June 15, 1937. A. J. SCHUTT 2,083,671

RADIATOR

Filed Jan. 19, 1935

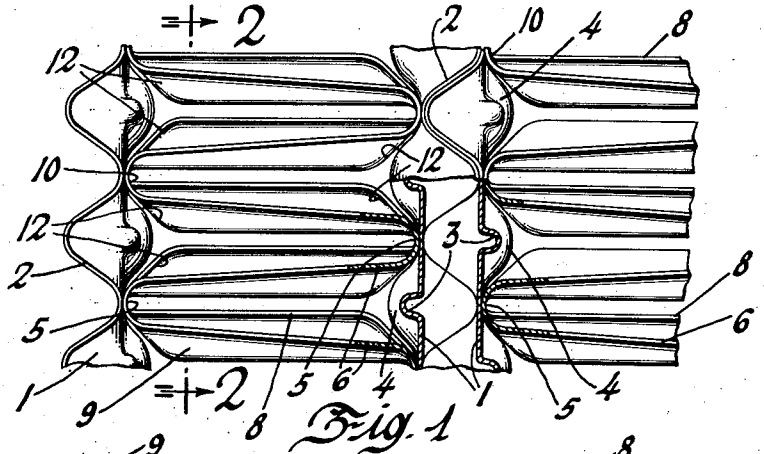


Fig. 1

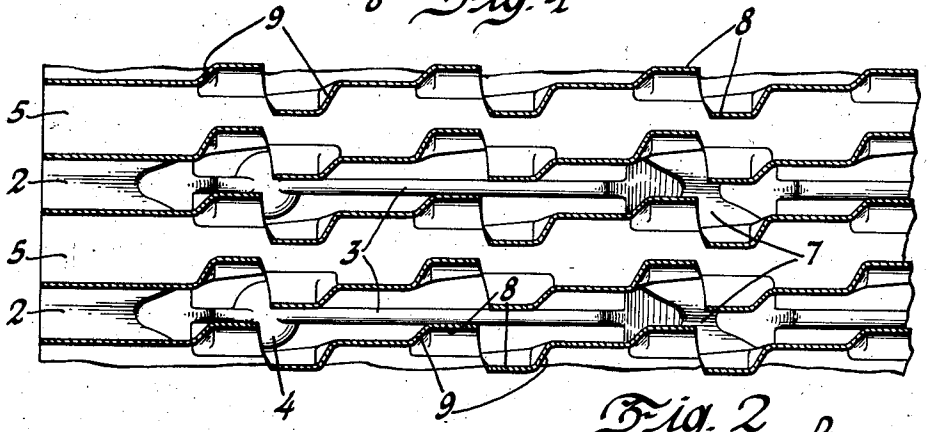


Fig. 2

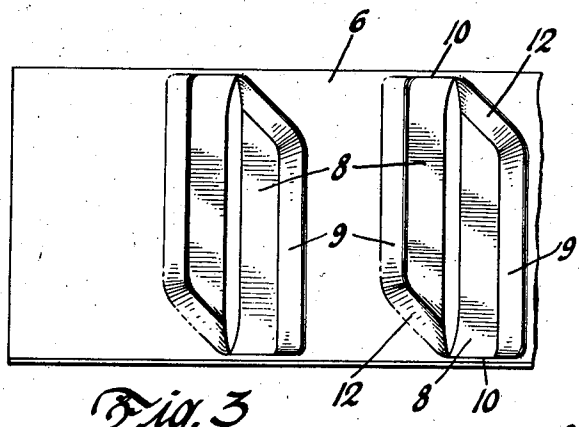


Fig. 3

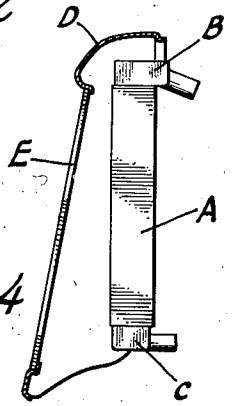


Fig. 4

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RADIATOR

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4 Claims. (Cl. 257—130)

This invention relates to motor vehicles and particularly to engine cooling systems.

For the purpose of improving frontal appearance most motor cars of today have an ornamental grille or grid positioned over the front face of the radiator. This appearance screen takes various forms and usually is carried by and incorporated in the shell or casing that encloses the heat radiating core. The practice has been simply to add the appearance element to conventional structure without regard to the fact that its position in the path of air flow affects heat dissipation. Since the usual radiator is designed for direct impact of the air stream its efficiency is impaired by the obstruction offered by the screen and consequent restriction of air flow. In such cases the amount of air available is less than the rated air flow capacity of the core and the proper amount of air for maximum heat transfer does not reach the core and the individual air particles are not used to best advantage and at least some do not absorb their full predetermined quota of heat, while others soon become heat logged.

