

257
262.11

May 21, 1946.

J. W. BROWN, JR

2,400,737

FINNED TUBE

Filed July 14, 1942

2 Sheets-Sheet 1

Fig. 1

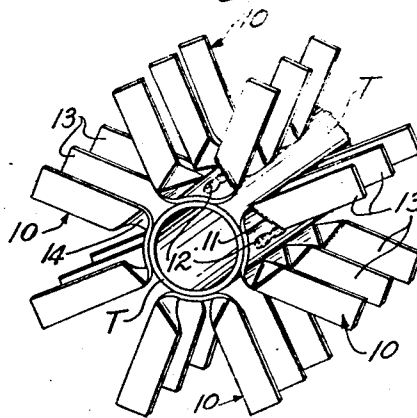


Fig. 2

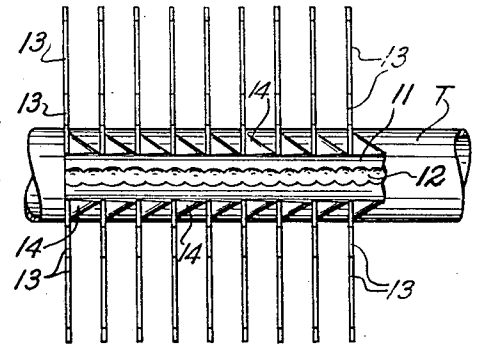


Fig. 3

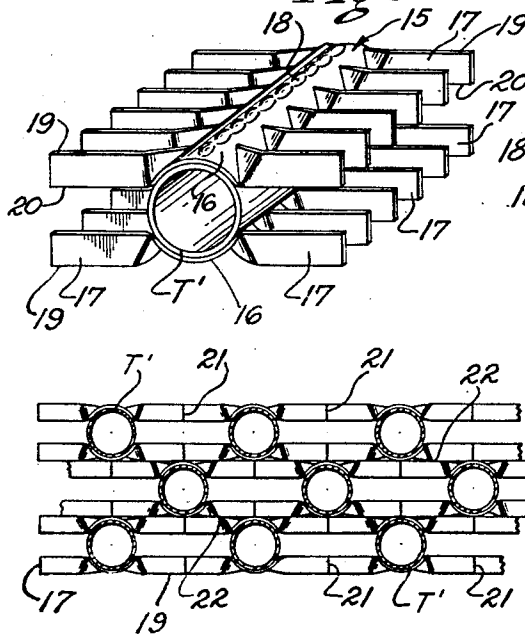


Fig. 4

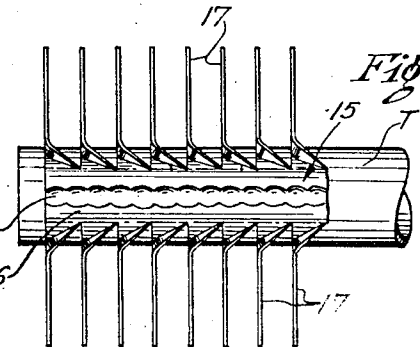


Fig. 6

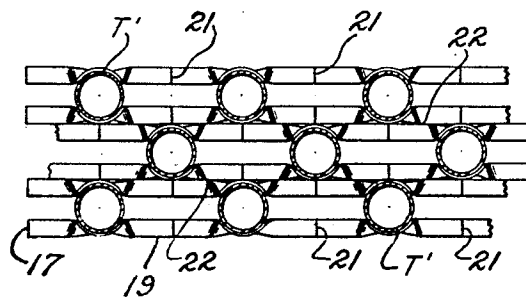
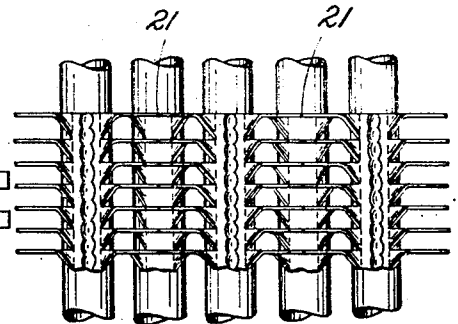


