Oct. 25, 1938. J. KARMAZIN 2,133,990

RADIATOR MANUFACTURE

Filed Jan. 25, 1935 2 Sheets-Sheet 1

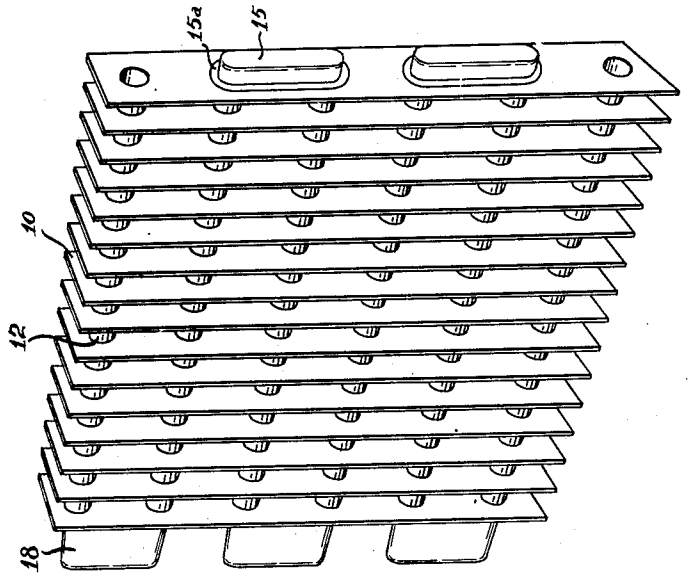


Fig. 1

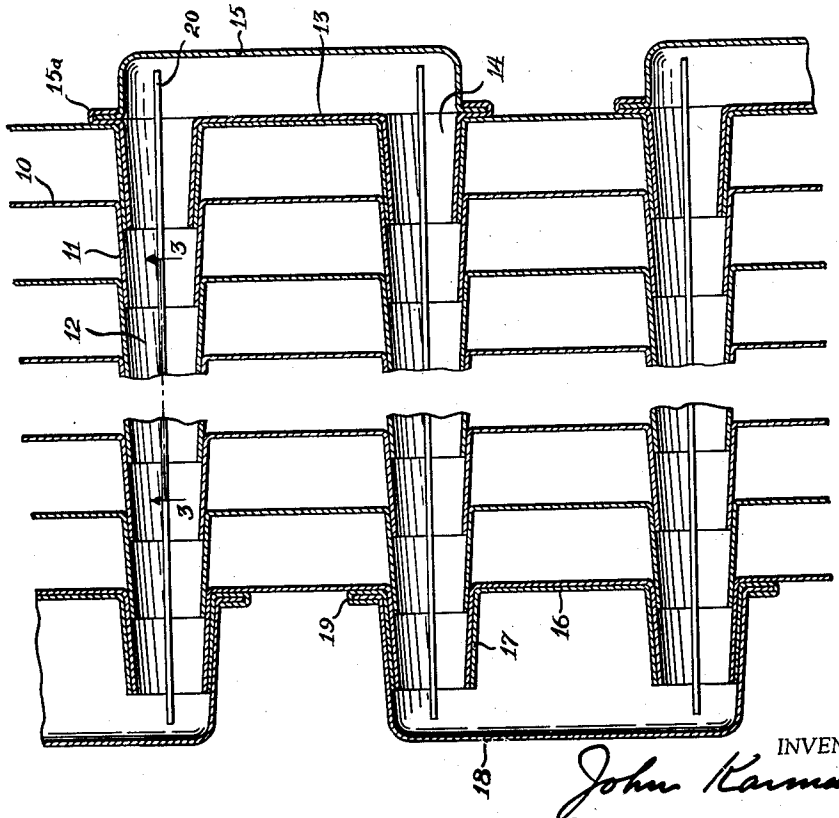


Fig. 2

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RADIATOR MANUFACTURE

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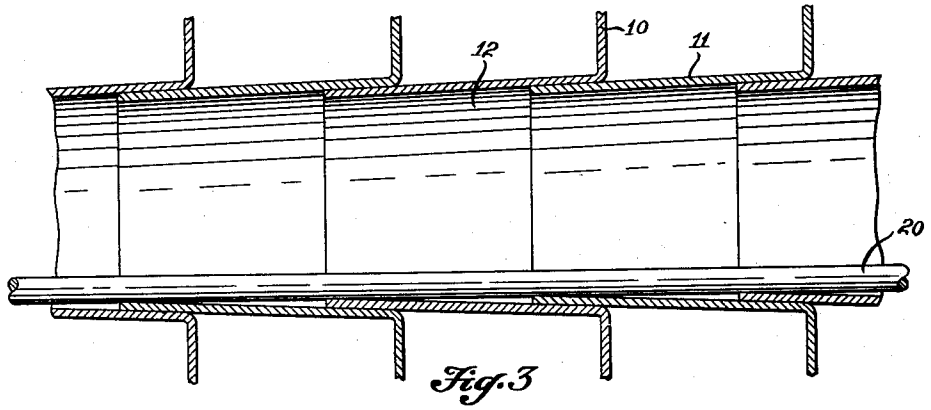


