This invention relates to a radiator and its preparation method, and especially refers to a fin-pipe shaped radiator specially adapted to semiconductor chilling unit and its preparation method. This radiator consists of vertical pipe and upper & lower horizontal pipe (both ends are blocked) welded into the heat radiation chamber, and the evaporator connected through pipeline with axially extending fins distributed on the external surface of the horizontal pipe and the vertical pipe in an angle “α” at the joint within the range of 0°<α≤90°. The main components are manufactured into sections by extruding, punching or other machining techniques and then soldered into a radiator. It has overcome the disadvantages of various and numerous welding points, complicated techniques and so on in existing manufactures, and has realized an industrialized batch production upon simple and reliable techniques.
Fig. 1
FIN-PIPE SHAPED RADIATOR SpECIALLY ADAPTED TO A SEMICONDUCTOR CHILLING UNIT AND THE METHOD OF MAKING SAME

TECHNICAL FIELD

[0001] This invention relates to a radiator and its preparation method, and especially refers to a fin-pipe shaped radiator specially applied to semiconductor chilling unit and its preparation method.

BACKGROUND OF THE INVENTION

[0002] So far in disclosed literatures, the overall structure of vertical pipe radiator are assembled by manual welding through perforating the upper & lower horizontal pipe and vertical pipe as well as adding heat radiating filaments. The horizontal pipe are usually formed by bare pipes welded to the vertical pipe, and the heat radiating areas on original horizontal pipe and vertical pipe are realized by welding filaments and fins to the bare pipes, therefore the connecting of the heat radiating filaments and fins to the bare pipes can only be realized by spot welding which will restrict the heat radiating areas, and as a result, the heat transfer efficiency is only 20%~30% of that in the overall structure. Furthermore, this kind of radiator has numerous welding points on the surface of the heat radiating pipes and is manufactured by complicated welding techniques which can be only realized by manual welding, thus it is not suitable for industrialized batch production, the parts are difficult to be manufactured by standardized production, and the reliability of welding quality is very weak.

SUMMARY OF THE INVENTION

[0003] A fin-pipe shaped radiator specially applied to semiconductor chilling unit includes vertical pipe (1) and upper & lower horizontal pipe (both ends are blocked) welded into the heat radiation chamber, and the evaporator (4) connected through pipeline, characterized in that bar fins (6) extending axially are distributed on the external surface of the horizontal pipe and the vertical pipe (1), and the included angle “α” at the joint is within the range of 0°<α≤90°.

[0004] The fin-pipe shaped radiator is characterized in that the horizontal pipe are made of section material with arched plate (2) forming a U shape trough with a side slot and two open ends, the pipe structure is formed by the cover panel (9) blocked at the open ends of the arched plate (2), and each end of the horizontal pipe is blocked with an end cap (7).

[0005] The fin-pipe shaped radiator is further characterized in that the bar fins (6) on the external surface of the horizontal pipe and vertical pipe (1) are distributed in radial and extending in axial.

[0006] The fin-pipe shaped radiator further includes that the bar fins (6) are integrated with the horizontal pipe or vertical pipe (1).

[0007] The fin-pipe shaped radiator can be further defined in that the horizontal pipe and vertical pipe (1) mentioned are adapted with the adjacent pipes or components by welding.

[0008] The fin-pipe shaped radiator is further characterized in that the horizontal pipe and vertical pipe (1) mentioned has a pressure release valve (3).

[0009] The fin-pipe shaped radiator is further characterized in that the horizontal pipe and vertical pipe (5) mentioned has an inspection hole with lens (8) to the internal chamber.

[0010] A method for preparing the fin-pipe shaped radiator includes the following steps:

[0011] A. Separately manufacture shaped vertical pipe (1), horizontal pipe and arched plate (2) by extruding technique, and manufacture end caps (7) (with groove welded around) and cover panel (9) (with hole flanging on the surface and grooves at both sides) by extruding technique with plate material coated with welding dressing; or machine through-hole directly on the surface of the horizontal pipe;

[0012] B. Cut the arched plate (2) and vertical pipe (1) into corresponded length;

[0013] C. Assemble the arched plate (2), cover panel (9) and end cap (7) manufactured in Step A and B into a mould pipe, connect the horizontal pipe and vertical pipe (1) prepared in Step B as per the requirement for assembling, and fasten with special fixtures and then put them into a soldering furnace, heat to melt the welding dressing on the surface of each component which will be fixed to each other as the melted dressing will spread over the joints by capillarity; in this step, the horizontal pipe with through-hole manufactured in Step A can be directly welded to the vertical pipe (1) prepared in Step B.

