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FIN STRUCTURE

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FIG. 1.

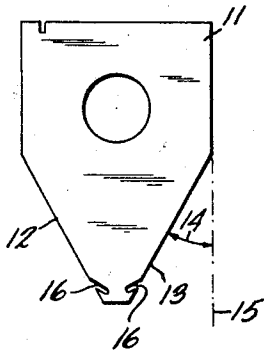


FIG. 3.

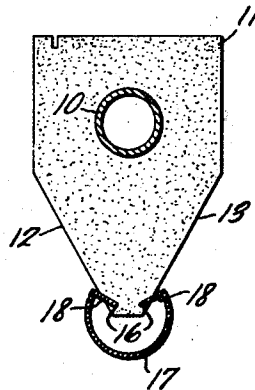


FIG. 2.



FIG. 4.

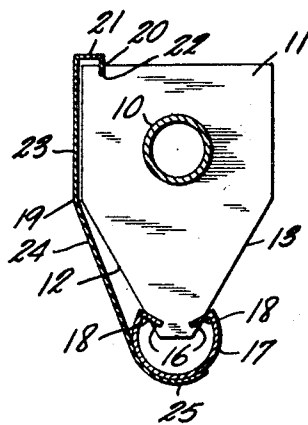
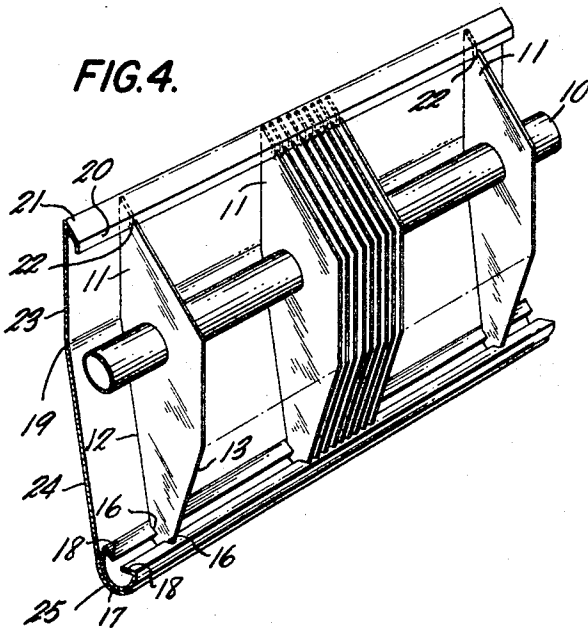


FIG. 5.

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FIN STRUCTURE

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This invention relates to an extended fin surface structure adapted to divert liquid condensate forming on the surface of the structure to a relatively small discharge area and to collect and carry off this condensate.

Extended fin surface structures of many types are commonly employed in heating and cooling systems for residences, offices and other living space. These structures consist generally of a tube for conducting a heat exchange fluid having a plurality of closely spaced fins attached to the tube which serve to improve the heat exchange capacity of the structure. These structures may be used both for heating and for cooling the surrounding air space. Where employed as heating means, little or no difficulty arises from moisture condensation. However, when a cooling fluid is circulated through the tube, the high moisture content of the warmer air being cooled by this system results in condensation of moisture on the surfaces of the fin and requires provision of means for collecting the condensate and transporting it away from the fin structure to a suitable drain.

The individual fins are fabricated of thin sheets of heat-conducting material and are usually of square, rectangular or circular shape. Attempts have been made to collect condensate by arranging troughs beneath the fin structure. The trough must be wide enough to collect condensate from the complete width of the fin structure, and this has had many disadvantages. In the first place, insufficient moisture is condensed to necessitate a large trough. Secondly, the wide trough seriously impairs the circulation of air around and through the fin structure, thus cutting down on the efficiency of heat transfer. This is particularly evident where the extended fin structure is employed in ceiling or valance heating where a large part of the extended fin structure is covered by a valance. In addition, such large troughs are expensive and cumbersome to install and maintain.

An additional problem is that of secondary condensation on the outside surface of the condensate troughs which in some cases may require insulation.

These problems have been recognized in the heating and air conditioning art and several attempts have been made to correct them. One such attempt has been the use of a square fin, with one point of the square arranged at the lowermost point of the structure. In this embodiment, it was hoped that the condensed moisture would converge downwardly along the tapered edges of the fin to the lower point of the square. The condensate would then be collected by means of a small, narrow trough disposed directly beneath the lowermost point of the fin. In practice, however, it was found that the tapered sides of the fin did not completely insure the converging of condensed moisture and much of the moisture dropped from portions of the fin not covered by the narrow trough.

