Jan. 30, 1951 C. S. SIMPELAAR 2,539,870

CROSSFLOW HEAT EXCHANGER

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Fig. 1

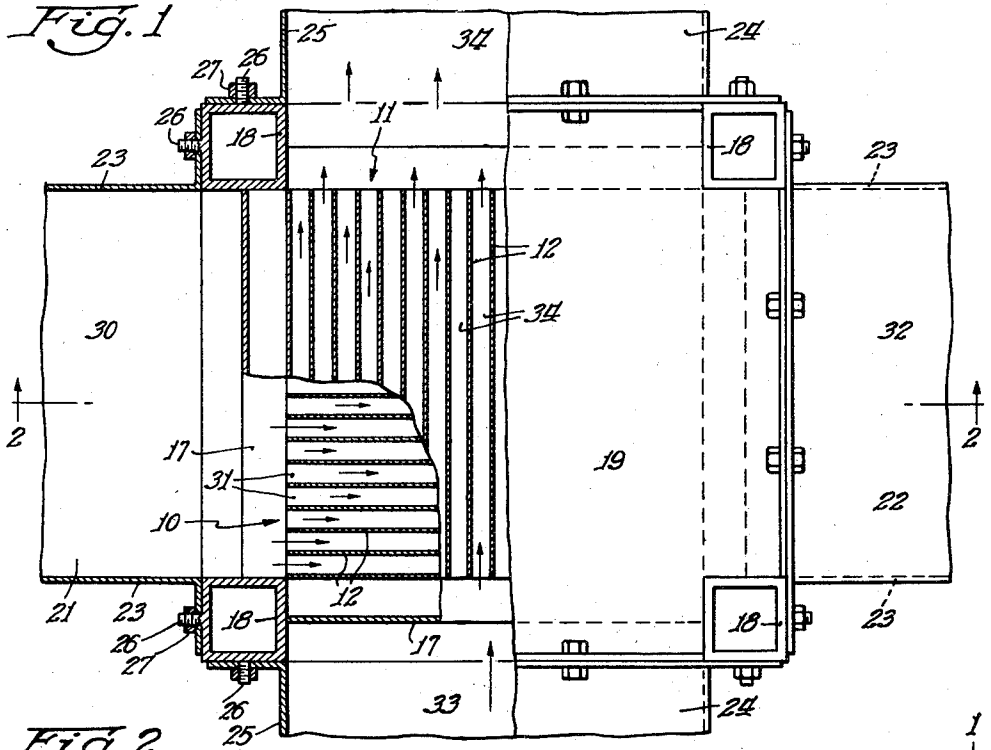
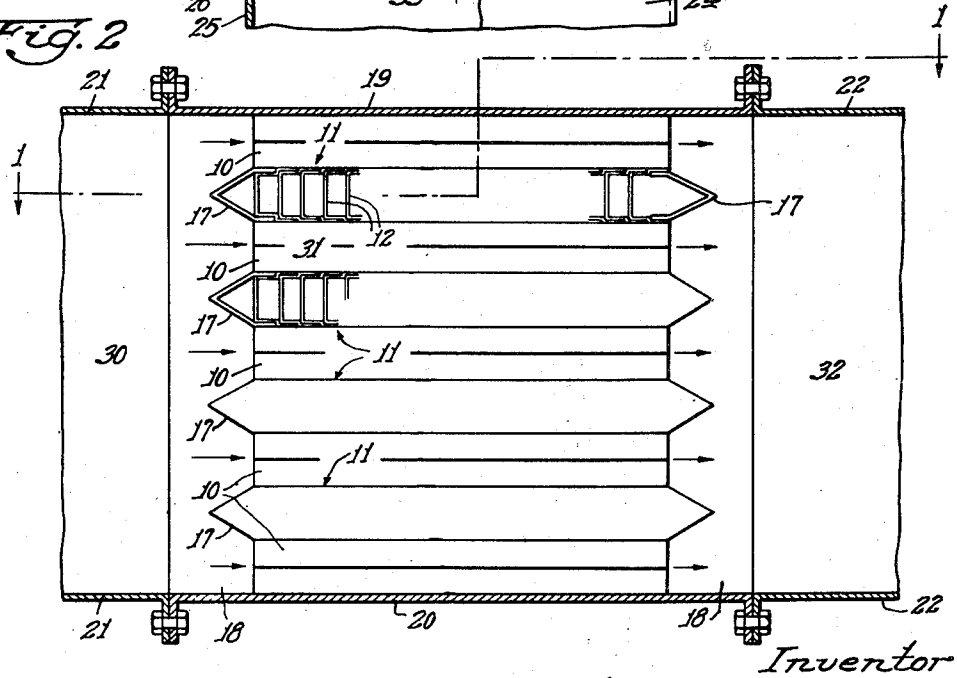


