Aug. 20, 1935. W. G. LAIRD 2,011,900

FIN RADIATOR

Filed Dec. 8, 1932

Fig. 1.

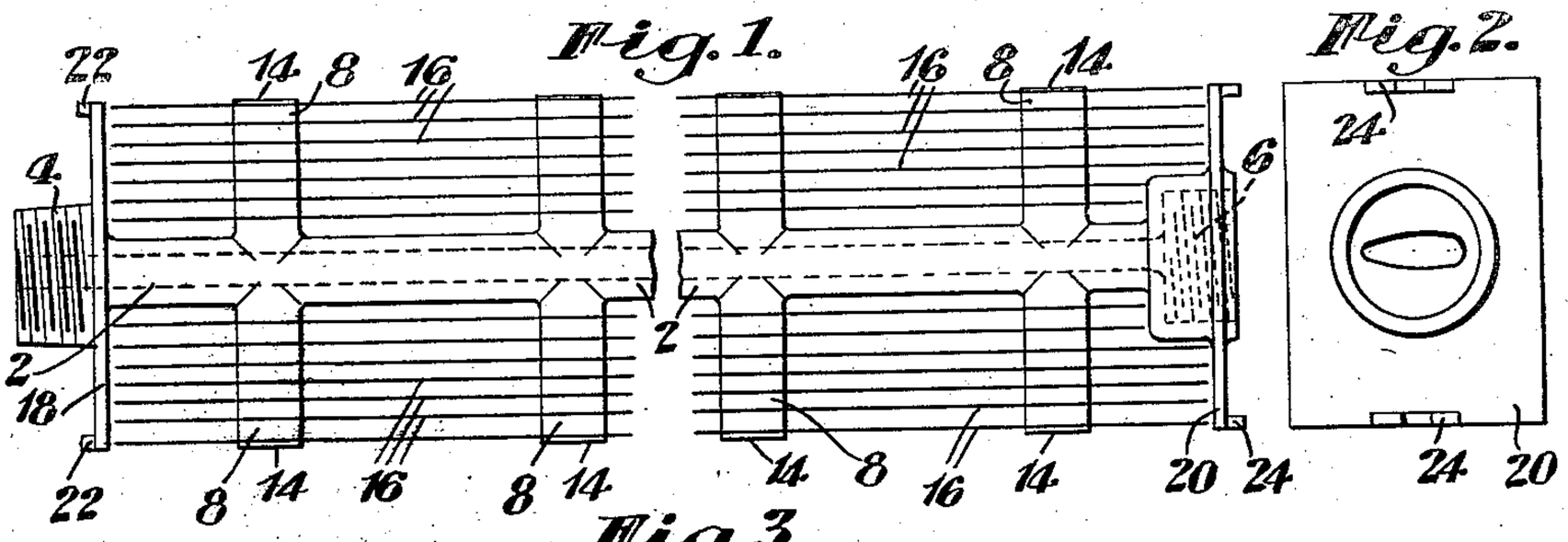


Fig. 2.

Fig. 3.

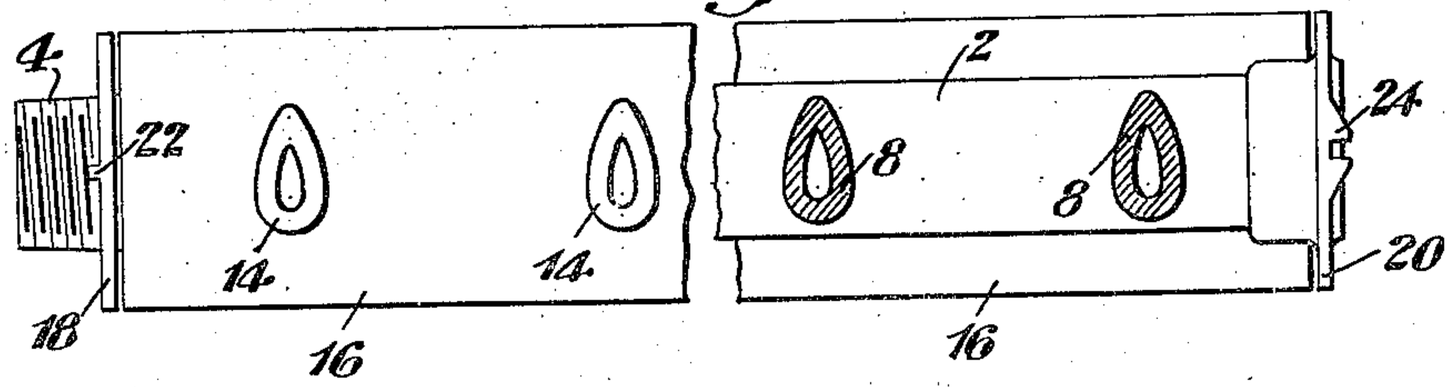


Fig. 4.

