

March 13, 1934.

C. GILLEAN

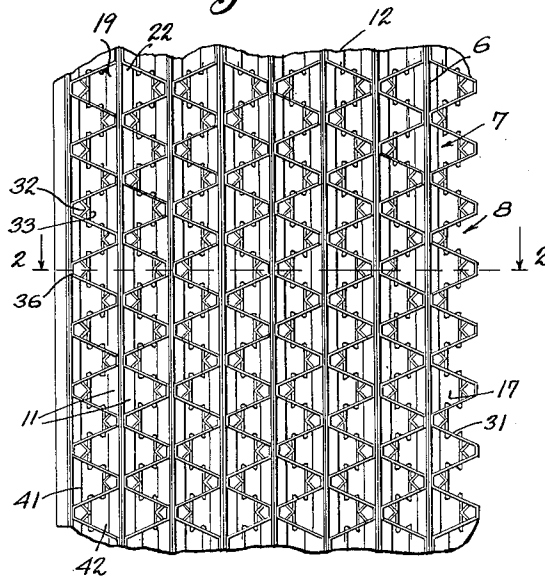
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RADIATOR

Filed Nov. 28, 1930

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Fig. 1.



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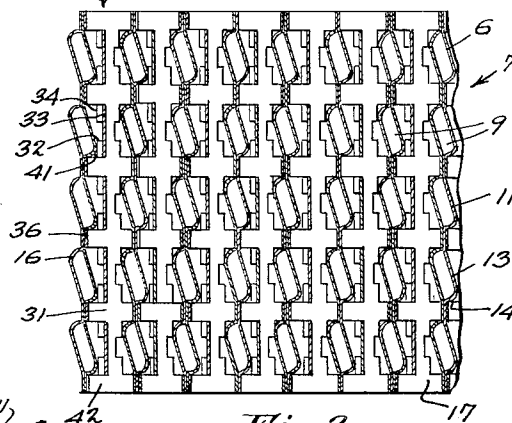
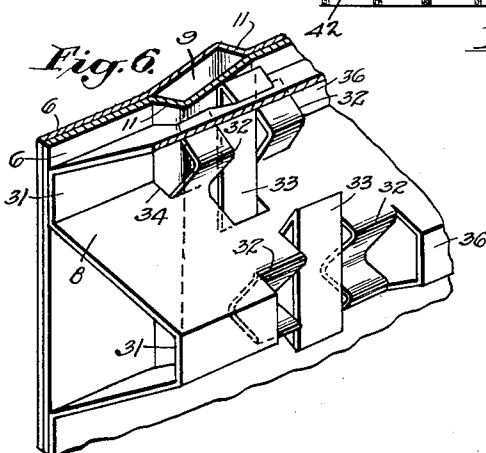


Fig. 2.

Fig. 6.



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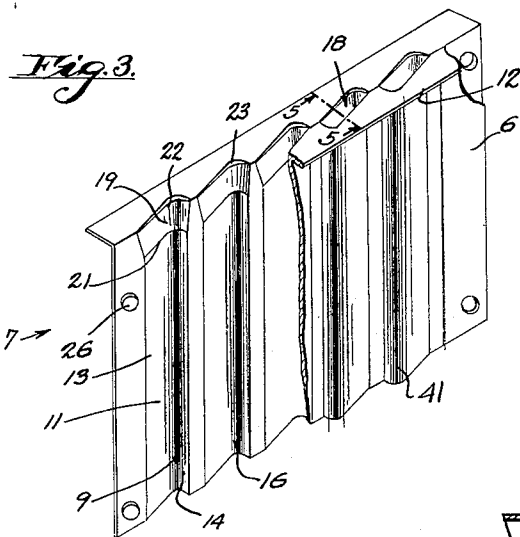
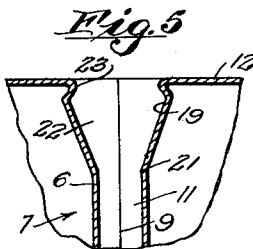
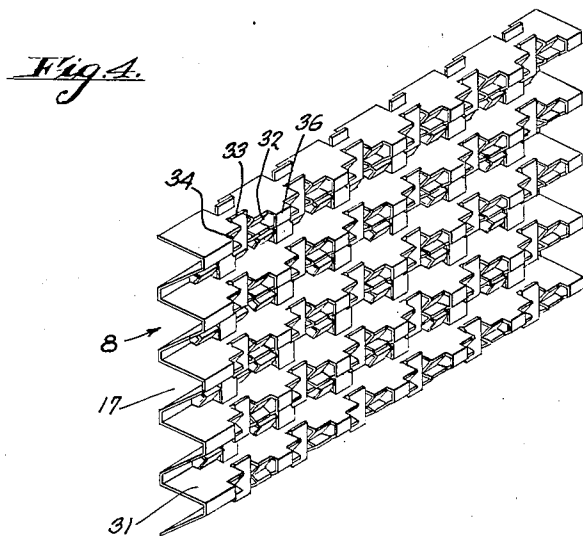
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UNITED STATES PATENT OFFICE

