Oct. 29, 1935. O. C. PALMER 2,018,922

RADIATOR CONSTRUCTION

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FIG. 1.

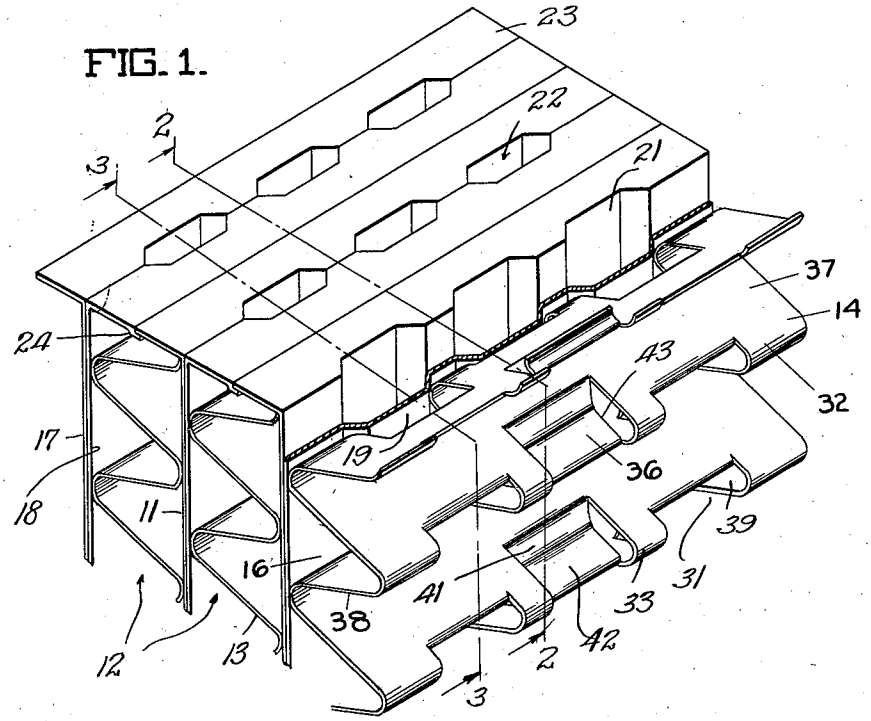


FIG. 2.

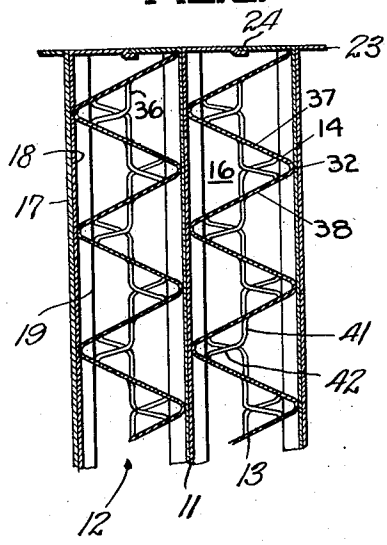
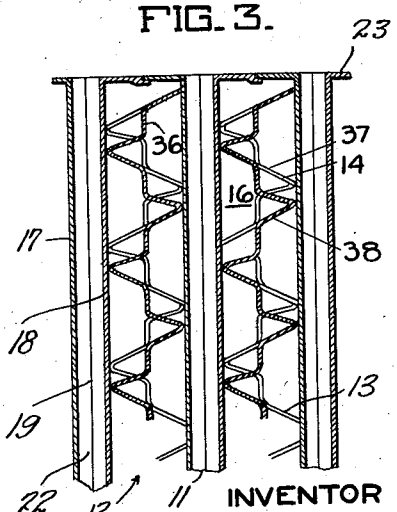


FIG. 3.



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FIG. 4.

