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HEAT EXCHANGER

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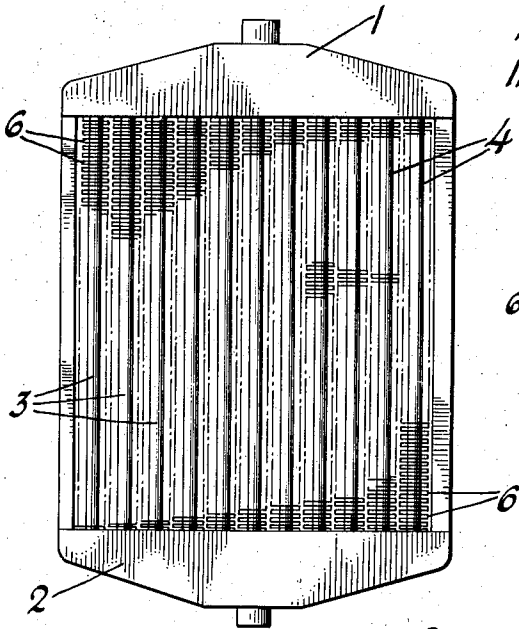


Fig. 1

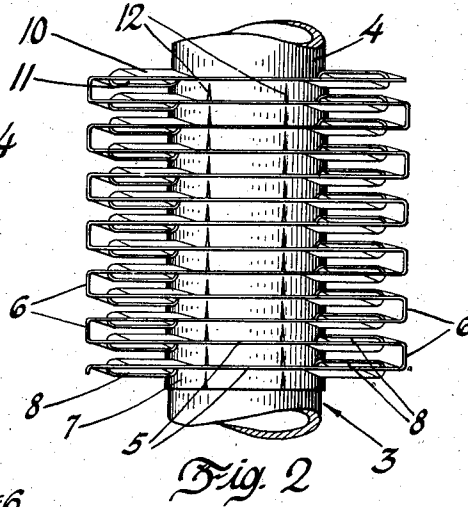


Fig. 2

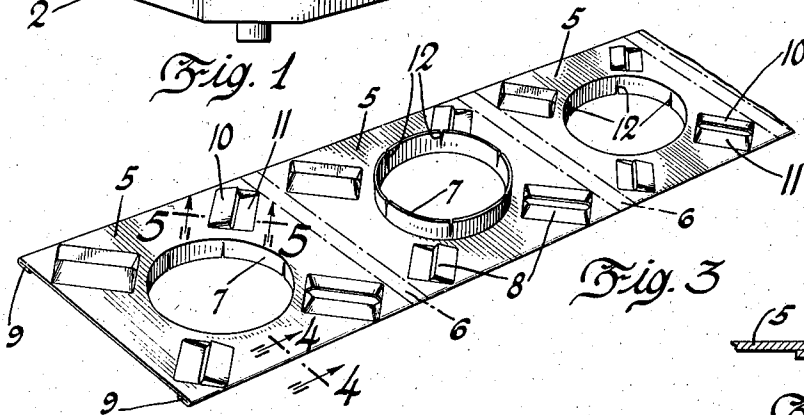


Fig. 3

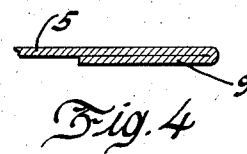


Fig. 4

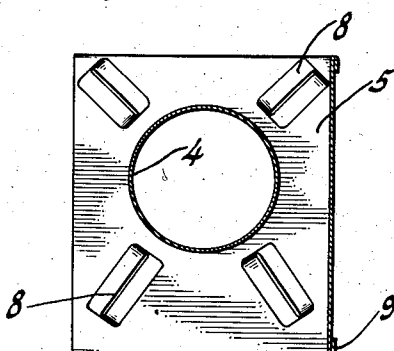


Fig. 5

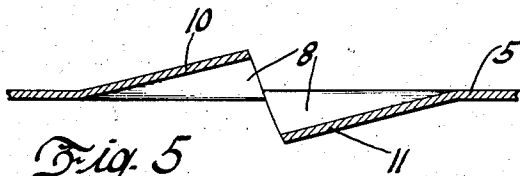


Fig. 6

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UNITED STATES PATENT OFFICE

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HEAT EXCHANGER

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2 Claims. (Cl. 257—262)

Unit heaters for attachment in a building heating system with a motor driven fan to direct room air over a number of steam pipes, as well as other types of heat exchangers, generally make use of a fin and tube type radiator. The several finned tubes form a core and extend in spaced relation between a pair of headers or tanks for connection with the steam or inlet pipe and condensate or return pipe, respectively, and air passing over the exposed radiating surface carries away heat.

An object of the present invention is to provide a finned tube which will be highly efficient in the transfer of heat in that the fins will rapidly adsorb heat from the tube containing heating medium and handle the air passing through the core to insure wiping contact of a large number of air particles.

A further and important object is to provide a fin assembly of simple design from the manufacturing standpoint so that production may be accomplished easily and quickly and at low cost.

The above and other objects and advantages of the invention will become apparent during the course of the following specification taken in connection with the accompanying drawing, wherein Figure 1 is a front elevation of a unit heater; Figure 2 is an elevation of a fragment of one of the finned tubes on an enlarged scale; Figure 3 is a detail perspective view of a fin strip after having been formed, but prior to bending to shape; Figures 4 and 5 are detail sectional views taken on lines 4—4 and 5—5, respectively, of Figure 3, and Figure 6 is a section through the tube shown of a slightly modified type of fin.