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RADIATOR

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9 Claims. (Cl. 257—130)

This invention relates to radiators, and has for an object the provision of an improved design of radiator whereby unusual efficiency is attained in the extraction of heat from the water or other fluid to be cooled.

Another object is to provide a radiator construction in which provision is made for the prevention of the accumulation of sediment and the like, which is apt to interfere with the normal circulation of water through the water passages and thereby interfere with the efficient absorption of heat from the water.

Another object is to provide a novel design of spacing fin interposed between the several groups of water passages to break up the air streams flowing therebetween.

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 embodiment which is illustrated in the drawings accompanying and forming a part of the specification.

Referring to the drawings:

Fig. 1 is a front elevation of a section of radiator construction embodying the principles of the present invention.

Fig. 2 is a horizontal sectional view, the plane of section being taken upon the line 2—2 of Fig. 1, with the direction of view as indicated by the arrows.

Fig. 3 is a perspective view showing a pair of plates defining one of the groups of water passages, one of these plates being partially broken away better to reveal the construction.

Fig. 4 is a perspective view of one of the fins whereby the pairs of plates are spaced.

Fig. 5 is an enlarged detail view in vertical section taken upon the line 5—5 of Fig. 3.

Fig. 6 is an enlarged detail view of a portion of one of the fins illustrating the corrugations and restrikes formed therein.

Specifically describing the preferred embodiment of my invention, my improved radiator construction comprises a plurality of vertically extending plates 6 arranged face to face in spaced pairs 7, with a radiating fin 8 interposed between each pair of plates. Each pair 7 of plates 6 defines a series of vertically extending water passages 9, each of which is formed by opposed corrugations 11 in the two associated plates 6. The plates 6 of each pair 7 are disposed so that the corrugations 11 thereof extend in the opposite direction from the corrugations 11 of the other plate of the same pair and with the corrugations 11 of the plates of each pair in registry

with each other, as best shown upon Figs. 2 and 3. Each of the plates 6 is provided with a horizontally extending flange 12 at its upper end, and the corrugations 11 in each of the plates extends downwards from the associated flange 12, as best shown upon Fig. 3. Instead of being of symmetrical configuration, however, each of the corrugations 11 is formed with a long side 13 and a short side 14 merging into each other in a rounded corner 16, the purpose being to eliminate to as great an extent as is practically possible the development of sharp angles forming pockets within which sediment may accumulate to decrease the effective capacity of each of the water passages 9 during use of the radiator. Constructing the corrugations 11 with a long and short side 13 and 14, respectively, also results in making each of the water passages 9 oblong in cross sectional configuration, with the major axis of the cross sectional area disposed obliquely with respect to the plane of the associated plates 6, as clearly shown upon Fig. 2. This presents a greater area of metal to the air flowing through the air passage 17 between each pair 7 of plates 6 in proportion to the capacity of the water passages 9, thereby increasing the cooling efficiency of the radiator.

Each of the water passages 9 is formed with a funnel-shaped inlet 18 at its upper end, formed by providing a deepened portion 19 at the upper end of each of the corrugations 11, this deepened portion 19 being of substantially the same depth at its lower end 21 as the associated corrugations 11 into which it merges, but materially deeper at the upper end 22 of the portion 19. However, the deepened portion 19 of each of the corrugations 11 does not extend completely to the plane of the associated flange 12, but is disposed slightly therebelow, whereby each flange 12 is permitted to extend slightly into the funnel-shaped inlet 18 of each of the associated water passages 9, forming a slight rib or bead 23, which adds materially to the inherent rigidity and strength of the entire structure, even though the ribs 23 are of such small dimensions that they do not interfere materially with the flow of fluid into and through the water passages 9.