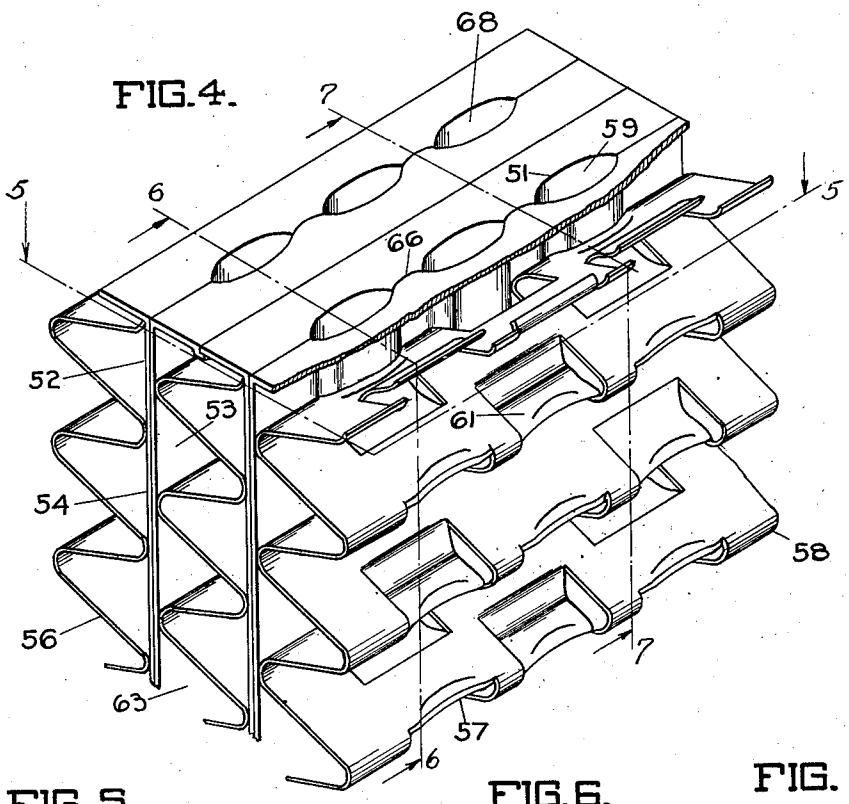


FIG. 5.

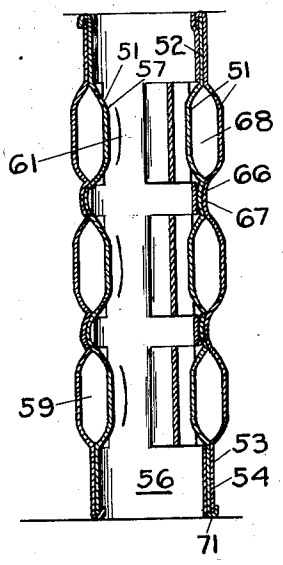


FIG. 6.

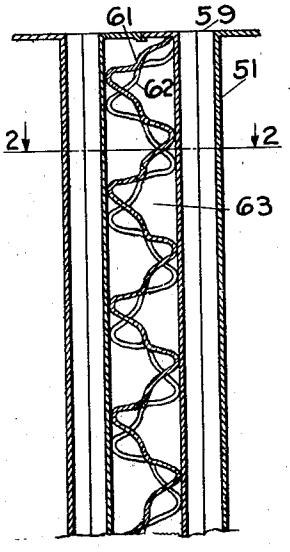
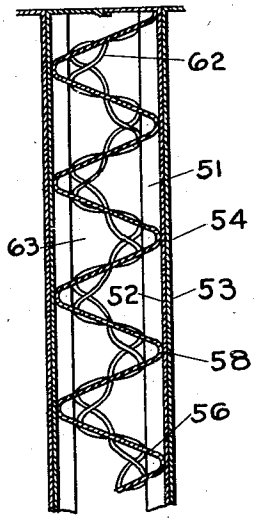


FIG. 7.



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RADIATOR CONSTRUCTION

Oscar C. Palmer, Phoenix, Ariz.

Application September 9, 1931, Serial No. 561,859

4 Claims. (Cl. 257—130)

This invention relates to radiator constructions, and has for an object the provision of an improved and simplified radiator construction of the type commonly employed in conjunction with internal combustion motors.

A more detailed object is to provide a radiator construction comprising spaced water tube members and corrugated fins disposed in the air passages therebetween, so as to divide each air passage into a plurality of parallel air cells, and in which the area of contact between each fin and the water tube member on each side thereof is established at a large number of places, so as to increase the efficiency of the radiator in conducting heat from the water flowing through the tubes to the radiating fins.