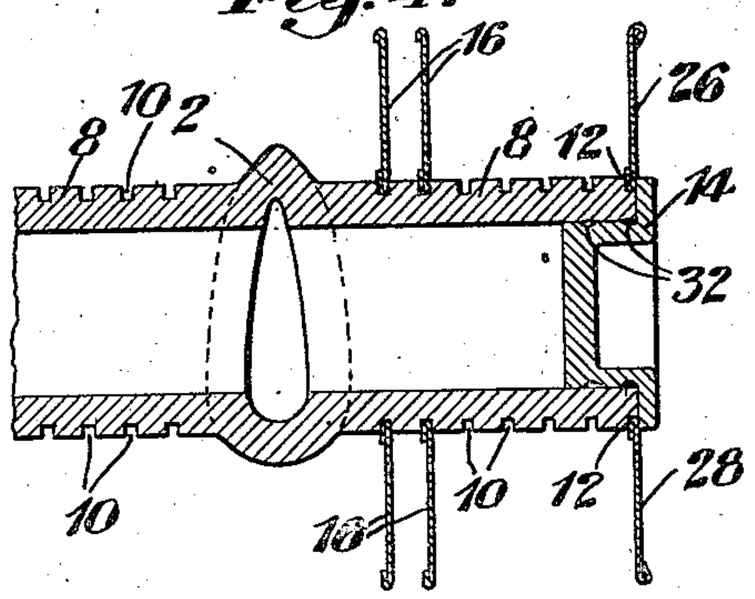


Fig. 5.

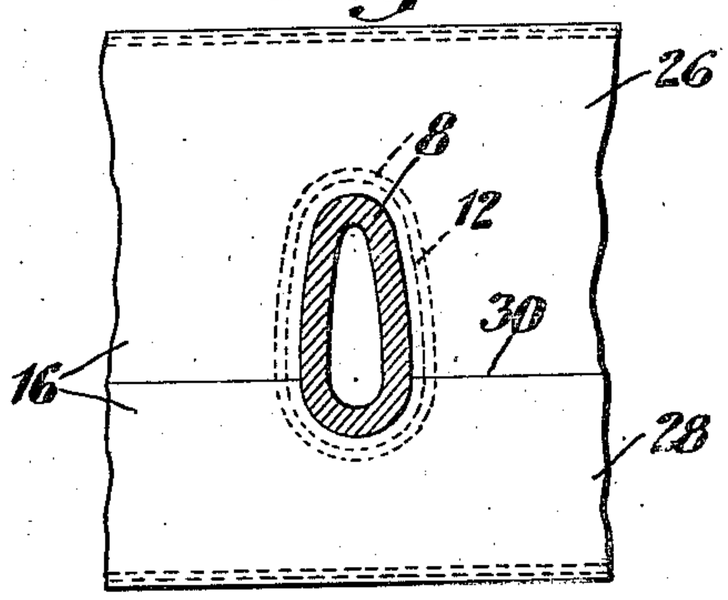


Fig. 6.

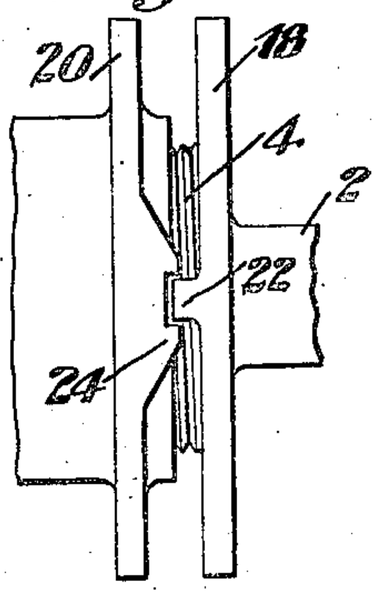


Fig. 7.