It is, therefore, an object of the present invention to relate the air flow capacities of the appearance member and the core so that the amount of air which can be handled effectively by the core is limited to substantially that passed by the screen.

A further object of the invention is to provide a simple and economical construction in which the heat radiating surfaces traversed by the air stream are formed to break up the air column and provide desired restriction to flow by repeatedly changing both the stratification and the direction of flow and by shifting individual particles from cell to cell successively as they progress through the core.

For a better understanding of the invention reference may be had to the accompanying drawing, wherein Figure 1 is a front elevation of a portion of the radiator core with parts in section; Figure 2 is a section taken on line 2—2 of Figure 1; Figure 3 is a plan view of a portion of one of the fins and Figure 4 shows on a small scale a core and shell assembly.

By way of explanation, Figure 4 illustrates a core A provided with top and bottom tanks B and C, having the usual pipe fittings for connection with the engine jacket and enclosed within a shell D which carries the appearance member E over the front face of the core. As before pointed out, the appearance member E obstructs the flow of air to the core A and the core is designed to meet this condition. As customary, the core unit consists of a number of spaced tubes connecting the top and bottom tanks for the flow therethrough in thin streams of water or other cooling medium from which heat is extracted by the air flowing in spaces between the tubes. Between the tubes, heat radiating fins divide the air flow space into a number of small cells and according to the present invention the fins are provided with specially designed formations which not only stiffen the fin and lend structural strength to the assembly, but also afford proper restriction to flow for approximating the capacity of the appearance member and insuring a course of flow by which successive portions of each fin are wiped by fresh particles of air.

A small section of a core embodying the invention is shown on an enlarged scale in Figure 1 where the water tube comprises a pair of similarly formed plates 1—1 of thin sheet copper, brass or the like, having their edges 2 corrugated in offset relation and nested together. To guard against inward collapse of a tube of great depth similar corrugations or knees may be formed in the wall strips intermediate the edges as at 7. For stiffening purposes each plate carries a series of transverse beads or ridges 3 pressed outwardly in line with the peaks of the offsets in the edges. Also pressed outwardly in transverse alinement with the beads 3 and near each corrugated edge are a number of rounded embossments 4. These embossments serve primarily to guide and locate between one another the rounded bends 5 connecting succeeding fins 6 of a deeply corrugated or zigzag spacer strip, also of thin sheet metal having good heat transfer properties. Each fin extends diagonally across the space between and joins adjacent walls of adjacent water tubes and converges toward next succeeding fins to cooperate therewith and with the water tube walls and define substantially triangular air cells oppositely disposed in stacked relation.

Assuming each fin to be flat from front to rear, the airstream in each cell would flow freely in a straight uninterrupted path but only those air particles in the outer layers would wipe the cell walls and these would soon become heat logged, and since air is a poor conductor, the center particles would remain comparatively cool. In order to cause a greater number of air particles to come into direct wiping contact with the metal and incidentally permit the depth of the core to be increased, it is proposed to repeatedly shift the positions of the particles. Where a large number of fins are used to the inch resulting

in air cells of low height this can be done by providing chuted openings at spaced intervals for progressively transferring portions of divided streams through successive cells, each transfer throwing fresh particles into wiping relation.

A preferred arrangement of chuted openings is seen best in Figure 2 where the openings are grouped in vertical alinement, whereby the transfer throughout the several cells takes place at corresponding distances in the depth of the core. Each opening is made by transversely slitting the fin throughout its width and pressing the material on opposite sides and immediately adjacent the slit in opposite directions out of the plane of the fin so that the deformation on one side extends into the cell above the fin and the deformation on the other side extends into the cell below the fin with the slitted opening enlarged by the deformations being of a size somewhat less than the cross sectional area of the cell. Between the deformations, the fin is left undisturbed.

The air leaving a given cell through one of the openings replaces that transferred from one of its neighboring cells and is replaced by that transferred from the other of its neighboring cells. Following the transfer, those particles which were in fin wiping strata move out of wiping contact, and others which previously were toward the center of the moving column are thrown toward the walls of the cell. After the particles progress beyond the several transfer points practically all have been in direct heat exchanging relation with at least a portion of the radiating surface for a part of their travel.

