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(54) **HEAT DISSIPATING FIN, HEAT DISSIPATING DEVICE AND METHOD OF MANUFACTURING THE SAME**

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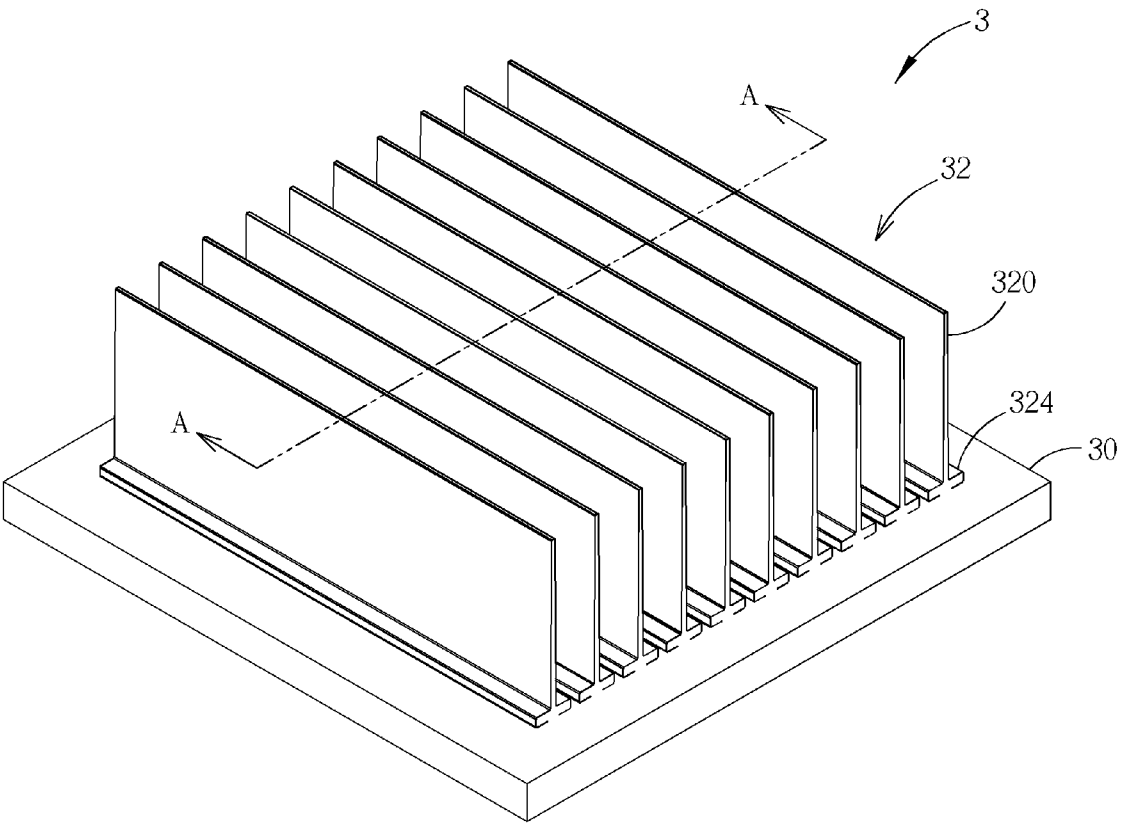
(52) **U.S. Cl.**

USPC **165/185**; 29/890.03; 164/98

(57) **ABSTRACT**

A heat dissipating device includes a base and a plurality of heat dissipating fins. Each of the heat dissipating fins includes a heat dissipating portion, a fixing portion and an overflow-proof structure. The fixing portion is fixed in the base. The overflow-proof structure is connected between the heat dissipating portion and the fixing portion. A width of the overflow-proof structure is larger than a width of the heat dissipating portion and larger than a width of the fixing portion.