In addition, elaborate attempts have been made to provide suitable troughs, some having concentric troughs with insulated portions disposed between the two. Troughs have also been disposed beneath the fins by the use of hangers or similar devices in an attempt to insulate the trough from the fin structure. None of the attempts of the prior art, however, has been considered acceptable

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and, although many people prefer the circulating fluid systems employing extended fin surface structures for winter heating of residences, forced air systems are now more extensively used because they can be used for both heating and cooling without the above-mentioned disadvantages.

It is therefore an object of the present invention to provide an extended fin surface structure from which condensate may be readily collected in an inexpensive and efficient manner without impairing the efficiency of the fin surface structure.

Another object of this invention is to provide a fin structure of novel shape and surface characteristics which serves to direct condensed moisture thereon to a discharge point on the lowermost part of the fin structure.

Another object of this invention is to provide a condensate trough which may be attached directly to a plurality of fins of an extended fin surface structure and which remains substantially free from secondary condensation in use.

These and other objects of this invention are accomplished by providing an extended fin surface structure with fins, each fin having a shape such that one or both sides are tapered angularly toward a point at the lowermost extremity, and by providing each fin with a roughened surface. A fin of this shape, with surface properly roughened, insures that the moisture formed by condensation on the fin surface will be as a thin continuous film of condensate on the fin and will gravitate to the lowermost and relatively narrow discharge portion of the fin, where it may be collected in a narrow trough.

It has also been found advantageous to dispose a light weight plastic trough directly beneath the narrow discharge portion of the fins and to attach this trough to the lowermost portion of each fin by providing slots in the sides of the fin to receive supporting edges formed on the trough. The slots are preferably formed at an angle directed downwardly from the tapered sides toward the opposing side of the fin. When the trough is attached in place, the supporting edges of the trough extend outwardly beyond the edge of the fin, to insure collection of all of the condensate. The trough is preferably resilient so that it may be extended laterally and attached by clipping. Where the trough is attached to every fin of the extended fin surface structure, the trough does not sag and efficient collection of condensate is assured from each fin surface. The plastic material is preferably non heat-conductive, which substantially eliminates the problem of secondary condensation.

In order to insure that all of the moisture condensed on the fin surface will gravitate to the lowest point on the fin and thus into the trough, the fin surface must be roughened. The reason for this is that in the case of the smooth or polished fin surface of aluminum or copper sheets furnished from the mill, condensed moisture forms in drops and, although most of the drops so formed gravitate to the trough as a result of cohesion to the surface, a few of them do not. However, it has been found that roughening the surface causes the condensed moisture to form a film on the surface of the fin rather than drops. The film adheres completely due to surface tension and all of the condensed moisture gravitates to the low point of the fin and into the trough. Roughening of the fin surface can be easily and inexpensively accomplished by wire brushing or buffing with a revolving wire brush or by dipping the surface in a chemical solution which will pit the fin surface. For instance, it has been found that a 5 to 10% solution of sodium hydroxide will result in a very rapid action of pitting the surface of aluminum fins or sheets.

Where these improved fin surface structures are employed in a ceiling or valance-level heating and cooling

system, the structure preferably includes a metal valance cover adapted to clip on to the extended fin surface structure and trough to provide an extremely simple, inexpensive and decorative cover for the extended fin surface structure. The cover comprises generally a body portion adapted to conform to the shape of the individual fins and has at one end a flange adapted to be received in and engaged by a slot formed in the upper surface of each fin. The lowermost portion of the cover is shaped to conform to the external surface of the trough and extends about the trough to form a positive engagement therewith. The cover is attached by simply placing the flange on its upper portion in engagement with the plurality of slots on the upper surface of the fins and by clipping the lowermost portion around the trough member attached to the fin.

These and other advantages of the invention will be more readily understood when the following is considered in connection with the accompanying drawings in which:

Figure 1 is an elevation showing one embodiment of the novel fin structure of this invention;

Figure 2 is a cross section of a trough according to this invention;

Figure 3 is an elevation showing the novel fin structure with trough attached;

Figure 4 is a perspective view of the extended fin surface structure of this invention with trough attached, showing the arrangement of the various components including the preferred valance cover; and

Figure 5 is an elevation of the fin surface structure of this invention with the trough and valance cover shown attached in cross section.

