Sept. 25, 1934. J. ASKIN 1,974,595

RADIATOR

Filed June 2, 1930 2 Sheets-Sheet 1

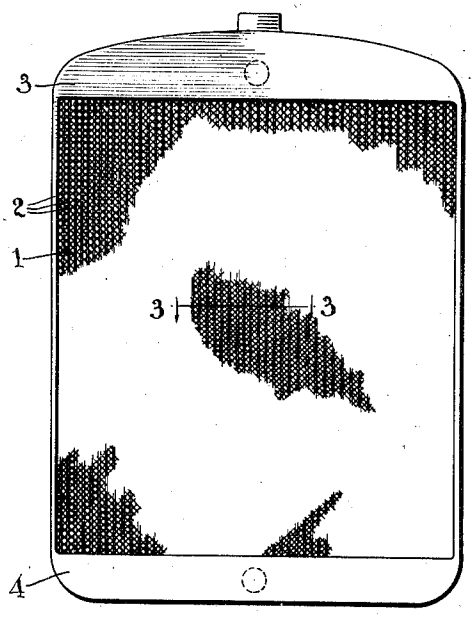


FIG. 1.

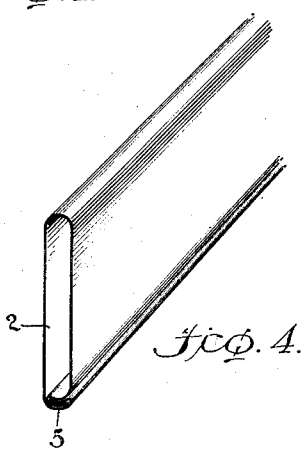
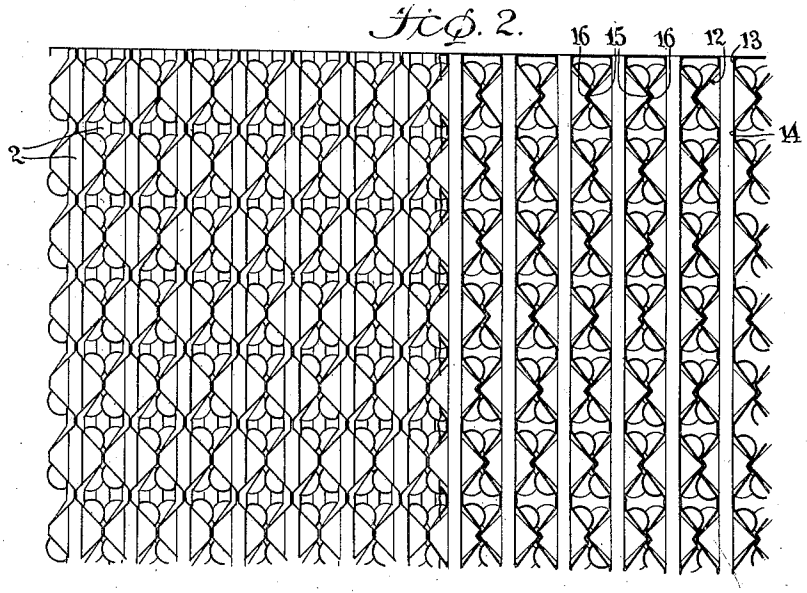


FIG. 4.

FIG. 2.



Inventor
Joseph Askin,

By Barton A. Bean Jr.

Attorney

Sept. 25, 1934. J. ASKIN 1,974,595

RADIATOR

Filed June 2, 1930 2 Sheets-Sheet 2

Fig. 3.

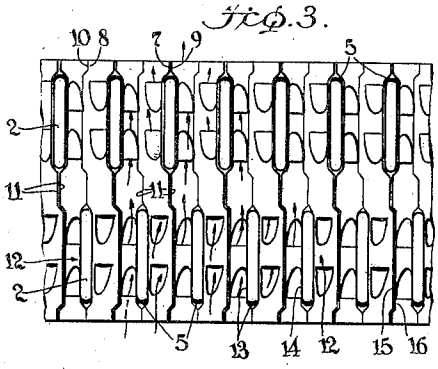


Fig. 6.