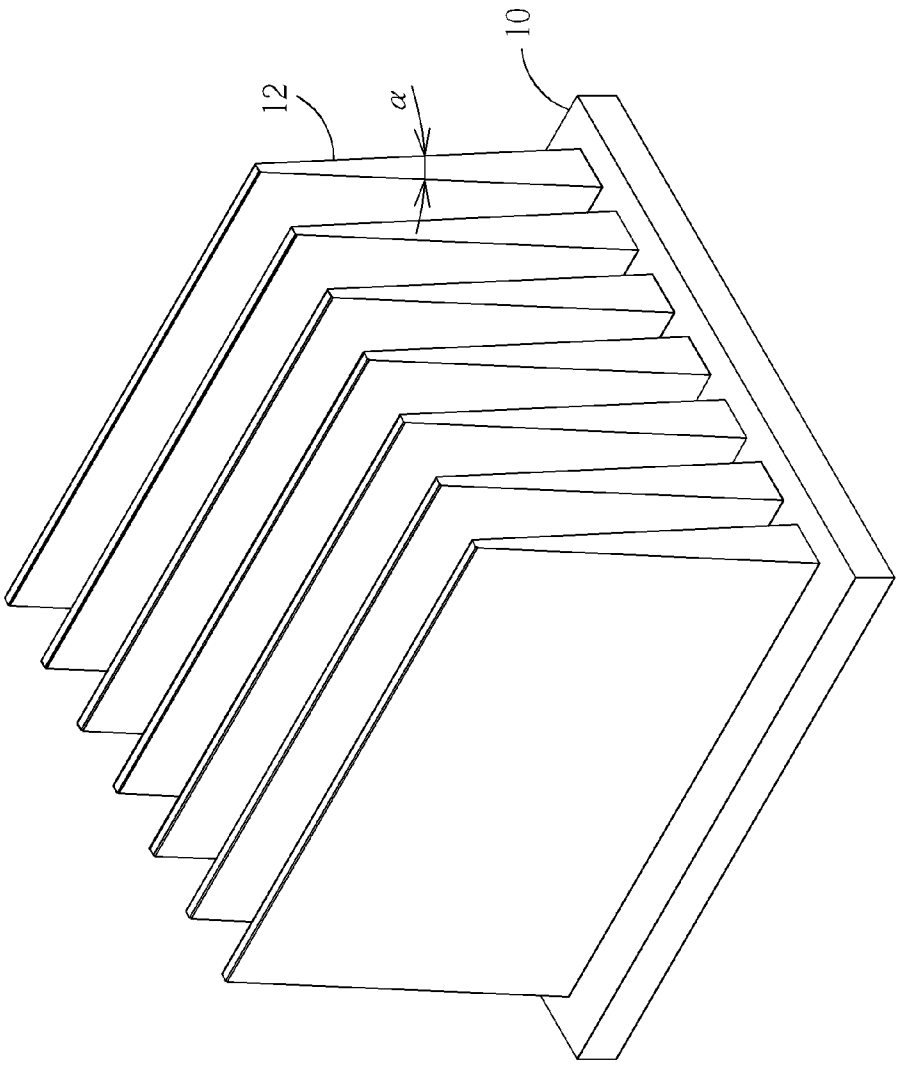


FIG. 1 PRIOR ART

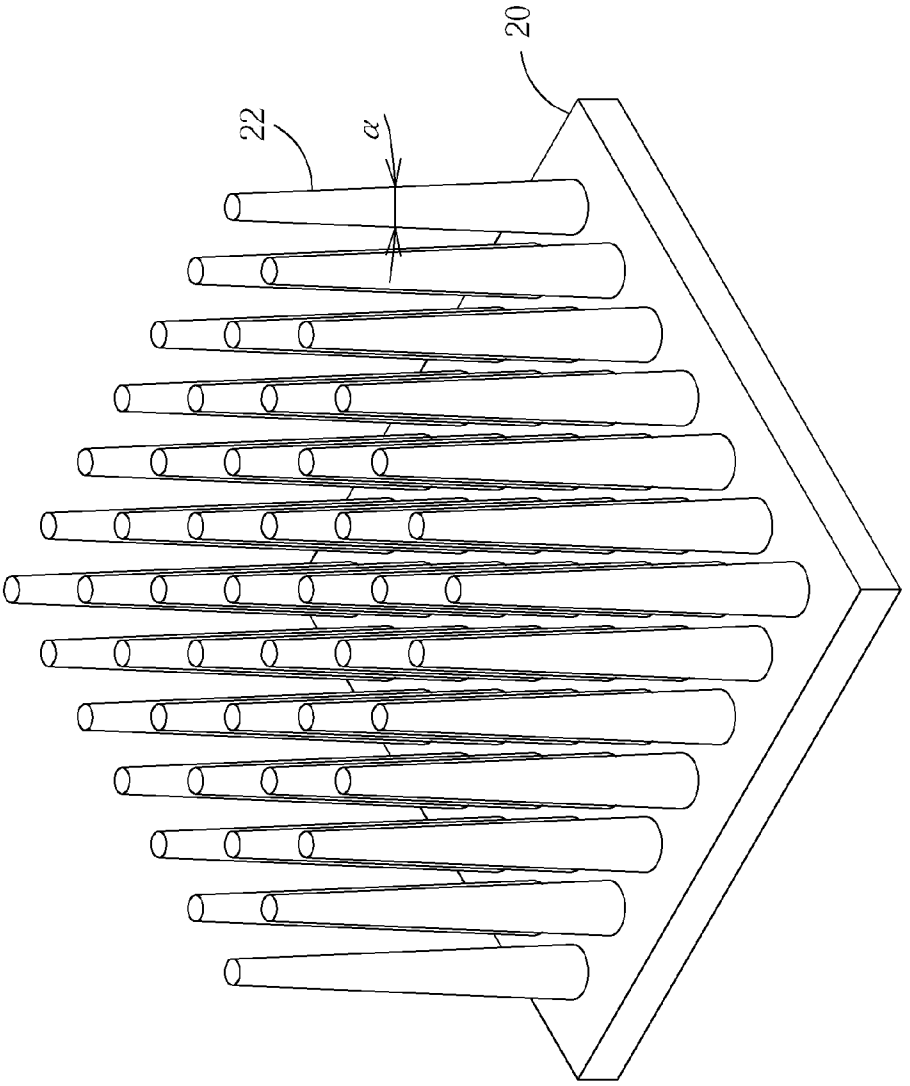


FIG. 2 PRIOR ART

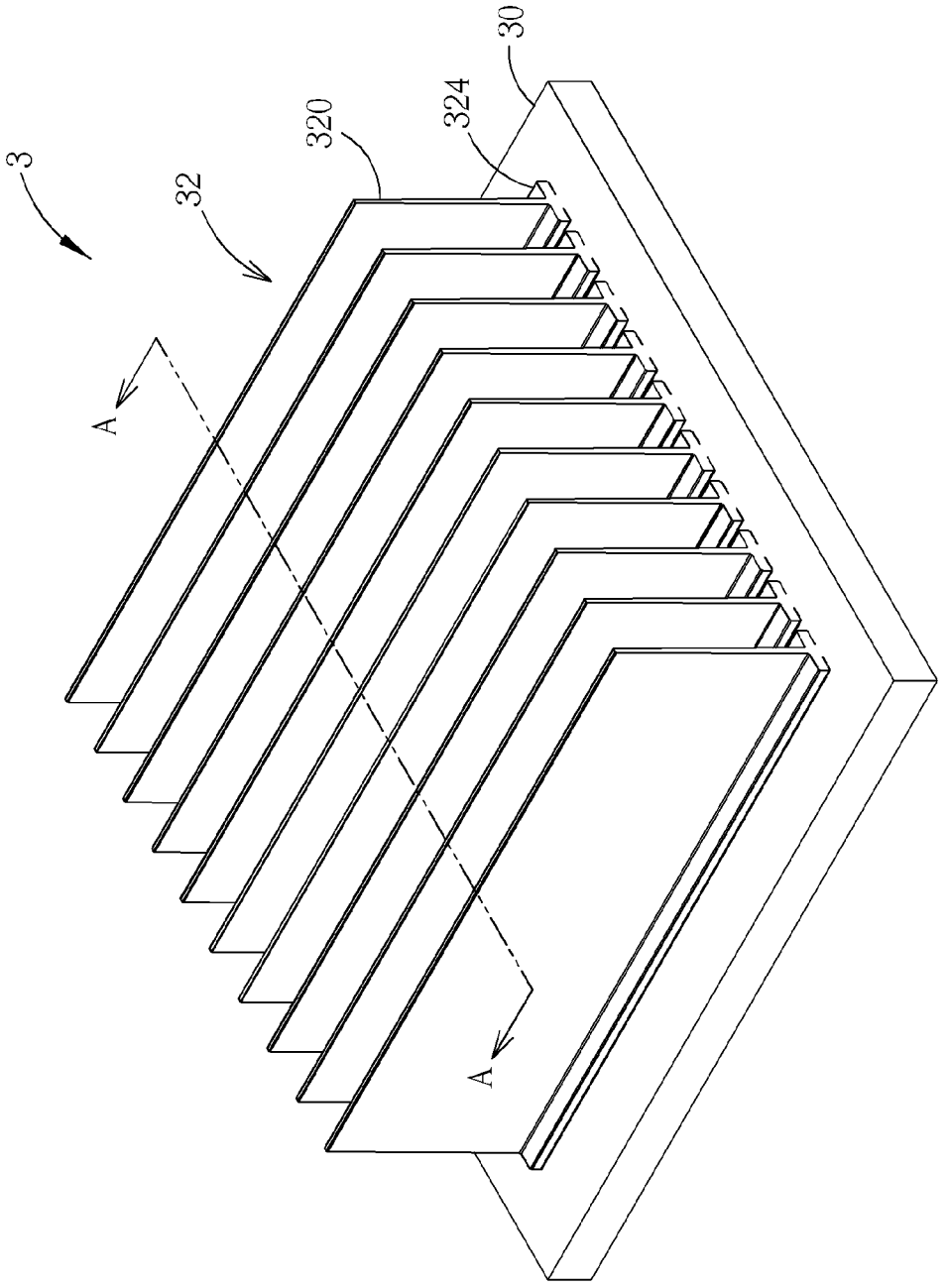


FIG. 3

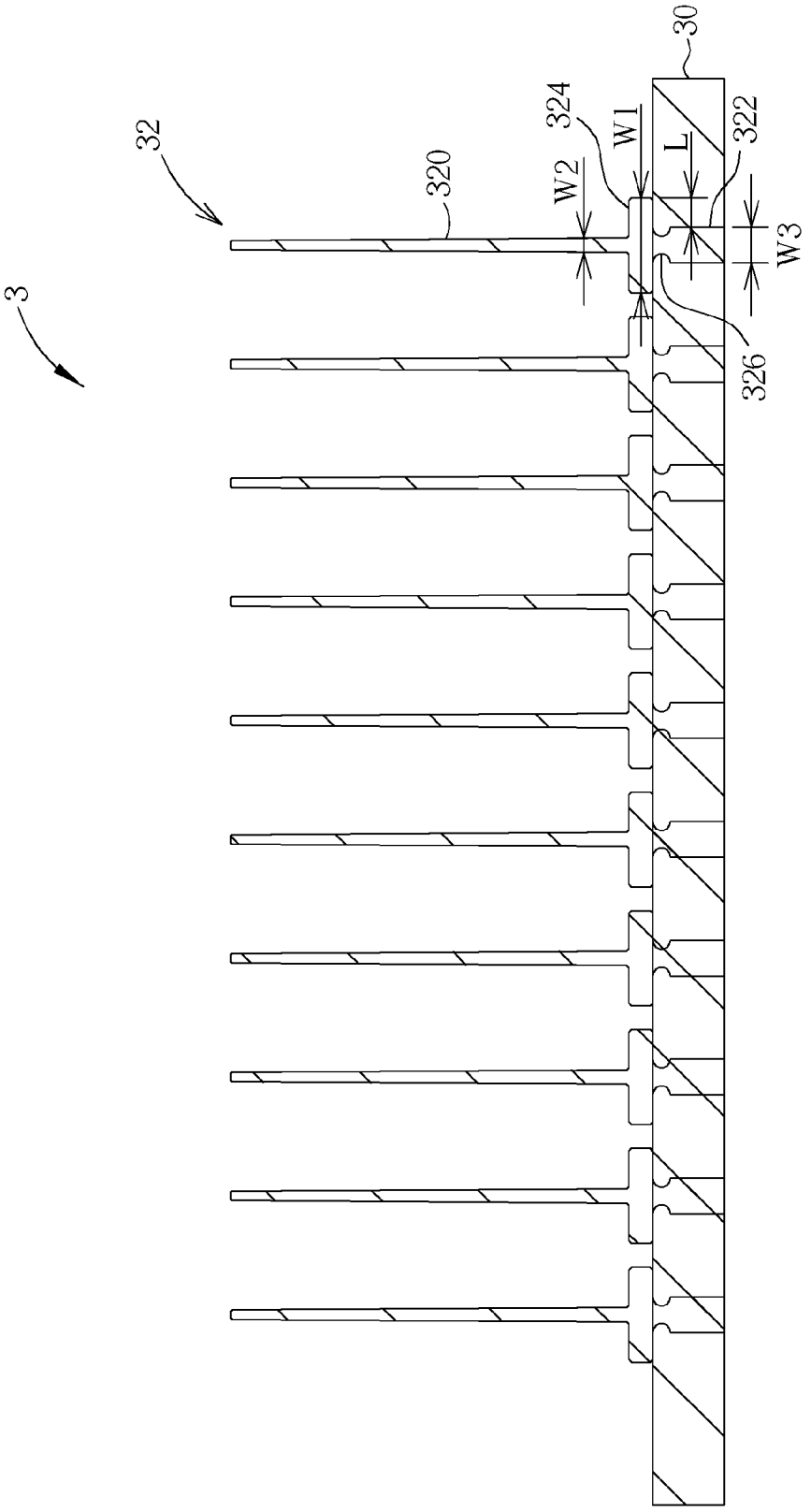


FIG. 4

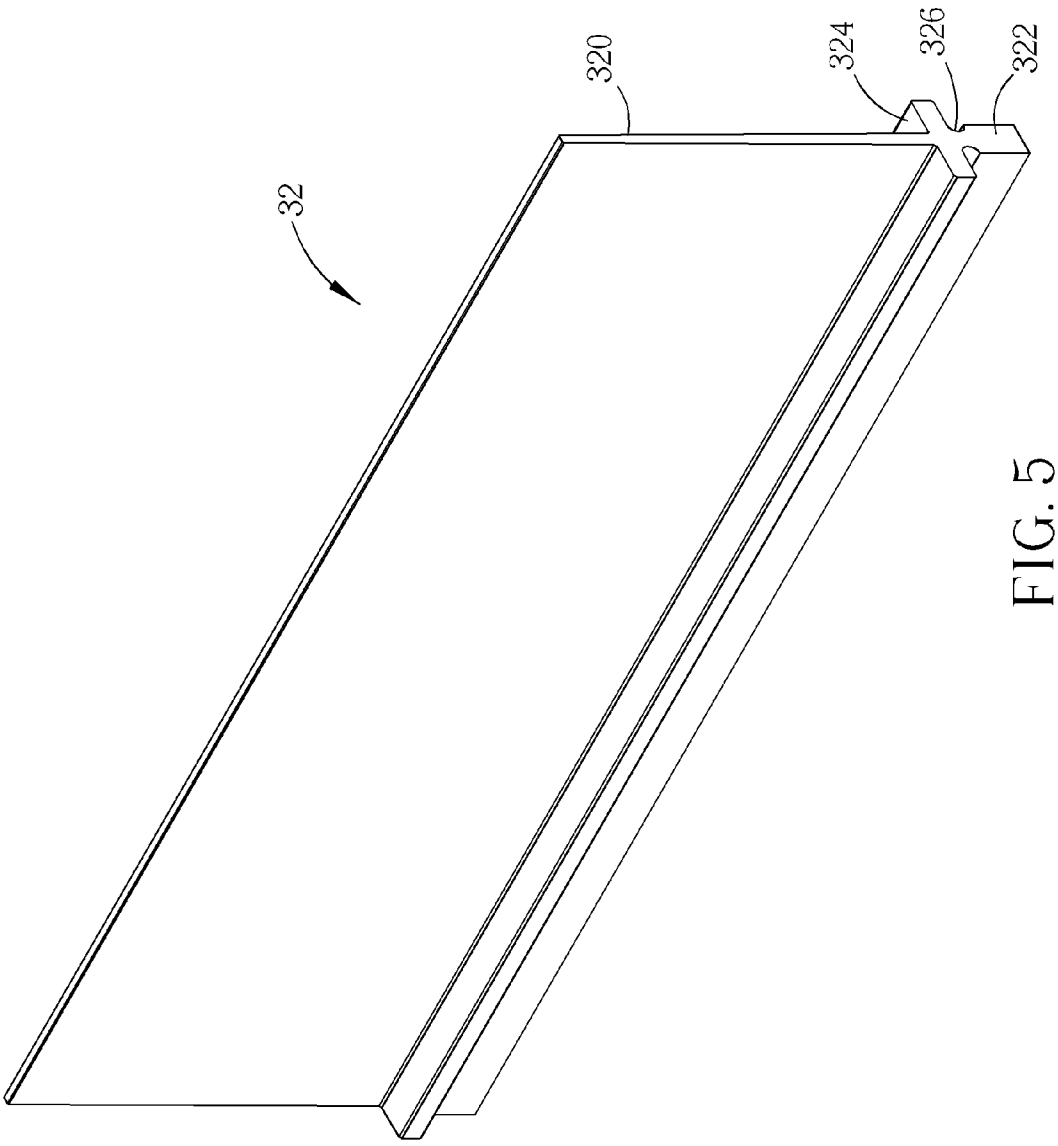


FIG. 5

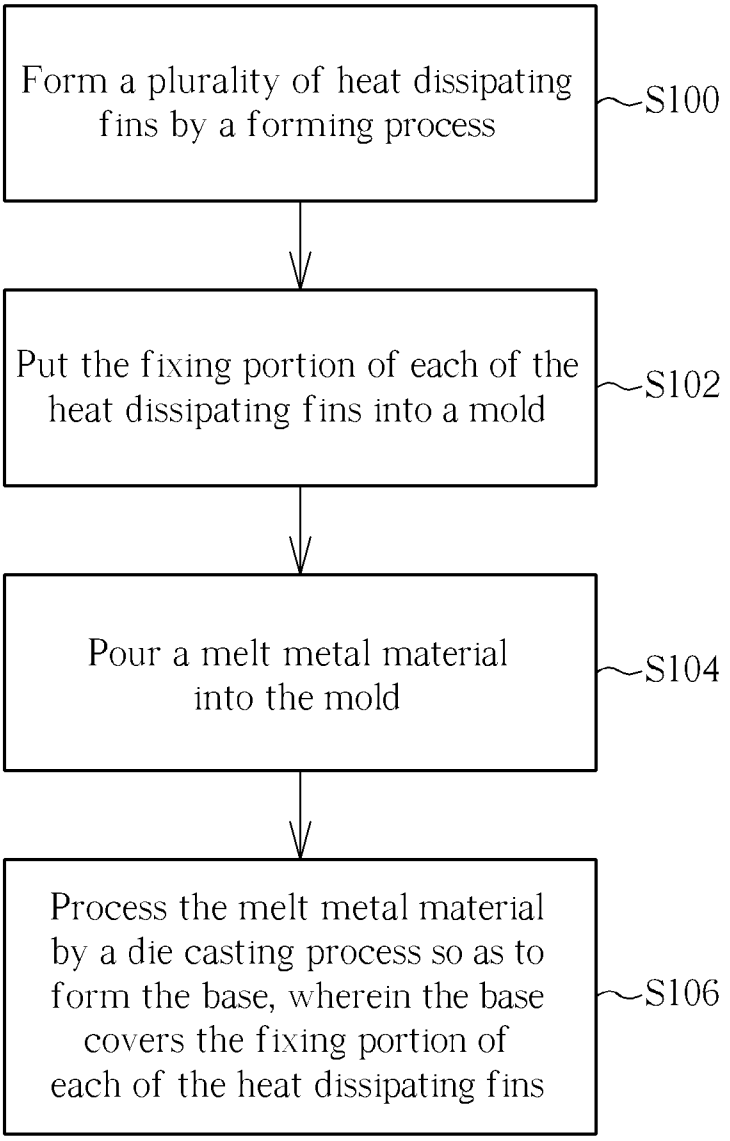

Form a plurality of heat dissipating fins by a forming process
S100
Put the fixing portion of each of the heat dissipating fins into a mold
S102
Pour a melt metal material into the mold
S104
Process the melt metal material by a die casting process so as to form the base, wherein the base covers the fixing portion of each of the heat dissipating fins
S106

