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Inventor(s) MAO; TZE-CHERN et al.

## IMMERSION COOLING TANK

### Abstract

An immersion cooling tank includes a tank body and a liquid flow tube. The tank body holds a coolant and an electronic device. The tank body defines an inlet and an outlet. The inlet and the outlet are respectively located at opposite ends of the electronic device for inputting and outputting the coolant. The coolant flows through the electronic device. The liquid flow tube includes at least one adjuster. The liquid flow tube is located inside the tank body and coupled to at least one of the inlet or the outlet. The at least one adjuster faces the electronic device for controlling an amount of the coolant flowing in or out of the tank body.

**Inventors:** **MAO; TZE-CHERN (New Taipei, TW), FU; YEN-CHUN (New Taipei, TW), CHANG; CHIH-HUNG (New Taipei, TW), CHANG; YAO-TING (New Taipei, TW), CHANG; LI-WEN (New Taipei, TW), WEI; CHAO-KE (New Taipei, TW)**

**Applicant:** **Fulian Precision Electronics (Tianjin) Co., LTD.** (Tianjin, CN)

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## Background/Summary

FIELD

[0001] The present disclosure relates to cooling systems, and more particularly to an immersion cooling tank.

BACKGROUND

[0002] Servers generate large amounts of heat. One way to cool a server is to immerse the server in a tank with coolant. However, due to uneven flow rates of the coolant, the coolant adjacent to an outlet of the tank flows slower than the coolant further away from the outlet, which causes uneven dissipation of heat of the server.

[0003] Therefore, improvement is desired.

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## Description

BRIEF DESCRIPTION OF THE DRAWINGS

[0004] Implementations of the present disclosure will now be described, by way of embodiments, with reference to the attached figures.

[0005] FIG. **1** is a schematic diagram of a first embodiment of an immersion cooling tank according to the present disclosure.

[0006] FIG. **2** is a schematic diagram of a cooling system and the immersion cooling tank of FIG. **1** according to the present disclosure.

[0007] FIG. **3** is a diagram of a first flow tube and a plurality of adjusters of the immersion cooling tank according to the present disclosure.

[0008] FIG. **4** is a schematic diagram of a second embodiment of the immersion cooling tank according to the present disclosure.

[0009] FIG. **5** is a schematic diagram of a cooling system and the immersion cooling tank of FIG. **4** according to the present disclosure.

DETAILED DESCRIPTION

[0010] It will be appreciated that for simplicity and clarity of illustration, where appropriate, reference numerals have been repeated among the different figures to indicate corresponding or analogous elements. Additionally, numerous specific details are set forth in order to provide a thorough understanding of the embodiments described herein. However, it will be understood by those of ordinary skill in the art that the embodiments described herein can be practiced without these specific details. In other instances, methods, procedures and components have not been described in detail so as not to obscure the related relevant feature being described. The drawings are not necessarily to scale and the proportions of certain parts may be exaggerated to better illustrate details and features. The description is not to be considered as limiting the scope of the

