Sept. 2, 1930. J. KARMAZIN 1,775,041

RADIATOR

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Fig. 1.

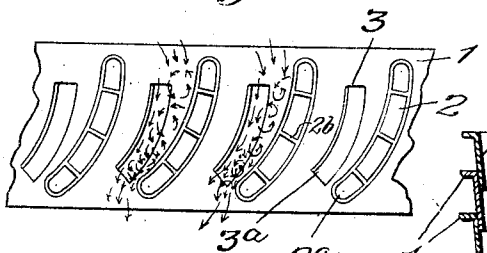
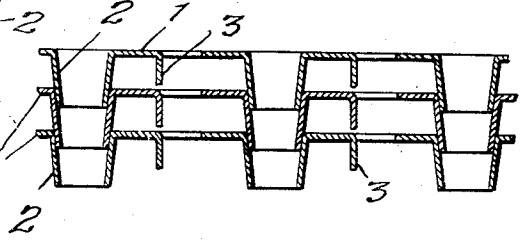


Fig. 2.



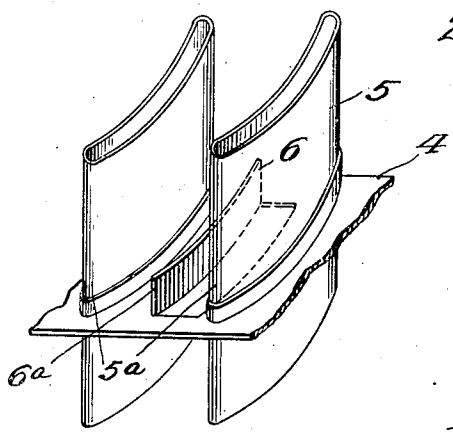


Fig. 4.

Fig. 3.

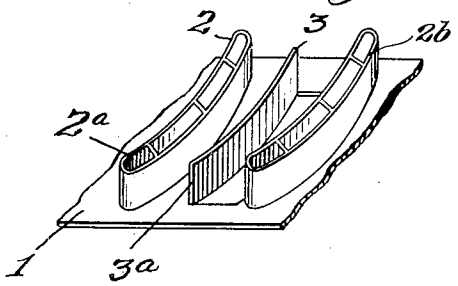
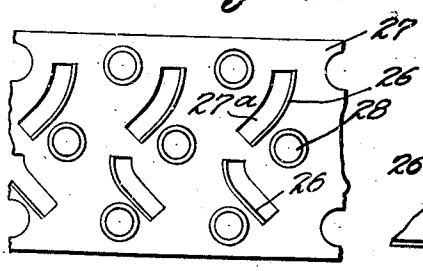


Fig. 12.



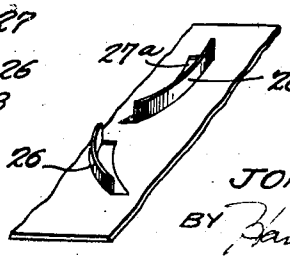


Fig. 13.

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Fig. 5.

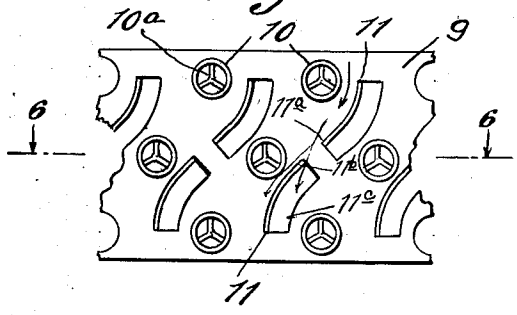


Fig. 7.

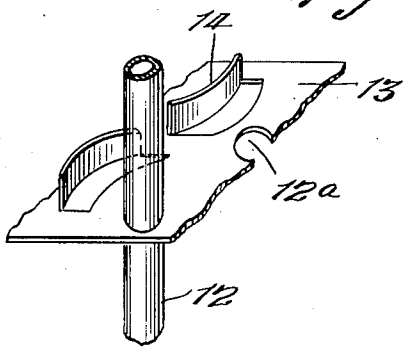


Fig. 6.

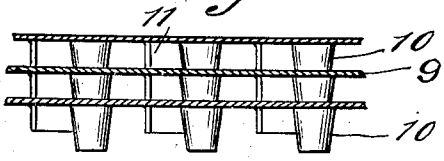


Fig. 9.