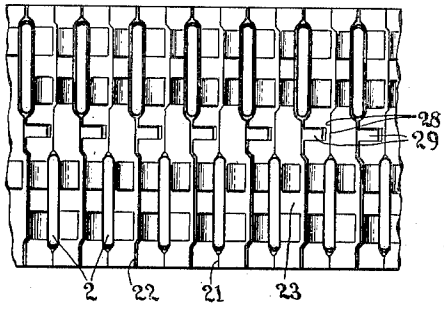


Fig. 5.

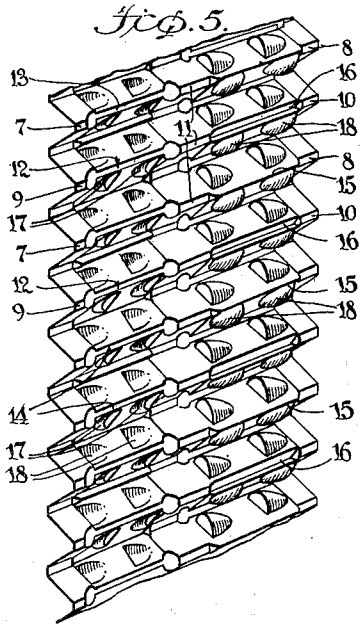
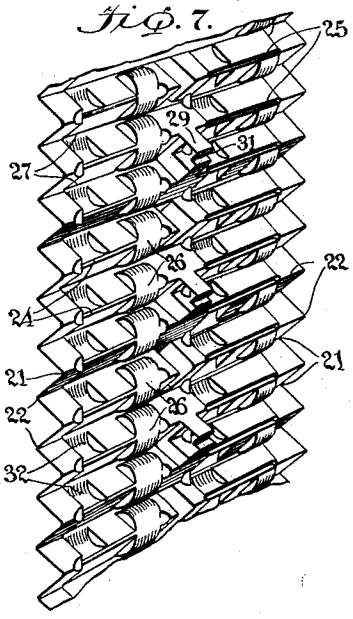


Fig. 7.



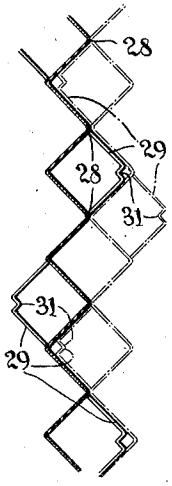


Fig. 8.

Fig. 9.

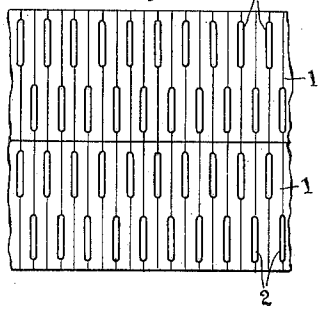
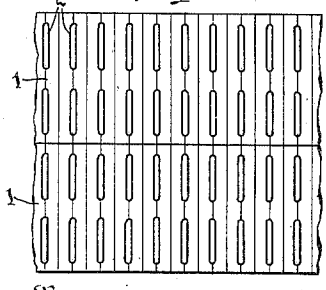


Fig. 10.



Inventor
Joseph Askin,

By
Barton A. Bean Jr.
Attorney

Patented Sept. 25, 1934 1,974,595

UNITED STATES PATENT OFFICE

1,974,595

RADIATOR

Joseph Askin, Buffalo, N. Y., assignor to Fedders Manufacturing Company, Inc., Buffalo, N. Y.

Application June 2, 1930, Serial No. 458,955

8 Claims. (Cl. 257—128)

This invention relates to radiators and it has particular reference to radiators of the water tube type.

Radiators constructed in accordance with the present invention have many possible utilizations, but they are particularly adapted for use in motor vehicles. In the usual type of automobile construction, motive power is provided by a water cooled internal combustion engine, to which cooling water is supplied through a radiator mounted in front of the motor. These radiators commonly include upper and lower tanks which communicate with each other through a plurality of water tubes around which air may circulate to cool the water passing through the tubes.

