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(54) Cooling fins for heat exchanger.

(57) Self-stacking cooling fins are so designed that they can be made on a continuous basis. Copper alloy strip 31 is fed between a pair of forming rolls 34, 35. During one half revolution of the rolls, openings for tubes and other projections are pushed out of the strip on one side. During the next half revolution of the rolls, openings for tubes and other projections are pushed out of the strip on the other side. Folds are formed between these sections of strip. The folds cause the strip to fold in zig-zag fashion, and the projections then all point in the same direction and space adjacent fins from each other.

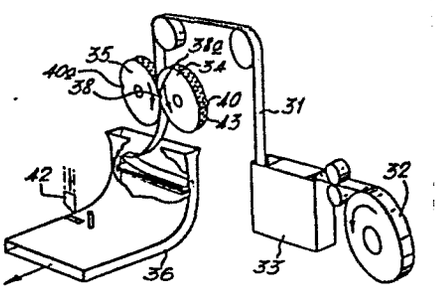

FIG.3.

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COOLING FINS FOR HEAT EXCHANGER

This invention relates to cooling fins for heat exchangers, and especially to heat exchanger comprising tubes in contact with the fins.

Such heat exchangers commonly include a multiplicity of tubes, often arranged in rows, which pass through openings, which may be either holes or slots in the side edges, in fins arranged in a stack in planes at right angles to the tube axes. The fins act as secondary cooling surfaces to the primary cooling surfaces provided by the tubes.

Fin spacing is achieved by interpreting elements between the fins to hold them apart. The spacing members often take the form of tabs raised out of the material of the fins themselves, and are arranged to contact the surface of an adjacent fin to ensure a gap between it and the fin from which the spacing member is raised. Such cooling fins are known as self-stacking cooling fins.

Each of the fins in the stack is a separate member. One method of manufacture is for strip material to be rolled to produce the necessary openings and raised portions, and then cut into the required lengths. Then the fins can be inserted in the stack.

The Applicants are also aware of the method of manufacture disclosed in the United States Patent No 3 266 567. In this method, a sheet of fin stock, the width of which is equal to the desired fin length, is

repeatedly perforated across its width along closely spaced lines which are spaced apart by the desired fin width: the sheet is then folded zig-zag fashion along the perforations to form the stack of fin elements. Projections raised out of the stock are on opposite sides for each adjacent fin width in order to space the fins when the stack is formed.

The invention provides self-stacking cooling fins for a heat exchanger comprising a strip having an alternating series of first and second portions, the first portions having projections upstanding from one side of the strip and the second portions having projections upstanding from the other side of the strip, the strip being folded between the first and the second portions in zig-zag fashion so that the projections extend in the same direction and space successive portions of the strip from each other.

With this arrangement, the fold regions are at the ends of the stack and do not impede the air flow through the stack. With the arrangement of the US patent referred to, the fold regions (the regions between the perforations that extend across the width of the stock) lie between adjacent fins and across the whole face of the stack, and these do impede air flow through the stack.

Advantageously, the projections have been formed by feeding the strip material between a pair of rolls having shaped peripheries.

Advantageously, one first portion and one second portion were formed during one revolution of the rolls. The rolls co-operate with each other such that over one half of their peripheral surfaces, projections are raised from one side of the strip, and over the other half of their peripheral surfaces, projections are raised from the opposite side of the strip. In principal, any even number of alternating regions could be provided at the roll periphery.

The invention also provides apparatus for and a method of manufacturing self-stacking cooling fins according to the invention.

The invention will noe be described by way of example with reference to the accompanying drawings, in which:

Figure 1 is a plan view of a strip forming a number of fins, but viewed as it would be if laid out flat;

Figure 2 is a sectional view on the lines 2-2 of Figure 1;

Figure 3 is a schematic perspective view of apparatus for fabricating the fins;

Figure 4 is an end view of one of the forming rolls; and

Figure 5 is a side view, partly broken away, of the rolls in mesh.

Referring to Figure 3, a strip 31 of plain copper alloy is fed between two forming rolls 34,35, and emerges into a hopper 36 bent in zig-zag fashion. Referring now to Figure 1, this shows the formed strip as it would appear if laid out flat: it will be appreciated however that the strip will not actually take up this shape in practice, but will actually be as shown in Figure 3.