[0014] The method further includes in Step B in which a pressure release valve (3) and an inspection hole with lens (5) are equipped to the surface of corresponded component of the radiator prepared in Step C.

[0015] The invention can be better defined in an alternative set of embodiments:

[0016] 1. A fin-pipe shaped radiator specifically adapted to a semiconductor chilling unit, comprising:

[0017] one or multiple vertical pipes with two open ends;

[0018] a upper and a lower horizontal pipe with two closed ends and one or multiple through-holes in the pipe;

[0019] wherein said vertical pipe are connected to said horizontal pipes by welding said open ends with said through-holes into a heat radiation chamber;

[0020] an evaporator connected to said horizontal pipes via said through-holes via one or multiple pipelines; and

[0021] multiple bar fins applied axially along the pipe on an external surface of said horizontal pipe and said vertical pipe;

[0022] 2. The fin-pipe shaped radiator of item 1, wherein the horizontal pipe is made of section material comprising:

[0023] an arched plate forming a U shape trough with a side slot and two ends;

[0024] a cover panel with through-holes; and

[0025] two end caps;

[0026] where said horizontal pipe is formed by fixing said cover panel on said side slot of said arched plate and said closed ends are formed by fixing said end caps to the two ends of said arched plate.

[0027] 3. The fin-pipe shaped radiator of item 1, wherein the bar fins on the external surface of the horizontal pipe and vertical pipe extend radially.

[0028] 4. The fin-pipe shaped of Item 1, wherein the bar fins are integrated with said horizontal pipe or vertical pipe.

[0029] 5. The fin-pipe shaped radiator of Item 1, wherein the horizontal pipe and vertical pipe are connected with said pipelines by welding.

[0030] 6. The fin-pipe shaped radiator of Item 1, wherein said horizontal pipe or said vertical pipe is provided with a pressure release valve.
7. The fin-pipe shaped radiator of Item 1, wherein said upper and lower horizontal pipes are provided with an inspection hole with lower for inspecting said heat radiation chamber.

8. A method for making said fin-pipe shaped radiator as in above items, comprising following steps:

a. making said vertical pipe and said arch plate using extruding shaping technology, making two side indentations on said cover panel by extruding technique or using slotting machine and applying welding dressing on said indentations; forming said through-holes with flaggings on said cover panel with welding dressing applied; cutting said vertical pipe, said arch plate and said cover panel with side indentations into predetermined length;

b. making said end caps with grooves by punch forming a plate material coated with welding dressing;

c. assembling said arch plate, said cover panel and said end caps into said horizontal pipe; jointing the horizontal pipe and vertical pipe through said through-holes by a fixing means and then putting into a soldering furnace, heating to melt the welding dressing so that the horizontal pipe with through-holes can be directly welded with the vertical pipe.

9. The method of Item 8, further comprising:

forming an opening for a pressure release valve on said horizontal or vertical pipes and fixing said pressure release valve into said opening;

forming an inspection hole with a transparent lens on said end cap and equipping said lens on said inspection hole.

DESCRIPTION OF THE INVENTION

This invention intends to introduce a fin-pipe shaped radiator specially applied to semiconductor chiling unit with favorable heat radiating effect and simplified structure which is suitable for standardized production.

The other is to introduce a fin-pipe shaped radiator specially applied to semiconductor chiling unit with favorable heat radiating effect which is suitable for industrialized production.

