Jan. 13, 1959 P. HODSON ET AL 2,868,514

MOUNTING SINUSOIDAL FIN ELEMENTS IN HEAT EXCHANGE ENVELOPE

Original Filed March 30, 1950

Fig. 1

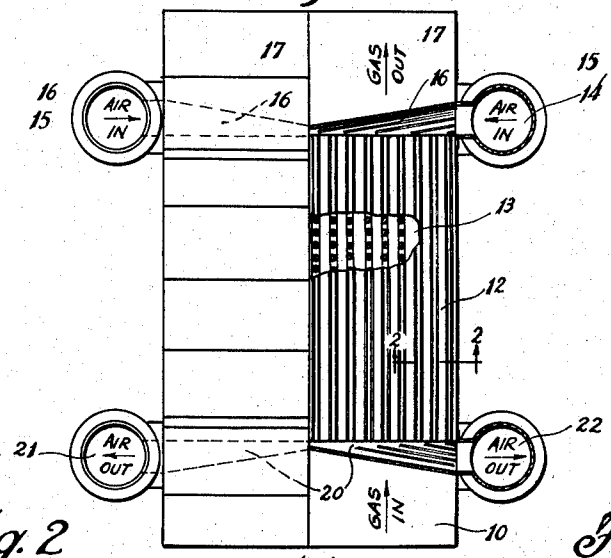


Fig. 2

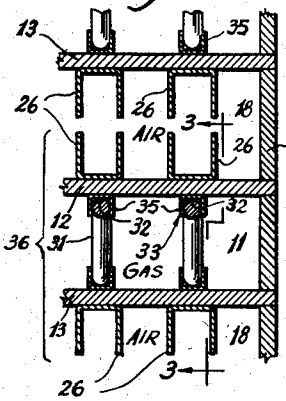


Fig. 3

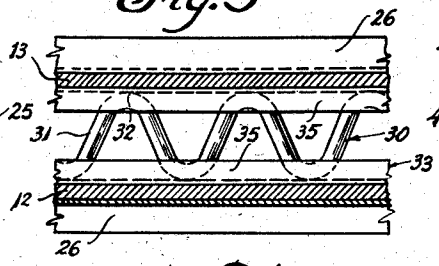


Fig. 4

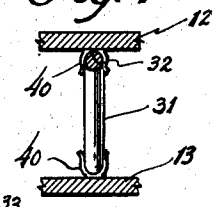


Fig. 7

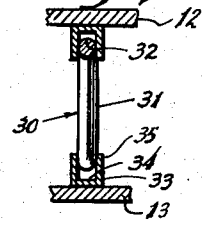


Fig. 5



Fig. 8

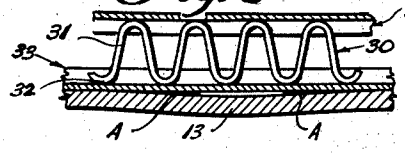


Fig. 6

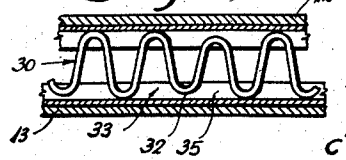


Fig. 10

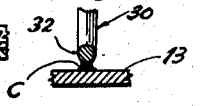
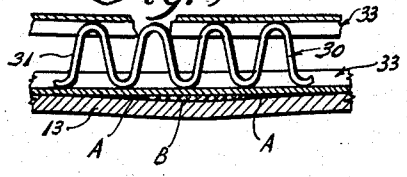


Fig. 9



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MOUNTING SINUSOIDAL FIN ELEMENTS IN HEAT EXCHANGE ENVELOPE

Peter Hodson and Sven Holm, Wellsville, N. Y.

Continuation of abandoned application Serial No. 152,952, March 30, 1950. This application June 2, 1955, Serial No. 521,203

1 Claim. (Cl. 257—245)

The present invention relates to heat transfer apparatus and particularly to an improved form of extended or finned surface for exchange of heat between two confined fluids. This is a continuation of the Peter Hodson and Sven Holm U. S. application Serial No. 152,952, filed March 30, 1950, now abandoned.