The strip 11 consists of successive portions 12 and 13. The portions 12 have projections upstanding from the upper side of the strip, as is apparent by reference to Figure 2. The portions 13 have projections upstanding from the lower side of the strip, but in other respects the projections are identical to those in the portions 12.

Referring to the portions 12, openings 15 formed in each side are staggered with respect to each other, so that the stacked fins can accommodate two rows of flat tubes offset with respect to each other in the heat exchanger. The material displaced out of the openings form projections 15a. In line with each opening 15 are louvres 21 formed by piercing the strip along parallel lines and bending the material up to form the louvres. Beyond the louvres 21, the strip has apertures 14. The material displaced in forming the apertures 14 forms two projecting flaps 14a, 14b. These flaps are the subject of

our co-pending British Patent Application No 82 0457.

The louvres 21 and the flaps 14a, 14b assist in creating turbulence in the in the air passing through the heat exchanger of which the fins form a part, and hence promote better heat transfer to the air.

The succession of staggered openings 15, louvres 21 and apertures 14 is repeated along the length of the fin.

At the ends of the portions 12, two folds 22, 23 are produced by the forming rolls. As is shown in Figure 3, an approximately 90° fold is produced at each line 22, 23, and the region 24 between the fold thus acts as a spacing member assisting the spacing of successive fins.

The portions 13 are the same as the portions 12, but the projections 14a, 14b, 15a and 21 are on the underside of the strip instead of on the top side.

When the strip is folded in zig-zag fashion, the projections all point in the same direction, and the openings 15 overlie each other. The projections space adjacent fins from each other.

Referring to Figure 3, plain copper alloy strip in a roll 32 is fed through a magazine 33 to a pair of forming rolls 34, 35. The strip is formed in the rolls and fed to a hopper 36 where it folds up in a stack. A guillotine 42 cuts the folded strip at intervals of time in order to produce suitable stacks of fin for heat exchangers.

Referring to Figures 4 and 5, Figure 5 shows an end view of the rolls but with the roll 35 rotated anticlockwise through 180° relative to the view of Figure 3. ~~Figure 5 is an end view of Figure 3.~~ Figure 4 is an end view of roll 34 seen in the direction of the arrows 4-4.

Projection 40 on roll 34 meshes with recess 40a to form fold lines 22,23. Clockwise from projection 40, the roll 34 has punches 43 for forming the openings 15 and punches 44 for forming the apertures 14, for one half the circumference of the roll 34. Equally, the roll 35 has a corresponding recess 43a and 44a for co-operating with the punches 43 and 44.

At the half circumference position, the roll 34 has a recess 38a which meshes with projection 38 to form folds 22, 23 but this time bent in the opposite sense to form the next fold of the zig-zag. For the remaining half-circumference, the roll 34 has recesses which correspond to punches on the roll 35, in the order to form the projections on the other side of the strip to those produced by the first half-circumference.

It will therefore be seen that one complete revolution of the rolls produces, for example, portion 12 during the first half-revolution and portion 13 during the second half-revolution.

The rolls also have blades (not shown) for producing the louvre 21. In addition, the rolls have small apertures 45 in their surface spaced around their entire circumferences for blowing the strip away from the rolls

when it emerges below the nip of the rolls. However, it would be possible to dispense with these and employ an external air blast directed to the space between the strip and the rolls where it emerges on each side of the strip.

The stack of fins fed out of hopper 36 will have aligned openings 15, and flat tubes are slotted in from each side. Tube plates to form part of header tanks are added, and the parts are brazed together.

CLAIMS

1. Self-stacking cooling fins for a heat exchanger comprising a strip having an alternating series of first and second portions, the first portions having projections upstanding form one side of the strip and the second portions having projections upstanding from the other side of the strip, the strip being folded between the first and second portions in zig-zag fashion so that the projections extend in the same direction and space successive portions of the strip from each other.

2. Self-stacking cooling fins as claimed in claim 1, wherein the projections have been formed by feeding the strip material between a pair of rolls having shaped peripheries.

3. Self-stacking cooling fins as claimed in claim 2 , wherein one first portion and one second portion were formed during one revolution of the rolls.

