

March 31, 1936.

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2,035,665

RADIATOR CONSTRUCTION

Filed April 11, 1932

3 Sheets-Sheet 1

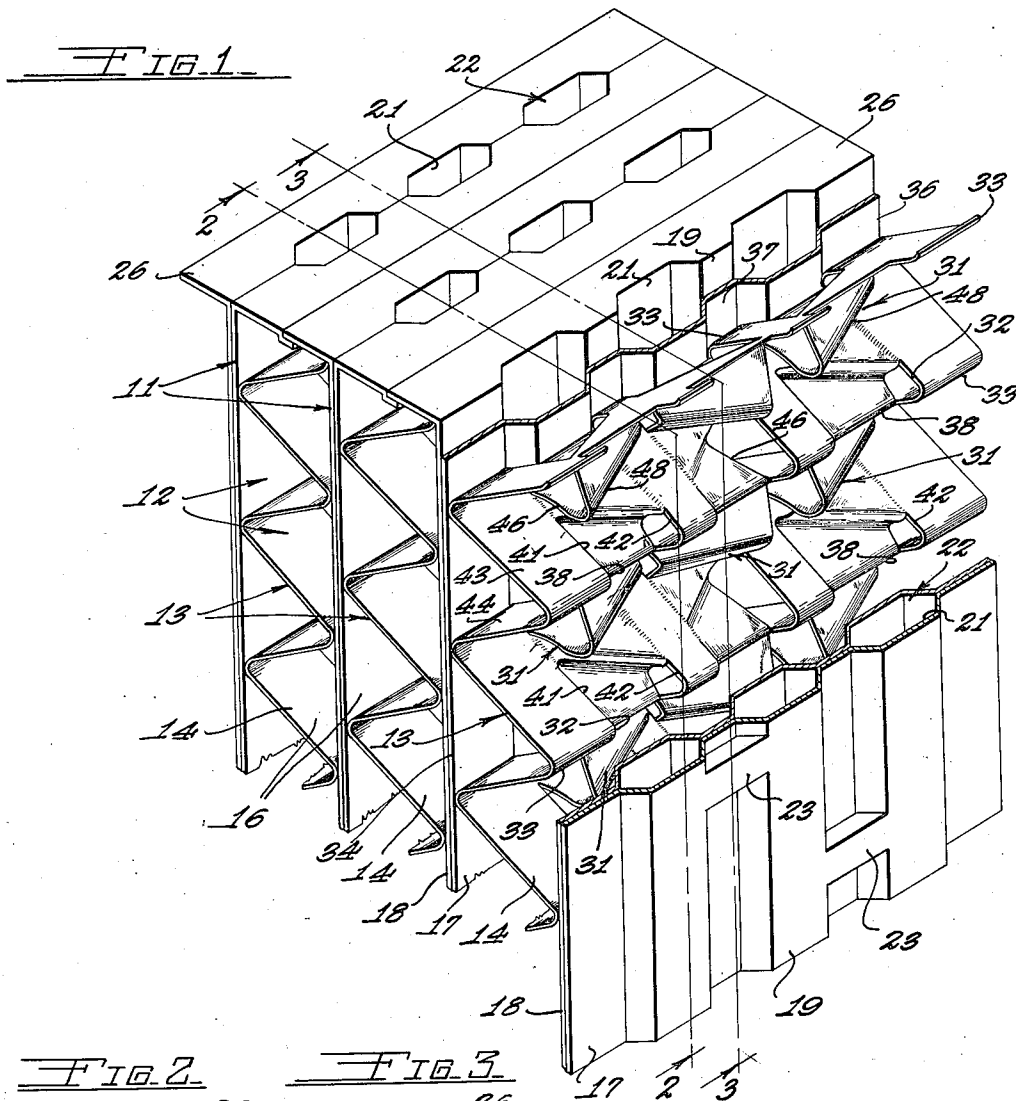


FIG. 2

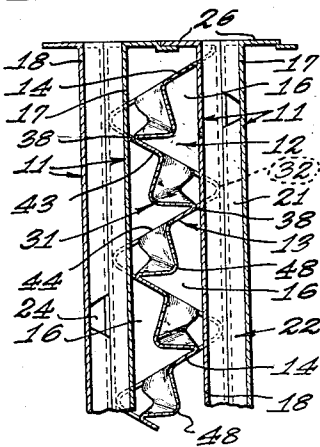
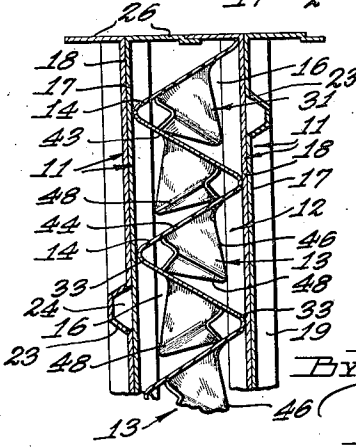