One well known form of heat exchanger for the transfer of heat between two confined fluids is made up of a plurality of spaced metallic plates forming passages through alternate ones of which a heating fluid such as a hot gas flows in heat exchange relationship with the fluid to be heated, such as air, traversing the intermediate passages. The present invention contemplates providing the passage walls through which heat is exchanged with a myriad of pin-like fins and improvement in the heat transfer relationship between the fins and the walls of which they constitute extended surface by making the fins in the form of sinuously bent wires having U-shaped loops whose stretcher parts are seated in channels bonded to the passage walls. 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 diagrammatic representation of a plate type heat exchanger in which the invention is embodied.

Figure 2 is a fragmentary sectional view of a plate type heat exchanger showing the manner in which the pin-like fins are applied to the passage forming walls in accordance with the present invention.

Figure 3 is a sectional view on the line 3—3 in Figure 2.

Figure 4 is a fragmentary view showing an alternative method of mounting the fins.

Figures 5 to 9 are diagrammatic views illustrating how a good heat transfer relationship is maintained between the fin element and the mounting channels therefor despite defects in the manufacture or assembly of these parts; and

Figure 10 is a fragmentary view showing the fin element directly secured to the plate.

Figure 1 diagrammatically shows a plate type heat exchanger in which the heating gas enters through the inlet **10** to flow longitudinally of the exchanger through alternate passages **11** (Fig. 2) formed between a plurality of spaced metallic plates **12** and **13**. The air to be heated is supplied by a pair of inlet headers **14**, **15** and flowing into the manifolds **16** traverses the intermediate passages **18** leading to the outlet manifolds **20** and thence into the air outlet ducts **21** and **22**. As shown in Fig. 2, pairs of plates **12** and **13** have the spaces therebetween along their side edges closed by closure strips **23** to form a unitary heat exchange envelope. Adjacent envelopes are spaced apart to define the air passages **18** whose sides are closed by spacer strips **25**. On the air side extended surface is provided in the forms of strip fins **26** of channel section.

To increase the efficiency of heat transfer from the

gas flowing in a passage **11**, the walls **12** and **13** are provided with extended surface in the form of a myriad of pin-like fins projecting in upright relation from the walls **12** and **13**. Continuous lengths of metallic wire are bent substantially sinusoidally to form a fin element **30** having a plurality of U-shaped loops therein whose leg portions **31** constitute pin-like fins extending in upright relation between the plates **12**, **13** while the stretcher portions **32** are alined along the axis of the wire and are, preferably, disposed in alinement in the general direction of gas flow. The stretcher portions **32** of a fin element **30** are seated in the grooves in a pair of channel members designated as a whole by the numeral **33**. The stretcher parts **32** of an element **30** preferably contact both the base portion **34** and the upright or leg parts **35** of these channels. The leg parts **35** themselves also constitute extended surface on the passage walls **12**, **13**. In assembling a heat transfer envelope **36**, Fig. 2, a pair of channel members **33** are first applied along opposite side edges of each sinuous element **30** with a strip of brazing foil intervening between the base **34** and inner faces of the legs **35** of the channel members and the stretcher portions **32** of the wire fin element. A series of fin elements **30** with channel members **33** assembled therewith are then mounted between a pair of plates **12**, **13** with other strips of brazing metal applied between the outer faces of the bases **34** of the channels **33** and the plates **12**, **13**. The spaces between the passage walls **12** and **13** at the sides are closed by the strips **23** which may be welded in place. The entire envelope assembly is then placed in a brazing oven and brazing bonds formed to transform the plates **12**, **13** and fins **31** with channels **33** into an integral unit.

Figure 4 shows a form which the channel member is in the form of a spring clip **40** which tightly grasps the stretcher portions **32** of the sinuously formed fin element **30** and thus affords an effective heat transfer bond between the fins **31** and plates **12**, **13**.