4. Self-stacking cooling fins substantially as hereinbefore described with reference to the accompanying drawings.

5. A heat exchanger including self-stacking cooling fins as claimed in one of claims 1 to 4.

6. Apparatus for manufacturing self-stacking cooling fins as

claimed in any one of claims 1 to 4.

7. Apparatus as claimed in claim 6, wherein the apparatus includes a pair of rolls, and means for directing an air blast to assist separation of the formed strip from the rolls.

8. Apparatus as claimed in claim 7, wherein the means for directing an air blast includes apertures in the periphery of at least one roll.

9. Apparatus for manufacturing self-stacking cooling fins substantially as hereinbefore described with reference to the accompanying drawings.

10. A method of manufacturing self-stacking cooling fins as claimed in any one of claims 1 to 4.

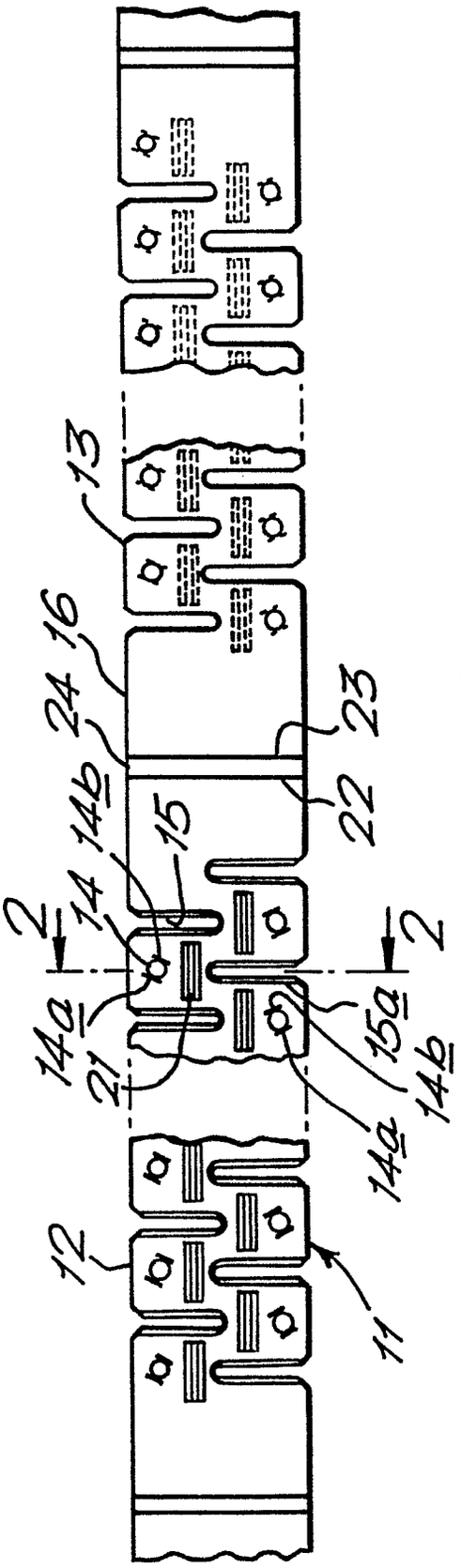
13
16
24
23
22
14b
15
14
2
2
14a
21
15a
14b
14a
12
11

FIG.1.

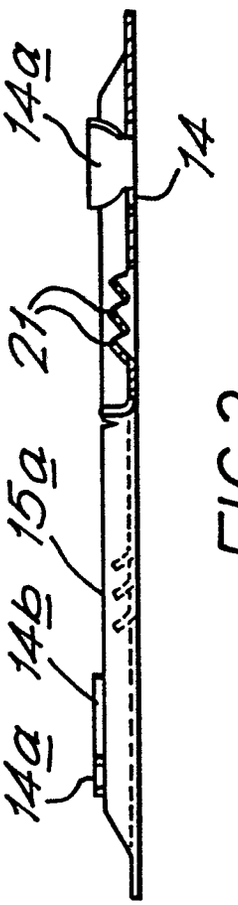
14a
14
21
15a
14b
14a

FIG.2.