Fig. 2



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Fig. 3

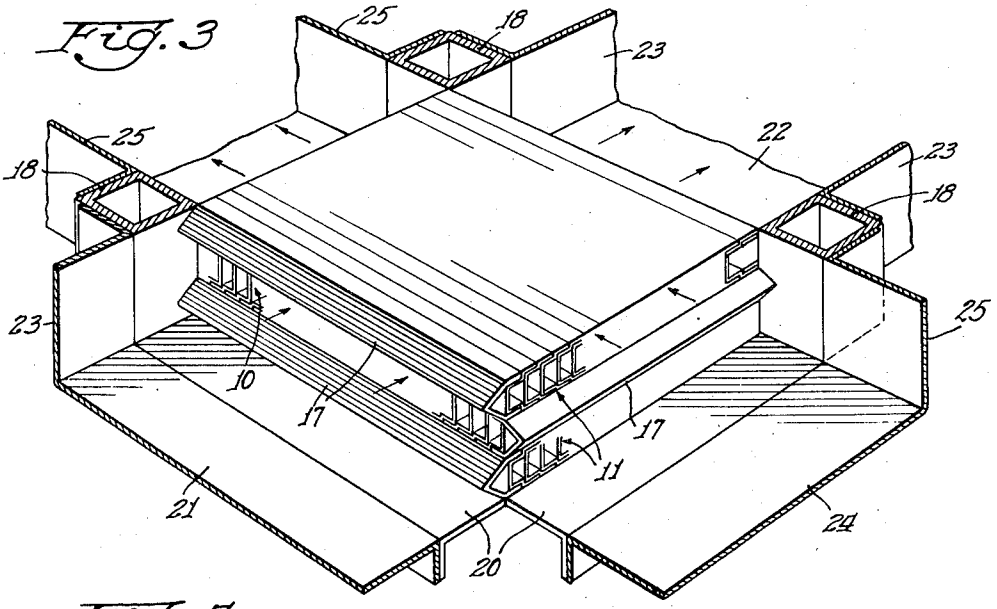


Fig. 4

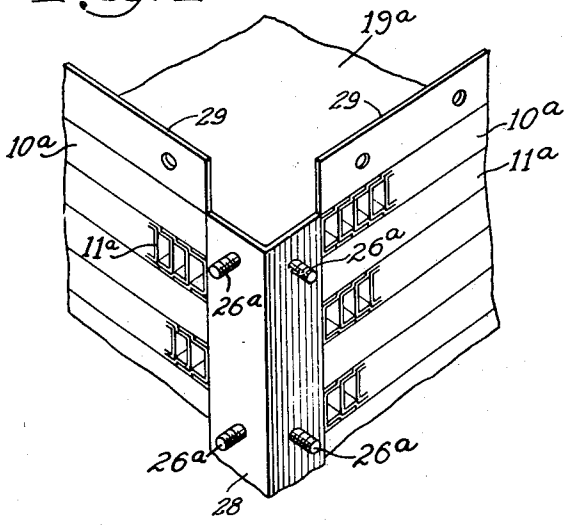
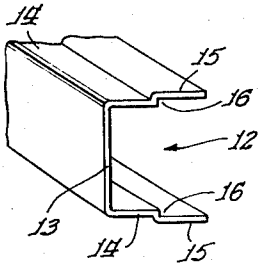


Fig. 5



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UNITED STATES PATENT OFFICE

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CROSSFLOW HEAT EXCHANGER

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Application April 24, 1946, Serial No. 664,543

2 Claims. (Cl. 257—245)

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This invention relates to cross flow heat exchangers and among its objects is so simplify the construction of heat exchangers of this type and to provide a highly efficient heat exchanger between gas to gas, one of which may be air as the heat exchange medium.

Another object is to provide a heat exchanger composed of a plurality of alternate and intermediate series of fin elements of which the alternate and intermediate series extend crosswise of each other, each series providing passages through which the fluid flows and so arranged that the heat in one fluid flowing through the passageways of one series is conducted by the fin elements to the fluid flowing through the adjacent other series of passages and is carried away by it.

This invention has particular reference to heat exchangers which employ a gas, such as air, as the coolant for cooling another gas.

Another object is to provide a heat exchanger of which the core may be constructed principally of similar fin elements bonded together.

Another object is to provide several series of nested and bonded together channel shaped fin elements wherein the fin elements provide the passages for the coolant and for the fluid to be cooled.

Other objects and advantages will appear in the course of this specification and with all of said objects and advantages in view, this invention consists in the several novel features hereinafter fully set forth and more particularly defined in the appended claims.

The invention is clearly illustrated in the drawings accompanying this specification, in which:

Fig. 1 is a view partly in plan and partly in section taken along the line 1—1 of Fig. 2 with certain portions broken away, of a cross flow heat exchanger embodying one form of the present invention;

Fig. 2 is a vertical longitudinal section taken on the line 2—2 of Fig. 1;

Fig. 3 is a perspective view partly in section and partly broken away of the heat exchanger illustrated in Figs. 1 and 2;

Fig. 4 is a fragmental perspective view of a slightly modified form of heat exchanger; and

Fig. 5 is a perspective view of a fragment of one of the fin elements employed in the structure of the heat exchanger.