FIG. 3



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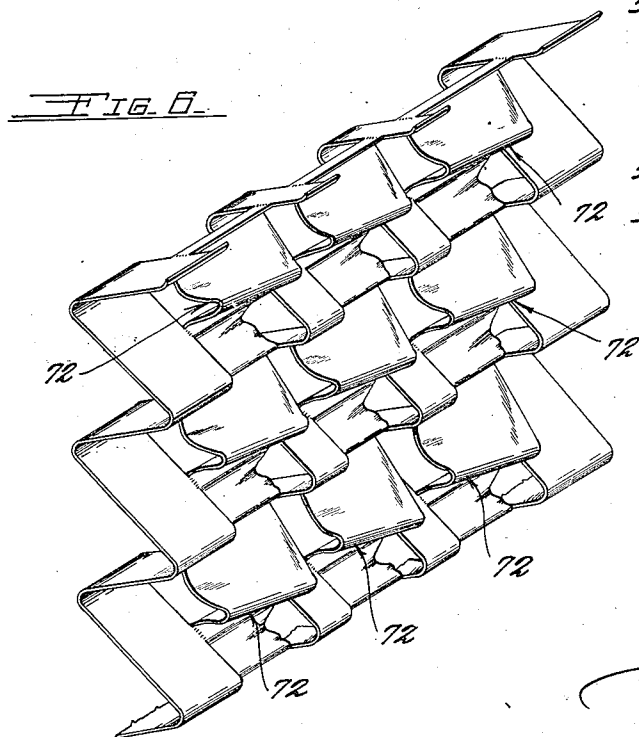
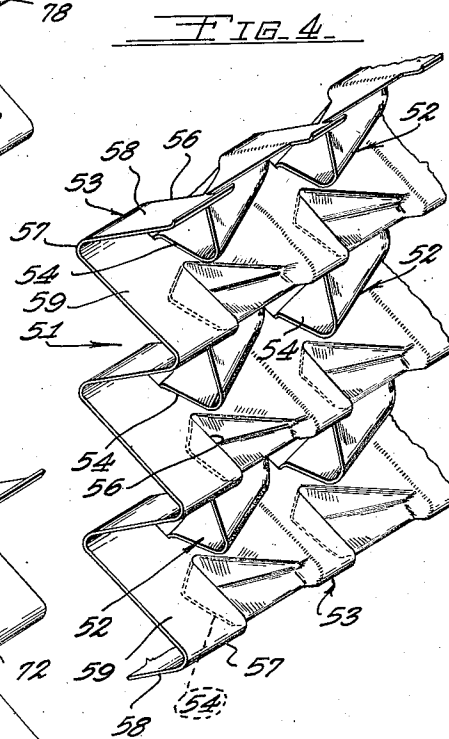
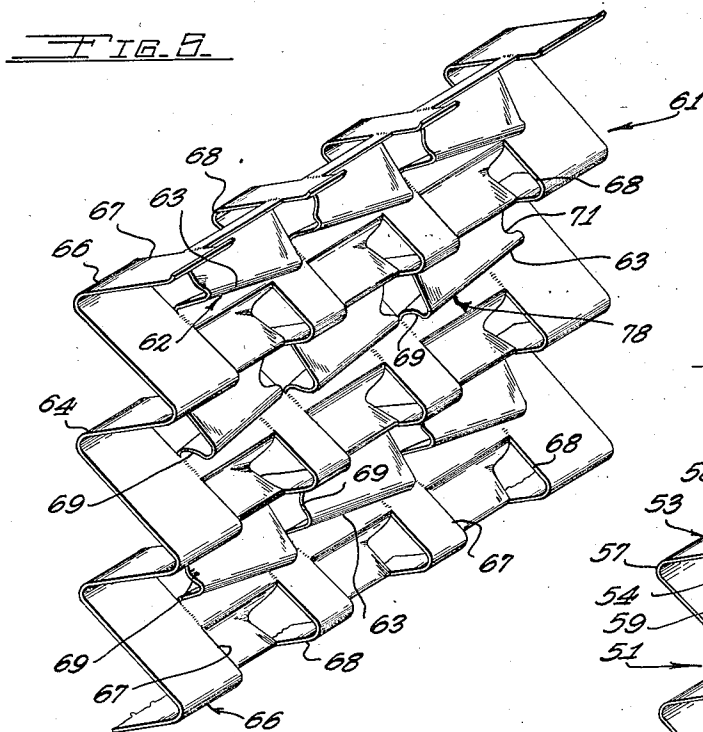
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3 Sheets-Sheet 2