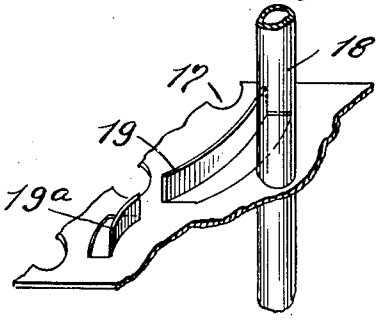


Fig. 8.

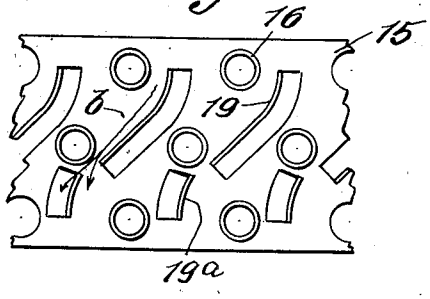


Fig. 10.

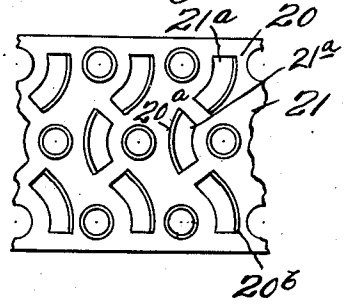
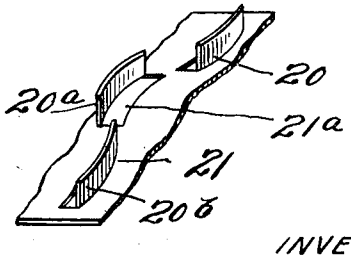


Fig. 11.



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RADIATOR

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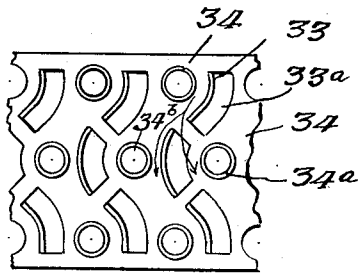

Fig. 14.

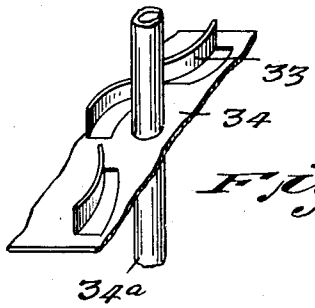

Fig. 15.

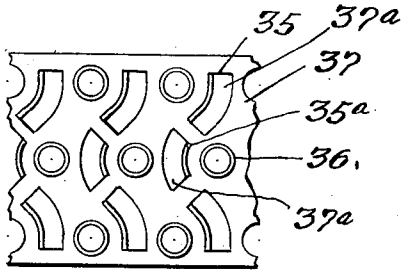

Fig. 16.

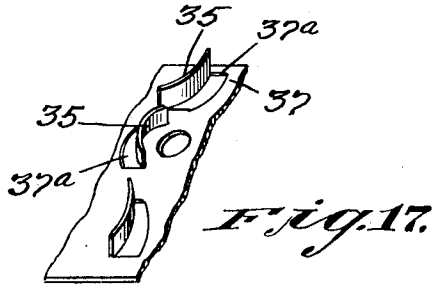

Fig. 17.

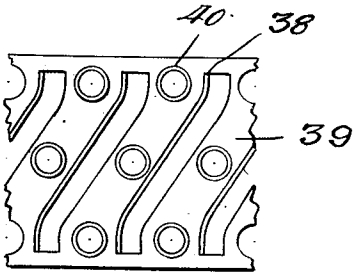

Fig. 18.

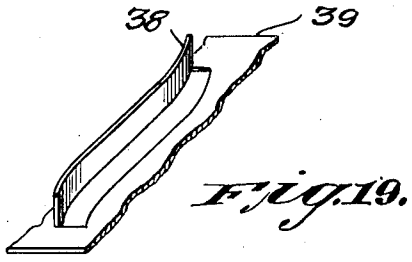

Fig. 19.

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Patented Sept. 2, 1930

1,775,041

UNITED STATES PATENT OFFICE

JOHN KARMAZIN, OF DETROIT, MICHIGAN

RADIATOR

Application filed February 21, 1925. Serial No. 10,745.

This invention relates to an improvement in radiators for motor vehicles and other purposes, and more particularly to radiators of the fin and tube type in which the tubes may be either integral with, or separate from, the fins.