Another object is to provide a large number of cutting edges presented to the air flowing through the air cells, these cutting edges being formed on portions of the metal of the fins, each of which is partially severed from the remainder of the associated fin, thereby increasing the efficiency of the fins in transferring to the air the heat which is delivered thereto from the water tube members.

A further object is to provide novel and highly efficient means for interconnecting each of the two plates of which each water tube member is composed, thereby assisting materially in the process of manufacture of the radiator construction, and also adding materially to the rigidity of the completed radiator construction.

A still further object is to provide a radiator construction having the above described characteristics, and which is particularly adapted to mass production, inasmuch as each of the several portions thereof may be manufactured by machine rolling and/or machine stamping at a high rate of production, and as a result of the interlocking features of the various elements of the radiator whereby they are securely and accurately held in proper relative position until final soldering.

The invention possesses other objects and advantageous features, some of which, with those enumerated, will be set forth in the following description of the invention's particular embodiments which are illustrated in the drawings accompanying and forming a part of the specification.

Referring to the drawings:

Fig. 1 is a perspective view showing a portion of a radiator construction embodying the principles of the present invention.

Fig. 2 is a transverse vertical sectional view, the plane of section being indicated by the line 2—2 of Fig. 1, and the direction of view by the arrows.

Fig. 3 is a transverse vertical sectional view, the plane of section being indicated by the line 3—3 of Fig. 1, and the direction of view by the arrows.

Fig. 4 is a view similar to Fig. 1, but showing a slightly modified form of radiator construction embodying principles of the present invention.

Fig. 5 is a horizontal sectional view, the plane of section being indicated by the line 5—5 of Fig. 4 and the direction of view by the arrows.

Fig. 6 is a transverse vertical sectional view, the plane of section being indicated by the line 6—6 of Fig. 4, with the direction of view as indicated.

Fig. 7 is a transverse vertical sectional view, the plane of section being indicated by the line 7—7 of Fig. 4, with the direction of view as indicated.

Referring first to that modification of my invention which is illustrated upon Figs. 1 to 3 inclusive, my improved radiator construction comprises a plurality of water tube members, indicated in their entirety at 11, disposed in spaced parallel relationship to define air passages 12 between each adjacent pair of water tube members 11. A radiating fin 13 is disposed in each of the air passages 12. Each fin 13 is corrugated with the corrugations 14 thereof extending transversely, i. e., perpendicularly with respect to the longitudinal dimensions of the water tube members 11. Hence, each of the air passages 12 is divided into a plurality of parallel air cells 16 extending from front to back of the radiator construction.

Each of the water tube members 11 comprises a pair of plates 17 and 18 arranged in face-to-face abutment. Each of the plates 17, 18 is provided with a plurality of beads 19 extending longitudinally thereof and projecting from the outer face of the plate. These beads are formed by extruding the metal of the plate, with the result that each bead is hollow, thus defining a channel 21 in the inner face of the plate. The two plates 17 and 18 of each water tube member 11 are arranged with their channels 21 in registry with each other, with the result that they cooperate to define water tubes 22 extending longitudinally of the water tube members 11.

At their upper and lower ends the plates 17 and 18 are bent over into perpendicularity with the remainder of the plates, thus presenting horizontal flanges 23, each of which is of sufficient width to engage the outer edge of the flange 23 of the proximal plate of the next adjacent water tube member 11. Preferably, a lap joint 24 is established between these interengaging flanges 23, it being understood that this lap joint is soldered or otherwise permanently fastened so

as to interengage the flanges 23 and thus develop a unitary structure composed of a plurality of the water tube members 11 and the fins 13 arranged therebetween.