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3 Sheets-Sheet 3

FIG. 7.

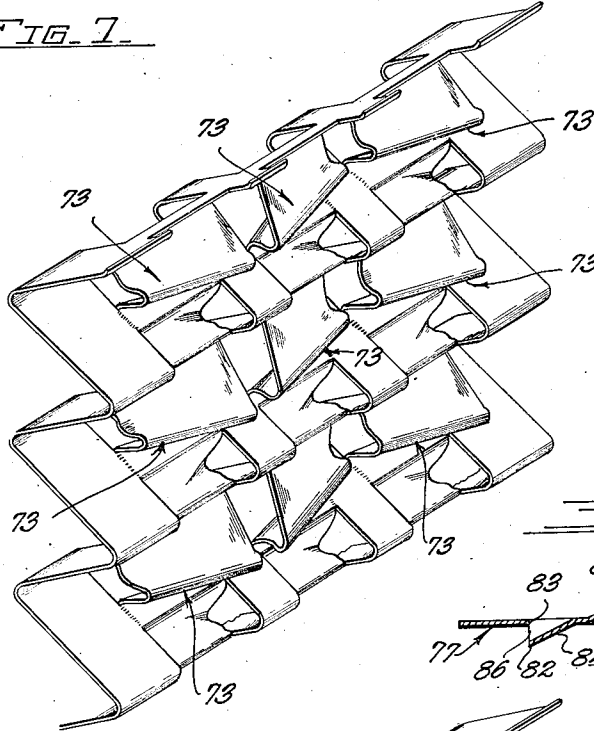


FIG. 9.