Fig. 5



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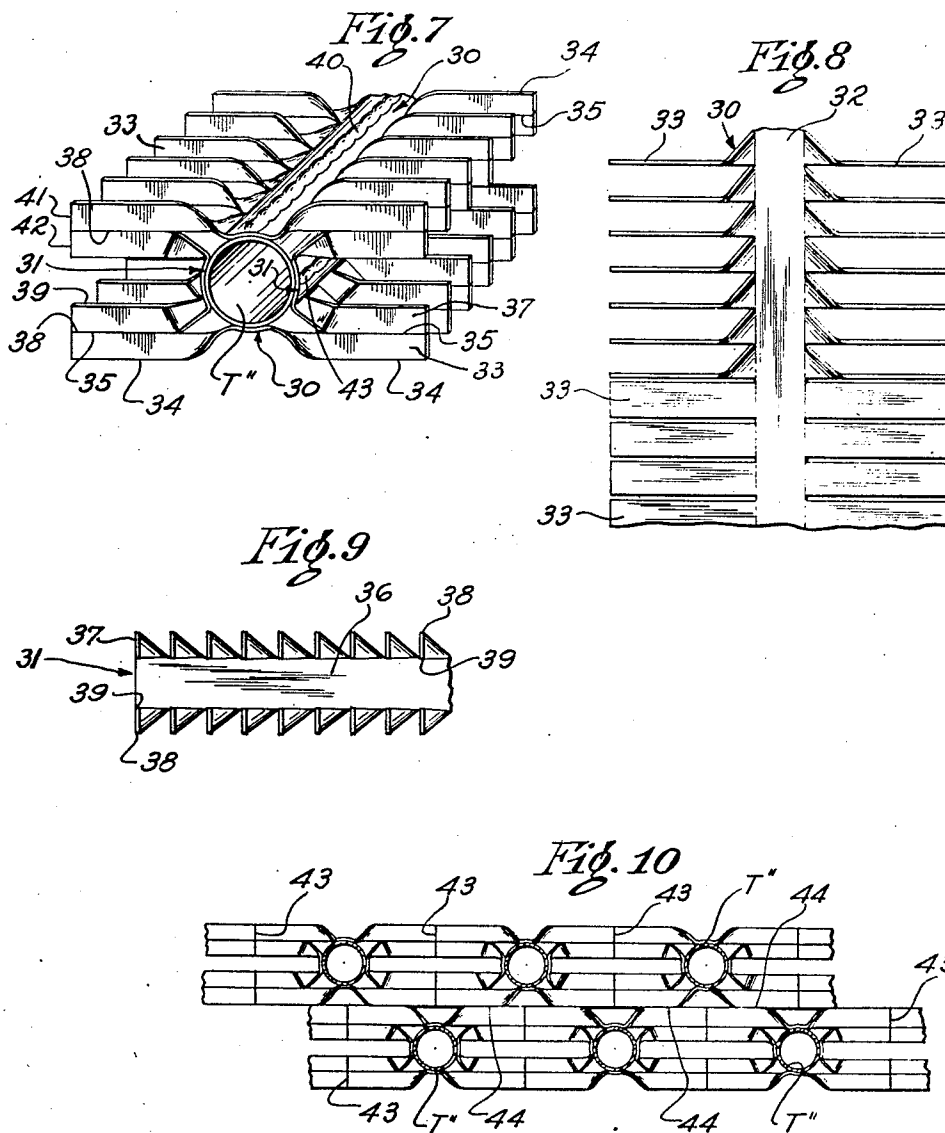
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FINNED TUBE

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2 Sheets-Sheet 2



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2,400,737

FINNED TUBE

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Application July 14, 1942, Serial No. 450,841

1 Claim. (Cl. 257—262)

This invention relates to finned tubes and more particularly to finned tubes adapted for use in heat exchangers where the flow of fluid on the exterior of the tubes is transversely of the axis of the tubes. For example, finned tubes made according to the present invention are suitable for use in radiators for automobiles, trucks, tractors and the like.

In my prior patents, Nos. 2,261,136 and 2,261,137 both issued November 4, 1941, I disclose finned tubes wherein fin members are welded longitudinally to the exterior of the tubes. These patents specifically disclose continuous channel section fin members wherein the members are welded to the tubes in a manner to provide adequate paths for the flow of heat from the flanges to the tubes. According to the present invention, I provide fin members having continuous base portions secured to a tube and extending preferably longitudinally thereof. The fin members are formed with fin portions projecting from the base portions and preferably formed integrally therewith. The fin portions are bent or twisted so as to lie in planes extending substantially at right angles to the axis of the base portions and the tube, thus adapting the fins for transverse flow of fluid on the exterior of the tube. Preferably the base portions of the fin members are welded to the tube as described and claimed in my aforesaid patents to provide adequate paths for the flow of heat between the fins and the tube, the welding operation preferably being carried out according to the method described and claimed in my copending application Serial No. 388,835, filed April 16, 1941, now Patent No. 2,298,250.