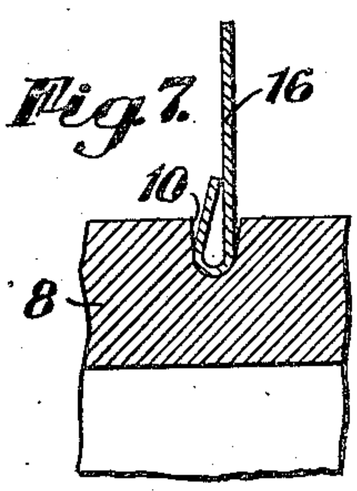
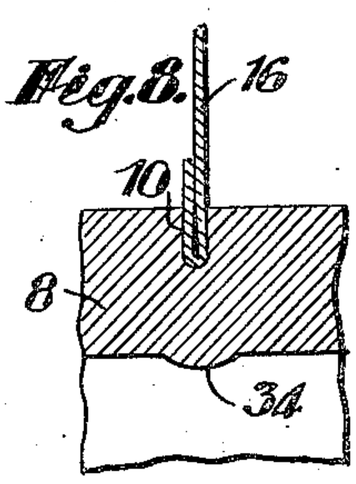


Fig. 8.



INVENTOR
WILBUR G. LAIRD

BY Arnold R. Workman
ATTORNEY

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2,011,900

FIN RADIATOR

Wilbur G. Laird, Pleasantville, N. Y.

Application December 8, 1932, Serial No. 646,258

21 Claims. (Cl. 257—146)

This invention relates to improvements in fin radiators and method of manufacture. More particularly the invention relates to a novel fin radiator having fins of relatively large area which are secured into the metal walls of a heating medium container or line by a novel process.

Various proposals have been made for securing a fin to the wall of a conduit for a heating medium, such for example as rolling a relatively narrow fin into the surface of the heating medium conduit. It has also been proposed to loosely insert individual fins into spaced slots along the top and sides of a substantially rectangular heating conduit. For the most part, these proposals have not been put into practice in the construction of radiators, although it is understood that spiral fin radiators have been made in which the fin is about three eights of an inch wide.

The primary object of the present invention is the provision of an improved fin radiator or heat exchange unit having a relatively large fin radiating surface in which the fins are embedded deeply into the metal wall of the heating medium conduit and held by a strong mechanical metal to metal joint.

A further object of the invention is the provision of an efficient fin radiator which is economical to construct.

Other objects and advantages of the invention will be apparent from the following detailed description thereof in connection with the accompanying drawing in which

Fig. 1 is a broken plan view of the improved radiator unit.

Fig. 2 is an end view looking from the right in Fig. 1.

Fig. 3 is a broken side elevational view of the radiator unit shown in Fig. 1 partly in section.

Fig. 4 is an enlarged broken vertical cross section through the radiator unit shown in Fig. 3 with certain of the fins removed to show details of construction and arrangement.

Fig. 5 is a broken vertical cross section of the detail shown in Fig. 4, taken through one of the grooves.

Fig. 6 is a broken side view showing the method of connecting two radiator units.

Fig. 7 is an enlarged broken sectional view showing a fin inserted in a groove, before compression of the metal in which the groove is formed.

Fig. 8 is a view similar to that of Fig. 7, after compression of the metal to close the groove.

Referring to the drawing, the improved radiator unit comprises a central heating medium supply conduit 2 provided at one end with male connecting threads 4 and at the other with corresponding female threads 6. The conduit 2 is provided at regular intervals throughout its length with projecting lateral conduits 8 which extend at right angles to and from each side of the conduit 2. These laterals are relatively short, closed-ended conduits or nipples, connecting into the supply conduit 2.

Each of the laterals 8 is provided with a series of endless grooves 10 spaced at regular intervals as shown in Fig. 4. In the preferred form of construction as shown in Fig. 4, the outer ends of the laterals 8 are merely notched as at 12, so that the notch, together with an end closure plug 14 forms a groove similar to the grooves 10.

Long thin metal fins 16, properly cut for the purpose, are set in the notches 10, in laterals 8, so that the fins run parallel to the conduit 2, as shown in Fig. 1. The fins are preferably made of very thin sheet copper and the edges thereof, including the cut-out edges fitting into the grooves 10, may be folded back or lapped as shown in Figs. 4 and 7. The lapped outer edge of the fin will give rigidity while the lapped edge in grooves 10 will increase the heat conducted from laterals 8.