FIG. 6

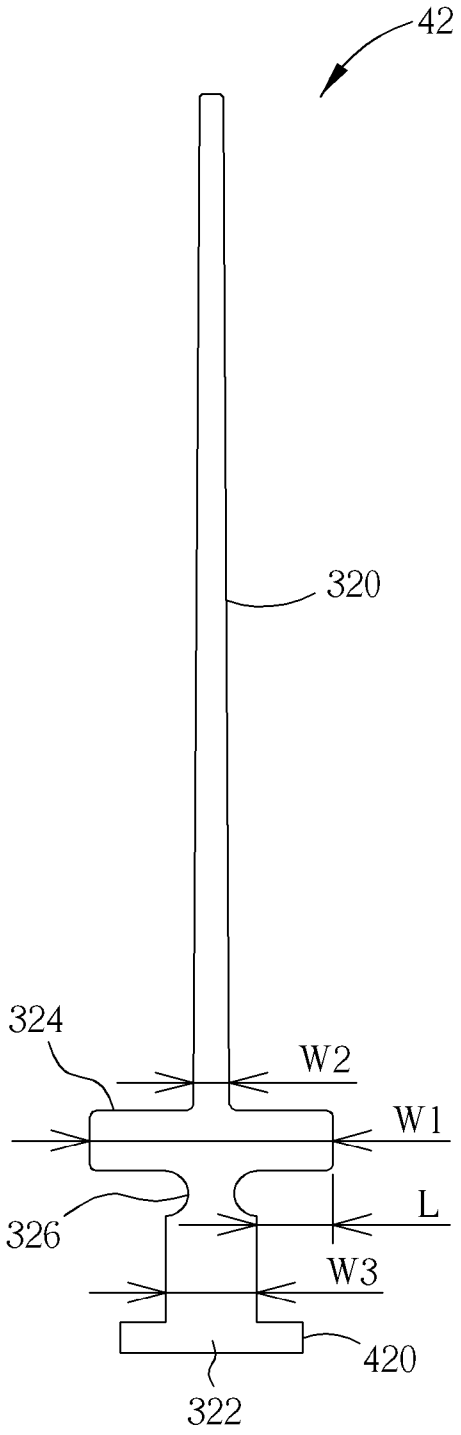


FIG. 7

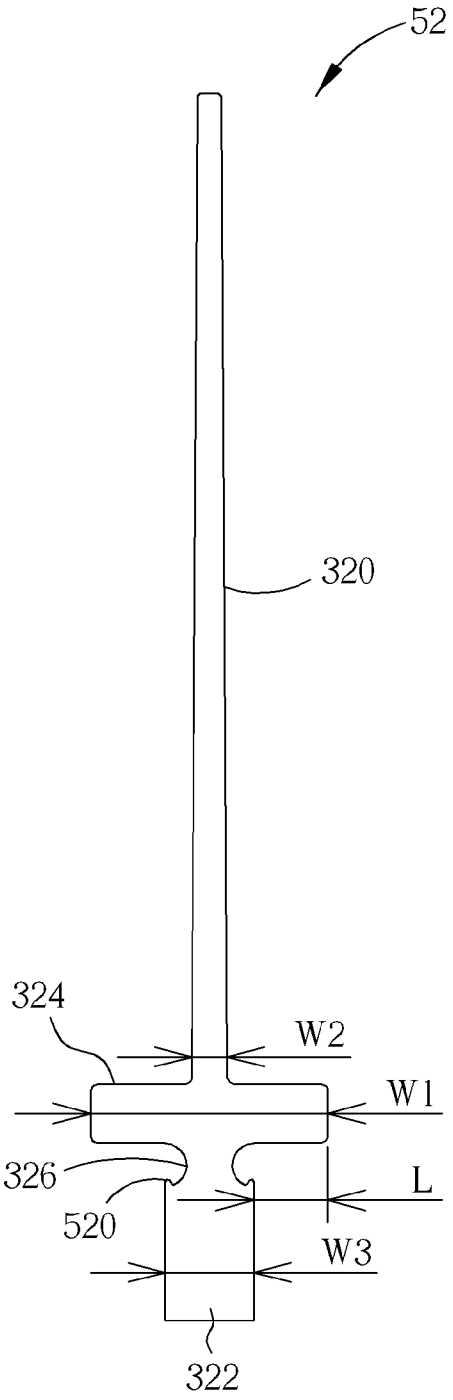


FIG. 8

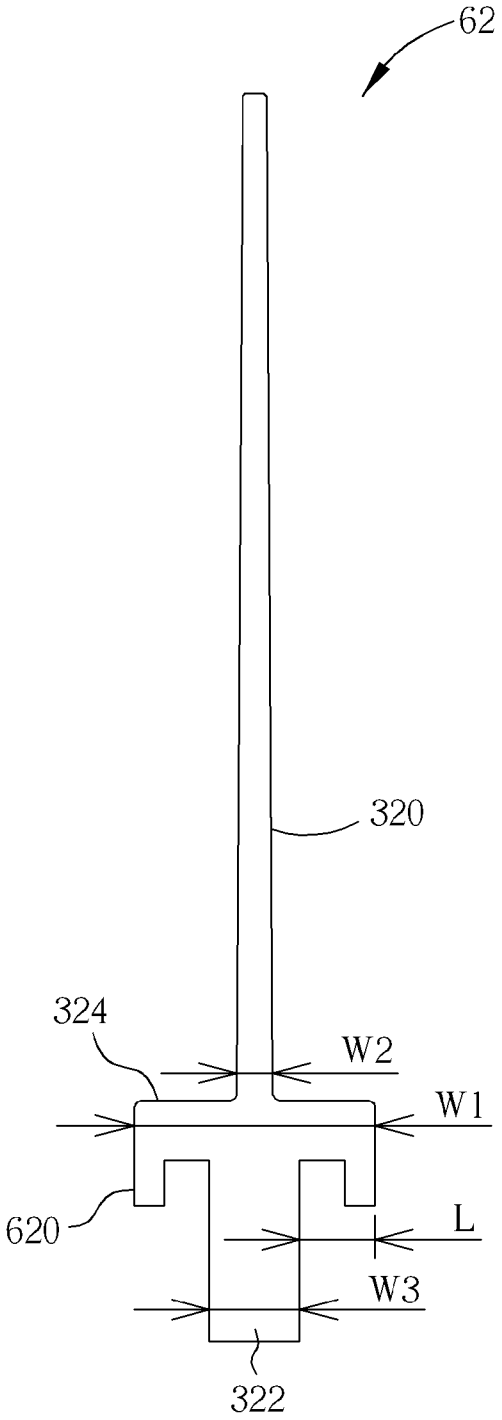


FIG. 9

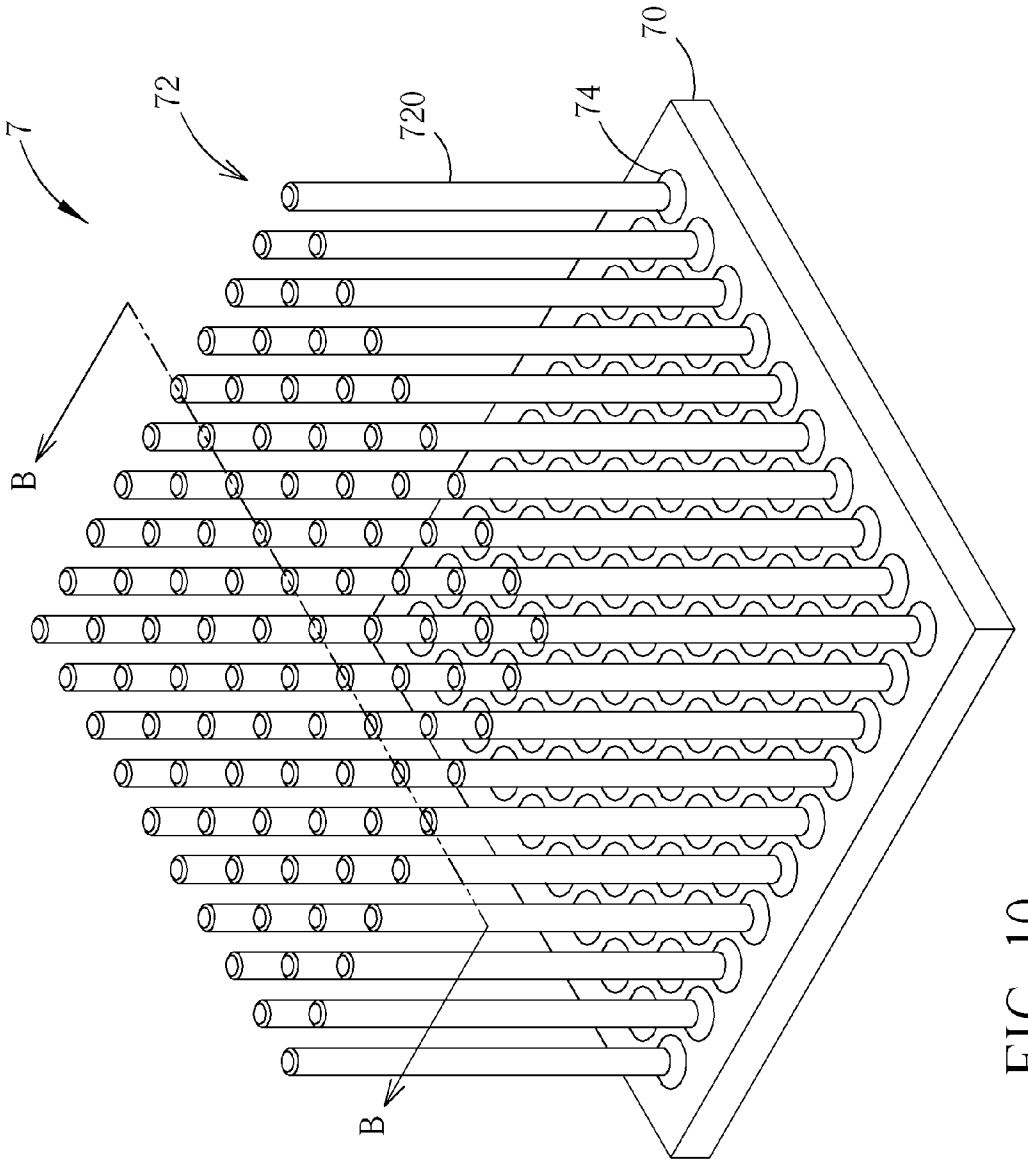


FIG. 10

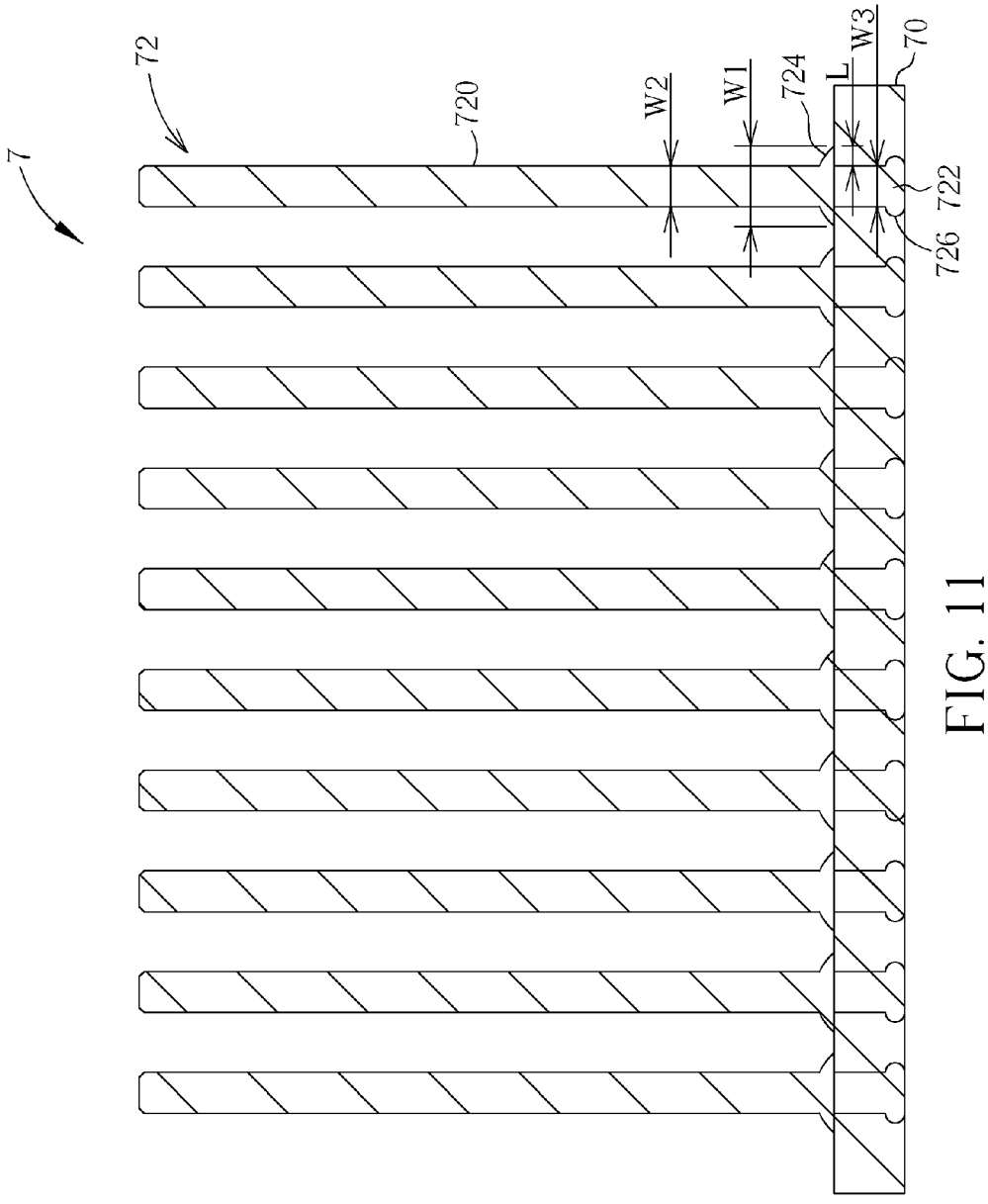


FIG. 11

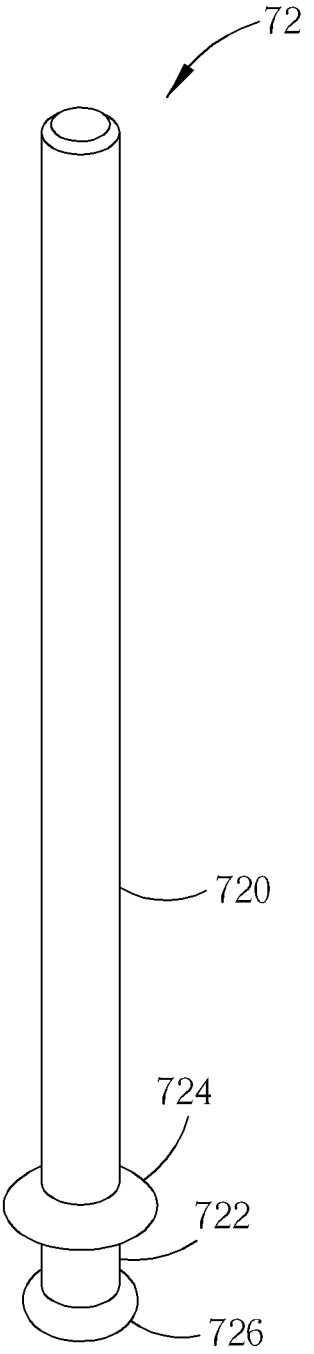


FIG. 12

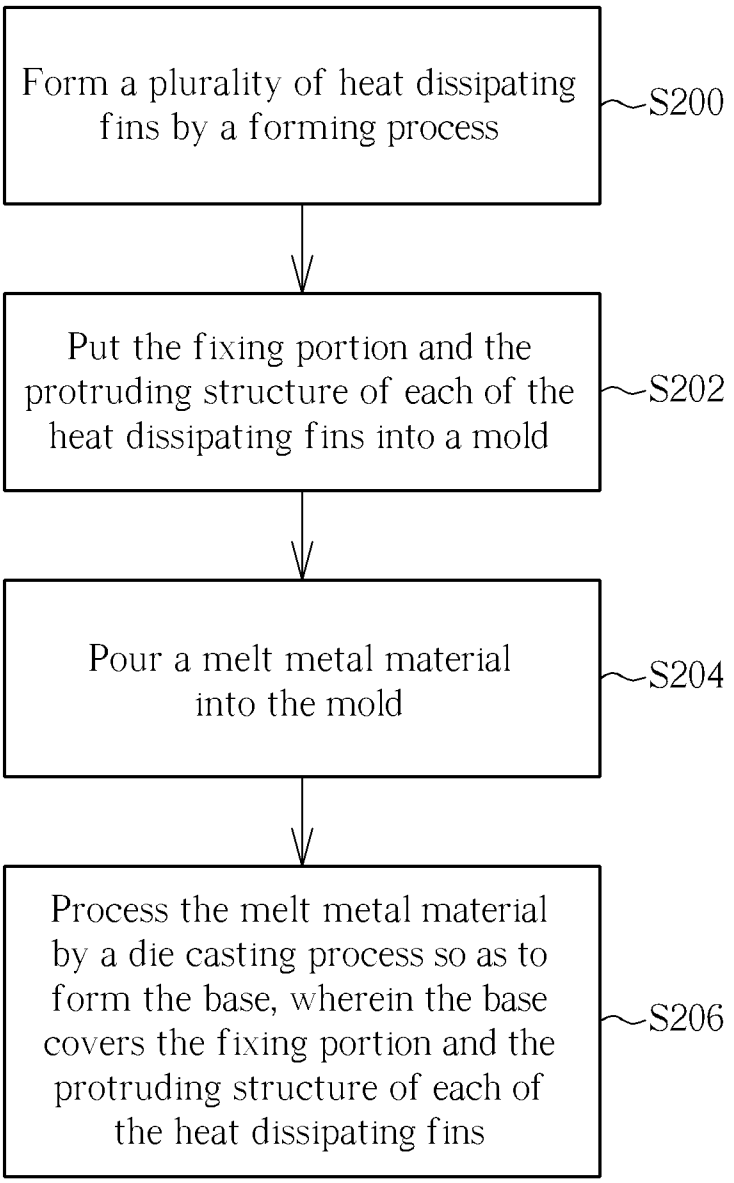

Form a plurality of heat dissipating fins by a forming process
S200
Put the fixing portion and the protruding structure of each of the heat dissipating fins into a mold
S202
Pour a melt metal material into the mold
S204
Process the melt metal material by a die casting process so as to form the base, wherein the base covers the fixing portion and the protruding structure of each of the heat dissipating fins
S206

FIG. 13

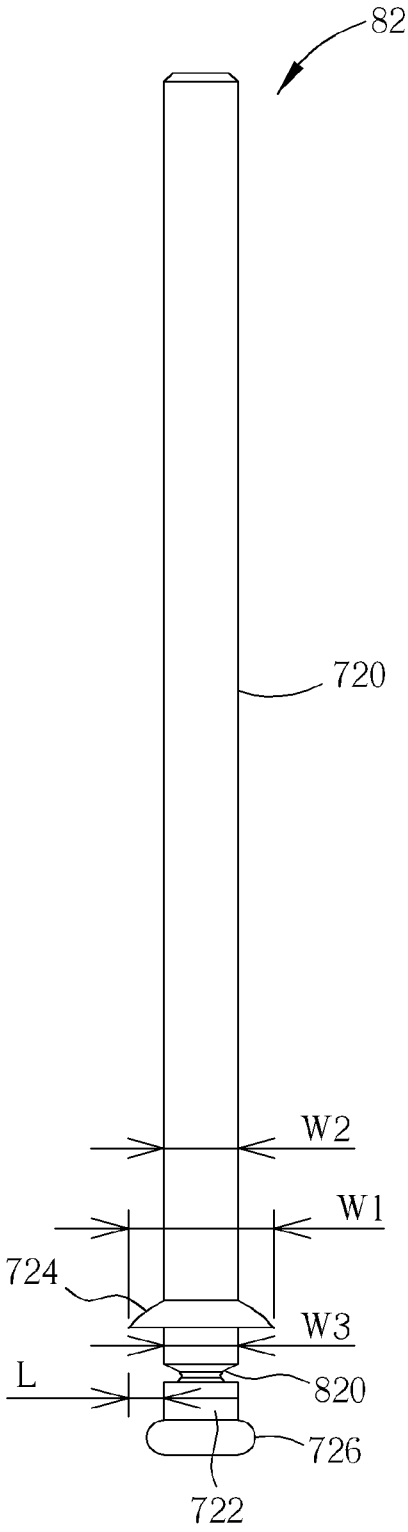


FIG. 14

HEAT DISSIPATING FIN, HEAT DISSIPATING DEVICE AND METHOD OF MANUFACTURING THE SAME

BACKGROUND OF THE INVENTION

[0001] 1. Field of the Invention

[0002] The invention relates to a heat dissipating fin, a heat dissipating device and a method of manufacturing the same and, more particularly, to a heat dissipating fin capable of preventing overflow while manufacturing a heat dissipating device.

[0003] 2. Description of the Prior Art

[0004] Heat dissipating device is a significant component for electronic products. When an electronic product is operating, the current in circuit will generate unnecessary heat due to impedance. If the heat is accumulated in the electronic components of the electronic product without dissipating immediately, the electronic components may get damage due to the accumulated heat. Therefore, the performance of heat dissipating device is a significant issue for the electronic product.