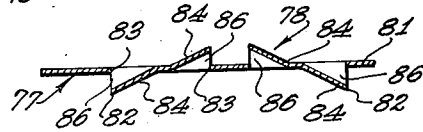
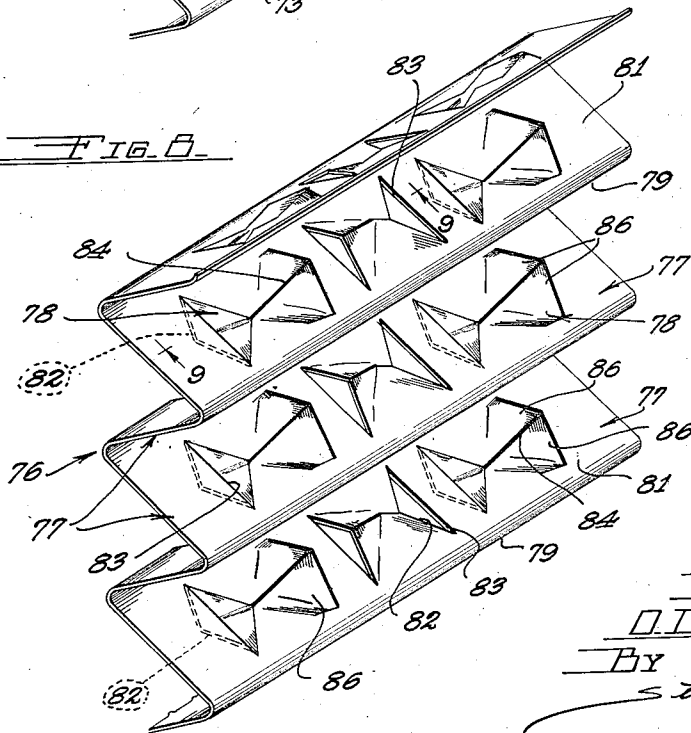


FIG. 8.



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RADIATOR CONSTRUCTION

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Application April 11, 1932, Serial No. 604,530

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 engines to cool the circulating water thereof.

Another object is to provide a radiator construction representing an improvement over that forming the subject matter of my copending application, Serial No. 561,859, filed September 9, 1931.

A more detailed object is to provide an improved spacing fin adapted to be received within the air passage between water tube members of a radiator and having transverse corrugations adapted to divide the air passage into a multiplicity of parallel air cells, and in which novel means are provided for increasing the cooling efficiency of the radiator by interrupting the otherwise relatively smooth flow of air through the air cells and causing it to impinge forcibly against the spacing fin and/or the tube members.

A more detailed object in this connection is to provide a corrugated spacing fin as described wherein the means for interrupting and deflecting the air flow is in the form of a plurality of restrikes, or minor corrugations, reversely bent with respect to the major corrugations in which they are formed, and disposed in positions of obliquity with respect thereto, thereby providing a large number of inclined surfaces lying in the paths of the air flowing through the air cells and adapted to direct the air across each air cell to impinge forcibly against the opposite side thereof.

A further object is to provide inclined restrikes or minor corrugations as described, which, in some of the modifications of the present invention, are of greater amplitude at one end than at the other end, thereby providing funnel-shaped structures adapted to direct air through the opening formed when each restrike is extended from the plane of the surrounding portion of the fin. This type of inclined and tapering restrike is preferably formed more to one side of the associated corrugation so that the tapering configuration of the restrike causes its crest to be disposed obliquely with respect to the plane of the fin itself in addition to extending obliquely with respect to the crest of the major corrugation.

A further object of the present invention is to provide an improved type of water tube member having means for establishing inter-communication between the several water tubes thereof and thereby not only increasing the volumetric capacity of that portion of the radiator which is adapted

ed to disseminate heat, but also facilitating the flow of water therethrough and providing additional protuberances upon the exterior surface thereof against which the air is adapted to impinge.

My invention possesses other objects and valuable features, some of which, with the foregoing, will be set forth in the following description of the preferred forms of my invention which are illustrated in the drawings accompanying and forming a part of the specification. It is to be understood that I do not limit myself to the showing made by the said drawings and description, as I may adopt variations of the preferred forms within the scope of my invention as set forth in the claims.

Referring to the drawings:

Figure 1 is a perspective view showing a section of radiator construction embodying the principles of the present invention, portions of the figure being broken away better to disclose the construction.

Figure 2 is a transverse vertical sectional view taken upon the line 2—2 of Figure 1 with the direction of view as indicated.

Figure 3 is a transverse vertical sectional view taken upon the line 3—3 of Figure 1 with the direction of view as indicated.