In building up radiators of this type it is customary to provide cooling fins between the tubes to increase the cooling surface and space positively and support the tubes, which are best formed of very light or thin-walled material, in order to render them efficient as heat conductors. As automobile radiators are subjected to severe racking strains, it is desirable that the fin structure be as strong as possible, consistent with light weight. Another object of the invention is to provide a radiator core capable of quick and inexpensive assembly with a minimum number of operations in order to meet the demands of quantity production.

It has heretofore been customary to form water tubes of elongated cross-section by bending a single strip of metal to tubular form, interlocking the edges thereof along a wide face of the tube, and then rendering the tube water-tight by a tinning or soldering operation. Such tubes may then be assembled with the fins and the entire structure united by soldering. The tinning of the tubes, however, adds considerably to the thickness of the walls, thus making them less efficient in usage and introducing an undesirable item of expense in manufacture. The present invention contemplates a construction wherein the tubes are sealed watertight by the same soldering operation which unites the assembled core parts, thereby reducing the cost of manufacture and avoiding unnecessary thickening of the cooling walls of the tubes. The construction embodies fins so designed as to permit of rapid assembly, and to provide, when united with the water tubes, a strong and efficient cooling unit.

These and other objects and advantages will become apparent from a perusal of the following description of various devices embodying the principles of the invention, illustrated in the accompanying drawings wherein:—

Fig. 1 is a front elevational view of a radiator.

Fig. 2 is an enlarged view, partly in front elevation and partly in cross-section of a portion of the core of the radiator shown in Fig. 1.

Fig. 3 is an enlarged transverse cross-sectional view taken along the line 3—3 of Fig. 1.

Fig. 4 is an enlarged fragmentary view in perspective of a water tube.

Fig. 5 is a fragmentary perspective view of one of the cooling fins shown in Figs. 1, 2 and 3.

Fig. 6 is an enlarged transverse cross-sectional view depicting another form of fin construction.

Fig. 7 is a fragmentary perspective view of one of the cooling fins shown in Fig. 6.

Fig. 8 is a longitudinal section taken through the fin shown in Fig. 7.

Figs. 9 and 10 are diagrammatic showings of modified constructions.

As shown in Fig. 1, the radiator comprises a core 1 including vertically disposed water tubes 2, which are in communication with upper and lower water tanks 3 and 4. The water tubes 2 are advantageously of narrow, elongated cross-section to afford a large cooling surface for a given water capacity, and the tubes are formed by bending a single strip of metal upon itself, and by interlocking the opposite edges thereof along a narrow face 5 of the tube, as shown in Fig. 4. The tubes 2 are arranged in parallel rows, and may be staggered as shown in Figs. 3 and 6, being held in position by stamped or pressed metal cooling fins, which are of corrugated formation, and which extend longitudinally of the tubes, together forming a cellular structure.

These spacing and cooling fins, two forms of which are illustrated in perspective in Figs. 5 and 7, are so deformed and shaped as to provide a large radiating surface, and also to embrace and engage the tubes firmly. This construction is desirable to provide simultaneously for the firm gripping of the tubes, so that they may not be displaced during use, and also to provide large areas of contact between the tubes and the fins, to facilitate the transfer of heat. At the same time, the deformation of the fins is such that they permit of the flow of air through the radiator core and around the tubes, in contact with a large surface area of the fins, so that heat taken up by the fins may in turn be given up to the air, thereby effecting the ultimate result of cooling the water which flows continuously through the tubes.

Fig. 5 illustrates a vertically disposed fin formed with corrugated portions, which, as viewed

with respect to the plane of the paper, alternately advance and recede from such plane. When so viewed, the fin may be considered further as having left and right hand sides, and front and back faces. It will be noted that the edge portions of the fins, on both the left and right hand margins, are flattened, to provide plane surfaces 7 and 8, and 9 and 10, respectively. The advancing crest of the fin, along the line between the edges 7 and 8, is depressed on the left hand side to form a truncation or pocket 13, while on the right hand side the advancing crest is brought out to a sharp apex 15. Intermediate the truncation 13 and apex 15 is a medial flattened portion 11, which lies in the same plane as the flattened portions 7 and 8.

