Dec. 22, 1953 W. E. HAMMOND ET AL 2,663,550

HEAT EXCHANGER ENVELOPE COMPRISING NOTCHED CHANNELS MOUNTING SINUOUS FIN ELEMENTS

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Fig. 1

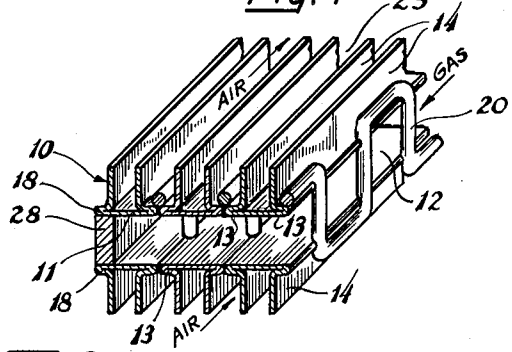


Fig. 2

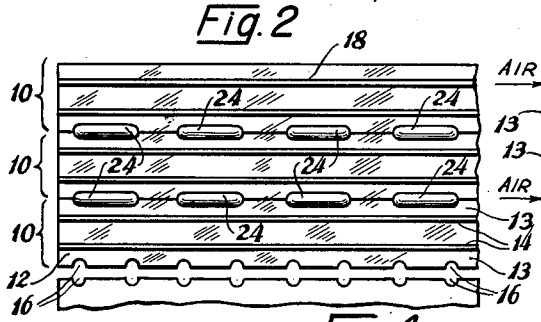


Fig. 3

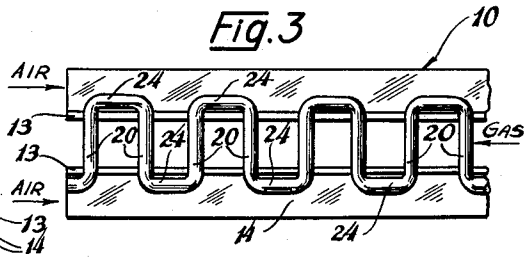


Fig. 4

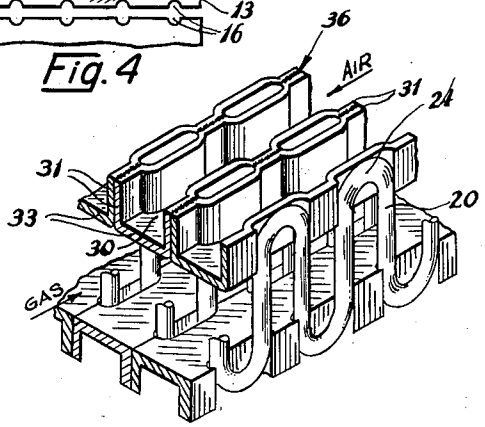


Fig. 5

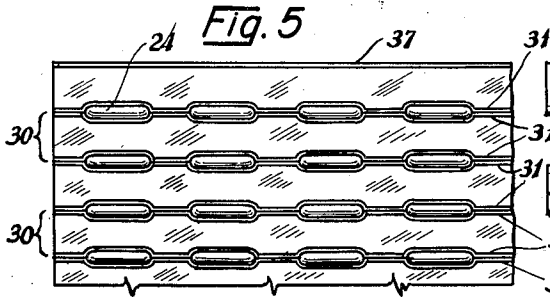
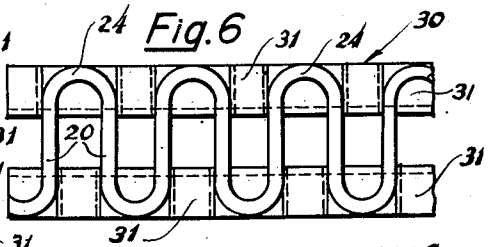


Fig. 6



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HEAT EXCHANGER ENVELOPE COMPRISING NOTCHED CHANNELS MOUNTING SINUOUS FIN ELEMENTS

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5 Claims. (Cl. 257—245)

1

The present invention relates to improvements in plate type heat exchangers utilized for the transmission of heat between two confined fluids and particularly to an envelope component therefor having extended surface on the walls of its fluid passage.