Figure 4 is a perspective view showing a slightly modified form of spacing fin, apart from the remaining structure of the radiator construction.

Figure 5 is another perspective view showing a further modified form of spacing fin.

Figure 6 is another perspective view showing a still further modified form of spacing fin.

Figure 7 is another perspective view showing another modified form of spacing fin.

Figure 8 is another perspective view showing another modified form of spacing fin.

Figure 9 is a detail, sectional view taken upon the line 9—9 of Figure 8 with the direction of view as indicated.

Broadly considered, the radiator construction of the present invention comprises a plurality of water tube members disposed in spaced parallel relationship to define air passages therebetween and a spacing fin interposed between each two water tube members. Each spacing fin is corrugated transversely so as to divide the associated air passage into a plurality of air cells of substantially triangular cross-sectional configuration; and preferably each of the corrugations of each spacing fin is provided with one or a plurality of indentations or "restrikes" in the form of a minor corrugation extending inwards with

respect to the major corrugation in which it is formed, so as to lie within the concave side thereof. These restrikes are severed from their supporting major corrugations along one or both ends of each restrike, thereby providing passages in the wall or walls of the associated major corrugations through which air can flow; and the restrikes or minor corrugations, instead of being disposed with their crests in parallelism with the crests of the major corrugations, lie obliquely with respect thereto, thereby presenting a multiplicity of inclined surfaces adapted to interrupt the otherwise relatively smooth flow of air through the air cells, and direct the air forcibly against the opposite portions of the spacing fin and/or the water tube member, thereby increasing the intimacy of contact between the air and the metal, making it possible to increase the efficiency of the radiator construction in disseminating heat to the air.

Specifically describing a preferred embodiment of my invention which is illustrated on 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 pair of adjacent water tube members 11. A radiating fin 13 is disposed in each air passage 12; and 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 air cells 16 extending from the front to the back of the radiator construction, each of these air cells being of substantially triangular cross-sectional configuration.

Each of the water tube members 11 comprises a pair of plates 17 and 18 arranged in face-to-face abutment, each plate 17, 18 being provided with a plurality of beads 19 extending longitudinally thereof and projecting from the outer face of the associated plate into the air passage 12 thereadjacent. These beads are formed by extruding the metal of the plate, with the result that each bead 19 is hollow, thereby defining a channel 21 in the inner face of the plate, and by arranging the plates 17 and 18 of each water tube member 11 with their channels 21 in registry, water tubes 22 are defined by the co-operation of the channels 21 of each pair of plates, these water tubes 22 being disposed between the plates 17, 18 and extending longitudinally of the tube members 11.

One of the valuable features of the present invention lies in the provision of transverse beads 23 interconnecting adjacent longitudinal beads 19. These transverse beads 23 preferably are substantially of the same height as the longitudinal beads 19 and are similarly formed, i. e. by extruding the metal of the plate leaving the beads 23 hollow on their inner faces, thus defining transverse passages 24, establishing interconnection between adjacent water tubes 22. Hence this construction of water tube member is adapted not only to increase the volumetric capacity of that portion of the radiator which is capable of disseminating heat, but also to facilitate the flow of water through the cooling portion of the radiator and provide additional unevennesses or protuberances on the outer surfaces of the water tubes against which air flowing through the radiator is adapted to impinge and absorb heat from the water tube member.

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 25, each of which is of sufficient width to engage the outer edge of the flange 25 of the proximal plate of the next adjacent water tube member 11. Hence, the several flanges 25 at each end of the radiator co-operate to define a header, it being understood that the joints between the flanges 25 are soldered or otherwise permanently fastened together, thus developing a unitary, water tight structure.