The corrugations 14 of each of the fins 13 correspond in height, measured perpendicularly to the planes of the water tube members 11, to the distance between the water tube members, this dimension being taken between beads 19, i. e., the distance between the water tube members is considered as the greatest distance, instead of as the distance between the tops or outermost portions of the beads 19. Hence, depressions 31 are formed in each of the transversely extending crests 32 of the corrugated fins 13. Between the depressions 31 tongues 33 retaining the original shape of the corrugations remain, these tongues being adapted to extend into engagement with the associated water tube member 11 between the longitudinally extending beads 19 thereof. Each of the depressions 31 preferably substantially corresponds in length to the width of the bead 19 which is to be seated therein.

The formation of each depression 31 results in the provision of an excess of metal 36 which is deflected into the air cell 16 directly opposite the crest 32 from which the excess metal 36 has been struck. This metal 36 extends from one wall 37 of the associated air cell 16 to the other wall 38 in a plurality of planes, as best shown upon Figs. 2 and 3, as a result of the fact that it is of greater length than the distance, measured in a straight line, between the two ends of that portion of the fin which is struck from the body thereof in forming the depression 31. Moreover, the front and rear ends of each of the sections 36 of metal are severed from the remainder of the fin 13, leaving each portion 36 of excess metal connected to the fin only at its ends. Accordingly, each portion 36 of excess metal presents cutting edges to the air flowing through the associated air cell 16, which serve to materially increase the efficiency of the radiator in disseminating heat extracted from the water flowing through the water tubes 22. This results from the fact that when a stream of air is cut by a relatively sharp edge much more intimate contact between the flowing air and the metal is established than when the air is flowing against a rounded edge or flat surface. Also, the presence of the plurality of cutting edges develops a turbulence in the air streams, causing them to be divided into a plurality of smaller air streams which are interrupted in their normally straight flow from front to back of the radiator construction, and thus caused to impinge more forcefully against the walls 37, 38 of the corrugations 14 or against the walls of the water tube members 11. This turbulence is further increased because of the fact that each air cell 16 is in communication with those cells immediately thereabove and therebelow, through the openings 39 which are formed when the portions 36 of excess metal are severed along their front and rear side edges from the remainder of the associated fin 13.

Preferably these lines of severance whereby the openings 39 are formed, extend to both sides of the associated crest 32, but to a greater distance in one wall, say the wall 37, than in the other wall 38 of the associated corrugation 14. Accordingly, each of the sections 36 which is extruded into each air cell 16 comprises a portion 41 disposed in a substantially vertical plane, and a portion 42 disposed in a substantially horizontal plane; and on account of the fact that the entire section 36 lies in a plurality of planes, the cutting edges 43 formed at the front and rear side edges thereof are disposed in crooked lines instead of in straight lines, this feature enhancing the tendency for the cutting edges to increase the turbulence within the air streams flowing through the radiator construction.

In the construction illustrated upon Figs. 1 to 3 inclusive, the extruded sections 36 are formed with each alternate extruded section 36 deflected in the opposite direction. For example, the extruded section 36 of any given crest 32 which is proximal to the front of the radiator construction is deflected upwards from one wall 38 of the corrugation 14 into the air cell 16 thereabove. The next extruded portion 36 toward the after surface of the radiator construction and of the same crest 32 is deflected downwards from the opposite wall 37 of the same corrugation 14 and into the same air cell 16. Hence, the air streams flowing through the several air cells 16 encounter cutting edges at many more places, with the result that a greater degree of turbulence and still higher cooling efficiency are obtained.

It will be observed that in the modification already described the water tubes 22 are of somewhat angular configuration, considered in a transverse plane. However, in the modification illustrated upon Figs. 4 to 7 inclusive, each of the beads 51 which projects from the outer surfaces of the plates 52 and 53, whereby the water tube members 54 are defined, is rounded in transverse configuration, as best shown upon Fig. 5. In order to establish the greatest amount of contact between the radiating fins 56 and the water tube members 54, the depressions 57 which are formed in each of the crests 58 are complementarily shaped. This establishes contact between each bead 51 and the metal of the associated fin 56 throughout substantially the entire width of the bead 51. Hence, intimate contact is established between the water tube members 54 and the radiating fins 56 at the closest possible location to the water which is flowing through the water tubes 59, it being understood that these tubes 59 are defined by the hollow interior portions of the beads 51 as in the case of the previously described modification.