embodiments described herein.
[0011] Several definitions that apply throughout this disclosure will now be presented.
[0012] The term “coupled” is defined as connected, whether directly or indirectly through intervening components, and is not necessarily limited to physical connections. The connection can be such that the objects are permanently connected or releasably connected. The term “comprising” means “including, but not necessarily limited to”; it specifically indicates open-ended inclusion or membership in a so-described combination, group, series and the like.
First Embodiment
[0013] Referring to FIGS. **1** and **2**, a cooling system **100** for cooling an electronic device **200** includes an immersion cooling tank **1** and a cold source distributor **5**. The immersion cooling tank **1** is connected to the cold source distributor **5**. The immersion cooling tank **1** is used for holding a coolant **20** to soak the electronic device **200**, and the cold source distributor **5** provides the coolant **20** to the immersion cooling tank **1** and performs heat exchange for the coolant **20**, so as to continuously provide the immersion cooling tank **1** with the coolant **20**.
[0014] The immersion cooling tank **1** includes a tank body **10** and a liquid flow tube **30**. The liquid flow tube **30** is located inside the tank body **10** and connected to the tank body **10**. The coolant **20** flows into the tank body **10** or out of the tank body **10** through the liquid flow tube **30**.
[0015] Referring to FIG. **1**, an inlet **11** and an outlet **12** are defined in the tank body **10**. The inlet **11** and the outlet **12** are located at opposite ends of the electronic device **200** for inputting and outputting the coolant **20**. The liquid flow tube **30** is provided with an adjuster **33**, and an end of the liquid flow tube **30** is connected to at least one of the inlet **11** or the outlet **12** inside the tank body **10**. The adjuster **33** faces the electronic device **200** to control the inflow or outflow of the coolant **20**.
[0016] When the electronic device **200** is immersed in the tank body **10** for cooling, the coolant **20** flows through the electronic device **200**. The liquid flow tube **30** connected to the inlet **11** or the outlet **12** of the tank body **10** controls the amount of the coolant **20** flowing into or out of the tank body **10** through the adjuster **33** so that the coolant **20** in the tank body **10** flows uniformly, and the electronic device **200** is cooled uniformly.
[0017] In one embodiment, in order to better cool the electronic device **200**, the inlet **11** and the outlet **12** are respectively provided at a lower end and an upper end of the tank body **10**. It can be understood that the positions of the inlet **11** and the outlet **12** can be switched, such that the inlet **11** is provided at the upper end, and the outlet **12** is provided at the lower end. The inlet **11** and the outlet **12** can also take on other forms. The coolant **20** flowing from the inlet **11** flows through the electronic device **200** and carries the heat generated by the electronic device **200** through the outlet **12**.
[0018] In one embodiment, the liquid flow tube **30** includes a first flow tube **31** and a second flow tube **32**. One end of the first flow tube **31** is connected to the inlet **11**, and one end of the second flow tube **32** is connected to the outlet **12**. The first flow tube **31** and the second flow tube **32** are provided at opposite ends of the electronic device **200** and arranged in parallel.
[0019] Referring to FIGS. **1** and **3**, the first flow tube **31** and the second flow tube **32** define a plurality of openings **311** facing the electronic device **200**. The plurality of openings **311** are arranged in parallel on the first flow tube **31** and the second flow tube **32**.
[0020] Referring to FIG. **1**, the first flow tube **31** and the second flow tube **32** each include a plurality of adjusters **33**. The plurality of adjusters **33** is mounted in the openings **311** and communicates with the first flow tube **31** and the second flow tube **32** so that the coolant **20** in the first flow tube **31** and the second flow tube **32** can flow out from or flow into the adjusters **33**.
[0021] In one embodiment, the first flow tube **31** and the second flow tube **32** are each provided with four adjusters **33**. It can be understood that, in other embodiments, the number of the adjusters **33** may be more or less according to the structures of the first flow tube **31** and the second flow tube **32**. The adjuster **33** has a substantially truncated cone shape. In other embodiments, the shape

of the adjuster **33** is not limited thereto.

[0022] Referring to FIG. **2**, the cold source distributor **5** is located on one side of the tank body **10** and connected to the inlet **11** and the outlet **12** of the tank body **10**. The cold source distributor **5** includes a cold source tube **50**, a heat return tube **51**, and a heat exchanger **52**. One end of the cold source tube **50** is connected to the inlet **11**, and one end of the heat return tube **51** is connected to the outlet **12**. The other ends of the cold source tube **50** and the heat return tube **51** are connected to the heat exchanger **52**, and a pump **53** is located between the heat return tube **51** and the heat exchanger **52**. The pump **53** causes the coolant **20** to flow out of the tank body **10** to the cold source distributor **5**. The cold source tube **50** provides cooled coolant **20** to the tank body **10**, and the heat return tube **51** transfers the heated coolant **20** to the cold source distributor **5**.

