substantially arranged on an identical plane. In other words, the distance between the top ends 142 of the combining portions 14 and the bottom of the concave portions 210 of the heat-dissipating body 20 are substantially the same. Those combining portions 14 can transfer heat to the heat-dissipating body 20 simultaneously, which will not cause the phenomenon that heat are distributed not uniformly (thermal gradients).

[0024] Refer to FIG. 3. In this embodiment, the first bottom surface 11 of the conductive base 10 is flushed with the second bottom surface 21 of the heat-dissipating body 20. However, the instant disclosure could be formed with different bottom surface for demands of heat-generating devices. Besides, the second top surface 22 of the heat-dissipating body 20 has a plurality of heat-dissipating protrusions 24. As shown in FIGS. 1 and 3, the heat-dissipating protrusions 24 are cone-shaped. However, the present invention is not limited hereto, for example it can be fli-shaped.

[0025] As shown in FIG. 3, concerning the manufacturing process of the conductive base 10 and the heat-dissipating body 20 according to the instant disclosure, a preferable embodiment is using metal powder injecting molding to make the copper conductive base 10 first, then putting the conductive base 10 in to a mold of the aluminum heat-dissipating body 20. Subsequently, the process of squeeze casting (or called extrusion forming technology, or liquid metal forging technology) can be used to make the heat-dissipating body 20 to combine with the conductive base 10 tightly. The process of squeeze casting pours molten aluminum into a heated mold at a low speed of 0.05～0.1 m/s. The molten metal is forced into the available space of the mold cavity. A high pressure about 50 Mpa (Mega-pascal) is continuously applied during the molten type until the metal solidified for solidifying the molten metal. This method is the same as low-pressure mold casting that has a big molding entrance and lower injecting speed. The advantage of this process embodiment is that air or gas is few entrapped into the mold. It is beneficial for closely combining the heat-dissipating body 20 and the conductive base 10, that air is avoided from entrapping therein to form an obstacle of heat-conductive. If the process of MIM, Metal Injection Molding, or powder metallurgy technology is used to manufacture the heat-dissipating body 20 combining with the conductive base 10, the voids between powders will shrike to form a porosity structure between the combining portions 14 and the combining groove 212 during sintering process. The porosity structure is not propitious for conducting heat.

[0026] Refer to FIGS. 4A and 4B, which are cross-sectional views of the compound heat-dissipating device of the instant disclosure. The heat-dissipating body 20 also has wedge-shaped structure between two contiguous combining grooves 212, which is clapsed by two contiguous combining portions 14. Therefore, the combination between the conductive base 10 and the heat-dissipating body 20 is very stable and firm.

[0027] The instant disclosure provides a concave-convex engagement fit in a meshed manner or matrix manner between the conductive base 10 and the heat-dissipating body 20. The design of the combining portions 14 enhances the concave-convex engagement between the aluminum heat-dissipating body 20 and the copper conductive base 10, and it prevents splitting from being happened between both. Besides, the meshed or matrix arrangement of the combining portions 14 between the conductive base 10 and the heat-dissipating body 20 also enhances heat-conductive more uniformly. Thus, the heat-dissipating body 20 and the conductive base 10 not only have well and firm combination effect, but also bigger joining area, heat-conductive area and higher efficient heat-dissipating.

Second Embodiment

[0028] Refer to FIGS. 5 and 6, which are perspective exploded views of a compound heat-dissipating device according to a second embodiment of the instant disclosure.
In this embodiment, the difference between this compound heat-dissipating device 100' and the above embodiment is that, the conductive base 10' has a plurality of different-shaped combining portions 16, the combining portions 16 are T-shaped in cross-sectional view. Each combining portion 16 has a top end which is rectangular-shaped, and has a level portion 161 and a neck portion 162 extended from the level portion 161 to the first top surface 12 of the conductive base 10. The heat-dissipating body 20' is formed with a plurality of combining grooves 216 corresponding with the combining portions 16 of the concave portion 210. Such T-shaped structure can prevent a split between the heat-dissipating body 20' and the conductive base 10'. The distribution of the combining portions 16 is similar to the first embodiment.

What is claimed is:
1. A compound heat-dissipating device, comprising:
   a conductive base, having a first bottom surface, a first top surface, and a plurality of combining portions protruding from the first top surface, each of the combining portions has a bottom end connected with the first bottom surface and a top end extended from the bottom end integrally, wherein the top end has a cross-sectional area bigger than that of the bottom end; and
   a heat-dissipating body, having a second bottom surface and a second top surface, the second bottom surface having a pair of concave portions corresponding to a contour of the conductive base, and a plurality of combining grooves formed in the concave portion, wherein the shape of the combining grooves is corresponding to that of the combining portions, and the combining portions are correspondingly combined with the combining grooves.

2. The compound heat-dissipating device according to claim 1, wherein the bottom surface of the conductive base is flushed with the second bottom surface of the heat-dissipating body.

3. The compound heat-dissipating device according to claim 1, wherein the second top surface of the heat-dissipating body has a plurality of heat-dissipating protrusions.

4. The compound heat-dissipating device according to claim 1, wherein the combining portions of the conductive base are arranged in meshed manner.

5. The compound heat-dissipating device according to claim 4, wherein the combining portions of the conductive base are arranged in rows manner along a longitudinal direction, wherein the odd rows of the combining portions in longitudinal direction are aligned to each other, and the even rows of the combining portions in longitudinal direction are aligned to each other.

6. The compound heat-dissipating device according to claim 1, wherein each of the combining portions has peripheries shrank from the top end thereof toward the bottom end thereof.

7. The compound heat-dissipating device according to claim 6, wherein the combining portions are trapezoid-shaped in cross-section, each top end of the combining portions is rectangular-shaped, and a pair of inclined surfaces are inwardly shrank from the top end gradually and connected to the first top surface of the conductive base.

8. The compound heat-dissipating device according to claim 1, wherein the conductive base is a copper conductive base, and the heat-dissipating body is an aluminum heat-dissipating body.

9. The compound heat-dissipating device according to claim 1, wherein the combining portions are T-shaped in cross-sectional view, each top end of the combining portions is rectangular-shaped, and has a level portion and a neck portion extended from the level portion to the first top surface of the conductive base.

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