[0005] Referring to FIGS. **1** and **2**, FIG. **1** is a schematic diagram illustrating a flat-type heat dissipating fin **12** of the prior art, and FIG. **2** is a schematic diagram illustrating a cylinder-type heat dissipating fin **22** of the prior art. In general, a heat dissipating device is usually equipped with a flat-type heat dissipating fin **12** shown in FIG. **1** or a cylinder-type heat dissipating fin **22** shown in FIG. **2**. As shown in FIGS. **1** and **2**, the flat-type heat dissipating fin **12** and the cylinder-type heat dissipating fin **22** are formed with the bases **10**, **20** integrally by a die casting process. Due to the requirement of mold stripping during the die casting process, the flat-type heat dissipating fin **12** or the cylinder-type heat dissipating fin **22** has a draft angle a between 2 degrees and 3 degrees so that the whole weight of the fin is heavy and the height of the fin is limited. Furthermore, the number of heat dissipating fins is reduced in the heat dissipating device due to the draft angle a so that the heat dissipating area is not enough and the heat dissipating efficiency is worse.

SUMMARY OF THE INVENTION

[0006] The invention provides a heat dissipating fin capable of preventing overflow while manufacturing a heat dissipating device. The heat dissipating fin is formed by a forming process without the draft angle of the conventional heat dissipating fin, so as to solve the aforesaid problems.

[0007] As mentioned in the above, the invention forms the heat dissipating fin by the forming process (e.g. aluminum extrusion process, rivet forming process, etc.) first and then forms the base, which covers the fixing portion of the heat dissipating fin, by the die casting process with the melt metal material. The heat dissipating fin of the invention has the overflow-proof structure capable of preventing the melt metal material from overflowing during the die casting process so as to prevent deckle edge from being generated. Since the heat dissipating fin of the invention is formed by the forming process, the draft angle of the conventional heat dissipating fin is unnecessary for the heat dissipating fin of the invention. Therefore, the whole weight of the heat dissipating fin of the invention can be lighter and the height of the heat dissipating fin of the invention can be higher than the prior art. Furthermore, the number of heat dissipating fins of the invention can be increased in the heat dissipating device so that the heat dissipating area can be increased and the heat dissipating efficiency can be enhanced.

[0008] These and other objectives of the present invention will no doubt become obvious to those of ordinary skill in the art after reading the following detailed description of the preferred embodiment that is illustrated in the various figures and drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

[0009] FIG. **1** is a schematic diagram illustrating a flat-type heat dissipating fin of the prior art.

[0010] FIG. **2** is a schematic diagram illustrating a cylinder-type heat dissipating fin of the prior art.