The technical solution for this invention is generally as follows:

A. Separately manufacture shaped vertical pipe (1), horizontal pipe and arched plate (2) by extruding technique, and manufacture end caps (7) (with groove welded around) and cover panel (9) (with hole flanging on the surface and grooves at both sides) by extruding technique with plate material coated with welding dressing; or machine through-hole directly on the surface of the horizontal pipe;

B. Cut arched plate (2) and vertical pipe (1) into corresponded length;

C. Assemble arched plate (2), cover panel (9) and end cap (7) manufactured in Step A and B into a mould pipe, connect the horizontal pipe and vertical pipe (1) prepared in Step B as per the requirement for assembling, and fasten with special fixtures and then put them into a soldering furnace, heat to melt the welding dressing on the surface of each component which will be fixed to each other as the melted dressing will spread over the joints by capillarity; in this Step, the horizontal pipe with through-hole manufactured in Step A can be directly welded to the vertical pipe (1) prepared in Step B.

The detailed technical solution for this invention also includes:

The horizontal pipe are made of section material with arched plate (2) of archy bar, the pipe structure is formed by the cover panel (9) blocked at the open ends of the arched plate (2), and each end of the horizontal pipe is blocked with an end cap (7). Obviously arched plate (2) can either apply the integrated material of "U" section, or formed by welding plate or profiled material, but integrated material of "U" section is recommended applying to arched plate (2) in an optimized technical solution. This structure is suitable for large-scale batch production.

The horizontal pipe can be also shaped with section material by extruding, and the through-hole connected to the vertical pipe can be directly machined on the surface, it has many welding points and the productive efficiency is low, and is only suitable for small-scale production, but it is still within the essential scope of this invention.

The bar fins (6) are distributed in radial and extending axially on the external surface of horizontal pipe and vertical pipe (1). And in the optimized technical solution, the bar fins (6) are distributed in radial equiangularity and extending axially on the external surface of horizontal pipe and vertical pipe (1).

The bar fins (6) are integrated with the horizontal pipe or vertical pipe (1). And in the optimized technical solution, they are shaped and integrated by aluminum sections through extruding.

The horizontal pipe, vertical pipe (1) and adjacent pipes or components are connected by welding.

A pressure release valve (3) is equipped to the horizontal pipe or vertical pipe (1).

An inspection hole with lens (5) to the internal chamber is equipped to the end of the horizontal pipe.

The preparation method also includes a Step D in which a pressure release valve (3) and an inspection hole with lens (5) are equipped to the surface of corresponded component of the radiator prepared in Step C.

This invention has the following essential characteristics and distinct progresses in technology:

1. The horizontal pipe and vertical pipe are shaped by a one-off extruding, the cover panel and through-hole are blanked by a one-off punching, and assembly is finished by a one-off welding in a soldering furnace. The main body of the radiator is shaped into a vertical-pipe radiator which has overcome the disadvantages in coil-pipe type radiator of simple circulation line and too many detours that block circulating and in plate type radiator of low resistance to pressure that will make the radiator distort or deform or make the weld points crack and so on.

2. The main parts are shaped by extruding, and thus the machining technique is simple and reliable with low cost and high rate of finished products. The vertical pipe, horizontal pipe and the bar fins at the end of horizontal pipe are shaped by one-off extruding which increases the heat radiating area by 8~10 times and improving the heat transferring efficiency by 60%~80% comparing with existing products.

3. Highly advanced soldering device is used for assembling which has overcome the disadvantage of bad quality and low efficiency in manual welding, and realized the industrialized batch production.

4. Bar fins are added to the surface of the vertical pipe and horizontal pipe to enlarge the effective heat radiating area and decrease the number of welding points.

BRIEF DESCRIPTION OF THE DRAWINGS

The invention has the following attached drawings:

FIG. 1 is the front plane view of the overall structure in this invention.

FIG. 2 is the left side plane view of the invention.
DESCRIPTION OF THE SPECIFIC EMBODIMENTS

The following practical example, which should not be regarded as a limit to this invention, is a description to this invention upon the attached drawing.

This practical example introduces a fin-pipe shaped radiator specially applied to semiconductor chilling unit, consisting of vertical pipe (1) and upper & lower horizontal pipes (both ends are blocked) welded into the heat radiation chamber with an evaporator (4) connected through pipeline and bar fins (6) extending axially and distributed in equiangular on the external surface of the horizontal pipes and the vertical pipe (1) as mentioned. The horizontal pipes are made of section material with arched plate (2) and a pipe structure formed by the cover panel (9) blocked at the open ends of the arched plate (2), and each end of the horizontal pipe is blocked with an end cap (7).