Referring to the invention and in particular to the embodiment shown in Figures 1, 3 and 4, a tube 10 adapted to conduct a heat transfer medium is provided with a series of thin sheet metal fins 11. The fin 11 as shown in Figure 1 has tapered portions 12 and 13, the angle 14 of the tapered portion with the vertical line 15 being 30 degrees. A pair of slots or indentations 16 are disposed in the tapered portions 12 and 13 and are downwardly inclined from the horizontal toward the center of the lower point of the fin 11.

The trough 17 shown in Figure 2 is of semi-cylindrical shape and has a pair of depending supporting edges 18 arranged to be received in slots or indentations 16 of the fin 11. The trough 17 is of resilient plastic material and may be easily clipped on or removed from slots 16 of fin 11.

The valance cover means 19, as shown in Figure 4, comprises a flange 20 on its upper end disposed on an arm 21 of the cover 19. The flange 20 is received in slots 22 provided in the upper surface of the fins 11. The main portions 23 and 24 of the cover 19 are arranged to substantially conform with the shape of the fin 11. The lower portion 25 is adapted to engage the trough 17 and is shaped to substantially conform to the circular shape of the trough 17.

The surface of the fin 11 in the embodiment shown in Figure 3 has been roughened, as indicated, by dipping the surface thereof in a 10% solution of sodium hydroxide. The fins 11 of Figures 1, 2 and 4 have been similarly roughened by buffing with a revolving wire brush. Treatment of the fins 11 in this manner permits the moisture to condense in the form of a thin film rather than as discrete droplets, and the surface tension of the film insures that the moisture gravitates to the collecting trough 17.

From the above description, it will be apparent that the moisture condensed on the surface of fin 11 when the extended fin structure is employed as a cooling element will be directed to the center and lowermost portion of the fin, where it may easily be collected in a narrow trough. The extended fin surface structure may be installed in the usual manner either by peripheral installation at the ceiling or at the floor level. Where the structure is installed in a ceiling or valance level heating and cooling system, the narrow width of the trough allows increased circula-

tion of air through and around the fin structure in spite of the necessity of providing a valance in front of the structure to conceal it from view.

It will be understood that the above-described embodiment of the invention is illustrative only and that modifications will occur to those skilled in the art. Therefore, the invention is not to be limited to the specific apparatus disclosed herein but is to be defined by the appended claims.

I claim:

1. An extended fin surface structure comprising a tube adapted to conduct a heat exchange fluid, a plurality of substantially vertical fins attached to said tube, each fin being tapered in width downwardly from its outermost extremity toward the center of the lowermost discharge portion of the fin, and each fin having a roughened surface thereon to insure condensation of moisture in a thin film, a slot entering each edge of each fin at an angle downwardly inclined from the horizontal and a trough extending the length of the structure, said trough having supporting edges adapted to be received by the slots in said fins, and said supporting edges, when in place, extending slightly beyond the edges of the fin to insure collection of all condensed liquid gravitating from the fin.

2. The extended fin surface structure of claim 1 wherein the trough is unitary and of resilient material so that it may be removably fastened to the fins.

3. The extended fin surface structure of claim 1 wherein the structure is provided with a valance cover comprising a body portion, a flange on the upper edge of the body portion, and a lower portion, said lower portion being adapted to clip on to and frictionally engage the trough, and said body portion substantially conforming to the outer edge of the vertical fins.

4. An extended fin surface structure comprising a tube adapted to conduct a heat exchange fluid, a plurality of substantially vertical fins attached to said tube, each fin being tapered in width downwardly from its outermost extremity toward the center of the lowermost discharge portion of the fin, a slot formed in each edge of each fin, and a trough extending the length of the structure, said trough having supporting edges adapted to be received by the slots in said fins, and said supporting edges, when in place, extending slightly beyond the edges of the fin to insure collection of all condensed liquid gravitating from the fin.

5. The extended fin surface structure of claim 4 wherein the trough is unitary and of resilient material so that it may be removably fastened to the fins.

6. The extended fin surface structure of claim 4 wherein the structure is provided with a valance cover comprising a body portion, a flange on the upper edge of the body portion, and a lower portion, said lower portion being adapted to clip on to and frictionally engage the trough.

7. An extended fin surface structure comprising a tube adapted to conduct a heat exchange fluid, a plurality of substantially vertical fins attached to said tube, each fin being tapered in width downwardly from its outermost extremity toward the center of the lowermost discharge portion of the fin, a slot formed in each edge of each fin at an angle downwardly inclined from the horizontal, and a trough extending the length of the structure, said trough having supporting edges adapted to be received by the slots in said fins, and said supporting edges, when in place, extending slightly beyond the edges of the fin to insure collection of all condensed liquid gravitating from the fin.

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