A well known type of apparatus for the transfer of heat between two confined fluids is made up of a plurality of metallic plates spaced to form passages through alternate ones of which a relatively hot fluid, such as a hot gas, flows in heat exchange relationship with air or other fluid to be heated on traversing the intermediate passages. In many such exchangers a series of "envelopes" are provided consisting of parallel plates with the space therebetween closed along one pair of opposite edges to bound the sides of the passage for the heating gas or other fluid. The envelopes are mounted in spaced relation to form the passages for the other fluid or air and the inter-envelope spaces are likewise closed along opposite side edges, which sides may be those corresponding to the closed edges of the air envelopes in case of parallel flow, or along the adjacent perpendicular sides in case of transverse flow. Such spaced envelopes form a core that is usually enclosed within a housing with which are associated the inlet and outlet manifolds leading to the sets of gas and air passages and the supply and discharge ducts for the two fluids.

To increase the heat transfer efficiency the walls of the fluid passages in heat exchangers of this type frequently are provided with extended surface in the form of fins extending into the path of the fluids and serving to increase the conduction of heat to and through the walls bounding the passages. In the application of Sven Holm Serial No. 752,008, dated June 3, 1947, now Patent No. 2,595,457, dated May 6, 1952, there is disclosed a form of extended surface for passage walls comprising sinuously bent wires forming loops extending between the walls bounding the gas passage and constituting pin-like fins extending from these walls. On the outer faces of these walls other extended surface is provided, sometimes in the form of channel members constituting longitudinal fins extending parallel to the direction of fluid flow. To promote sufficient heat transfer good bonds have to be provided between the pin fin elements on the inner walls of the gas passage and also between the outer walls of this passage and the channel members and such bonds have heretofore been provided by brazing.

The present invention contemplates the formation of the heat exchange envelope from structural shapes such as channels that have bases constituting the passage walls and flange portions which are specially formed to mount the sinuously formed elements whose loop portions constitute pin-fins extending from the passage walls.

2

The invention will best be understood upon consideration of the following detailed description of illustrative embodiments thereof when read in conjunction with the accompanying drawings in which:

Figure 1 is a perspective view showing a fragmentary portion of a heat exchange envelope embodying the invention.

Figures 2 and 3 are plan and side elevational views corresponding to Figure 1.

Figure 4 is a perspective view of a fragmentary portion of a heat exchange envelope embodying another form of the invention, while

Figures 5 and 6 are corresponding plan and elevational views.

As appears in Figure 1 the heat exchange envelope is made up of upper and lower sets of channel members 10 disposed in side by side relation in parallel rows so that the base portions 11 of the channels in each row aline to constitute a boundary wall of the heat exchange passage 12 formed between the two sets of channels. In Figures 1 to 3 the bases 11 have lateral lips or ledges 13 that extend outwardly beyond the channel legs 14. The side flanges or legs 14 of the channels constitute the extended surface projecting from the outer walls of the gas passage into the air passage between adjacent envelopes. The extended surface in the gas passage is comprised of a series of pin-like fins which are the leg portions 20 of loops formed in sinuously bent wire elements disposed so that the loops are upright and extend back and forth between the opposite walls of the gas passage. The lateral flanges 13 on the bases 11 of the channel components of the envelope are in contact with those of adjacent channels to form the air flow spaces 23 (Fig. 1) between the leg portions 14 of one channel and those of the adjacent channels. The lateral flanges 13 are formed with notches or recesses 16 (Fig. 2) in which the leg portions 20 of the sinuously bent wires are engaged. The notches 16 on the flanges 13 on adjacent channel members 10 register with each other to form apertures or narrow slots through which the leg portions 20 of the sinuous wire elements extend with the stretcher portions 24 of the loops resting in contact with the outer faces of the lateral