A preferred, but not necessarily the only embodiment of the invention, is illustrated. Shown in Figure 1 is a unit heater assembly which includes a top tank or inlet header 1 and a bottom tank or outlet header 2 with an intermediate core or tube assembly 3 extending between the tanks. The core comprises a number of spaced tubes carrying heat radiating fins, each of which may be of the type shown in Figure 2.

In this view the tube fragment 4 extends through a number of spaced fins 5 formed from a continuous strip folded upon itself to substantially zigzag shape. Each fin, therefore, has connecting portions 6—6 at opposite ends extending in opposite directions and joining next succeeding fins. That is to say, each fin has a laterally extending portion 6 at one side connecting it to the fin above and an angularly bent portion 6 at the other side connecting to the fin below. The several connecting portions 6—6 serve to space the

fins 5—5 apart and the fins are additionally spaced apart by annular flanges or collars 7 projecting laterally and defining tube receiving openings through the fins.

The collars extending between the fins cooperate to form a substantially continuous tube-like wall in which the main tube 4 is nested in close fitting relation. If desired, the several collars may be secured to the tube as by solder, welding or the like, although reliance may be placed merely on the frictional surface contact for holding the fins against displacement. At any rate the collars provide a large area of tube contacting surface which facilitates the flow of heat from the tube 4 into the fins 5—5 for dissipation into the air stream.

Increased dissipation is obtained by controlling the direction of air flow in a way to insure a maximum number of air particles coming into wiping contact with the fin. This can be accomplished by providing in each fin the series of louvered openings 8, the action of which will be referred to more in detail later.

In the manufacture of the fin strip a continuous ribbon of thin metal, such as copper or brass, may be formed at regular intervals with a group of formations, as illustrated in Figure 3, and subsequently folded upon itself along transverse lines between succeeding groups of formations, to provide the series of fins. The strip preferably is reversely bent upon itself along opposite longitudinal edges as at 9 to reinforce the edge and stiffen the entire strip. At spaced intervals, portions of the fin material are punched out to provide a longitudinal row of tube receiving openings and the peripheral margin of each of these is formed with a laterally projecting annular flange which constitutes the collar 7. To facilitate the formation of the pressed out collar, circumferentially spaced slits 12 may be cut at intervals in the margin of the opening to prevent the material crowding upon itself.

It is to be noted in Figure 3 that alternate collars project out of the plane of the strip on the same side and that the remaining collars project on the opposite side of the strip. Since the collars associated with succeeding openings extend in opposite directions and because the strip is folded upon itself in zigzag relation, in the assembled fin strip all of the collars will extend from the fins in the same direction as is illustrated in Figure 2, where each collar projects below its fin. The folding of the strip occurs about transverse lines between succeeding tube receiving openings and for the sake of clear-

ance such lines of bending are indicated in Figure 3 by broken lines which also define the successive sections of the fin strip which constitute the fins.

The louvered openings 8 in each section may be arranged in any convenient manner and are here shown as extending on lines radiating from the center of the tube opening. Each is formed by slitting the fin and then pressing the thin material on opposite sides of the slit in opposite directions from the plane of the fin to provide a set of inclined deflectors, one extending above the fin as at 10, and the other below as at 11. The movement of the air particles at each louvered opening will be apparent upon an inspection of Figure 5 and considering this figure for the moment, if the air streams wiping opposite sides of the fin are considered as moving toward the left those particles wiping the underside of the right-hand end of the fin will ride down the inclined under surface of the baffle 11 and move into space at the slit and similarly those air particles wiping the upper side of the fin move down the inclined upper surface of the deflector and then into a non-wiping strata. The two deflectors 10 and 11 cooperate in shifting the air stream and the leading edge of the deflector 10 serves to divide the stream and the divisions, having previously been in a non-wiping strata, now come into contact with the opposite sides of the fin. By employing several of such chuted openings in the fin there will occur several changes in the relation of air particles to the fin, whereby a large number of air particles will be brought into wiping engagement with the fin surface and more work is obtained from a given number of particles.

Somewhat increased dissipation can be secured by offsetting the row of tube receiving openings from the longitudinal center line of the strip and

presenting the widest side of the fin to the incoming fresh air. A single fin having an offset tube opening is illustrated in Figure 6 and from this view it will be seen that most of the fin is directly exposed to unrestricted flow thereacross of the air stream and only a small portion at the rear obstructed by the tube. Otherwise the fin is as heretofore described and forms an integral part of a continuous zigzag strip.

We claim:

1. In a fin and tube radiator, a fin strip comprising a continuous ribbon having a series of spaced openings therein and being reversely folded at intervals to provide a series of spaced fins with said openings in alinement to receive a tube, each fin having therein a series of circumferentially spaced slits in radial relation to the opening in the fin, with the material immediately adjacent and on opposite sides of each slit pressed in opposite directions out of the plane of the fin for cooperation in providing an inclined chuted opening through the fin.

2. In a fin and tube heat exchanger, a continuous fin strip having succeeding portions thereof in right angular relation to each other so that alternate portions lie in parallel planes with one set of alternate portions constituting superposed fins spaced apart by the other set, reinforcing formations on the leading and trailing longitudinal edges of the strip, each fin portion being further stiffened by a lateral flange defining a tube embracing opening and by a series of circumferentially spaced formations, each comprising offset scoops pressed in opposite directions from the fin on opposite sides of a line slit, with the lines of adjacent slits angularly related to each other.

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