The horizontal pipe or vertical pipe (1) with bar fins is shaped and integrated by aluminium sections through extruding.

The horizontal pipes, vertical pipe (1) and adjacent pipes or components are connected by welding.

A pressure release valve (3) is equipped to the horizontal pipes or vertical pipe (1).

An inspection hole with lens (5) to the internal chamber is equipped to the end of the horizontal pipe.

The method for preparing the fin-pipe shaped radiator specially applied to semiconductor chilling unit, including the following steps:

A. Separately manufacture shaped arched plate (2) and vertical pipe (1) by extruding technique, and manufacture end caps (7) (with groove welded around) and cover panel (9) (with hole flanging on the surface and grooves at both sides) by extruding technique with plate material coated with welding dressing;

B. Cut arched plate (2) and vertical pipe (1) into corresponded length;

C. Assemble arched plate (2), cover panel (9) and end cap (7) manufactured in Step A and B into a mould pipe, connect the horizontal pipe and vertical pipe (1) prepared in Step B as per the requirement for assembling, and fasten with special fixtures and then put them into a soldering furnace, heat to 230°C around to melt the welding dressing on the surface of each component which will be fixed to each other as the melted dressing will spread over the joints by capillarity.

The preparation method also includes a Step D in which a pressure release valve (3) and an inspection hole with lens (5) are equipped to the surface of corresponded component of the radiator prepared in Step C.

I claim:

1. A fin-pipe shaped radiator specifically adapted to a semiconductor chilling unit, comprising:

   one or multiple vertical pipes with two open ends;
   a upper and a lower horizontal pipe with two closed ends
   and one or multiple through-holes in the pipe;

   wherein said vertical pipe are connected to said horizontal pipes by welding said open ends with said through-holes into a heat radiation chamber;

   an evaporator connected to said horizontal pipes via said through-holes via one or multiple pipelines; and

   multiple bar fins applied axially along the pipe on an external surface of said horizontal pipe and said vertical pipe.

2. The fin-pipe shaped radiator of claim 1, wherein the horizontal pipe is made of section material comprising:

   an arched plate forming a U shape trough with a side slot and two ends;

   a cover panel with through-holes; and

   two end caps;

   where said horizontal pipe is formed by fixing said cover panel on said side slot of said arched plate and said closed ends are formed by fixing said end caps to the two ends of said arched plate.

3. The fin-pipe shaped radiator of claim 1, wherein the bar fins on the external surface of the horizontal pipe and vertical pipe extend radially.

4. The fin-pipe shaped radiator of claim 1, wherein the bar fins are integrated with said horizontal pipe or vertical pipe.

5. The fin-pipe shaped radiator of claim 1, wherein the horizontal pipe and vertical pipe are connected with said pipelines by welding.

6. The fin-pipe shaped radiator of claim 1, wherein said horizontal pipe or said vertical pipe is provided with a pressure release valve.

7. The fin-pipe shaped radiator of claim 1, wherein said upper and lower horizontal pipes are provided with an inspection hole with lens for inspecting said heat radiation chamber.

8. A method for making said fin-pipe shaped radiator as in claim 2 comprising following steps:

   a. making said vertical pipe and said arched plate using extruding shaping technology; making two side indentations on said cover panel by extruding technique or using slotting machine and applying welding dressing on said indentations; forming said through-holes with flangings on said cover panel with welding dressing applied; cutting said vertical pipe, said arched plate and said cover panel with side indentations into predetermined length;

   b. making said end caps with grooves by punch forming a plate material coated with welding dressing;

   c. assembling said arched plate, said cover panel and said end caps into said horizontal pipe; jointing the horizontal pipe and vertical pipe through said through-holes by a fixing means and then putting into a soldering furnace, heating to melt the welding dressing so that the horizontal pipe with through-holes can be directly welded with the vertical pipe.

9. The method of claim 8, further comprising:

   forming an opening for a pressure release valve on said horizontal or vertical pipes and fixing said pressure release valve into said opening;

   forming an inspection hole with a transparent lens on said end cap and equipping said lens on said inspection hole.

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