The radiator unit as shown in Figs. 1, 2 and 3 includes rectangular end plates 18 and 20, of relatively thick metal, attached to the conduit 2.

These plates 18 and 20 are substantially the same size as (or slightly larger than) a cross-section of the radiator unit and are provided to protect the ends of the fin sheets and to aid in the handling and mounting of the radiator unit. The end plate 18 is provided with projections 22 which are adapted to lock into notches 24 on plate 20 of a separate radiator unit to determine their proper alignment. The threads 4 and 6 are accurately made so that when threads of two units are screwed together a tight connection is formed at the time the elements 22 and 24 interlock.

The conduit 2 and laterals 8 may be made of ordinary round steel pipe connected together by threaded joints, but in accordance with the preferred method of the present invention the conduit 2, laterals 8 (including grooves 10 and notch 12), end plates 18 and 20, as well as the threaded ends 4 and 6 are die-cast in a single piece, and of aluminum or aluminum alloy. The plugs 14 may be made along with this casting as parts to be broken off the casting and driven into the ends of laterals 8. The conduit 2 and laterals 8 preferably have the tear-drop shaped section as shown in the drawing. This gives a stream line to these elements which materially adds to the efficiency of the unit. The shape of elements 2

and 8 permits passage of a larger volume of air through the unit.

Each of the long fin sheets 16, except the outside fins, preferably comprises upper and lower parts 26 and 28 respectively as shown in Fig. 5. In assembling the fins into a unit the upper fin-sheets 26 may be set into the grooves in the laterals 8, after which the unit may be turned over and the fin-sheets 28 inserted so that they contact sheets 26 at the line 30. The outside fin-sheets are punched to slip into notches 12 on the ends of laterals 8, and as soon as they are in place plugs 14 are inserted, to hold the outside sheets in place. In this arrangement of the fin-sheets the outside sheets are not cut (Fig. 3), while the other (cut) fin-sheets are much more readily assembled into the unit than otherwise would be the case. It is to be understood that the respective areas of sheet-strips 26 and 28 are properly proportioned with respect to the contact areas connected with the laterals 8.

Plugs 14 are preferably grooved as at 32 opposite notch 12 and the adjoining groove 10 in laterals 8.

After the fins 16 are assembled and plugs 14 are inserted as described, the radiator unit is placed in a press and the metal of laterals 8 compressed to close the grooves 10 and notches 12 onto the fins and force plugs 14 into place. The effect of this compression is illustrated in Fig. 8 which shows the fin 16 locked into the metal of the lateral with a firm metal to metal union. This figure also shows how the metal of the lateral is upset opposite each groove so that a slight ridge 34 is formed inside the lateral. The ridges formed opposite notches 12 and adjacent groove 10 (in conjunction with grooves 32) are taken advantage of to lock plugs 14 in place. All of the laterals 8, including plugs 14, are compressed in a single operation, and in order to maintain proper rigidity across the unit a metal bar adapted to snugly fit the opening of conduit 2 may be inserted therein during the compression operation. The plugs may be expanded in the ends of the laterals if any leakage occurs.

The fin radiator unit of the present invention has many advantages over known radiators of the fin type, because of the large contact area between fins and laterals, and low resistance to the flow of air between the fins. The fin surfaces may be easily cleaned of dust and dirt whereas other types of units are difficult to clean. The area of contact between the fins and the heating medium supply conduits of the improved unit herein described is several times that of units in which the fins are expanded onto the heating conduit.

A wide variety of metals may be employed in constructing the present unit which could not be joined satisfactorily by known methods of construction. For example, aluminum can be joined to copper, or steel to aluminum. It is to be understood that the fins may be made of other metals than copper, such as brass, steel, aluminum or other available metal or alloy. Likewise, while it is preferred to form the die-casting of an alloy of aluminum, it may be made of other metals or alloys suitable for the purpose.

The unit as described may be made in two standard lengths, and the heating surface necessary for any particular purpose made up by combining the required number of units. The width of the unit may also vary and a single die may be varied by suitable minor changes to cast laterals of the desired length. The unit may be made with laterals on one side only of the conduit 2, and in some instances laterals may be placed on four sides.

