

Feb. 24, 1959

T. L. WOOLARD ET AL

2,874,941

BRAZED EXTENDED SURFACE HEAT EXCHANGER

Filed Sept. 6, 1955

2 Sheets-Sheet 1

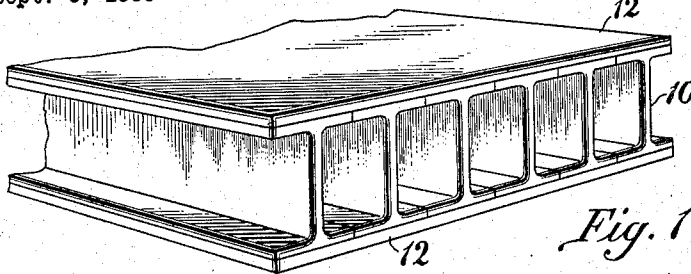


Fig. 1

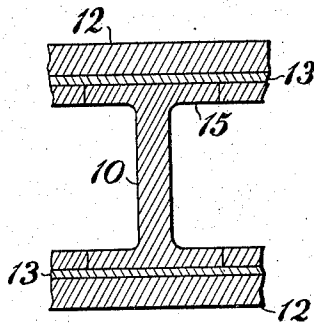


Fig. 2

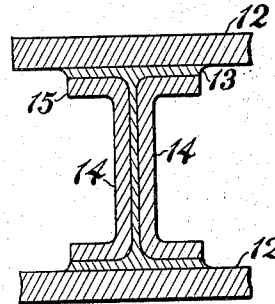


Fig. 3

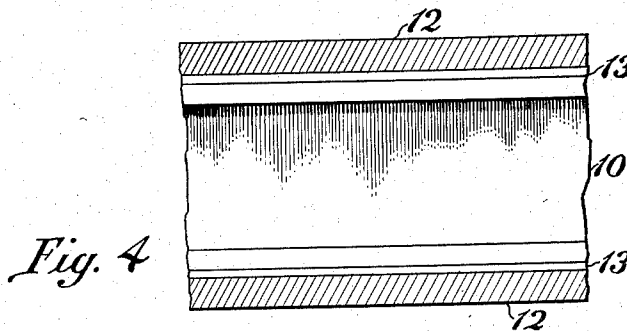


Fig. 4

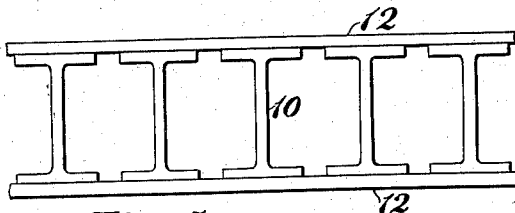


Fig. 5

INVENTORS
T. L. Woolard
David G. Peterson
BY Wayne H. Lang
AGENT

Feb. 24, 1959

T. L. WOOLARD ET AL

2,874,941

BRAZED EXTENDED SURFACE HEAT EXCHANGER

Filed Sept. 6, 1955

2 Sheets-Sheet 2

Fig. 6

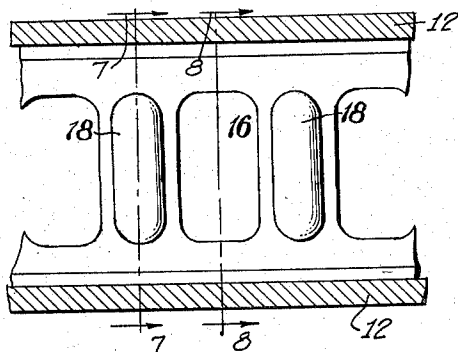
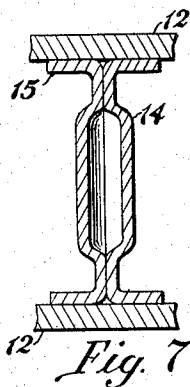