In order to provide the rounded recesses 57, it is necessary to form additional depressed portions 61 by secondary crimping after the extruded portions 62 have been formed as described hereinabove in conjunction with the first described modification. However, these secondary depressions 61 are formed only at the central portion of each depression 57, with the result that the extruded portion 62 is rounded so that the air streams flowing through the various air cells 63 encounter still another set of obstructions to their normal straight flow through the radiator. This roundness results from the fact that the metal extruded when forming the secondary depressions 61 is not severed from the remainder of the fin, and consequently a bump or rounded protrusion is formed upon each extruded section 62, as will best be understood by observation of Fig. 4.

It is obvious, of course, that the beads 51 themselves offer baffles or obstructions to the straight flow of the air streams through the air cells, causing the air impinging against their forward or leading edges, which, of course, are inclined with respect to the direction of the motion of the air with respect thereto, to be swung

against the air cells and to impinge against the inclined walls of the associated air cell with additional force.

Another feature of convenience in my improved radiator construction is the manner of interconnection of the two plates **52** and **53** defining each of the water tube members **54**. A secondary bead **66** is formed by crimping the metal of one of the plates, say the plate **52**, so as to extrude the metal from the inner face of the plate, this bead extending longitudinally of the plate **52** between adjacent water tube forming beads **51**. A complementary channel **67** is similarly formed in the opposed plate **53**, the bead **66** being seated within the channel **67** so as to hold the two plates **52** and **53** with the channels **68** presented by the hollow interiors of the beads **51** in registry with each other, thereby defining the longitudinally extending water tubes **59**. The two plates **52** and **53** are held in face-to-face engagement by crimping the front and rear edges of one plate around and in tight engagement with the corresponding edges of the other plate, as best illustrated upon Fig. 5. This crimping, which is indicated at **71**, holds the plates **52** and **53** together, so as to retain the secondary beads **66** seated within their sockets **67**, thereby establishing a cooperation whereby the plates **52** and **53** are retained accurately and rigidly in proper relative position until the entire radiator construction is soldered.

It is believed that the method of operation of the various modifications of my improved radiator construction will be readily understood from the above description of their constituent parts by anyone skilled in the art to which the present invention appertains.

It is to be understood that the details of the invention as herein disclosed, are subject to alteration within the spirit or scope of the appended claims.

I claim:

1. In a radiator construction, a water tube member comprising a pair of plates arranged face-to-face and having registering channels in their inner faces defining water tubes, one of said plates having a groove formed therein between and substantially parallel to said channels, and a ridge on the other plate complementary to and seated within said groove to hold said plates with their channels in registry.

2. In a radiator construction, a water tube member comprising a pair of plates arranged face-to-face and having longitudinally extending channels in their inner faces defining water tubes, one of said plates having a longitudinally extending groove formed therein between said channels, and a ridge on the other plate complementary to and seated within said groove to hold said plates with their channels in registry.

3. A fin for spacing water tube members of a radiator, comprising a plate having transverse corrugations, a portion of the crest of each corrugation being deflected inwards to provide a section of excess material lying within the concave side of the associated corrugation, and each of said sections of excess material being severed from the remainder of said plate along that edge thereof which is proximal to the front of the radiator, thereby presenting a cutting edge to the stream of air flowing through the radiator, the line of severance of each of said sections extending from the crest of the associated corrugation into both side walls thereof, but to a greater distance in one side wall than in the other, thereby presenting a section which is asymmetrical with respect to the associated corrugation, and adjacent sections in each corrugation being misaligned with respect to each other.

4. A fin for spacing water tube members of a radiator, comprising a plate having transverse corrugations, a portion of the crest of each of said corrugations being deflected inwards to provide a section of excess material lying within the concave side of the associated corrugation, said sections of excess material being severed from the remainder of said plate along their front and rear edges to present cutting edges to the stream of air flowing through said radiator, the lines of severance of each section extending from the crest of the associated corrugation into both side walls thereof, but to a greater distance in one side wall than in the other, thereby presenting a section which is asymmetrical with respect to the associated corrugation, and adjacent sections in each corrugation being disaligned with respect to each other.

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