flanges 13 in the air passage between the longitudinal fins therein constituted by the legs 14 of the channel members. Inasmuch as the recesses 16 are open at their ends the stretcher portions 24 of the loops are exposed to the fluid (air) that flows on the outer side of the wall constituted by the abutting bases of the channels 10. At the edges of the envelope the outside base flanges 18 of the extreme end channels are not notched but serve to mount the closure bars 28 for the sides of the envelope.

The assembled channel members and sinuously bent fin elements forming an envelope with finned walls are bonded together to provide good heat transfer bonds as by brazing.

In the form shown in Figures 4 to 6 the channel members 30 have their upright legs 31 in contact with each other and these together form strip fins in an air passage. In this construction the flanges 31 of the channels are depressed or recessed at a plurality of points spaced longitudinally thereof to a depth half the diameter of the sinuous wire fin elements so that when sets of channels are mounted in side by side relation so that their bases 33 constitute the confronting walls of the gas passage the open ended notches or depressions 33 in adjacent channels register with each other to form sockets for receiving the stretcher portions 24 of the sinuously bent wires and contiguous portions of the leg parts 20. Here also the recesses 33 being open at their ends cause the stretcher portions 24 of the loops to be exposed to the streams of air.

At the outer side margin of the envelopes the extreme channels do not have recesses in their legs 37 (Fig. 5). These however serve for bonding the passage walls to a strip or bar which closes the gas passage along the side edges of the envelope.

Welds 36 may be formed along the abutting longitudinal edges of adjacent flange portions 31 which not only effects the seal between adjacent channels of the envelope but anchors the wire fin elements in place.

What we claim is:

1. An envelope component for a heat exchanger comprising two parallel rows of metallic channels positioned in abutment in side by side relation so that the bases of channels in each row aline to constitute a wall of a fluid passage within the envelope with the channel legs extending from the outer faces of the envelope as longitudinal fins, contiguous channels being formed with open ended recesses that confront each other so as to receive and to support between them in upright relation in said passage and parallel to the direction of flow therein a wire element sinuously bent into U-shaped loops whose legs extend back and forth across said passage and constitute pin-fin extended surface of the walls

thereof with the stretcher portions of said loops located near the open ends of said recesses and exposed to the fluid on the other side of said wall.

2. An envelope component for a heat exchanger comprising metallic channels positioned in abutment in side by side relation so that their bases aline to constitute walls of a fluid passage within the envelope and disposed in two parallel rows with their bases in confronting relation to form the boundary walls of said passage and with their legs extending from the outer faces of the envelope as longitudinal fins; sinuous wire elements bent into U-shaped loops whose legs are positioned in upright relation in said passage and engaged between contiguous pairs of contiguous channels at opposite sides of said passage to constitute pin-fin extended surface of the walls thereof.

3. A heat exchanger as recited in claim 1 wherein said channels have flanges projecting laterally from the outer faces thereof in alignment with their bases and provided with recesses at a plurality of points spaced longitudinally in accordance with the pitch of said sinuous fin elements, the recesses in the flanges of contiguous channels registering to form sockets receiving the leg portions of the loops of said wire elements.

4. A heat exchanger as recited in claim 3 wherein the recesses in the flanges of contiguous channels register to form sockets through which the leg portions of the loops of said wire elements extend with the stretcher portions of said loops resting on the outer faces of said channels.

5. A heat exchanger as recited in claim 1 wherein said recesses in said channel members comprise transverse grooves formed in the outer faces of the legs of said channels at a plurality of points spaced longitudinally thereof in accordance with the pitch of bending of said sinuous fin elements, the grooves in the legs of adjacent channels registering to form sockets into which the stretcher portions of said looped elements extend.

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