Fig. 3

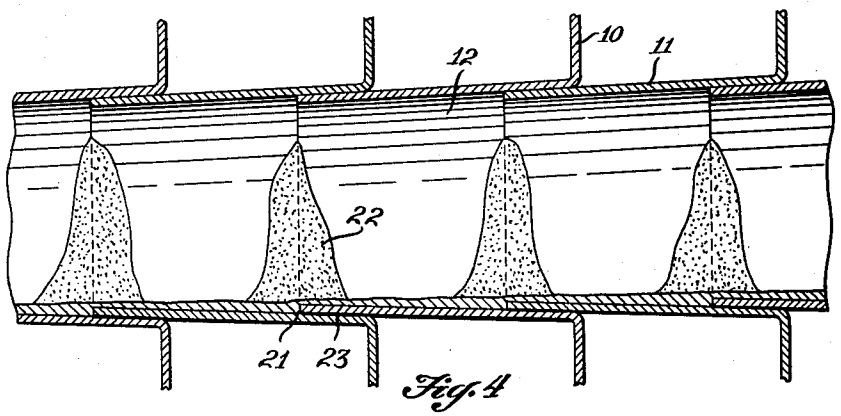


Fig. 4

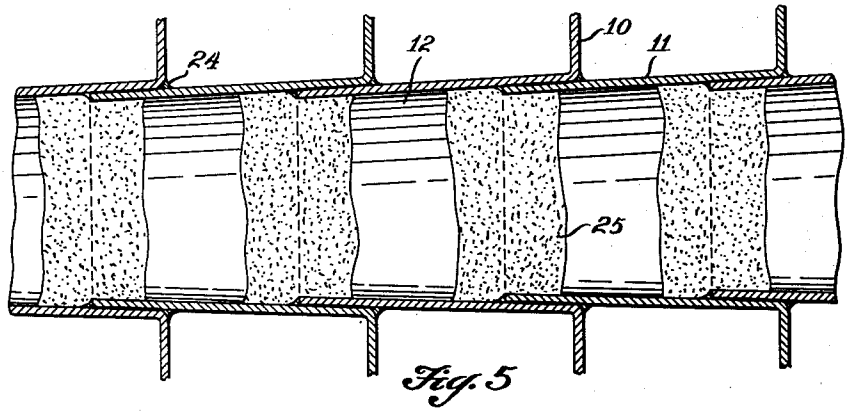


Fig. 5

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2,133,990

RADIATOR MANUFACTURE

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Application January 25, 1935, Serial No. 3,490

1 Claim. (Cl. 29—157.3)

This invention relates to radiator manufacture.

It is an object of this invention to provide a method of manufacture of tubing and radiators in which the tubing or radiator may be assembled and bonded together in a fluid-tight manner without undue loss of bonding material.

Further objects and advantages of the present invention will be apparent from the following description, reference being had to the accompanying drawings, wherein a preferred form of the present invention is clearly shown.

In the drawings:

Fig. 1 is a view in perspective of a type of radiator adapted to be manufactured by my improved method;

Fig. 2 is a horizontal cross-sectional view of a radiator as it lies on its side before it is subjected to bonding operation;

Fig. 3 is an enlarged cross-sectional view taken along the line 3—3 of Fig. 2;

Fig. 4 is a view, somewhat similar to Fig. 3, showing the bonding material as it is being distributed between the joints of the structure; and

Fig. 5 is a view showing the joints in their completed stage.

In practicing this method a radiator or heat transfer element may be assembled very easily and the bonding material may be distributed effectively and without material loss during the bonding operation.

A radiator made in accordance with this method may include a plurality of fins 10 which have formed therein a plurality of integral projections 11 by any suitable forming method. Preferably the fins 10 are made from a single strip of material in which projections 11 are formed at proper intervals and thereafter the strip is cut in proper length to form the fins 10. The fins 10 are stacked with the projections 11 in nesting relation as shown in Fig. 2, the fins being pressed together slightly to form a fairly tight joint between the nested portions of the projections. Preferably the projections 11 are cone-shaped; but any form of projection may be made in which is adapted to nest within the adjacent projection. If desired suitable header constructions are placed at the ends of the longitudinal tubes 12 formed by the nested projections 11. In the structure shown, these headers are formed at one end of the radiator by providing stampings 13 from which cones or projections 14 have been formed and the edge of which has been flanged around a cup 15 as indicated at 15a. At the other end of the radiator the headers are formed from the stamping 16 in which the cones or projections 17 are directed inwardly into the header instead of outwardly. The edge of the stamping 16 is bent around the edge of the cup 18 as indicated at 19. In the construction shown in the drawings, the headers form a sinuous passageway with the tubes 12; but it is to be understood that any connections may be used with the tubes 12, so that either individual fluids may be fed to the tubes 12, or a single fluid may be fed through the tubes in series and/or parallel relationship.