In the ordinary type of internal combustion engine radiator providing a series of spaced conduits through which the water may flow in one direction while the air flows in another direction between and around the water conduits, the air is permitted to flow, except for the obstruction in its path, in substantially straight lines through the radiator, so that relatively speaking, the streams of air flowing through the openings in the radiator contact only at their outer edges with the fins of the radiator and with the walls of the water tubes, and only the outer edges of the streams of air flowing through the holes in the radiator are heated by the heat from the water tubes while the inside or central portions of the streams of air are not heated at all. In other words, the air flowing through the ordinary radiator in substantially straight lines, except for immaterial deflections as it goes around the walls of the water tubes, is not caused to circulate and to swirl and move the various portions of the air stream in sweeping contact along the metallic portions of the radiator, to withdraw a great amount of heat therefrom.

It is an object of this invention to provide a radiator which can be cheaply constructed but which will cause vortex and swirling currents in the air streams as they pass through the radiator, to cause all portions of the air stream to come in contact with the heated walls of the water tubes and the fins so as to withdraw a greater amount of heat from the radiator.

Another object of the invention is to provide a radiator which will accomplish the above result but which will at the same time offer a path of minimum resistance to the flow of air through the radiator.

Another object of the invention is to provide a radiator of the type described, in which the air currents flowing through the same will be curved and deflected, and contracted and expanded, so as to cause a churning and whirling of the air currents to bring all portions of the air streams into contact with the radiating surfaces.

Another object of the invention is to provide a radiator of the type described, in which the air currents will be caused to press against the walls of the water tubes rather than to merely flow past the walls, as in the ordinary radiator construction.

Another object of the invention is to provide a radiator of the type described, in which the air currents will be deflected in curved planes, preferably of changing directions in their passage through the radiator, and will be discharged in the direction of rotation of the cooling fan at the rear of the radiator so as to decrease the resistance to the fan and to the flow of air through the radiator.

Another object of the invention is to provide a radiator which will break up and divide the air streams flowing therethrough and provide a metallic conduit between the water tube walls and the otherwise center of the air streams to promote the cooling efficiency of the radiator.

Various other and incidental objects relating to the general purposes outlined above will appear as the description of the invention proceeds.

Referring now to the drawings, which illustrate several possible forms of embodiment of the invention,—

Fig. 1 is a plan view of one form of radiator element;

Fig. 2 is a sectional view through a portion of the radiator formed by the elements of Fig. 1;

Fig. 3 is a perspective bottom view of the radiator element shown in Fig. 1;

Fig. 4 is a perspective view of a fin and tube type radiator, in which the fins are separate from the tubes;

Fig. 5 is a plan view, and Fig. 6 is a sectional view on the line 6—6 of Fig. 5, showing an integral fin and tube type radiator provided with deflecting plates formed from the fin portions for directing the air currents into contact with the water tubes;

Fig. 7 is a perspective view illustrating how the same embodiment of the invention may be applied to radiators having separate fins and tubes;

Figs. 8 and 9 are respectively plan and perspective views of another form of embodiment of the invention;

Figs. 10 and 11 are plan and perspective views, respectively, of still another form of embodiment of the invention;

Fig. 12 is a plan view, and Fig. 13 is a perspective view, of a radiator fin provided with deflecting plates which cause a vortex of air currents around the cooling tubes;

Figs. 14 and 15, 16 and 17, and 18 and 19, are, respectively, plan and perspective views of still other forms of embodiment of the invention.

In the form of embodiment of the invention illustrated in Fig. 1, the radiator is formed of a plurality of fin members 1, preferably of thin sheets of metal, which have formed integral therewith, a plurality of tapered tubular projections 2, so arranged, that the bottom of the projections 2 of one fin will telescope into the top of the projections 2 of the adjacent fin, to form water conduits through the radiator from the upper to the lower header, as illustrated in Fig. 2. The tubular projections 2 are given an arcuate or curved shape, as is clearly shown in Figs. 1 and 3, and a number of projections 3 are struck out from the material of the fin 1 and project from the fin in the same direction as the tubes 2, the projections 3 being also given an arcuate shape, as illustrated.

