Jan. 12, 1932 G. M. HORVATH 1,840,318

RADIATOR CORE

Filed March 7, 1929 2 Sheets-Sheet 1

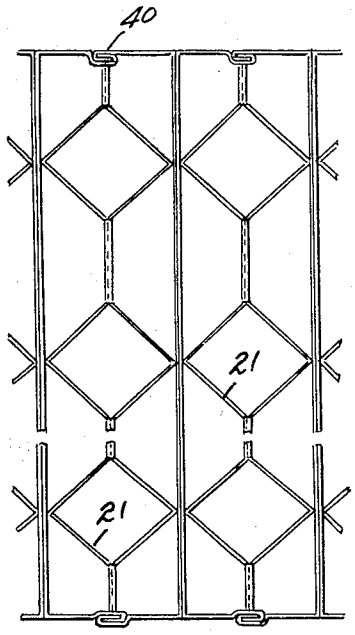


Fig. 2

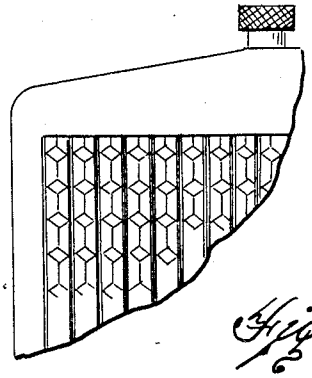

Fig. 1

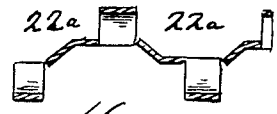


Fig. 5a

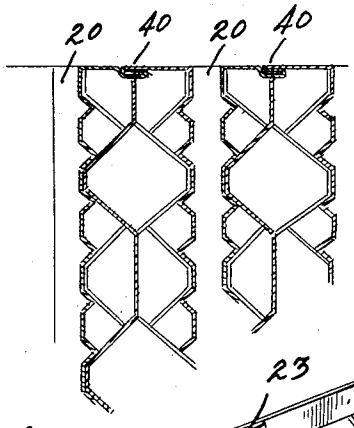


Fig. 4

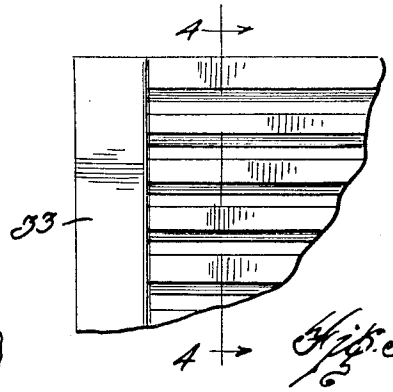


Fig. 3

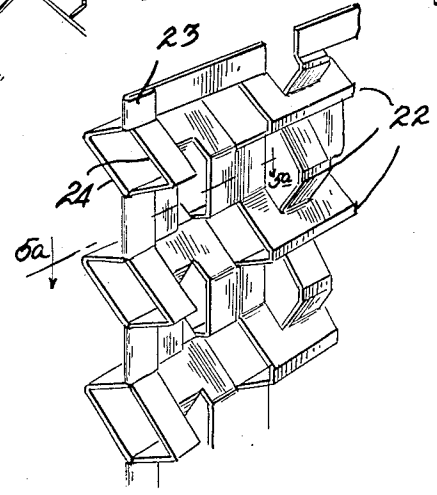


Fig. 5

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Jan. 12, 1932. G. M. HORVATH 1,840,318