Fig. 7

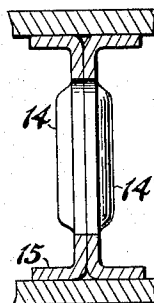


Fig. 8

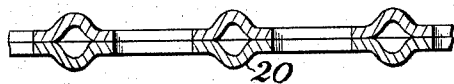


Fig. 9

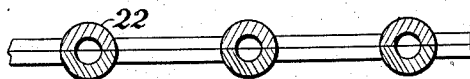


Fig. 10

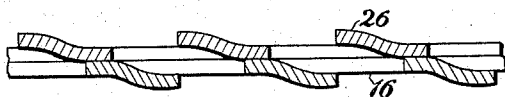


Fig. 11

INVENTORS

T. L. Woolard

BY *David G. Peterson*

Wayne H. Lang
AGENT

1

2,874,941

BRAZED EXTENDED SURFACE HEAT EXCHANGER

Thomas L. Woolfard and David G. Peterson, Wellsville, N. Y., assignors to The Air Preheater Corporation, New York, N. Y., a corporation of New York

Application September 6, 1955, Serial No. 532,679

4 Claims. (Cl. 257-245)

The present invention relates to plate type heat exchange apparatus utilized in the transmission of heat between two confined fluids, and particularly it relates to an envelope component for a heat exchanger having extended surface between the walls of a fluid passage therethrough.

An envelope of a plate type heat exchanger for the transfer of heat between two confined fluids is basically composed of a plurality of metallic plates spaced apart to form passages through alternate ones of which a relatively hot fluid, such as hot gas, flows in heat exchange relationship with air or other fluid to be heated on traversing the intermediate passages. Frequently, a series of envelopes are provided consisting of parallel plates with the space therebetween closed along one pair of parallel 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 air or other fluid to be heated, and the inter-envelope spaces are likewise closed along opposite side edges. Such spaced envelopes form a core that is usually enclosed within a housing that is provided with inlet and outlet manifolds leading to and away from the gas and air passages through the heat exchanger.

To increase the transfer of heat through walls of the fluid passages, heat exchangers of this type are frequently 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. Sinuously bent wires forming loops extending between walls have been frequently used as extended surface elements within the envelope while 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 provide good heat transfer between extended surface elements on the inner and outer walls of the fluid passages, good bonds must be provided between elements.

In a typical extended surface heat exchange envelope utilizing sinuous wire elements brazed in an upright position between spaced plates, the principal stress occurs at the edges of the brazed joints thereby producing an unbalance of moments and a tendency toward tearing apart of the brazed elements. In this invention, the principal stress in the brazed joint occurs at the center of each flange thereby eliminating any unbalance of moments which would tend to produce a tearing action and eventual failure of the brazed joint at other than maximum conditions of stress.

Sinuously bent wires of the type defined possess good heat transfer characteristics and furthermore brazed joints used to bond such wires to their respective walls are strong and possess adequate strength to withstand pressure differentials common to some heat exchangers, however, with increased conditions of temperature and pressure, there is a demand for a brazed extended surface

2

assembly having improved strength characteristics making possible use thereof on regions of elevated pressures and temperatures.

It therefore becomes an object of this invention to provide an improved extended surface arrangement for a plate type heat exchanger.

It is a further object of this invention to provide an extended surface arrangement for a plate type heat exchanger which is relatively easy to manufacture and maintain.

The principal object of this invention however is to provide an extended surface arrangement which is inherently strong and therefore capable of continuous operation at relatively high conditions of temperature and pressure.

The invention will be best understood upon consideration of these objects in conjunction with the accompanying drawings in which:

Figure 1 is a perspective view of a heat exchanger envelope utilizing this invention.

Figure 2 is a fragmentary transverse sectional view of the device illustrated in Figure 1.

Figure 3 is a fragmentary transverse sectional view of modified form of heat exchange device.

Figure 4 is a longitudinal elevation of the device illustrated in Figure 2.