A general object of my present invention is to provide a finned tube particularly adapted for transverse flow of fluid on the exterior thereof and which can be manufactured economically and rapidly from inexpensive materials such as steel. Another object is to provide a finned tube having one or more fin members extending generally longitudinally thereof, with fins extending therefrom and lying in planes substantially normal to the axis of the tube. Another object is to provide such a finned tube in which adequate paths are provided for the flow of heat between the fins and the tube. A further object is to provide such a finned tube in which large radiating surfaces can be provided in a compact space. Another object is to provide finned tubes which can be arranged compactly to provide a heat exchanger having a large radiating surface.

Further objects and advantages of my invention will become apparent from the following de-

scription of preferred forms thereof, reference being made to the accompanying drawings in which Figure 1 is a perspective illustrating one form of finned tube made according to my invention; Figure 2 is a side elevation of the tube shown in Figure 1; Figure 3 is a perspective showing a modified type of finned tube; Figure 4 is a side elevation of the tube shown in Figure 3; Figure 5 is an elevation showing a section of a heat exchanger made up of a plurality of tubes shown in Figures 3 and 4; Figure 6 is a fragmentary section through the heat exchanger of Figure 5; Figure 7 is a perspective showing a further modification of my invention; Figures 8 and 9 are views of the fin members employed in the modification shown in Figure 7 before they are welded to the tube; and Figure 10 is a transverse section through a heat exchanger embodying a plurality of tubes such as those shown in Figure 7.

As shown in Figures 1 and 2 of the drawings, a finned tube made according to my invention may comprise a tube T having a plurality of fin members indicated generally at 10, welded thereto. Each of the fin members 10 consists of a base portion 11 preferably welded to the tube T by a series of spot welds indicated diagrammatically at 12 and proportioned as described in my prior patents aforesaid to provide adequate paths for the flow of heat between the fins and the tube. Fins 13 project from the base portion 11, each of the fins preferably being integral with the base portion and being twisted as shown in the drawings so that the fins lie in spaced parallel planes which are preferably at right angles to the axis of the tube.

It will be noted that the fins are shaped so that each complete fin member can be formed from strip stock by slitting the stock inwardly from both edges toward the center base portion to form the separate fins 13 and then bending or twisting the fins adjacent their juncture with the base portion 11, as indicated at 14, into planes at right angles to their original plane and also at right angles to the longitudinal axis of the base portion. This operation can be carried out in a punch press, and preferably the forming operation in the modification shown in Figures 1 and 2 is carried out before the fin members are welded to the tube. The bending of the fin members is preferably carried out so that the space left between oppositely disposed fins extending from each base portion is wide enough to receive a welding electrode so that the welding operation can be carried out in accordance with the disclosure of my appli-

cation aforesaid. In the present instance the tube is shown as having four fin members 10 secured thereto. However, a greater or lesser number may be employed depending upon the service for which the tube is intended.

The structure just described provides a very efficient heat exchange element, for none of the metal is wasted and an adequate path is provided for the flow of heat between the fins through the base and into the tube. The fins 13 are full width throughout, and the junctures between the fins and the base members 11 are preferably of the same width as the fins themselves. Thus heat can flow between the fins and the base member as rapidly as it can flow along the fins themselves for the cross-sectional area of the junctures is as great as the maximum cross-sectional area of the fins in any plane normal to the direction of flow of heat between fins and base. Further, the welding operation carried out as described in my aforesaid patents provides a path between the base and the tube which is as great in total cross-sectional area as the path between the fins and the base. Thus an efficient structure is provided in which full advantage can be taken of the heat transferring ability of the fins.

The structure offers low resistance to the flow of commodities on the exterior thereof because of the fact that the fins present only their edges in the direction of flow. The fins as well as the tube may be made of various thicknesses and materials. Because of the large fin areas obtainable and because of the efficiency of the structure, finned tubes made of light gauge steel have sufficient heat transferring capacity to enable them to be used in cooling radiators for internal combustion engines. This may be accomplished, for example, by connecting a plurality of tubes arranged parallel to each other into suitable headers at their ends.