Each of the major corrugations 14 of each fin 13 is provided with preferably a plurality of restrikes or minor corrugations 31 which preferably are of substantially V-shape or arcuate cross section, being joined to the associated supporting corrugations along both lateral edges of the restrike. In its preferred construction, the number of restrikes 31 formed in each major corrugation 14 coincides with the number of water tubes 22 in each water tube member 11, the restrikes 31 being disposed in registry with the beads 19, thereby permitting the beads 19 to seat within the depressions 32 formed in the crests 33 of the major corrugations 14 when the restrikes 31 are pressed inwards. This permits the crest 33 of each major corrugation to engage the outer face of the proximal water tube member 11, adjacent its front and rear edges 34 and 35 respectively and at the flat portions 37 between the beads 19, whereas the crests of the beads 19 of the water tube members 11 engage the metal of the proximal fin 13 along the bases 38 of the restrikes 31, i. e. at the lines 39 along which the metal is bent in forming the restrikes 31. Thus it may be seen that the maximum area of contact between the water tube members and the space fins is established, this being an important factor in conducting the maximum amount of heat from the water tube members to the spacing fins whence it is disseminated to the air flowing through the radiator.

In forming each of the restrikes 31, the crest 33 of the associated major corrugation 14 is broken along lines of severance 41 and 42 extending across the crest 33 and into both side walls 43 and 44 of that major corrugation. Preferably, however, one of the lines of severance, say the line 41, extends for a greater distance into one of the side walls, say the side wall 43, than into the other side wall 44. Accordingly, when the restrike 31 is extruded from the plane of the surrounding metal, the minor corrugation or restrike thus formed will be of greater amplitude at the end 46 associated with the longer cut or line of severance 41. Moreover, the crest 48 of each restrike 41 thus formed will lie in obliquity with respect to the plane which bisects the associated major corrugation 14 by passing through the crest 33 thereof, i. e., the crest of the major corrugation extends substantially horizontally, whereas the crest 48 of each of the minor corrugations 31 is inclined with respect to the horizontal. Moreover, owing to the greater amplitude of each minor corrugation 31 at one end than at the other, its crest 48 is inclined also with respect to the plane of the entire fin 13. In other words, one end of each restrike 31 is at a greater distance from the proximal water tube member than the other end of that restrike. Thus, it may be seen that a multiplicity of inclined surfaces are presented by these obliquely disposed restrikes to the streams of air flowing through the air cells 12. These inclined surfaces serve to enhance the efficiency of the radiator construction in the

dissemination of heat by interrupting the otherwise relatively smooth flow of air, causing the air to impinge with relatively great force against the restrikes themselves and then against the opposite wall of the associated area as well, because of the fact that the air is caused to deviate from its straight course and is thrown forcibly against the opposite wall of the cell as a result. However, the air flowing through each air cell is not merely thrown across that individual cell, but a portion of it is drawn through the openings formed by the cuts or lines of severance 41 and 42 and then directed into the next adjacent air cell. The forward edges of the restrikes 31 and the edges of the major corrugations from which the after ends of the restrikes have been removed present a multiplicity of cutting edges to the air stream which in themselves are highly efficient in the dissemination of heat to the air. The effect of the cutting edges is materially enhanced by the obliquity of the restrikes 31 leading therefrom inasmuch as the stream of air is not only cut where it impinges against the cutting edge, but is also caused to deviate sharply from its natural course so that it impinges with greatly enhanced force against the metal of the fin immediately adjacent the forward edge of each of the restrikes. In fact, I have found by actual test that although the restrikes 31 do not materially interfere with the volume of air flowing through the radiator this design of radiator construction is of greatly increased efficiency in heat dissemination. The tendency for air to flow through the openings formed by the cuts 41 and 42 is enhanced by the peculiar configuration of the restrikes 31 which in effect are substantially funnel shaped, certain of the restrikes being disposed with their larger ends foremost. The air is adapted to enter these larger ends and to be guided by the inclined restrikes through the openings into the next adjacent air cell, as can readily be understood by observation of the arrangement of the restrikes upon Fig. 1.