Referring to said drawings, and first to Figs. 1 to 3 inclusive, the reference characters 10 designate several series of fin elements and the reference characters 11 designate several other

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series of fin elements extending crosswise of the first mentioned series. The several series of fin elements are arranged in alternate and intermediate relation and each series provides passages through which the fluids flow from inlets to outlets. The fin elements are preferably in the form of nested and bonded together channel shaped members 12 (see Fig. 5), each formed with a cross wall 13 and two side walls 14, each of which has an outwardly offset edge portion 15. At the offsets, ledges 16 are formed against which the next adjacent nested fin seats. The wide contacting surfaces of the overlapping parts of the side walls provide large areas for the bonding material. In the finished structure, the alternate and intermediate series of fin elements are also bonded together, thereby providing great capacity for heat conductivity.

At the inlet and outlet ends of the channels are fin elements 17, V-shaped in section. The walls of the V-shaped fin elements terminate in parallel edge portions in overlapping relation with respect to the next adjacent fin elements. The end fin elements 17 at the inlet side are provided for deflecting the incoming gas into the passages that extend crosswise of the V-shaped fin elements. The latter may be of the same length as the channel shaped fin elements so as to leave open angles at the corners of the structure and extending through said open angles are posts 18 to which the ends of the V-shaped fin elements are bonded.

Upper and lower housing plates 19, 20 are bonded to the structure formed by the fin elements, and bolted or otherwise secured to flanges at the ends of said plates 19, 20 are walls 21, 22 of ducts 30, 32, and bolted or otherwise secured to the posts 18 are other walls 23 which join with the walls 21, 22 to form the ducts for one series of the fin elements. Other walls 24 are bolted or otherwise secured to flanges formed on the plates 19, 20, together with other walls 25 bolted or otherwise secured to the posts 18 form the inlet and outlet ducts 33, 34 for the other series of fin elements.

In Fig. 1 threaded studs 26 are shown as secured in the posts and extend out through flanges of the walls 24, 25 and have nuts 27 threaded on them for securing the walls to the posts.

In the modified form of core illustrated in Fig. 4, the V-shaped end fins are omitted and in place of the posts seen in Fig. 1, angle shaped plates 28 are substituted therefor, which angle shaped plates are bonded to the fin elements. The walls of the ducts may be fastened to the

flanges 29 of the top plate 19*a* and the bottom plate (not shown) and to the angle iron plates 28, as in the preferred form of the invention. The angle iron plates 28 are provided with threaded studs 26*a* by which walls of the ducts may be secured to the angle iron plates. The fin elements of the device illustrated in Fig. 4 are shown at 10*a*, 11*a*.

It is to be observed that in constructing the heat exchangers embodying the present invention, the fin elements are assembled in their crosswise relation, the top and bottom plates 19, 20 secured thereto and the posts 18 set in place. The various elements may be coated with brazing material and the entire structure is placed in a suitable furnace and heated to a fusing temperature.

In the operation of the heat exchanger one fluid, for instance air, flows through the inlet duct 30, through the passages 31 and discharges through the outlet duct 32. The other fluid enters the heat exchanger through inlet duct 33 and passes through the passages 34 and discharges through the outlet duct 34. The heat exchange medium in flowing through the passages formed by the fin elements gives up its heat to the walls of said fin elements and the walls conduct the heat to the other fluid.

Having thus described my invention, it is obvious that various immaterial modifications may be made in the same without departing from the spirit of my invention; hence, I do not wish to be understood as limiting myself to the exact form, construction, arrangement and combination of parts herein shown and described or uses mentioned.

What I claim as new and desire to secure by Letters Patent is:

1. In a cross flow heat exchanger, a plurality of alternate and intermediate series of channel shaped fin elements, the fin elements of each series having parallel side walls formed with offset edge portions overlapping the walls of adjacent fin elements, the fin elements of each series being nested and bonded together, end fin elements, V-shaped in cross section, and having edge portions disposed in overlapping relation with respect to the next adjacent fin elements, said end fin elements being disposed at an end of one series of fin elements and disposed contiguous with the outer sides of the endmost channel shaped fin elements, and the several series of fin elements bonded together and forming crosswise arranged passages having inlet and outlet ends.

2. In a cross flow heat exchanger, a plurality of alternate and intermediate series of channel shaped fin elements, the fin elements of each series having outwardly offset walls and being nested and bonded together, and the adjacent series extending crosswise of each other, end fin elements, V-shaped in cross section, the walls of which terminate in parallel edge portions disposed in overlapping relation with respect to the next adjacent fin elements, said end fin elements being disposed at the inlet ends of both series of fin elements and disposed contiguous with the outer sides of the endmost channel shaped fin elements, for deflecting the incoming fluid to the passages between said channel shaped fin elements and the several series of fin elements being bonded together and forming crosswise arranged passages having inlet and outlet ends.

CLYDE S. SIMPELAAR.

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