The next advancing crest, defined generally by the edges 9 and 10, is also formed on the left hand side with a pocket 12, and a flat medial portion 11, but on the right hand side the apex 15 is replaced by a depressed or reentrant portion or saddle 16. It will thus be seen that, on the left hand side of the ribbon, alternate or advancing crests are formed with truncated or flattened portions, merging into the flattened portions 7 and 11, or 9 and 11, thereby providing pockets for receiving a tube 2. It will also be understood that when two fins are properly brought together, the flattened portions 7, 9, and 11, of one fin, will abut similar parts on the other fin, and the tube 2 will be snugly encased.

To this point, reference has been made only to those edges or parts which are exposed to view in Fig. 5, or those regarded as being on the projecting portions of the front face. The receding apices of the corrugations of the left hand portion of the fin, or those which would be exposed to view on the right hand side if the ribbon were rotated 180 degrees on a vertical axis, are similar in form to those apparent on the right hand exposed face, except that they are in staggered or offset order. Thus, the receding apex between the portions 7, 11 and 9, 11, is reentrant, as is the portion 16, while the next receding apex is sharp, as shown by the edge 15. Similarly, the right hand rear face of the ribbon will show, at the receding apices, truncated portions 12 and 13. Stating the construction in other language, the advancing and receding apices on the left hand side will show the various elements in the following order, pocket 13, saddle 16, pocket 12, apex 15, thus completing the series. Starting from the same point on the right hand face, the order at the successive meeting edges of the corrugations would be: apex 15, pocket 12, saddle 16, pocket 13, etc.

The left and right hand portions of the fin are of like construction, but the order of the elements is varied or offset, so that, when two fins are placed on opposite sides of a tube, the truncated portions or pockets 12 and 13 will embrace the tube, the reentrant portions or saddles 16 of one ribbon will receive the sharp apices 15 of the other fin, and the flat surfaces 7, 8, 9, 10, and 11 will mutually contact.

It will thus be seen that each tube is in direct contact with appreciable areas of the several fins, and that adjacent fins are also in direct contact with each other, alongside of, above, below, and laterally of the pockets 13. The engagement of the apices 15 with the saddles 16 provides an interlock, preventing relative longitudinal movement of the fins, while the intimate and extensive contact of fin with tube, and fin with fin, provides a valuable factor permitting of the dissipation of heat from the tube walls by direct conduction to a large surface area of metal.

It will further be understood that air is constantly flowing through the fins during operation of the vehicle, so that the heat in the fins may be transferred to the air. To enhance this effect, the advancing and receding faces of the ribbon or fin are further deformed to provide a number of cooling lips in the path of travel of the air.

As illustrated in Fig. 5, each corrugation is formed with struck out portions 17 and 18, of general conical shape; the portions 17 on the left hand side of the advancing surfaces of ribbon being shown as struck down, while the portions 18 on the right hand side of the same face being struck up. Similarly, there is an alternation in the direction between the advancing and receding faces of the members 17, which alternation is continued in like manner with respect to the members 18. The effective result of these expediencies is indicated in Fig. 3, and may also be envisioned from a consideration of Fig. 2, from which it will be noted that air travels through the radiator core in a tortuous path, first over one face of any given corrugation, and is then diverted, for the balance of its travel, over the opposite surface, as indicated by the arrows. These air deflectors provide a highly effective distribution of the heat and its transfer to the cooling air.