While it is preferred to secure the fins in grooves in the laterals in the manner described above, the laterals may be built up of alternating fins and interlocking ring members as described in the applicant's pending application, Serial No. 585,054 filed January 6, 1932, which has now matured into Patent 1,985,932, issued Jan. 1, 1935.

It is to be understood that the radiator unit of the present invention is a heat exchanger and may be used for cooling as well as heating, in fact for interchange of heat between any fluids.

The grooves 10 as cast in laterals 8 have a rounded bottom and straight sides which have a slight taper. It is to be understood that the grooves may be cut in the laterals and that the fins may be cut and inserted in the grooves in the ways shown in applicant's application Serial No. 646,259 filed concurrently therewith.

Instead of making notches 12 on the ends of laterals 8 the holes in the outside fins may be cut smaller so as to barely fit over the plug insert portion. These fins will then engage the whole end of the laterals.

Having thus described the invention in its preferred form, what is claimed as new is:

1. A fin radiator unit, comprising a substantially central heating medium distributing conduit, relatively short metal heating medium supply branches extending from two opposite sides of said conduit at regularly spaced intervals therealong, said branches being adapted to receive heating medium from said conduit, relatively thin long metal fins attached to the branches on each side of said conduit and extending substantially parallel thereto, each fin extending substantially the full length of said unit and adapted to conduct heat from the branches to which it is attached.

2. A fin radiator unit as defined by claim 1 in which the portion of each fin attached to a branch is compressed between the walls of a former groove in said branch.

3. A finned heat exchange unit comprising a main fluid supply conduit, a plurality of relatively short metal laterals connecting into a side of said conduit at spaced intervals therealong, said laterals being adapted to receive fluid from said conduit, a plurality of long relatively thin metal fins deeply and firmly embedded in the metal walls of the laterals and extending substantially parallel to said conduit, said fins being adapted to transmit heat to or from the fluid in said conduit and laterals.

4. A finned heat exchanger as defined by claim 3 in which the portion of each fin attached to a lateral is held firmly between the side walls of a groove in said lateral.

5. A finned heat exchange unit comprising a substantially central fluid supply conduit for the supply of a heating or a cooling fluid, a plurality of relatively short metal laterals connecting into two opposite sides of said conduit at spaced intervals therealong, said laterals being adapted to receive fluid from said conduit, a plurality of long relatively thin metal fins spaced from each other and attached to the laterals on each side of said conduit, each fin extending substantially the full length of said conduit and firmly secured into metal walls of the laterals to which it is attached by a metal to metal joint including side walls formerly forming a groove in the lateral in which an edge of the fin is retained by the compression strain of the metal of the lateral.

6. A finned heat exchange unit, comprising a main conduit for supplying a heating or a cooling fluid, a relatively short metal lateral connecting into said conduit, a plurality of metal fins attached to said lateral by having an edge of each fin compressed between two substantially straight side walls formerly forming a groove in the metal wall of the lateral.

7. A finned heat exchange unit as defined by claim 6 in which said conduit and said lateral are substantially tear-drop shaped in cross section.

8. A conduit skeleton for making a finned heat exchange unit, comprising a metal casting including a main conduit for supplying a heating or a cooling medium and a plurality of laterals cast integral with and opening into said conduit at spaced intervals therealong and on opposite sides of said conduit, spaced transverse grooves in the outer surface of each lateral, said grooves having substantially straight sides and extending into the metal walls of the lateral a substantial distance.

9. A conduit skeleton as defined by claim 8 in which said conduit and said laterals have a substantially tear-drop shaped cross section.

10. A finned heat exchange unit, comprising a main heating or cooling fluid supply conduit, a plurality of relatively short metal laterals connecting into a side of said conduit at spaced intervals therealong, said laterals being adapted to receive fluid from said conduit, a plurality of long thin metal fins having edges embedded into the metal walls of the laterals and extending substantially parallel to said conduit, certain of said fins comprising two long fin strips mounted in substantially the same plane, each of which has an edge embedded into the metal walls of the laterals.

11. In a finned heat exchange unit, a metal conduit section adapted to receive a heating or cooling fluid, a plurality of thin metal fins each having an edge deeply embedded in the wall of the conduit and compressed between two substantially straight side walls formely forming a groove in the metal wall of the conduit.