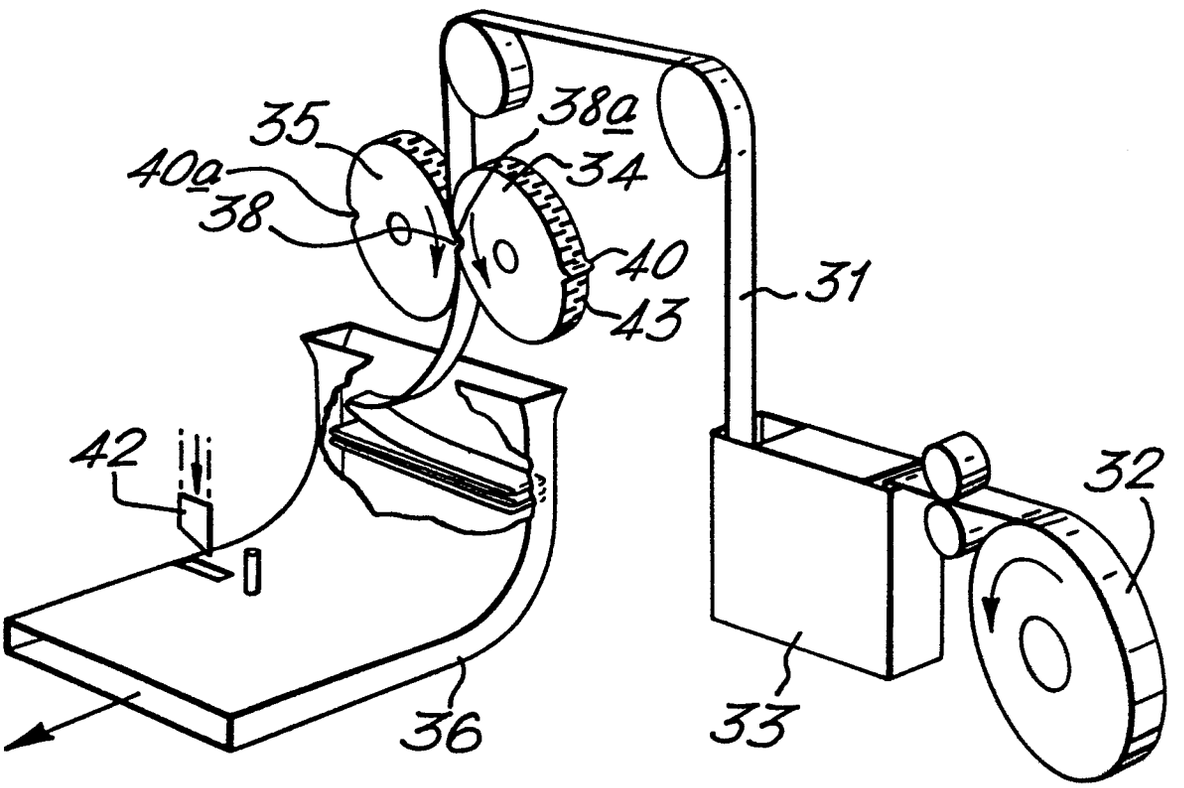

FIG.3.

FIG.4.

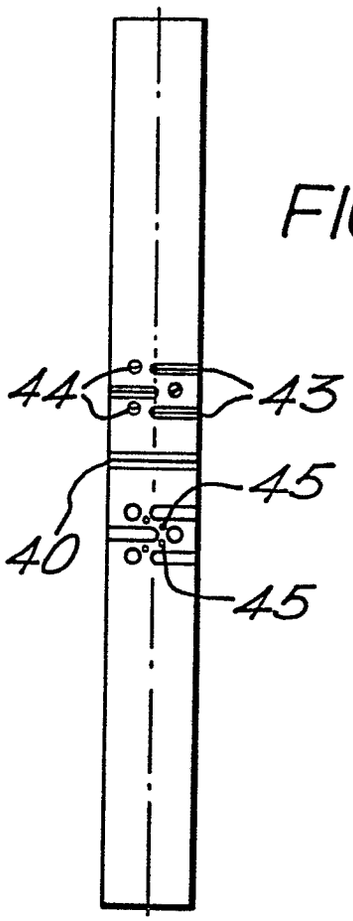

FIG.5.