The modified form of fin shown in Figs. 6 and 7 will be described in the same manner as that employed in conection with Figs. 3 and 5. It will be noted that the edge portions of this fin are not flattened, but are sharp, as indicated by the numerals 21 and 22. The left hand portion of the fin is formed, however, with tube-receiving pockets on the successive advancing crests, which are designated by the numeral 24. These pockets are made of greater area than the pockets 12 and 13 of the preceding embodiment, however, by striking up the metal of the contiguous corrugations 23, to form contact portions 26, which lie in the same plane as the bottom faces of the pockets 24. The successive advancing crests on the right hand side of the fin are depressed, to form reentrant portions or saddles 25.

The receding apices on the left hand side of the ribbon, designated by the numeral 27, are sharp, as were the apices 15 of the preceding embodiment, while the receding apices on the right hand side of the ribbon are designated by the numeral 21, since they are truncated to form pockets, similar to those exposed to view on the left hand face of the fin. Thus, it will be seen that the count of the advancing and receding apices on the left hand edge of the ribbon would be: pocket 24, apex 27, pocket 24, apex 27, etc.; while on the right hand side, starting from the same point, the count would be: saddle 25, pocket 24, saddle 25, pocket 24, etc. As in the case of the first-described embodiment, the elements which contact the tube and adjacent fin are staggered or offset with respect to each other.

Near the central portions of the fin are apices or edges 28 which are in line with the apices 21 and 22 and between these apices 28 are struck out tangs 29 which have approximately the contour of the corrugations from which they are formed but which are reversed or on opposite hand, as is clearly shown in Fig. 8. It will also be observed that the tangs are struck out in opposite directions, those extending to the right of Fig. 8 being formed from every fourth corrugation and those to the left being intermediate of those to the right. The tangs each have inwardly

deflected portions 31 which serve to render them more resilient. Struck out loops 32 are provided on the corrugations of the offset portions to provide additional cooling extensions for the fins.

In building a core using this type of fin the same steps are carried out as in the previously described construction. Juxtaposed fins are, as shown in the assembly of Fig. 6, reversed so that the edge portions or apices 21 of one contact with edges 22 of the others and vice versa, while the pockets 24 are opposed to provide space therebetween for the water tubes 2. The tangs 29 of each fin enter the re-entrant angles of the corrugations of the opposed or juxtaposed fins, one of which is shown in broken lines in Fig. 8, this entry being aided by the resilience imparted by the tangs by the deflected portions 31 thereof. The apices 27 engage the saddles 25. This interfitting of the fin parts enables the ready alignment and retention of the core parts. After the parts are assembled to the form shown in Fig. 6 the core faces are dipped into molten solder, joining and sealing in one operation the tube edges and the contacting fin edges 21 and 22.

The tubes 2 have been illustrated as elongated in cross-section and disposed with their long cross-sectional axis normal to the faces of the core. They may, however, be of various cross-sections and be disposed at various angles. In Figs. 3, 5, 6 and 9 the fin ribbons or strips each have two oppositely disposed tube-seating recesses, for building cores having two rows of tubes each bearing a staggered relationship to the other. It will be apparent to one skilled in the art that the tubes of the two rows may be in alignment as indicated in Fig. 10, by forming both recesses on the same side of the fin.

It may also be seen that any number of recesses may be provided in each fin for building up radiators having a like number of rows of water tubes. A core having a single row of tubes for example may be built up of fins having a single offset portion or tube-seating recess, such as would be produced by splitting or severing along the longitudinal center the fin shown in Fig. 5. In building large radiators having more than two rows of tubes, it has been found to be expeditious to completely form a plurality of two row cores as depicted in Figs. 3 or 6 and mount them together face to face as indicated in Figs. 9 and 10. In Fig. 9 a construction comprising four rows of tubes is shown, each row being staggered relative to the next adjacent row. Fig. 10 shows a four row construction wherein the tubes are in alignment.