The rear 2^a of the tubes 2, and the rear 3^a of the projections 3, are preferably spaced nearer together than the front portions of the tubes and projections, so that the current of air entering from the front between the tubes 2 and projections 3 will be compressed or drawn together in its passage between these members and discharged at a higher velocity at the rear of the tube. The air also entering the radiator in straight lines, strikes the walls of the tube 2, and is given a rotating or whirling motion, as illustrated by the arrows in Fig. 1, so as to bring various portions of the stream of air into contact with the walls of the tubes 2. The drawing together of the air stream near the rear of the projections, causes the whirling currents to be broken up to a certain extent, so that in the passage of these currents through the next course of tubes, such as illustrated in Fig. 16, the portions in the center of the whirls are brought outward and into contact with the water tubes of the second row to withdraw more heat from the radiator.

Fig. 4 illustrates how the invention may be applied to radiators having separate fins 4 and tubes 5, with projections 6 struck up and bent outwardly from the material of the fin. The tubes 5 are preferably of a flattened contour and are given an arcuate or "turbine blade" shape, as in the preceding figure, so as to cause the air to contact with the inner portion of the arc of the tubes in its passage through the radiator and the rear 6^a of the projections 6 and 5^a of the tubes 5 are brought nearer together, as illustrated in Fig. 1, to cause a Venturi motion or compression of the air current, as it passes through this narrowed opening.

Figs. 5 to 13 and 14 to 19 illustrate in various ways how the invention may be applied to radiators using round tubes, either to the ordinary type of fin and round tube radiator in which the fins and tubes are separate, or to the radiators of the type in which the round tubes are integral with the fins, such as described and claimed in my co-pending application, Serial No. 2,742, filed January 16, 1925.

Fig. 5 shows a fin 9, provided with a plurality of integral round, tubular projections 10 extending therefrom, with the bottoms of the projections 10 of one fin extending into the top of the projection 10 of the adjacent fin to form water conduits through the core, as illustrated in Fig. 6. The bottoms of the projections 10 may be provided with a plurality of baffles 10^a integral with the walls thereof and extending into the center of the water streams to break up the same and conduct the heat of said centers to the walls of the tubes, as described in my co-pending application, Patent No. 1,591,323, granted July 6, 1926. These baffles may, of course, be provided in the embodiment of the invention illustrated in Fig. 1 or in any of the embodiments herein described.

A plurality of arcuate projections 11 are struck out from the fins 9 and are curved as illustrated in Fig. 5 to give a whirling and turbine-vane motion to the air currents passing through the radiator, so as to bring various portions of the streams of air into contact with the walls of the tube 10 and with the walls of the fin 9. The rear portion 11^a of the front projection 11 and the front portion 11^b of the rear projection 11 may be slightly offset so that a portion of the air which passes along the front of the front fin 11 may be deflected to pass along the rear of the back fin 11, where a portion of it may escape through the opening 11^c, which is left in the fin 9, and pass into the chamber between the next ad-

jacent fins. Fig. 7 illustrates how this embodiment of the invention may be applied to a separate fin and tube type radiator by using a plurality of round tubes 12 which pass through holes 12ª in the fin 13, the fin being provided with a series of projections 14, struck out therefrom and arranged as illustrated in Fig. 5, so as to deflect the air currents and cause them to sweep around and in contact with the walls of the tubes 12 of the exposed surfaces of the fin 13 and projections 14.

Figs. 8 and 9 illustrate another embodiment of the invention in which the fins 15 may be either provided with rows of integral tubular projections 16 or provided with holes 17 to accommodate the separate round tubes 18. The projections 19, are struck out from the material of the fin 15 and the projections 19 and projections 19ª are staggered with relation to the fins, as illustrated, to provide a slightly different path of circulation for the air and to cut up and divide the air currents to a greater extent. The stream of air entering and flowing along the front edge of the projection 19 is split up or divided by the projection 19ª, as indicated by the arrows *b*, to cause a greater amount of circulation.

Figs. 10 and 11 illustrate in plan and perspective a different style of projection in which each of the tubes is partially surrounded with a projection 20 struck out from the fins 21 and being approximately on the same axis as the nearest tube, the front projections 20 being at one side of the opening 21ª, formed in the fin, and the middle projections 20ª being on the other side of said opening, while the rearward row of projections 20ᵇ is on the same side of the opening as the projections 20, thereby giving a serpentine or circuitous path to the air current flowing through the radiator.

In this, as in the other embodiments, it is to be noted that the air entering the radiator at substantially right angles to the same, does not sweep through the radiator in straight lines, but is caused to press against the inner curved walls of the tubes and projections, is compressed and expanded by the arrangement of the tubes and projections, and the streams of air are bent, split, broken and caused to swirl and brush along the heated walls of the tubes and fins to abstract a maximum amount of heat therefrom.