Fig. 1 shows the restrikes 31 arranged with the alternate restrikes inclined in opposite directions, i. e. one of the restrikes, say that proximal to the front of the radiator construction, has its larger end or end formed by the longer line of severance 41, foremost, whereas the next restrike 31 in the same corrugation and toward the rear of the radiator construction has its similar end, i. e., the end formed by the shorter line of severance 42, foremost. It should be understood, however, that various arrangements of the inclined restrikes may be resorted to without departing from the spirit of the present invention. For example, all of the restrikes of each corrugations might incline in the same direction.

Moreover, Fig. 1 shows all the restrikes 31 deflected downwards from the uppermost side walls of their associated major corrugations. However, the restrikes might be alternated in this respect also, i. e. they might be deflected downwards from one corrugation and upwards from the next adjacent corrugation, and so on. Inasmuch as these alternative forms differ so slightly from that which has been illustrated, it is not deemed necessary to illustrate them.

Fig. 4 shows a slightly modified form of fin construction 51 which is similar to that described with the exception that the smaller ends of the obliquely disposed restrikes 52 are not severed from the major corrugations 53 from which they are formed. The larger ends 54 of the restrikes 52 are cut or otherwise severed along lines of sev-

erance 56 extending across the crest 57 of the major corrugations 53 and into both side walls 58 and 59 of that corrugation but to a greater distance in one side wall 58 than in the other. Hence, the restrikes 52 are shaped similarly to the restrikes 31 previously described in general configuration and also in position with respect to the remaining portions of the fin 51.

Fig. 5 shows a further modified form of spacing fin 61 having restrikes 62, the crests 63 of which are inclined with respect to the crests 64 of the major corrugations 65. However, the crests 63 of the minor corrugations 62 are disposed substantially in parallelism with the plane of the spacing fin 61. This is accomplished by making both lines of severance 67 and 68 at the forward and after ends respectively of each restrike 62, of the same length, the result being that each restrike or minor corrugation is of constant amplitude throughout its entire length. However, after the restrike has been depressed inwards into the hollow or concave side of the major corrugation 66, it is twisted slightly so as to depress the forward end of the restrike 62 nearer one of the side walls of the supporting major corrugations than to the other, whereas the after end of the restrike is closer to the other wall of the major corrugation. This results in forming a slight crimp or bend 69 in one wall of the restrike 62 adjacent the forward end of the restrike and a similar crimp or bend 71 in the other wall of the restrike adjacent the other end thereof. Accordingly, these obliquely disposed restrikes provide a multiplicity of inclined surfaces against which the air flowing through the air cells is adapted to impinge and be deviated thereby from its otherwise relatively straight course.

In Fig. 5, the restrikes 62 of one major corrugation are shown with their forward ends higher than their after ends, whereas the restrikes 62 of the next adjacent corrugation are disposed with their forward ends lower than their after ends. In other words, the direction of inclination of one row of restrikes is opposite to the direction of inclination to the next row of restrikes.

In Fig. 6, the restrikes 72 are all inclined in the same directions, i. e. their forward ends are higher than their after ends. It is obvious, however, that other deviations from the form shown upon Fig. 5 might be resorted to without departing from the spirit of the present invention. For example, the alternate restrikes 73 of each major corrugation might incline in opposite directions, as in the modification illustrated upon Fig. 7.

Figs. 8 and 9 illustrate a still further modified form of spacing fin 76, the major corrugations 77 of which are provided with restrikes or minor corrugations 78, each of which instead of being deflected inwards from the crest 79 of the associated major corrugation 77, is formed entirely in one of the side walls 81 thereof. One end 82 of each restrike 78 is separated from the side wall 81 by a line of severance 83 extending transversely of the corrugation 77, but not across the crest 79 thereof. The end 82 is then pressed out of the plane of the side wall 81 preferably forming at the same time a ridge or crest 84 extending from the center of the end 82 to the point of intersection of the planes of the two sides 86 of the restrike 78 thus formed with the plane of the wide wall 81 on which the restrike is supported. Preferably alternate restrikes 78 of a given side wall 81, are pressed in opposite directions; that is to say, one

restrike 78 is pressed upwards from the plane of the side wall 81, while the next restrike is pressed downwards from that plane. Moreover, these alternately formed restrikes are 5 disposed with the ends thereof which merge into the plane of the side wall, adjacent each other, so that they both slope toward each other and toward the plane of the associated side wall, as best shown upon Fig. 9.