Suitable automatic distribution of bonding material to the spaced joints is provided. Thus strips 20 of bondng material are inserted into the tubes 12 before the radiator structure is closed up by the headers, and if desired the strips 20 may be made long enough so that the ends thereof extend into the headers to provide bonding material for the headers. As an alternative, a slight amount of bonding material may be provided for the headers separately from the strips 20.

After the radiator has been assembled as heretofore described the same is placed in a horizontal position and is subjected to heat, as by being introduced into a brazing furnace in which a reducing atmosphere, such as hydrogen, is maintained. Preferably the radiators are laid on their sides on the usual conveyor which carries the radiators through the furnace, and the radiators remain on their sides throughout the heating operation, thus being maintained with the same portions of the tubes 12 in their lower position as they are carried by the conveyor. No turning of the radiators is necessary. While the radiator travels through the heating zone, the bonding material is melted and the right amount is automatically distributed to each transverse joint, because the bonding material melts and flows down and is pocketed at the lowest uncovered point 21 of each projection against the end of the projection telescoped therein. As the bonding material melts wasteful coating of the interior of the projections 11 is prevented by maintaining the same portion of the tube lowermost, and the bonding material after flowing down by the shortest path to the joint flows by capillary attraction upwardly along the transverse joint, as shown at 22 in Fig. 4, and outwardly between the two telescoped projections as indicated at 23, this action continuing all the way around the circumference of the joint until a completely bonded joint is produced, as indicated in Fig. 5, the material flowing out through the joint to the outside of the tube as indicated at 24. Complete rings of bonding material, extend-

ing unbrokenly from the interior to the exterior of the tube are thus formed. The portions 25 are very thin coatings of the bonding material which are irregularly distributed near the edges of the joints during the capillary flow of the bonding material. Thus as the radiator travels through the brazing furnace, the joining material adheres to the inner faces of the cone projections at the telescoped portions and to the adjacent outer faces of the projections telescoped therein so that the seams are tightly closed and are fluid-tight. Some of the bonding material drops from the strips into the headers and also distributes by capillary attraction all the way upwardly and around the seams 15a and 18 and forms tight joints there also.

The radiator is cooled sufficiently to prevent oxidation while still in the reducing atmosphere. After the brazing, if desired, the radiator may be painted, galvanized, or coated with any protective material desired.

This method may be used to make radiators of sheet metal, such as sheet steel, which has a relatively low coefficient of conductivity, approximately between 0.10 and 0.11 and any bonding material which has sufficient affinity for the sheet material may be used. When sheet steel is used, the strips 20 may be made of pure copper, which has a relatively high coefficient of conductivity, approximately such as 0.92 which is over eight times that of sheet steel, and such bonding material may take the form of pure copper wires, although any form of strips may be used which are capable of automatically distributing the bonding material while melting.

This method is also applicable in the manufacture of tubing, whether a single tube is made or whether a plurality of parallel tubes, fastened together, are made. The same method may be used in manufacturing a single tube, with or without fins, by aligning loops of the ferrous material, inserting the bonding material into the tube, and passing the tube through the heating zone, while maintaining the same portions of the tube lowermost, in the same manner as described in the manufacture of the composite tube or radiator.

The term "radiator" is used herein in a generic sense and is intended to include heat transfer devices in which the heat flows either from or to the fluid within the tubes.

While the form of embodiment of the invention as herein disclosed, constitutes a preferred form, it is to be understood that other forms might be adopted, all coming within the scope of the claim which follows.

What is claimed is as follows:

The method of increasing the conductivity of a manufactured heat exchange tube structure and of decreasing the cost of its manufacturing equipment and the cost of its manufacture, which comprises aligning and telescoping tubular projections of relatively low cost, low heat conducting sheet steel fins to form a tube having a series of aligned joints, distributing a relatively small quantity of relatively high cost, high heat conducting cuprous material, having many times higher heat conducting power than said sheet steel, along the bottom and interior of said tube structure, heating said tube structure in a reducing atmosphere, maintaining the tube structure in a substantially horizontal position while being heated and maintaining, while being heated, the same portion of said tube structure in the lowermost position to prevent wasteful coating of the projections between said aligned joints, to guide and proportionally distribute said bonding material to said joints and to cause said bonding material to form a series of rings of relatively high heat conductivity extending continuously from the interior to the exterior of said tubes.

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