RADIATOR CORE

Filed March 7, 1929 2 Sheets-Sheet 2

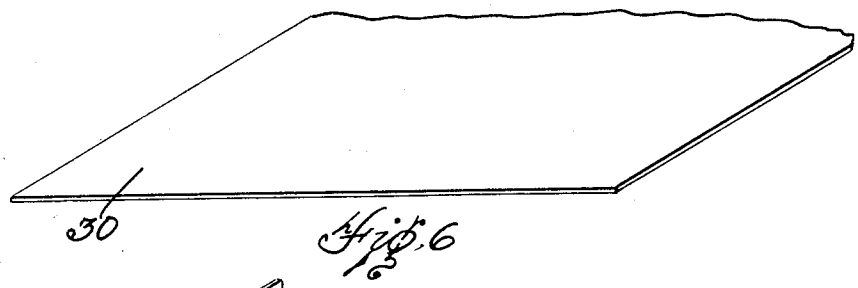


Fig. 6

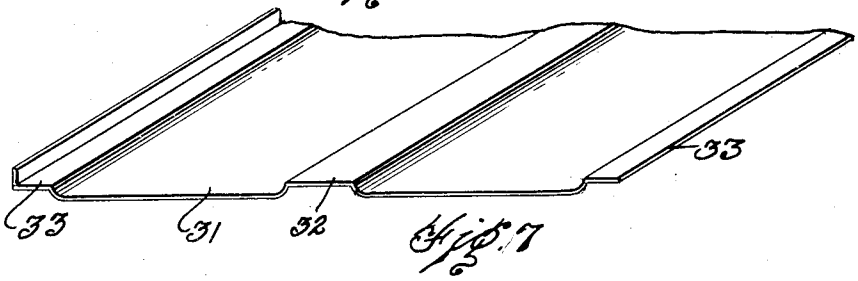


Fig. 7

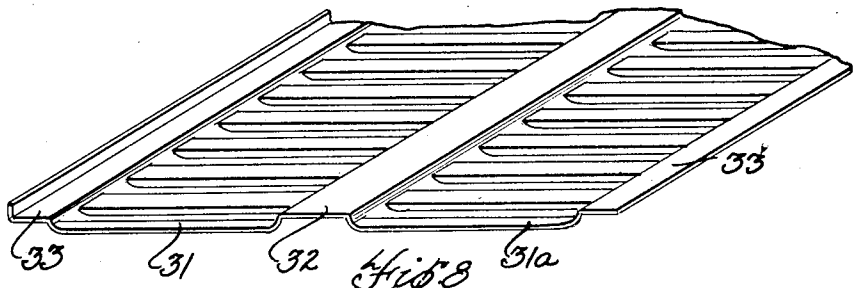


Fig. 8

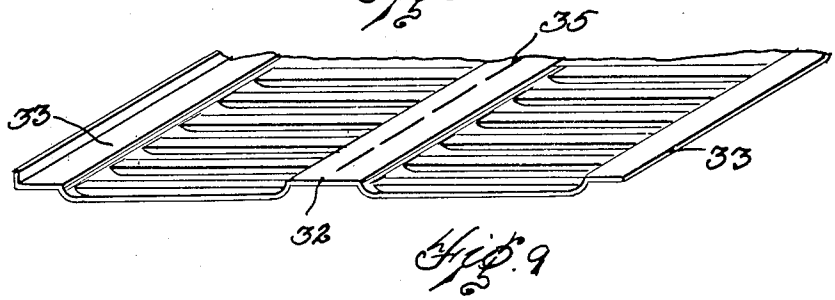


Fig. 9

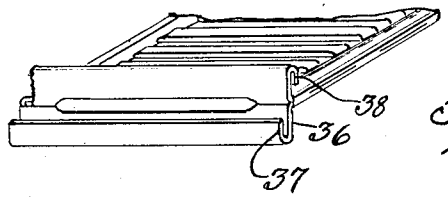


Fig. 10

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# UNITED STATES PATENT OFFICE

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## RADIATOR CORE

Application filed March 7, 1929. Serial No. 344,938.

The present invention relates to heat exchange devices and more especially to so-called "radiators" for liquid cooled internal combustion engines such as are used with automotive vehicles.

Among the objects of the invention is to provide a core for such radiators which shall be more easily and economically constructed than the commonly used types of radiator core and which at the same time shall be more efficient in heat exchange than the known types of construction.

Another object is the simplifying of the operation of preparing the parts and assembling them in the proper relation.

Still other objects will readily occur to those skilled in the art upon reference to the following description and the accompanying drawings in which

Fig. 1 is a fragmentary view in elevation of a radiator constructed in accordance with the present invention.

Fig. 2 is an elevation of a portion of the core of such a radiator.

Fig. 3 is a side elevation taken as from either side of the construction shown in Fig. 4.

Fig. 4 is a section on the line 4—4 of Fig. 3.

Fig. 5 is a perspective view of a portion of one of the spacer elements.

Fig. 5*a* is a section on line 5*a*—5*a* of Fig. 5.

Figs. 6 to 10 inclusive are perspective views showing the steps of formation of one of the water tubes.

As indicated in the drawings the radiator core consists broadly of a series of flattened vertical tubes 20 maintained in spaced relation by means of spacers 21 which latter are adapted to present a very large area of surface to the air passing through the core between the tubes 20. The spacer is preferably of the form shown in Fig. 5 and consists of a strip of metal of good heat conductivity such as copper or bronze shaped as indicated in this figure.