[0011] FIG. **3** is a schematic diagram illustrating a heat dissipating device according to a first embodiment of the invention.

[0012] FIG. **4** is a cross-sectional view illustrating the heat dissipating device along line A-A shown in FIG. **3**.

[0013] FIG. **5** is a schematic diagram illustrating the heat dissipating fin shown in FIG. **3**.

[0014] FIG. **6** is a flowchart illustrating a method of manufacturing the heat dissipating device shown in FIG. **3**.

[0015] FIG. **7** is a cross-sectional view illustrating a heat dissipating fin according to a second embodiment of the invention.

[0016] FIG. **8** is a cross-sectional view illustrating a heat dissipating fin according to a third embodiment of the invention.

[0017] FIG. **9** is a cross-sectional view illustrating a heat dissipating fin according to a fourth embodiment of the invention.

[0018] FIG. **10** is a cross-sectional view illustrating a heat dissipating fin according to a fifth embodiment of the invention.

[0019] FIG. **11** is a cross-sectional view illustrating the heat dissipating device along line B-B shown in FIG. **10**.

[0020] FIG. **12** is a schematic diagram illustrating the heat dissipating fin shown in FIG. **10**.

[0021] FIG. **13** is a flowchart illustrating a method of manufacturing the heat dissipating device shown in FIG. **10**.

[0022] FIG. **14** is a cross-sectional view illustrating a heat dissipating fin according to a sixth embodiment of the invention.

DETAILED DESCRIPTION

[0023] Referring to FIGS. **3** to **5**, FIG. **3** is a schematic diagram illustrating a heat dissipating device **3** according to a first embodiment of the invention, FIG. **4** is a cross-sectional view illustrating the heat dissipating device **3** along line A-A shown in FIG. **3**, and FIG. **5** is a schematic diagram illustrating the heat dissipating fin **32** shown in FIG. **3**. As shown in FIGS. **3** and **4**, the heat dissipating device **3** comprises a base **30** and a plurality of heat dissipating fins **32**. As shown in FIGS. **4** and **5**, each of the heat dissipating fins **32** comprises a heat dissipating portion **320**, a fixing portion **322** and an overflow-proof structure **324**. The fixing portion **322** is fixed in the base **30**. The overflow-proof structure **324** is connected between the heat dissipating portion **320** and the fixing portion **322**. A width W1 of the overflow-proof structure **324** is larger than a width W2 of the heat dissipating portion **320** and larger than a width W3 of the fixing portion **322**. In this embodiment, a length L of the overflow-proof structure **324**

protruded from the fixing portion **322** can be between 1 mm and 10 mm, wherein a thickness of the overflow-proof structure **324** is uniform. In another embodiment, a thickness of the overflow-proof structure **324** may vary gradiently.

[0024] Furthermore, each of the heat dissipating fins **32** may further comprise a recess structure **326** formed on the fixing portion **322**. In this embodiment, the recess structure **326** is arc-shaped. In another embodiment, the recess structure **326** may be polygon-shaped.

[0025] Referring to FIG. **6**, FIG. **6** is a flowchart illustrating a method of manufacturing the heat dissipating device **3** shown in FIG. **3**. First of all, step S**100** is performed to form a plurality of heat dissipating fins **32** by a forming process. In this embodiment, the aforesaid forming process may be an aluminum extrusion process so as to form each of the heat dissipating fins **32** as a flat-type heat dissipating fin. Afterward, step S**102** is performed to put the fixing portion **322** of each of the heat dissipating fins **32** into a mold (not shown). Step S**104** is then performed to pour a melt metal material (e.g. aluminum, etc.) into the mold. Finally, step S**106** is performed to process the melt metal material by a die casting process so as to form the base **30**, wherein the base **30** covers the fixing portion **322** of each of the heat dissipating fins **32**, as shown in FIG. **4**. In this embodiment, the overflow-proof structure **324** of each of the heat dissipating fins **32** is capable of preventing the melt metal material from overflowing during the die casting process so as to prevent deckle edge from being generated. When the length L of the overflow-proof structure **324** protruded from the fixing portion **322** is between 1 mm and 10 mm, the overflow-proof structure **324** can prevent the melt metal material from overflowing during the die casting process effectively so as to prevent deckle edge from being generated. Furthermore, the recess structure **326** of each of the heat dissipating fins **32** can hold the metal material effectively so as to enhance the combination strength between the base **30** and the heat dissipating fins **32**.

[0026] Referring to FIG. **7** along with FIG. **4**, FIG. **7** is a cross-sectional view illustrating a heat dissipating fin **42** according to a second embodiment of the invention. The difference between the heat dissipating fin **42** and the aforesaid heat dissipating fin **32** is that the heat dissipating fin **42** further comprises a protruding structure **420**. As shown in FIG. **7**, the protruding structure **420** protrudes from one end of the fixing portion **322**. When the heat dissipating fin **32** shown in FIG. **4** is replaced by the heat dissipating fin **42** shown in FIG. **7**, the protruding structure **420** of the heat dissipating fin **42** can cooperate with the overflow-proof structure **324** to hold the metal material so as to enhance the combination strength between the base **30** and the heat dissipating fin **42**. It should be noted that the same elements in FIG. **7** and FIG. **4** are represented by the same numerals, so the repeated explanation will not be depicted herein again. Moreover, the heat dissipating fin **42** can be also formed by the forming process of the aforesaid step S**100**.

[0027] Referring to FIG. **8** along with FIG. **4**, FIG. **8** is a cross-sectional view illustrating a heat dissipating fin **52** according to a third embodiment of the invention. The difference between the heat dissipating fin **52** and the aforesaid heat dissipating fin **32** is that the heat dissipating fin **52** further comprises a hook structure **520**. As shown in FIG. **8**, the hook structure **520** is formed in the recess structure **326**. When the heat dissipating fin **32** shown in FIG. **4** is replaced by the heat dissipating fin **52** shown in FIG. **8**, the hook structure **520** of the heat dissipating fin **52** can hook the metal material so as to enhance the combination strength between the base **30** and the heat dissipating fin **52**. It should be noted that the same elements in FIG. **8** and FIG. **4** are represented by the same numerals, so the repeated explanation will not be depicted herein again. Moreover, the heat dissipating fin **52** can be also formed by the forming process of the aforesaid step S**100**.

[0028] Referring to FIG. **9** along with FIG. **4**, FIG. **9** is a cross-sectional view illustrating a heat dissipating fin **62** according to a fourth embodiment of the invention. The difference between the heat dissipating fin **62** and the aforesaid heat dissipating fin **32** is that the heat dissipating fin **62** further comprises an extending structure **620** and does not comprise the aforesaid recess structure **326**. As shown in FIG. **9**, the extending structure **620** is extended from the overflow-proof structure **324** toward the fixing portion **322**, and the overflow-proof structure **324** and the extending structure **620** are formed as U-shape. When the heat dissipating fin **32** shown in FIG. **4** is replaced by the heat dissipating fin **62** shown in FIG. **9**, the extending structure **620** of the heat dissipating fin **62** can cooperate with the overflow-proof structure **324** to hold the metal material so as to enhance the combination strength between the base **30** and the heat dissipating fin **62**. It should be noted that the same elements in FIG. **9** and FIG. **4** are represented by the same numerals, so the repeated explanation will not be depicted herein again. Moreover, the heat dissipating fin **62** can be also formed by the forming process of the aforesaid step S**100**.

[0029] Referring to FIGS. **10** to **12**, FIG. **10** is a schematic diagram illustrating a heat dissipating device **7** according to a fifth embodiment of the invention, FIG. **11** is a cross-sectional view illustrating the heat dissipating device **7** along line B-B shown in FIG. **10**, and FIG. **12** is a schematic diagram illustrating the heat dissipating fin **72** shown in FIG. **10**. As shown in FIGS. **10** and **11**, the heat dissipating device **7** comprises a base **70** and a plurality of heat dissipating fins **72**. As shown in FIGS. **11** and **12**, each of the heat dissipating fins **72** comprises a heat dissipating portion **720**, a fixing portion **722**, an overflow-proof structure **724** and a protruding structure **726**. The fixing portion **722** and the protruding structure **726** are fixed in the base **70**. The overflow-proof structure **724** is connected between the heat dissipating portion **720** and the fixing portion **722**. A width W**1** of the overflow-proof structure **724** is larger than a width W**2** of the heat dissipating portion **720** and larger than a width W**3** of the fixing portion **722**. In this embodiment, a length L of the overflow-proof structure **724** protruded from the fixing portion **722** can be between 1 mm and 10 mm. The protruding structure **726** protrudes from one end of the fixing portion **722**. In this embodiment, a thickness of the overflow-proof structure **724** varies gradiently. In another embodiment, a thickness of the overflow-proof structure **724** may be uniform.

