

FINS FOR HEAT EXCHANGER

5 FIELD OF TECHNOLOGY

The present invention relates to an improvement made to a fin suitable for use in a single row fin-and-tube heat exchanger.

10 BACKGROUND OF THE INVENTION

Fin-and-tube exchanger, or coil, often has tubes and a stack of plate fins of small thickness with air flowing over the fins. The coil may have more than one row of tubes, but the fins are formed from a single sheet fitted over all the tubes. Such form of heat exchanger are designed to be bendable so as to reduce the use of installation space while increasing heat exchanging efficiency, as exemplified in United States Patent No. 5573059. Hitherto, most of the bendable heat exchanger uses a double row fin so as to provide sufficient strength in the fin for bending. In fact, a single row fin is actually superior in terms of heat exchanging effectiveness. The reason why a single row heat exchanger is less popular mainly owes to the difficulty in forming a bendable fin without compromising its structural integrity. As the width of a single row fin is less than a double row fin, a single row fin with bending configuration, for example cuts or notches as shown in United States Patent No. 5573059, is easily damaged when being pulled out from a fin press station. In view of the above, this invention provides a single row fin configured with bending feature without compromising its overall strength and a method of producing the fin.

SUMMARY OF THE INVENTION

One object of this invention is to provide an improved heat radiating fin suitable for use in a single-row heat exchanger of an air conditioner.

Another object of this invention is to provide a bendable fin so that installation space of the single-row heat exchanger in an air conditioner can be reduced.

- 5 Another object of this invention to provide a fin with simple configuration for bending purpose that could reduce the chances of product rejection from a fin press station.

Another object of this invention is to provide a fin configured with a simple configuration to allow bending without compromising its structural integrity.

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Another object of this invention is to provide a one-piece fin such that heat exchanger thereof can drain condensate water effectively.

- 15 Another object of this invention is to provide simple method of producing the bendable fin via cutting and bending.

- At least one of the preceding objects is met, in whole or in part, by the present invention, in which one of the embodiments of the present invention is a heat radiating fin for use in a heat exchanger comprising: a rectangular elongate plate; a plurality of holes in the plate; 20 and at least one straight cut extending 70 to 90 % across the width of the plate, the cut being such that it can be converted to a V-shaped notch by bending the plate about an axis in the uncut region.

- 25 In one of the preferred embodiment, the plate has a thickness of 80 to 130 μm .

In one of the preferred embodiment, the plate is made of aluminium.

Preferably, the plate is bent about the axis at an angle of 5° to 45° .

Advantageously, the cut is extending across the plate in a direction perpendicular to the length of the plate.

At least one of the preceding objects is met, in whole or in part, by the present invention,
5 in which one of the embodiments of the present invention is a method of producing a heat radiating fin for use in a heat exchanger comprising the steps of: cutting 70 to 90 % straight across the width of a strip of rectangular plate having a plurality of holes; and submitting an axis in the uncut region of the plate to a bending force to convert the cut to a V-shaped notch.

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Preferably, the method submits uncut region of the plate to bend about the axis at an angle of 5° to 45°.

Preferably, the plate used in the method has a thickness of 80 to 130 µm.

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Preferably, the plate used in the method is made of aluminium.

Advantageously, the cutting step is performed across the plate in a direction perpendicular to the length of the plate.

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BRIEF DESCRIPTION OF THE DRAWINGS

For the purpose of facilitating an understanding of the invention, there is illustrated in the accompanying drawing the preferred embodiments from an inspection of which when
25 considered in connection with the following description, the invention, its construction and operation and many of its advantages would be readily understood and appreciated.

Fig. 1 is a side view showing part of a fin included in an embodiment of this invention.

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Fig. 2 is side view showing a bent form of the fin of Fig. 1.

Fig. 3 is an exploded view of a heat exchanger having a single row heat exchanger with fin of Figs. 1 and 2.

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Fig. 4 is a flow chart showing an exemplary method of producing a single row fin of Figs. 1 and 2, followed by its assembly into a heat exchanger.

10 BRIEF DESCRIPTION OF THE INVENTION

This invention relates to a heat radiating fin suitable for use in a single row heat exchanger, a method of producing the fin and a method of adopting or assembling the fin in a heat exchanger.

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Exemplary, non-limiting embodiments of the invention will be disclosed with reference made to Figs. 1 to 4. However, it is to be understood that limiting the description to the preferred embodiments of the invention is merely to facilitate discussion of the present invention and it is envisioned that those skilled in the art may devise various modifications without departing from the scope of the appended claim.

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Only a portion of the fin (10) in the preferred embodiment is shown in Figs. 1 and 2 to facilitate the understanding of the present invention. As shown in Fig. 1, the fin (10) comprises: a rectangular elongate plate (20); a plurality of holes (30) in the plate; and at least one straight cut (40) extending 70 to 90 % across the width of the plate, leaving behind at 10 to 30 % of the width as the uncut region.

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The fin comprises a thin elongate plate (20) having a plurality of holes (30) in it. The elongate plate (20) is preferably made of material having high heat conductivity. Preferably,

aluminium is used. Further, the plate (20) is preferably having a thickness which provides sufficient rigidity. Particularly, the plate (20) has a thickness of 80µm to 130 µm. Further, patterned slits or protrusions (not shown) may be formed in a portion on the plate between the holes to enhance rigidity to the plate. The plurality of holes (30) are spatially arranged
5 along the length of the plate. Even though the holes are shown to be aligned along the elongate direction of the plate in Figs. 1 and 2, they can also be arranged in a zigzag state. The sizes of holes (30) shall be sufficient to accommodate refrigerant tubes (31) inserted there through, as shown in Fig. 3. More particularly, each of the holes has a diameter of 4 mm to 10 mm.