The plates 6 of each pair 7 are held in selected position, i. e., with the corrugations 11 thereof in registry with each other, by means of a boss 26 adjacent each end of the plate, and receivable within complementarily formed recesses adjacent each end of the other plate of the same pair. Hence, the bosses 26 at the forward edge of each pair 7 of plates 6 extend in one direction, say to

the right, as viewed upon Fig. 3, whereas the bosses 26 associated with the after edge of the pair 7 extend to the left.

The spacing between each pair 7 of plates 6 is determined by the fin 8, which is also corrugated, but in a direction transverse with respect to the direction in which the corrugations 11 of the water passages plates 6 extend. The corrugations 31 of each of the fins 8 are preferably V-shaped in cross sectional configuration, the depth of the V determining the spacing between the pairs 7 of plates 6. However, instead of being continuous throughout the entire width of the fin 8, the corrugations 31 thereof are broken up in groups of restrikes 32 and 33 formed by deflecting the crest of each corrugation inwards toward the opposite side of the fin 8, there being a group of restrikes for each of the corrugations 11 of the water passage 9 spaced along the corrugation 31 of the fin by distances equal to the spacing of the corrugations 11 of the water tube members. The restrikes 32 and 33 are illustrated herein as including a pair of restrikes 32 having a predetermined configuration preferably V-shaped extending from the crest of the corrugation 31 inwardly of the air passage formed by the corrugation 31, the point of the V extending in the opposite direction to the point of the V-shaped main corrugation 31, while between the pair of restrikes 32 the second restrike 33 is formed, the sum of the width of the pair of restrikes 32 and the second restrike 33 extending a distance substantially equal to the width of a corrugation 11 of the water tube plates, and all of the restrikes being struck back from the crest of the main corrugation 31 such distance as to form a recess in which may be received the projecting portion of the water tube corrugation 11 so that the water passage 9 may seat (see Figs. 2 and 6). Between each adjacent pair of restrikes 32 V-shaped tongues 36 remain, each of these tongues being adapted to seat between proximal edges of two adjacent water passages 9, with the result that they act as locators adapted to retain the fin 8 against slipping transversely with respect to the associated water passage plates 6. Moreover, the V-shaped tongues 36 hold the restripped portions of the fins spaced slightly from the metal of the plates 6, thereby permitting more complete circulation of air between the fins and the plates 6 than in the case of the conventional construction wherein a relatively large area of contact between the fins and the plates obtains.

By forming the restrikes 32 and 33 of different configuration, the air passage formed by a main corrugation 31 is divided into a plurality of smaller air passages. To accomplish this, the restrikes 32 are preferably V-shaped, while the second restrike 33 is preferably flat and is pressed inwardly a depth substantially equal to that of the point of the V defined by the first restrike 32 (see Fig. 6). Moreover, both ends of both restrikes 32 and 33 are severed from the metal of the remainder of the fin 8, with the result that the air streams passing through the air passages 17 is cut by a large number of cutting edges presented by these severed ends of the restrikes 32 and 33, as is best realized by observation of Fig. 6. This cutting of the stream of air flowing through the radiator between the sets of water passages 9 results in extreme turbulence of the air stream, causing it to impinge against the metal of each of the fins 8, as well as against the metal of the plates 6 which define the water passages 9. Hence, the air does not merely sweep through the air passages, brush-

ing against the faces of the metal, but it is caused to come into relatively hard contact with the metal at many points, thereby increasing the efficiency of the radiator construction in conducting the heat absorbed into the metal from the water and delivering it to the air flowing through the radiator. This increased efficiency in cooling capacity is also attained by reason of the fact that the water passages 9 are oblong in cross sectional configuration, thereby presenting a larger area of metal to the air flowing between the pairs of plates in proportion to the cross sectional area of each of the water passages 9. Also, positioning the water passages with their major axes disposed in obliquity with the plane of the plates by which they are defined presents shoulders 41 at frequent intervals in each of the air passages 17 through which the air streams are flowing. Hence, these air streams are caused to impinge against the shoulders, with the opposite surface of which the water to be cooled is in contact. Hence, a relatively large amount of the heat to be absorbed from the water is transmitted directly to the air from the metal of the plates 6, especially at the shoulders 41, and without the necessity of flowing first through the metal of the plates 6 and then through soldered joints where the tongues 36 may contact with the plates 6, and then into the metal of the fins, whence the heat would have to be absorbed by air flowing through the cells 42.

The turbulence produced in the air streams flowing between the pairs 7 of plates 6 occurs not only by breaking up the flow of air through each of the cells 42, but it also causes air to flow from one cell to another in a crosswise direction, inasmuch as the apertures cut in each of the fins 8 when the ends of the restrikes 32 and 33 are severed from the metal of the remainder of the fin establish communication between adjacent air passages 17. As will readily be understood, this feature also tends to increase the turbulence of the air flowing through the radiator, as well as to equalize the cooling capacity of the various portions of the radiator.