By passing the strips of metal through suitable rollers or dies they are slitted and corrugated as indicated in this figure so as to present numerous angular projections on each side of the central plane of the sheet and it is preferred to so form these strips that there are approximately the same number of angular projections on each side of this plane. These angular projections, which are indicated at 22, are all of substantially the same height so as to contact with a water tube as will be described later; and it is preferred also to bend the metal left in the median plane alternately up and down as indicated at 22*a* so that the passing air will be deflected laterally.

The spacer elements described are produced preferably by means of such a machine as is set forth and claimed in the prior United States Patent No. 1,240,212, issued Sept. 18, 1917, to the present applicant.

The water tubes are preferably formed as indicated in Figs. 6 to 10 and also in Figs. 3 and 4. In the formation of the tubes the flat blank 30 is first passed through suitable rollers to give it the formation shown in Fig. 7 in which two parallel depressed portions 31 are separated by a wide flat portion 32 and having a flat edge 33 on each side.

The next step in the operation of forming the tubes consists in regularly corrugating the portions 31 to produce the effect indicated at 31*a* in Fig. 8.

After the ribbon or blank has been formed as in Fig. 8, it is cut to a suitable length and bent over on itself along the line 35 so as to produce the flattened corrugated tube with the edges 33 coming together.

Before the bending operation which is described, is carried out, it is preferred to flatten the blank at each end and bend outward at right angles a portion thereof to form a flange 36 which is bent back upon itself as at 37, one half of the blank being bent back on itself in one direction and the other one half in the other direction as indicated at 38. This provides portions which hook into similar flanges as indicated at 40 in Fig. 4. After the tubes have been hooked together as indicated the mating hooking elements will be flattened to fix them permanently together in a tightly locked seam. This operation provides a series of the flattened tubes of whatever number may be found desirable, all locked together to form a unit.

After the tubes have been prepared and fastened together as indicated the spacing elements formed as in Fig. 5 are placed between the tubes and when properly formed the angular projections on the spacing elements will each lie in a depression of the corrugated wall of a water tube.

Before forming the parts as described above, is it preferred to tin the metal so that all of the parts will be provided with a coating of the tinning material which will preferably be a soldering material, so that after assembling the several parts as just mentioned the whole assembly is then heated to such temperature as will melt the tinning or soldering coating thereon and when the assembly is allowed to cool all the parts will be united into one whole.

By this operation the spacer element becomes united to the water tubes with a metallic union and permits thereby the ready conduct of heat from the walls of the tube to the spacer element and consequently a more ready passage of heat from the water to the passing air.

In carrying out the heating operation the simplest method and the preferred method is to dip the assembly into a bath of oil, preferably palm oil or tallow, heated to a sufficient temperature so that the oil not only furnishes the heat necessary for the soldering operation, but acts as a flux to prevent oxidation during the heating and also acts as a means to prevent oxidation during the cooling off of the assembly.

However, before allowing the assembly thus prepared to cool, it is preferred to dip the front and rear faces a short distance into a bath of melted solder so as to reinforce the edges of the spacers and tubes and insure the sealing of the edges of the latter.

The corrugating of the walls of the water tubing increases the outside area and also a more intimate contact between the water and the metal of the tubes is accomplished because of the agitation of the water passing therethrough. The strength of the assembly is also increased in that the projecting portions of the spacer are fixed in position through their lying within the corrugations. Even before soldering the assembly the coacting of these angular projections or corrugations prevents relative movement of the parts in handling the assembly.

It will be noted that the present construction provides for conduction of the heat from the water not only to the outer surface of the water tubes as in conventional construction but also to the metal of the spacer, thereby greatly increasing the heat dissipation surface.

Further, by forming the spacers as described and uniting them with the water tubes, the latter are greatly reinforced and enabled to withstand considerable internal pressure. They are, therefore, much less liable to damage from freezing or steam pressure.

Now, having described the invention and the preferred form of embodiment thereof, it is to be understood that the said invention is to be limited not to the specific details herein described and illustrated, but only by the scope of the claim which follows:

I claim:—

In a radiator core, a plurality of parallel, vertically disposed water tubes each of which includes two substantially parallel and adjacent sheets having symmetrically disposed, horizontal, outward crimps or projections, each sheet having its upper and lower edges bent outwardly to form horizontal flanges having elongated hooks on their free edges, the hooks of the adjacent sheets of adjacent tubes being interlocked to form a core, the tubes being formed to provide a straight line, vertical path therethrough, the spaces between the interlocked sheets containing a spacer member having projecting portions which overlap and underlap the projections or crimps of the tube sheets and which are secured thereto, substantially as shown.

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