[0030] Referring to FIG. **13**, FIG. **13** is a flowchart illustrating a method of manufacturing the heat dissipating device **7** shown in FIG. **10**. First of all, step S**200** is performed to form a plurality of heat dissipating fins **72** by a forming process. In this embodiment, the aforesaid forming process may be a rivet forming process so as to form each of the heat dissipating fins **72** as a cylinder-type heat dissipating fin. Afterward, step S**202** is performed to put the fixing portion **722** and the protruding structure **726** of each of the heat dissipating fins **72** into a mold (not shown). Step S**204** is then performed to pour a melt metal material (e.g. aluminum, etc.) into the mold. Finally, step S**206** is performed to process the melt metal material by a die casting process so as to form the

base **70**, wherein the base **70** covers the fixing portion **722** and the protruding structure **726** of each of the heat dissipating fins **72**, as shown in FIG. **11**. In this embodiment, the overflow-proof structure **724** of each of the heat dissipating fins **72** is capable of preventing the melt metal material from overflowing during the die casting process so as to prevent deckle edge from being generated. When the length L of the overflow-proof structure **724** protruded from the fixing portion **722** is between 1 mm and 10 mm, the overflow-proof structure **724** can prevent the melt metal material from overflowing during the die casting process effectively so as to prevent deckle edge from being generated. Furthermore, the protruding structure **726** of each of the heat dissipating fins **72** can cooperate with the overflow-proof structure **724** to hold the metal material so as to enhance the combination strength between the base **70** and the heat dissipating fins **72**.

[0031] Referring to FIG. **14** along with FIG. **11**, FIG. **14** is a cross-sectional view illustrating a heat dissipating fin **82** according to a sixth embodiment of the invention. The difference between the heat dissipating fin **82** and the aforesaid heat dissipating fin **72** is that the heat dissipating fin **82** further comprises a recess structure **820**. As shown in FIG. **14**, the recess structure **820** is formed on the fixing portion **722**. When the heat dissipating fin **72** shown in FIG. **11** is replaced by the heat dissipating fin **82** shown in FIG. **14**, the recess structure **820** of the heat dissipating fin **82** can hold the metal material effectively so as to enhance the combination strength between the base **70** and the heat dissipating fin **82**. It should be noted that the same elements in FIG. **14** and FIG. **11** are represented by the same numerals, so the repeated explanation will not be depicted herein again. Moreover, the heat dissipating fin **82** can be also formed by the forming process of the aforesaid step S**200**.

[0032] As mentioned in the above, the invention forms the heat dissipating fin by the forming process (e.g. aluminum extrusion process, rivet forming process, etc.) first and then forms the base, which covers the fixing portion of the heat dissipating fin, by the die casting process with the melt metal material. The heat dissipating fin of the invention has the overflow-proof structure capable of preventing the melt metal material from overflowing during the die casting process so as to prevent deckle edge from being generated. Since the heat dissipating fin of the invention is formed by the forming process, the draft angle of the conventional heat dissipating fin is unnecessary for the heat dissipating fin of the invention. Therefore, the whole weight of the heat dissipating fin of the invention can be lighter and the height of the heat dissipating fin of the invention can be higher than the prior art. Furthermore, the number of heat dissipating fins of the invention can be increased in the heat dissipating device so that the heat dissipating area can be increased and the heat dissipating efficiency can be enhanced. Moreover, the invention may form the recess structure, the protruding structure, the hook structure and/or the extending structure on the heat dissipating fin so as to enhance the combination strength between the base and the heat dissipating fin.

[0033] Those skilled in the art will readily observe that numerous modifications and alterations of the device and method may be made while retaining the teachings of the invention. Accordingly, the above disclosure should be construed as limited only by the metes and bounds of the appended claims.

1. A heat dissipating fin comprising:
a heat dissipating portion;
a fixing portion; and
an overflow-proof structure connected between the heat dissipating portion and the fixing portion;
wherein a width of the overflow-proof structure is larger than a width of the heat dissipating portion.

2. The heat dissipating fin of claim **1**, wherein a length of the overflow-proof structure protruded from the fixing portion is between 1 mm and 10 mm.

3. The heat dissipating fin of claim **1**, further comprising a recess structure formed on the fixing portion.

4. The heat dissipating fin of claim **3**, further comprising a hook structure formed in the recess structure.

5. The heat dissipating fin of claim **1**, further comprising a protruding structure protruded from one end of the fixing portion.

6. The heat dissipating fin of claim **1**, further comprising an extending structure extended from the overflow-proof structure toward the fixing portion.

7. The heat dissipating fin of claim **6**, wherein the overflow-proof structure and the extending structure are formed as U-shape.

8. The heat dissipating fin of claim **1**, wherein a thickness of the overflow-proof structure is uniform or varies gradiently.

9. A heat dissipating device comprising:
a base; and
a plurality of heat dissipating fins, each of the heat dissipating fins comprising:
a heat dissipating portion;
a fixing portion fixed in the base; and
an overflow-proof structure connected between the heat dissipating portion and the fixing portion;
wherein a width of the overflow-proof structure is larger than a width of the heat dissipating portion.

10. The heat dissipating device of claim **9**, wherein each of the heat dissipating fins further comprises a recess structure formed on the fixing portion.

11. The heat dissipating device of claim **10**, wherein each of the heat dissipating fins further comprises a hook structure formed in the recess structure.

12. The heat dissipating device of claim **9**, wherein each of the heat dissipating fins further comprises a protruding structure protruded from one end of the fixing portion.

13. The heat dissipating device of claim **9**, wherein each of the heat dissipating fins further comprises an extending structure extended from the overflow-proof structure toward the fixing portion.

14. The heat dissipating device of claim **13**, wherein the overflow-proof structure and the extending structure are formed as U-shape.

15. The heat dissipating device of claim **9**, wherein a thickness of the overflow-proof structure is uniform or varies gradiently.

16. A method of manufacturing a heat dissipating device comprising:
forming a plurality of heat dissipating fins by a forming process, wherein each of the heat dissipating fins comprises a heat dissipating portion, a fixing portion and an overflow-proof structure, the overflow-proof structure is connected between the heat dissipating portion and the fixing portion, a width of the overflow-proof structure is larger than a width of the heat dissipating portion;

putting the fixing portion of each of the heat dissipating fins into a mold;

pouring a melt metal material into the mold; and

processing the melt metal material by a die casting process so as to form a base, wherein the base covers the fixing portion of each of the heat dissipating fins and the overflow-proof structure of each of the heat dissipating fins prevents the melt metal material from overflowing.

17. The method of claim **16**, wherein the forming process is an aluminum extrusion process and each of the heat dissipating fins is a flat-type heat dissipating fin, or the forming process is a rivet forming process and each of the heat dissipating fins is a cylinder-type heat dissipating fin.

18. The method of claim **16**, wherein forming a plurality of heat dissipating fins by a forming process further comprises forming a recess structure on the fixing portion.

19. The method of claim **16**, wherein forming a plurality of heat dissipating fins by a forming process further comprises forming a protruding structure on the fixing portion and enabling the protruding structure to protrude from one end of the fixing portion.

20. The method of claim **16**, wherein forming a plurality of heat dissipating fins by a forming process further comprises forming an extending structure on the overflow-proof structure and enabling the extending structure to extend from the overflow-proof structure toward the fixing portion.

21. The heat dissipating fin of claim **1**, wherein the width of the overflow-proof structure is larger than a width of the fixing portion.

22. The heat dissipating device of claim **9**, wherein the width of the overflow-proof structure is larger than a width of the fixing portion.

23. The method of claim **16**, wherein the width of the overflow-proof structure is larger than a width of the fixing portion.

* * * * *