Figure 5 is a transverse sectional view of an alternate element arrangement showing elements between spaced plates.

Figure 6 is a longitudinal elevation of a modified form of extended surface between two spaced plates.

Figure 7 is a transverse sectional view as seen from line 7-7 of Figure 6.

Figure 8 is a transverse sectional view of the invention as seen from line 8-8 of Figure 6.

Figures 9, 10 and 11 are alternate pin arrangements particularly adaptable to manufacture according to this invention.

As indicated in the drawing, two heat exchange plates 12 are spaced apart by I-sections 10 which comprise an extended surface member extending between spaced plates. A plurality of such I-sections are placed between plates 12 and bonded thereto by a quantity of brazing material 13 which is inserted between members prior to its being subjected to a brazing temperature.

The I-sections may be formed integrally by extruding or they may be built up from a pair of channel members 14 in back-to-back relation as shown in Figure 3. When such a composite I-section is utilized, the same type of brazing material as is used to bond the I-section to plates 12 may also be used to bond channel sections 14 into an integral body.

Flanges 15 of the I-shaped section may be made to extend laterally any predetermined distance to provide accurate spacing means between adjacent parallel sections in the manner illustrated by Figure 1. However, by spacing the I-sections as illustrated by Figure 5 it is possible to induce a wide range of flow characteristics upon fluid flowing through the passageways between plates.

Figures 6, 7 and 8 illustrate an alternate arrangement wherein the web portion of channels forming the composite I-sections are first perforated to form openings 16 in alternation with ligaments 18. The ligaments 18 are subsequently formed into semi-circular or other curved shape so as to comprise, when placed in registry with similarly formed ligaments, tubular or substantially tubular pins as illustrated by Figures 9 and 10. By varying the form given the ligaments and by off-setting adjacent channels 14 so a ligament 26 is in lateral alignment with an opening 16, the extended surface member may take the form of the device illustrated by Figure 11.

3

These and other modifications of this invention are believed to fall fully within the scope of this invention, and it is therefore to be understood that this invention embraces all the various forms of the device that fall within the scope of the appended claims.

What is claimed is:

1. A heat exchanger envelope having a pair of metallic plates spaced apart to form passage walls for a fluid passageway therebetween; a plurality of extended surface members mounted between spaced plates to effect an improved transmission of heat to and through the passage walls, each extended surface member comprising a pair of cooperating channel members lying in back-to-back relation to form a composite I-section including spaced composite flanges with opposite faces thereof contacting the spaced metallic plates; and a quantity of brazing material intermediate cooperating channel members to bond said channel members into an integral body.

2. A heat exchange envelope as recited in claim 1 wherein the composite I-section is perforated to provide a series of interrupted ligaments extending between passage walls.

3. A heat exchanger envelope having a pair of spaced metallic plates which define a fluid passageway therebetween; a plurality of extended surface members mounted between spaced plates to transfer heat to and through

4

the passage walls, each extended surface member comprising a pair of channel members lying in back-to-back relation to form a composite I-shaped element including spaced composite flanges with opposite faces thereof contacting the spaced metallic plates, and each of said channel members perforated to provide ligaments between longitudinally spaced perforations, said channel members laterally offset one from another to provide substantial lateral alignment of a ligament of one channel with a perforation of an adjacent channel.

4. A heat exchanger envelope as defined in claim 3 wherein longitudinally spaced edges of adjacent ligaments are laterally displaced to provide a passageway between ligaments.

References Cited in the file of this patent

UNITED STATES PATENTS

1,492,897	Ryder	May 6, 1924
1,751,757	Phillips	Mar. 25, 1930
2,172,667	Nelson	Sept. 12, 1939
2,566,161	Brown, Jr.	Aug. 28, 1951
2,595,440	Austin	May 6, 1952
2,703,226	Simpelaar	Mar. 1, 1955

FOREIGN PATENTS

910,308	Germany	Apr. 29, 1954
---------	---------	---------------