A type of tube especially adapted for service in such radiators is shown in Figures 3 and 4. Here the tube T' has two fin members indicated generally at 15 welded thereto. Each of these fin members comprises a base portion 16 and a plurality of fins 17, the fins being formed integrally with the base portions and the base portions preferably being welded to the tube in accordance with my aforesaid patents and application as indicated diagrammatically at 18. In this modification, however, the fins 17 instead of extending radially outwardly as in the previous modification, project outwardly in such manner that the edges 19 and 20 of each of the fins are preferably parallel to each other. Also the fins are bent in such manner that the edges 19 lie in substantially the plane of the base portions 16 so that the over-all dimension of the finned tube between the edges 19 of opposite fins is substantially the same as the diameter of the tube plus the thickness of the base portions.

This arrangement makes it possible to provide a compact heat exchanger wherein the ends of fins on adjacent tubes can abut each other as indicated at 21 in Figures 5 and 6 and the edges 19 of the fins of adjacent tubes can engage each other as indicated at 22 in Figure 6. Thus an assembly of the tubes such as shown in Figures 5 and 6 provides a heat exchanger having an extensive finned area in very compact form and in such form that the resistance to flow of air or other fluid through the exchanger is kept at a minimum. The exchanger shown in Figures 5 and 6 may be completed by using any conven-

ient type of header or any other convenient connection (not shown).

In Figures 7 to 10, inclusive, I have illustrated a further modification of my invention wherein the tube T'' has finned members indicated generally at 30 and 31 welded thereto. This modification is quite similar to the form shown in Figures 3 to 6 except that each tube has four finned members instead of two, thus giving a greater surface of fin. Here the members 30 comprise, as shown in Figures 7 and 8, base portions 32 and integrally formed fins 33. The fins are formed preferably by slitting a strip from its edges toward the center as shown in the lower part of Figure 8, and then twisting the resultant fins as indicated in the upper part of Figure 8 so that the main body of each fin lies on the side of the base portion away from the tube. The base portions 32 are welded to the tube as before, the welded areas being indicated diagrammatically at 40. This produces a construction in which the edges 34 and 35 of the fins are parallel to each other.

The fin members 31 are disposed between the fin members 30 and consist of base portions 36 from which the fins 37 extend. As illustrated in Figures 7 and 9, these fin members are generally similar to the fin members 10 shown in Figure 1 except that the bending operation is carried out so that the edges 38 and 39 of the several fins are parallel to each other. When welded to the tube by the welds 43, the outer edges 38 of the fins 31 contact the inner edges 35 of the fins 33. Preferably the fins 37 are shorter than the fins 33 so that the ends 41 and 42 of the fins 33 and 37, respectively, terminate in this same line. This arrangement makes it possible to assemble a plurality of tubes into a compact arrangement as shown in Figure 10 with the ends of fins of adjacent tubes in contact with each other as at 43, and the outer edges 34 of fins on adjacent tubes contact each other as at 44. In elevation a heat exchanger as shown in Figure 10 appears generally similar to that shown in Figure 5, and as in the previous case, the heat exchanger may be completed by providing suitable headers for the several tubes.

From the foregoing description of preferred forms of my invention it will be seen that my finned tubes are particularly adapted for transverse flow of fluid on the exterior thereof and provide an extensive area for heat transfer with relative low resistance to flow. My invention contemplates various arrangements and shapes of fins, and finned tubes made according thereto can be incorporated into heat exchangers of different types. Because of the construction wherein a plurality of fins are formed integrally with an elongated base portion, finned tubing can be made according to my invention rapidly and at relatively low cost. The structure is such that adequate paths are provided for the flow of heat from the several fins into the base of the fin members and to the tube, thus insuring a tube which is highly efficient from the heat exchange standpoint.

Those skilled in the art will appreciate that various changes and modifications in my invention may be made without departing from the spirit and scope thereof. Accordingly it is to be understood that my patent is not to be limited to the preferred forms described herein, or in any manner other than by the scope of the appended claim.

I claim:

A heat exchange element comprising a tube having a pair of longitudinally extending finned members welded thereto, each finned member comprising an elongated base portion welded to a tube and two rows of spaced fins integral with the base portion and the fins having substantially

plane portions lying in planes parallel to each other and normal to the axis of the tube, the longitudinal edges of the fins in each row being parallel to each other, and lying in planes parallel to and spaced from the planes of the longitudinal edges of the fins in the other rows.

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