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 plurality of plates arranged face to face in spaced pairs, each of said plates having longitudinally extending corrugations, and the plates of each pair being arranged with their corrugations disposed oppositely and in registry with each other to define water passages therebetween, each of said corrugations being deepened adjacent an end thereof to define a funnel-shaped inlet into the water passage defined thereby, and a rib extending from each plate into the larger end of each of said funnel-shaped inlets.

2. In a radiator construction, a plurality of plates arranged face to face in spaced pairs, a laterally extending flange at the upper edge of each plate, each of said plates having corrugations extending longitudinally thereof from its flange, the plates of each pair being arranged with their corrugations disposed oppositely and in registry with each other to define water passages therebetween, and each of said corrugations being deepened below the plane of the associated flange to define a funnel-shaped inlet into the water passage defined thereby.

3. In a radiator construction, a plurality of

- plates arranged face to face in spaced pairs, a laterally extending flange at the upper edge of each plate, each of said plates having corrugations extending longitudinally thereof from its flange, the plates of each pair being arranged with their corrugations disposed oppositely and in registry with each other to define water passages therebetween, each of said corrugations being deepened below the plane of the associated flange to define a funnel-shaped inlet into the water passage defined thereby, and the flange of each plate continuing slightly into the larger end of each of said funnel-shaped inlets to present a strengthening rib.
4. In a radiator construction, a plurality of plates arranged face to face in spaced pairs, each of said plates having longitudinally extending corrugations, and the plates of each pair being arranged with their corrugations disposed oppositely and in registry with each other to define water passages therebetween, and a fin interposed between each two pairs of plates and having transversely extending corrugations, the crests of said corrugations being deflected inwards in restrikes and the outer crests of each of said restrikes being also deflected inwards in another restrike, each end of each of said restrikes being severed from the remainder of the associated fin to cut the stream of air flowing through the corrugations of said fin.
5. In a radiator construction, a plurality of plates arranged face to face in spaced pairs, each of said plates having longitudinally extending corrugations, and the plates of each pair being arranged with their corrugations disposed oppositely and in registry with each other to define water passages therebetween, and a fin interposed between each two pairs of plates and having transversely extending corrugations, the crests of said corrugations being deflected inwards in restrikes and the outer crests of each of said restrikes being also deflected inwards in another restrike, said other restrikes on each side of each of said fins all lying in a common plane, and each end of each of said restrikes being severed from the remainder of the associated fin to cut the stream of air flowing through the corrugations of said fin.
6. In a radiator construction, a plurality of plates arranged face to face in spaced pairs, each of said plates having longitudinally extending corrugations and the plates of each pair being arranged with their corrugations disposed oppositely and in registry with each other to define water passages therebetween, each of said corrugations being enlarged adjacent an end thereof to define a funnel-shaped inlet into the water passage defined thereby larger than the largest cross sectional area of the water passage.
7. In a radiator construction a plurality of water tube members arranged in spaced relation to each other to define an air space between each pair of said members, and a fin interposed between each pair of said water tube members having transverse corrugations dividing said air space into a plurality of air passages, the crest of each corrugation having at least two differently configured restrikes deflecting portions of said crest inwardly of the associated air passage, the ends of said restrikes being severed from the remainder of the fin to present disaligned cutting edges to the stream of air passing through said air passage and dividing said air passage into a multiplicity of smaller air passages.
8. In a radiator construction, a plurality of water tubes arranged in spaced rows to define an air space between each pair of rows of water tubes, and a fin interposed between each pair of said water tubes having transverse corrugations dividing said air space into a plurality of air passages, the crest of each corrugation having at least two differently configured restrikes deflecting portions of said crest inwardly of the associated air passage, the ends of said restrikes being severed from the remainder of the fin to present disaligned cutting edges to the stream of air passing through said air passage and dividing said air passage into a multiplicity of smaller air passages.
9. In a fin for interposition between members forming water tubes of a radiator, a plate having corrugations extending transversely of said water tubes to define a plurality of air passages, the crest of each corrugation having at least two differently configured restrikes deflecting portions of said crest inwardly of the associated air passage, the ends of said restrikes being severed from the remainder of the fin to present disaligned cutting edges to the stream of air passing through said air passage and dividing said air passage into a multiplicity of smaller air passages.

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