[0023] The cold source distributor **5** further includes a cooling nozzle **54** and a heat return nozzle **55**. One end of the cooling nozzle **54** and one end of the heat return nozzle **55** are connected to the heat exchanger **52**. The cooling nozzle **54** provides cooling water to the heat exchanger **52**, and the heat return nozzle **55** transports heated water from the heat exchanger **52** out of the heat exchanger **52**. Specifically, in the cold source distributor **5**, the cooling water is transported to the heat exchanger **52** through the cooling nozzle **54**, and the heated coolant **20** is cooled by the cooling water and then transported to the tank body **10**. After the coolant **20** absorbs heat from the electronic device **200** and becomes heated, the heated coolant **20** is output through the heat return tube **51** to the heat exchanger **52** through the pump **53**. After the heated coolant **20** exchanges the heat with the cooling water provided by the cooling nozzle **54**, the coolant **20** is transported to the tank body **10** through the cold source tube **50** again. The cooling water that has undergone heat exchange with the heated coolant **20** becomes heated and is output from the cold source distributor **5** through the heat return nozzle **55**. It can be understood that the heated water output from the cold source distributor **5** can be reused with minimal waste.

[0024] Referring to FIGS. **1**, **2**, and **3**, a plurality of electronic devices **200** is placed in the tank body **10** for cooling. The cold source distributor **5** provides the tank body **10** with the coolant **20**. The coolant **20** flows through the first flow tube **31** connected to the inlet **11** and is discharged from the adjusters **33** into the tank body **10**. The amount of the coolant **20** around the electronic device **200** adjacent to the inlet **11** and the amount of coolant **20** around the electronic devices **200** further away from the inlet **11** are uniform, and the heat generated by the electronic devices **200** is transferred to the coolant **20**.

[0025] The pump **53** of the cold source distributor **5** drives the heated coolant **20** to flow through the adjusters **33** of the second flow tube **32** and the heat return tube **51** into the heat exchanger **52**. In the heat exchanger **52**, the heated coolant **20** performs the heat exchange with the cooling water, then the coolant **20** is transported back into the tank body **10**, and the heated cooling water is transported through the heat return nozzle **55** out of the cold source distributor **5**. The electronic devices **200** are cooled by the coolant **20** circulating between the cold source distributor **5** and the immersion cooling tank **1**.

[0026] In this embodiment, the electronic devices **200** are servers. It can be understood that the electronic devices **200** may also be other devices capable of generating heat.

Second Embodiment

[0027] Referring to FIG. **3**, FIG. **4**, and FIG. **5**, a second embodiment of the immersion cooling tank **1** differs from the first embodiment in that the first flow tube **31** is omitted from the inlet **11** of the tank body **10**. Instead, a driving member **40** for driving the coolant **20** is provided at one end of the electronic devices **200** adjacent to the inlet **11**. The driving member **40** and the second flow tube **32** are respectively arranged at opposite ends of the electronic device **200**.

[0028] Referring to FIG. **4**, a driving direction of the driving member **40** is the same as a flow direction of the coolant **20**. In one embodiment, the driving member **40** is a fan blade. It can be understood that the driving member **40** can also be replaced with other structures capable of driving the coolant **20** in the tank body **10**. One driving member **40** is provided at a lower end of each of two electronic devices **200** adjacent to the inlet **11**. It can be understood that the coolant **20** adjacent to the inlet **11** flows faster than the coolant **20** flowing upwards. Therefore, the driving members **40** located adjacent to the inlet **11** increase the flow of the coolant **20** flowing through the electronic devices **200**.

[0029] When the coolant **20** flowing into the tank body **10** passes through the driving member **40** to the second flow tube **32**, the coolant **20** takes away the heat generated by the electronic devices **200**, and then flows out of the tank body **10** through the second flow tube **32**.

[0030] In summary, the embodiments of the present disclosure provide the immersion cooling tank **1** and the cooling system **100** for uniformly cooling the electronic devices **200**, thereby avoiding uneven cooling of the electronic devices **200** due to uneven flow rates of the coolant **20** adjacent to the inlet **11** or the outlet **12**.