10 Thus it may be seen that each of the restrikes 86 is of greater amplitude at the end 82 thereof than at that end thereof which merges with the plane of the side wall 81. This greater amplitude at the end 82 is evidenced by both greater 15 depth and greater width of the restrike 78 at the end 82 thereof than at its other end. The greater height of the restrike 78 at its end 82 results in positioning the crest 84 of the restrike obliquely with respect to the crest 79 of the major corruga- 20 tion 77; and inasmuch as the wall 81 in which the restrike 78 is formed lies in a plane extending obliquely with respect to the plane of the entire fin 76, the crest 86 of each restrike is also disposed obliquely with respect to the plane of the 25 fin 76.

I claim:

1. In a radiator construction, vertically disposed tube members having spaced beads projecting from their faces, said beads being hollow 30 to define water tubes therein, and said members being spaced apart to define air passages therebetween with said beads projecting into said air passages, and fins disposed within said air passages, each fin comprising a plate having cor- 35 rugations therein extending angularly with respect to said beads, the walls of said corrugations being broken at spaced intervals to form air passages therethrough, and the material of said fin being extruded adjacent each break defining a 40 restrike joined to the associated corrugation along both lateral edges of the restrike, the crest of each of said restrikes being disposed obliquely with respect to the horizontal and each of said 45 restrikes being of gradually increasing amplitude from one end thereof to the other to dispose the crest of the restrike obliquely with respect to the vertical.

2. In a radiator construction, a pair of spaced water tube members, and, a spacing fin interposed 50 therebetween, comprising a plate having corrugations therein, each of said corrugations being broken in two spaced lines of severance extending across the crest thereof and further into one side wall of the associated corrugation than into

the other side wall thereof, that portion of said crest disposed between said lines of severance being reversely bent forming a restrike extending into the concave side of the corrugation, each of said restrikes being of greater amplitude at one 5 end thereof than at the other to dispose the crest of the restrike obliquely with respect to the crest of the associated corrugation.

3. In a radiator construction, tube members having spaced beads projecting from their faces, 10 said beads being hollow to define water tubes therein, transverse hollow beads on said members defining water tubes interconnecting said first mentioned water tubes, and said members being spaced apart to define air passages there- 15 between with said beads projecting into said air passages, and fins disposed within said air passages, each fin comprising a plate having corrugations therein extending angularly with respect to said beads, the walls of said corrugations 20 being broken at spaced intervals to form air passages therethrough, and the material of said fin being extruded adjacent each break defining a restrike, the crest of each of said restrikes being disposed obliquely with respect to the crest of the 25 associated corrugation.

4. In a radiator construction, a plurality of parallel tubes, and intermediate spacing fins cor- 30 rugated to provide alternately oppositely disposed channels extending transversely of said fins, and crests alternately engaging the tubes on opposite sides of each of said fins, the walls of said cor- 35 rugations having air passages therethrough at spaced intervals and the material of the fin being extruded adjacent said air passages defining 40 minor corrugations joined along both lateral edges thereof to the walls of the supporting major corrugation, and said minor corrugations being twisted into obliquity with respect to the asso- 45 ciated major corrugation, an end of at least one wall of each of said minor corrugations being bowed inwards with respect to that minor cor- 50 rugation and thereby restricting that end of the channel defined by that minor corrugation whereby each of said minor corrugations engages a portion of the fluid stream flowing through the channel into which that minor corrugation extends and deflects it from straight line motion into impingement with a wall of that channel, and also entraps a portion of the same fluid stream and diverts it through the associated air passage to a neighboring channel.

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