In order to afford the proper degree of resistance to free flow and control the air flow capacity of the core and thereby obtain the full benefit from and the most work out of the amount of air available when an appearance member is used, it is proposed to impart to the air stream a somewhat tortuous course. For this purpose each formation or scoop comprises a portion **8** extending longitudinally of the fin in offset relation thereto and a laterally extending portion **9** joined to the fin and to the portion **8** by abrupt bends. At one side as at **10** the formation merges directly into the fin at the rounded apex of the triangular air cell into which the scoop extends, while at the other side or part projecting into the cell near its base the lateral wall **9** joins with a deflecting portion **12** extending at an angle to the lip or edge of the scoop. Thus the plane of the fin is diagonal to and substantially bisects the opening, and the air passing through the opening is deflected sidewise from the larger portion of the air cell into the larger portion of the next adjacent and oppositely disposed cell and this action combined with that resulting from the sharply bent longitudinal and lateral wall portions of the cooperating scoops further rearranges the air particles and impedes the rate of flow and, therefore, air flow capacity of the core. The shape of the scoops is such that a high degree of inherent strength is built into the fin and a rugged assembly results therefrom.

While the construction described was evolved after careful study of the conditions presented in connection with the use of an ornamental front facing and was designed with such conditions in mind, it is not limited to use in association with a grille or other obstruction. It has been found that by varying the depth of the louver the core can be adjusted to handle efficiently any amount of air which may be delivered to it. When a grille is used the louver should be raised in accordance with the amount of air passing to the core and if there is no obstruction at all the height of the louver can be lowered the proper degree. In other words, the extent of offset governs the resistance to air flow. The particular form of louver not only enables the manufacture of a core with louvers adjusted properly with reference to air supply available in its particular installation and use, but also imparts to the fin a high degree of inherent strength and reinforcement of the core as a whole, and in addition the louvers are easy to make and avoid manufacturing difficulties heretofore encountered in the formation of fin offsets.

I claim:

1. An automobile radiator particularly adapted for use with a forwardly positioned grille or screen, and including a series of spaced tubes for the flow of cooling medium, a series of fins dividing the spaces between the tubes into a number of air cells, each fin having a series of slits therein in alinement with corresponding slits in other fins with the material on opposite sides of each slit offset in opposite directions out of the plane of the fin to enlarge the opening afforded by the slit and to provide air chutes between succeeding cells, each offset comprising a riser portion extending laterally of the fin and a stepped portion extending substantially parallel to the fin, with relatively sharp bends between said portions and with the fin whereby the air particles move in zigzag paths diagonally to the fins and shift positions relative to the fin surface at each slit so that a maximum number of air particles are brought into wiping contact with the fin surface each for only a small portion of its travel through the radiator.

2. In a heat exchanger, heat radiating fins extending diagonally across the spaces between succeeding tubes to provide in each space a series of successively oppositely disposed triangular air cells, means strengthening the fins and providing chuted openings all alike and located in the same relative positions in all the fins, for subdividing air streams entering the cells and successively at succeeding points in all the fins shifting air particles in relation to fin surface and directing them through a succession of cells, comprising in each fin a series of formations arranged in pairs with the pairs spaced apart and in vertical alinement with corresponding formations in other fins, and the cooperating formations of each pair being on opposite sides of a transverse slit and extending out of the plane of the fin but in opposite directions therefrom, each formation including a riser portion extending laterally and making an abrupt bend from the fin on a line spaced from the slit and projected from adjacent one edge of the fin transversely across the same to a point spaced from the opposite fin edge, together with a laterally extending riser portion forming a continuation of the first mentioned portion but being bent on a line projected diagonally from the end of the first mentioned line to the slit, and a stepped portion making abrupt bends with both of the aforesaid riser portions and extending to the slit in a plane offset from and transversely inclined to the plane of the fin.

3. In a heat exchanger, a fin having a transverse slit with portions on opposite sides thereof offset from the plane of the fin, but in opposite directions with relation to each other for mutual cooperation to provide a stepped chute, each of said offset portions including a riser section ex-

tending at an angle to the fin on a transverse line spaced from the slit and projected from adjacent one edge of the fin and across the fin to a point spaced from the other edge, together with an auxiliary riser section also extending at an angle to the fin but on a diagonal line from the first section to the edge of the slit and a stepped section joined to both of the aforesaid riser sections and extending to the edge of the slit in a plane lying generally in the direction of the fin from front to erar.

4. In a heat exchanger, a series of fins extending between spaced tubes to provide a series of air cells, each fin having therein a transverse slit with the material on opposite sides of the slit offset oppositely out of the plane of the fin from a transverse line spaced from the slit and including a stepped section immediately adjacent the slit lying in the general direction of air flow in the cell and an angularly extending riser portion connecting said stepped section with the fin, and making abrupt bends with both the fin and the stepped section.

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