[0031] The embodiments shown and described above are only examples. Even though numerous characteristics and advantages of the present technology have been set forth in the foregoing description, together with details of the structure and function of the present disclosure, the disclosure is illustrative only, and changes may be made in the detail, including in matters of shape, size and arrangement of the parts within the principles of the present disclosure up to, and including, the full extent established by the broad general meaning of the terms used in the claims.

## Claims

**1**. An immersion cooling tank comprising: a tank body configured to hold a coolant and an electronic device, the tank body defining an inlet and an outlet, the inlet and the outlet respectively located at opposite ends of the electronic device and being configured for inputting and outputting the coolant, a flow passage being formed for the coolant to circulate through the electronic device; and a liquid flow tube comprising at least one adjuster, the liquid flow tube located inside the tank body and coupled to at least one of the inlet or the outlet, the at least one adjuster facing the electronic device for controlling an amount of the coolant flowing in or out of the tank body, wherein the liquid flow tube comprises a first flow tube and a second flow tube; the first flow tube is coupled to the inlet, and the second flow tube is coupled to the outlet; the first flow tube and the second flow tube are respectively located at opposite ends of the electronic device and arranged in parallel; the flow passage of the coolant comprises the tank body, the inlet, the first flow tube, circulating through the electronic device, the second flow tube, and the outlet, the liquid flow tube defines at least one opening facing the electronic device; the at least one adjuster is mounted in the at least one opening and communicates with the liquid flow tube; wherein the tank body comprises at least one driving member for driving the coolant to flow, the liquid flow tube and the at least one driving member are respectively located at opposite ends of the electronic device, and the at least one driving member is located adjacent to the inlet; and a driving direction of the at least one driving member is same as the direction of the flow passage of the coolant.

**2**. The immersion cooling tank of claim 1, wherein the liquid flow tube is coupled to the outlet; and the coolant flows in a direction from the at least one driving member to the liquid flow tube through the electronic device, and the coolant carries heat generated by the electronic device to the liquid flow tube.

**3**. The immersion cooling tank of claim 2, wherein the at least one driving member is a fan blade.

**4**. The immersion cooling tank of claim 3, wherein the liquid flow tube defines a plurality of openings arranged in parallel.

**5**. An immersion cooling tank comprising: a tank body configured to hold coolant and an electronic device, the tank body defining an inlet and an outlet, the inlet and the outlet respectively located at opposite ends of the electronic device and being configured for inputting and outputting the coolant, a flow passage being formed for the coolant to circulate through the electronic device; and a liquid flow tube comprising at least one adjuster, the liquid flow tube located inside the tank body and coupled to at least one of the inlet or the outlet, the at least one adjuster facing the electronic device for controlling an amount of the coolant flowing in or out of the tank body, wherein the liquid flow tube comprises a first flow tube and a second flow tube; the first flow tube is coupled to the inlet, and the second flow tube is coupled to the outlet; the first flow tube and the second flow tube are respectively located at opposite ends of the electronic device and arranged in parallel; the flow passage of the coolant comprises the tank body, the inlet, the first flow tube, circulating through the electronic device, the second flow tube, and the outlet, the liquid flow tube defines at least one opening facing the electronic device; the at least one adjuster is mounted in the at least one opening and communicates with the liquid flow tube, the tank body comprises at least one driving member for driving the coolant to flow, and the at least one driving member is a fan blade, and the at least one driving member is located adjacent to the inlet, and a driving direction of the at least one driving member is same as the direction of the flow passage of the coolant.

**6**. The immersion cooling tank of claim 5, wherein the liquid flow tube is coupled to the outlet; the liquid flow tube and the at least one driving member are respectively located at opposite ends of the electronic device; and the flow passage of the coolant is in a direction from the at least one driving member to the liquid flow tube to circulating through the electronic device.

**7**. The immersion cooling tank of claim 6, wherein the liquid flow tube defines a plurality of openings arranged in parallel.

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