It will thus be seen, that the corrugated fins, hereinbefore described, when assembled and joined together at their edges will provide a cellular cooling element which will have great rigidity due to the interlocking means between the individual fin strips and the diagonal disposition of cooling portions. The water tubes will be gripped between juxtaposed fins and the interlocked edges thereof and will be sealed and joined by the same soldering operation which joins the abutting fin edges. This manner of sealing the water tubes has an additional advantage in that the thickness of the tube walls is increased only along a narrow face of each tube, the thin walls being preserved in the wide tube faces, these being in contact over an appreciable area with the cooling fins permitting direct conduction of heat to a large surface of metal, and the remaining wide face areas are directly exposed to air passing through the core. This cooling air will be given a turbulent motion by the air deflectors struck up from the fin corrugations, directing it into more intimate contact with the fin and tube elements and thereby increasing the cooling capacity of the radiator. It will further be understood that these specifications are to be regarded as illustrative of, and not specifically limiting, the principles of the invention as set forth in the following claims.

What is claimed is:

1. In a radiator core, parallel water tubes, and opposed corrugated fins separating said tubes, the edge apices of the corrugations being in abutment, portions of the fins intermediate the edges thereof being deformed at the meeting edges of the corrugations to form pockets for the water tubes, and portions of certain corrugations intermediate of the fin edges being struck out to provide resilient tangs for interfitting engagement with adjacent corrugations of opposed fins.

2. In a radiator core, a water tube, a corrugated cooling fin, portions of the apices of the corrugations being flattened for abutment with said tube, and portions of said corrugations being struck out to provide enlarged surfaces coplanar with said flattened portions.

3. In a radiator core, a plurality of opposed corrugated fins, the apices of edge portions of the corrugations of adjacent fins being in contact, intermediate portions of the fins being recessed to receive water tubes, water tubes between adjacent fins in said recesses, portions of said corrugations at the recessed portions of the fins being struck out to provide enlarged surfaces in contact with said tubes.

4. A radiator core comprising a plurality of opposed fins of metallic ribbon formed with transverse corrugations, and a water tube between each pair of opposed faces of adjacent fins, said water tubes traversing said corrugations and being staggered on opposite sides of a medial line of the fins, the apices of the corrugations of said fins being offset on their opposed faces to form receiving pockets for the tubes, and other portions of the apices of the opposed faces of the corrugations being formed with complementary interfitting means.

5. As an article of manufacture, a radiator fin comprising a strip of metallic ribbon formed with transverse angular corrugations, the crests of the corrugations on one face of the ribbon at one side of a medial portion thereof being formed with truncations, alternate crests of the corrugations on the opposite face of said portion of the ribbon being formed with depressed portions, the remaining side of the ribbon being formed with similar truncations in the crest portions on said opposite face of the ribbon and with similar depressions on the crest portions of the first face of the ribbon.

6. As an article of manufacture, a radiator fin comprising a strip of metallic ribbon formed with transverse angular corrugations, the crests of the corrugations on one face of the ribbon being formed with truncations on one side of the medial portion thereof and with depressed portions on the remaining side, the remaining face of said last named side of the ribbon having the crests thereof formed with truncations, and alternate raised and depressed tangs extending from the medial portion of the ribbon relative one face thereof.

7. In a radiator core, a plurality of substantially parallel water tubes and longitudinally dis-

posed corrugated fins disposed between said tubes, the meeting edges of the corrugations on one portion of each fin being deformed at the zone of contact with said tubes to provide pockets for said tubes embracing said tubes throughout substantially one half the transverse perimeter of the tube, the meeting edges of the corrugations of adjacent fins remote from said tubes being formed with saddle portions and sharp apices engaging each other, another portion of each fin being formed with tube-engaging pockets and saddle portions and apices; the saddles and apices of said portions being offset with respect to each other.

8. In a radiator core, a plurality of opposed corrugated fins, the apices of edge portions of the corrugations of the opposed fins being in contact and secured together, alternate meeting edges of the corrugations on one portion of the fin being deformed to provide pockets for water tubes, intermediate meeting edges of the corrugations being formed with means for interengagement with complementary means on opposed fins, some of said corrugations being formed with struck-out tangs interfitting adjacent corrugations of opposed fins, and inwardly and outwardly struck-out deflectors between the meeting edges of the corrugations.

JOSEPH ASKIN.