It may be seen in Fig. 5 that good heat transfer bonds are maintained between the sinuous finned elements **30** and the channels **33**, and hence with the heat transfer plates **12**, **13** to which the latter are brazed, even though the sinuous wire element **30** may be distorted or sprung so that the stretcher portions **32** of some loops do not contact the base **34** of the channel element **33** because as illustrated here and in Fig. 7 a good heat transfer bond is provided by the large area of contact between the inner faces of the leg portions **35** of the channel **33** and stretchers **32** in the fin member **30**. Figure 6 shows that even in cases where one or more loops in the sinuous fin element **30** have been incompletely formed, as being shortened, adequate contact is provided between the stretcher portion **32** of the misformed loop and the sides **35** of the channel member **33** to afford good heat transfer conditions. This is shown in Figure 7 also.

In Figs. 8 and 9 it is assumed that the passage wall **13** has been bowed so that it is no longer flat and hence is not in full planar contact with the base **34** of the mounting channel **33** for a sinuous fin element **30**. Nevertheless, in the brazing operation capillary attraction will cause some of the brazing metal to flow first into the areas A as indicated in Fig. 8 and, when these have been built up, further brazing metal will subsequently flow into the area B as indicated in Fig. 9. Thus, despite bowing of the plate **13** a good heat transfer relationship is afforded between the passage wall plate **13** and the fins **31** which constitute extended surface thereof. This is to be contrasted with the conditions shown in Fig. 10 wherein it is assumed that the sinuous fin element is applied directly to a wall plate **13**. Here the springing of the sinuous element, the misformation of a loop therein, or bowing

of the wall plate 13 would provide a gap between the plate and the stretcher portion 32 of the loop into which brazing metal would flow to form a fillet C which however would not produce such good heat transfer relationship as is afforded by contact between the sides 34 of a channel member 33 and the stretchers 32 of the sinuous fin element 30 where the base 34 of the channel would be in proper heat transfer contact with the plate 13.

What we claim is:

In a heat exchanger having metallic plates constituting walls of a fluid passage, and a plurality of heat exchange elements mounted in spaced relation in said passage parallel to each other and the direction of fluid flow through the passage, each element consisting of an individual metallic wire bent to substantially sinusoidal form to provide a ribbon-like element formed of a plurality of U-shaped loops lying substantially in a common plane extending substantially perpendicular to said plates, each loop having legs and a base, the bases of said loops forming the edges of said ribbon-like element; the improvement comprising a metallic channel member with base and flanges at angles thereto, said flanges being

spaced apart approximately the thickness of said wire and ribbon-like element and extending along and parallel to the major axis of the ribbon-like element with bases of the loops fitting closely into said channel member and with the side faces of the ribbon-like element in contact with the flanges of the channel member and an edge of the ribbon-like element contacting the base of the channel member at intervals along a line parallel to the axis of the channel; and metallic joints permanently joining the flanges and faces of said channel to the side faces and to said edge, respectively, of said ribbon-like element over an area therebetween that is several times the projected area of the thickness of said area at the point of contact between the edge of said element and the base of said channel.

References Cited in the file of this patent

UNITED STATES PATENTS

1,721,878	Grimes	July 23, 1929
2,330,549	Bowers	Sept. 28, 1943
2,645,462	Holm	July 14, 1953

UNITED STATES PATENT OFFICE

CERTIFICATE OF CORRECTION

Patent No. 2,868,514 January 13, 1959

Peter Hodson and Sven Holm

It is hereby certified that error appears in the above numbered patent requiring correction and that the said Letters Patent should read as corrected below.

In the grant, lines 1, 2 and 3, for "Peter Hodson and Sven Holm, of Wellsville, New York," read -- Peter Hodson and Sven Holm, of Wellsville, New York, assignors to The Air Preheater Corporation, of New York, N. Y.,--; line 12, for "Peter Hodson and Sven Holm, their heirs" read -- The Air Preheater Corporation, its successors --; in the heading to the printed specification, line 4, for "Peter Hodson and Sven Holm, Wellsville, N. Y." read -- Peter Hodson and Sven Holm, Wellsville, N. Y., assignors to The Air Preheater Corporation, New York, N. Y. --.

Signed and sealed this 28th day of July 1959.

(SEAL)
Attest:

KARL H. AXLINE

Attesting Officer

ROBERT C. WATSON
Commissioner of Patents