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It shall be noted that only a part of an air conditioner is shown in Fig. 3 to facilitate the understanding of this invention. Optionally, connectors or mounting means (not shown) can be configured in the plate to facilitate engagement of the tubes, or other parts of a heat exchanger or an air conditioner, thereto.

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The plate (20) with holes (30) can be prepared in advance by a press-punching process in a fin press station. Subsequently, the plate (20) is subjected to a cutting and bending process as described herein. As shown in Figs. 1 and 2, a straight cut (40) is formed by cutting the plate (20) across the width of the plate. To avoid breakage, depth of the straight cut (40) is
20 preferably 70 to 90 % of the width of the plate, leaving behind at 10 to 30 % of the width as the uncut region. As shown in Fig. 2, the remaining width, being the uncut region, forms a hinge-like feature when the plate is bent. Such configuration enables the plate to bend about the axis (41) at an angle of 5° to 45°.

25 There can be more than one cut (40) spatially along the length of the plate (20), depending on the desired bending capability of the fin. In the preferred embodiment, the straight cut (40) is perpendicular to the direction of the length of the plate. Alternatively, the straight cut (40) can be slanted to the direction of the length of the plate. In the case where more than one straight cuts are formed on the plate, each of the cuts can be different from one

another. Nevertheless, the depth of each cut (40) shall be 70 to 90 % of the width of the plate, as the case may be.

The distance between each cut may vary according to needs. In the preferred embodiment, the distance between each cut along the plate should be at least approximately 2 cm away from each other. In the preferred embodiment, as shown in Figs. 1 and 2, there are 2 cuts along the plate (20) that separates the plate into 3 parts. Fig. 2 showed exemplary bending angle between the separated parts, along the axis (41), represented by symbol θ and α . θ can be either same or different with α . More particularly, angles of θ and α are within the range 5° to 45°.

Also shown in Fig. 2, upon bending the plate about an axis (41) in the uncut region, the straight cut (40) is converted to a V-shaped notch while the plate (20) is bent. The uncut region is the connecting part between the separated parts. Due to mechanical stress, a groove (not shown) may be formed at the uncut region when the plate is bent.

This invention further provides a method for producing the fin as described in the foregoing. Particularly, the method comprising the steps of: cutting 70 to 90 % straight across the width of a strip of rectangular plate (20) having a plurality of holes (30); and submitting an axis (41) in the uncut region of the plate (20) to a bending force to convert the cut (40) to a V-shaped notch. In accordance to the preceding description, the cutting step can be performed across the plate (20) along a cutting line, as shown as dashed line in Figs. 1 and 2. In another embodiment, the cutting step can be performed slanted to the direction of the length of the plate.

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Fig. 4 shows a process flow of assembling a heat exchanger using the fin (10) in the preferred embodiment. Step (100) denotes a step where a hair pin refrigerant tubes are prepared. Step (101) denotes a step where a plurality of the elongate plates (20) are prepared in a fin press station, where patterns such as holes, slits or protrusions as

mentioned in the preceding description may be configured thereto. Step (102) denotes a step where the plates (20) are collected, stacked and inserted with the refrigerant tubes through the plurality of holes. Step (103) denotes a step where the tubes are expanded so as to engage the plates (20). Step (104) denotes a step of cutting the plates according to the method as described in the preceding description, followed by a step of bending the plates by submitting it to a bending force which converts the cut (40) to a V-shaped notch. Step (105) denotes a step of affixing the refrigerant tubes at a certain angle with coil brackets (50). Step (106) denotes a step of connecting U-bend pipes (60) between the tubes by a pipe brazing process.

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It shall be noted that there is no fin notching step in the fin press station. Hence, the chances of fin rejection may be reduced. Further, cutting is conducted after the plates are stacked and inserted with the refrigerant tubes, thereby providing extra strength to the uncut region in the plates.

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The present invention may be embodied in other specific forms without departing from its essential characteristics. The described embodiments are to be considered in all aspects only as illustrative and not restrictive. The scope of the invention is, therefore indicated by the appended claims rather than by the foregoing description. All changes, which come within the meaning and range of equivalency of the claims, are to be embraced within their scope.

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CLAIMS

1. A heat radiating fin (10) for use in a heat exchanger including:
a rectangular elongate plate (20);
5 a plurality of holes (30) in the plate; and
at least one straight cut (40) being formed only at one side of the plate that extends 70 to
90 % across the width of the plate, the cut being perpendicular to the width of the plate and
it can be converted to a V-shaped notch by bending the plate about an axis (41) in the uncut
region.
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2. A heat radiating fin according to claim 1, wherein the plate (20) has a thickness of
80 μ m to 130 μ m.
3. A heat radiating fin according to claim 1 or 2, wherein the plate (20) is made of
15 aluminium.
4. A heat radiating fin according to any one of claims 1 to 3, wherein the plate (20) is
bent about the axis at an angle of 5° to 45°.
- 20 5. A heat radiating fin according to any one of claims 1 to 4, wherein the cut (40) is
extending across the plate (20) in a direction perpendicular to the length of the plate (20).