12. A finned heat exchange unit, comprising a cast metal body or conduit skeleton and a plurality of thin sheet metal fins, said conduit skeleton comprising a main fluid supply conduit and a plurality of relatively short laterals connecting into a side of said conduit, and each of said fins having an edge embedded into the side wall of a portion of the cast metal conduit skeleton.

13. In a finned heat exchange unit, a die-cast aluminum conduit section adapted to receive a heating or cooling fluid, a plurality of thin sheet copper fins each having an edge deeply embedded and firmly held in the cast aluminum forming the wall of said conduit section by an intimately impinging metal to metal joint.

14. A finned heat exchanger, comprising a main fluid supply tube, a plurality of relatively short metal laterals connecting into a side of said tube at spaced intervals therealong, said laterals being adapted to receive fluid from said tube, each lateral having a fin mounted thereon, said fin having a marginal portion seated in the wall of the lateral and extending therearound, said fin being rigidly held in the metal wall of the lateral by a metal to metal pressure joint.

15. In a finned heat exchange unit, a cast metal body comprising a main conduit for supplying a heating or cooling medium, relatively short normally closed-ended laterals connecting into said conduit, said main conduit and said laterals comprising an integral casting, and a separate closure means closing the outer end of each of said laterals.

16. An assembled finned heat exchange unit, comprising a metal casting including a main conduit for supplying a heating or cooling medium and a plurality of open-ended laterals cast integral therewith and opening into said conduit at spaced intervals therealong, relatively thin sheet metal fins set in and firmly held in the cast metal wall of each lateral, and closure means for closing the outer ends of said laterals and for holding an outer fin thereon.

17. A finned heat exchange unit, comprising a one piece cast metal body including a relatively thick walled passage for a heating or cooling medium, a relatively thin sheet metal fin having an edge extending a substantial distance into the wall of said passage, said fin having a relatively large exposed surface area and being rigidly held in the wall of said passage by a firm metal to metal pressure joint in which the metal of the wall intimately impinges against the opposite sides of the embedded portion of the fin.

18. As an article of manufacture, a finned heat exchange unit, comprising a one piece die-cast metal body including a main conduit for a heating or cooling medium and a plurality of tubular branches connecting into said conduit adapted to receive heating or cooling medium therefrom, and a plurality of relatively thin sheet metal fins of relatively large surface area mounted on each branch, each fin having an edge thereof extending into the metal wall of the branch a substantial distance, and rigidly held therein by the external friction of the metal of the branch wall intimately impinging against opposite sides of the embedded portion of the fin.

19. A finned heat exchanger, comprising a main conduit for a heating or cooling medium, a plurality of metal heat conducting branches connected into said conduit, a plurality of relatively thin sheet metal fins of relatively large surface area mounted in the metal of each branch, the joint between the metal of the branches and the fins mounted therein comprising a firm metal to metal contact formed by the intimate impingement of the metal of the branch against the embedded portion of the fins.

20. A finned heat exchange unit comprising a substantially central main metal conduit for a heating or cooling medium, a plurality of tubular metal laterals opening into opposite sides of said main conduit and adapted to receive heating or cooling medium therefrom, the outer ends of said laterals being closed, a plurality of relatively thin sheet metal fins of relatively large surface area extending parallel to and substantially the full length of said main conduit and at substantially right angles to said laterals, a sufficient portion of the surface area of said fins being embedded in the metal walls of said laterals to rapidly conduct heat to the extended surface area of the fins, the embedded portion of said fins being held in the metal of the lateral walls by a firm metal-to-metal joint formed by the intimate impingement of the metal of the lateral walls against the embedded surface area of the fins, whereby an efficient heat transfer from said laterals to the fins is effected and maintained.

21. A finned heat exchange unit, comprising a main metal conduit for a heating or cooling medium, a plurality of tubular metal laterals

opening into a side of said main conduit and adapted to receive heating or cooling medium therefrom, a plurality of relatively thin sheet metal fins of relatively large surface area extending between adjacent laterals parallel to said conduit, each of the fins which extend between adjacent laterals having an edge embedded in the metal side wall of each of said adjacent laterals and held therein by a firm metal-to-metal joint formed by the intimate impingement of the metal of the lateral walls against the embedded edges of the fins.

WILBUR G. LAIRD.