Figs. 12 and 13 illustrate a form of the invention similar to that of Figs. 5 and 7 in which the projections 26 on the fins 27 are located at the opposite sides of the openings 27ª, formed in the fin elements so as to cause a greater portion of the air to pass through these openings and to the space between the next adjacent upper or lower fins. The openings 28 may be formed as integral tubular projections or to accommodate separate round tubes upon which the fins may be pressed.

Figs. 14 and 15 illustrate an embodiment of the invention similar to Figs. 10 and 11, with the projection 33, however, located in reverse position from the openings 33ª in the fins 34 to that shown in Figs. 10 and 11, so as to cause a portion of the air which flows around the tube 34 to deflect to the tube 34ª and a portion to the tube 34ᵇ, instead of flowing in merely serpentine lines through the radiator.

Figs. 16 and 17 show the projection 35 located in a different relation to the tubes 36 and the fin 37, with the projection 35 on one side of its opening 37ª and the projection 35ª on the opposite side of its opening 37ª.

Figs. 18 and 19 illustrate the projections 38 as extending substantially from the front to the back of the radiator fin 39 and being parallel and on opposite sides of the rows of tubes 40 and following the rows of said tubes so as to cause the air currents to flow in parallel paths along and around the tubes from front to back of the radiator.

While I have illustrated and described various possible forms of embodiment of my inventon, it is to be understood that still other modifications and changes may be made and parts of the invention may be used without others, without departing from the spirit of the invention or the scope of the appended claims, and that the claims, unless otherwise limited, are intended to cover radiators in which the fins and tubes are either integral or separate.

I claim:

1. In a fin and tube type radiator, a plurality of telescoped tubular projections for conducting water through the radiator, a plurality of fins integral with said tubes and dividing the air which flows between said tubes into a plurality of streams, and means integral with said fins, projecting into the spaces between said tubes for dividing the air streams flowing therethrough.

2. In a fin and tube type radiator, a plurality of rows of tubes extending from end to end of the radiator for conducting water through the radiator, a plurality of fins integral with said tubes and dividing the air which flows between said tubes into a plurality of streams, and curved means integral with said fins, projecting into the spaces between said tubes for dividing and diverting the air streams flowing therethrough.

3. In an automobile radiator, a plurality of integral fin and tube type elements, each having a plurality of water tube projections and a plurality of fin members integral with and at right angles to the water tube projections, said tubular projections telescoping to form water tubes, and a plurality of curved projections on said fins extending into the spaces between said tubes, and causing the

air streams flowing through the radiator to be broken up and deflected into contact with the walls of said water tubes.

4. In a radiator, the combination with a plurality of elongated tubes curved in a plane perpendicular to the length to afford a restricted flow of cooling fluid between adjacent tubes, of cooling fins between adjacent tubes and integral with said tubes.

5. In a radiator of the character described, having fin plates, a plurality of tubes spaced by said fin plates and integral therewith, and cooling fins arranged between adjacent tubes, the rearward parts of said tubes and fins being nearer together than the forward portions thereof.

6. An automobile radiator having integral means forming a plurality of water conduits and a plurality of air conduits, means to break up the streams of water flowing through the water conduits and to conduct heat from the center thereof to the walls of the water conduits, and projecting means extending transversely of the air conduits to break up the streams of air flowing through said air conduits and to conduct heat from the walls of the air conduits to the center of the air stream.

7. An automobile radiator, having integral means forming a plurality of water conduits and a plurality of air conduits, means to break up the stream of water flowing through the water conduits and to conduct heat from the center thereof to the walls of the water conduits, and projecting means extending transversely of the air conduits to break up the streams of air flowing through said air conduits and to conduct heat from the walls of the air conduits to the center of the air stream, said means in the water conduits and the air conduits being integral with the walls of said conduits.

8. In an automobile radiator, a plurality of rows of arcuate shaped water tubes extending through the radiator from the upper to the lower header, a plurality of fins integral with said tubes and extending at right angles across the line of tubes, and arc-shaped means integral with the fins projecting into the spaces formed between the tubes and fins to deflect air flowing between said tubes.

9. In an automobile radiator, a plurality of rows of arcuate shaped water tubes extending through the radiator from the upper to the lower head, a plurality of fins integral with said tubes and extending at right angles across the line of tubes, and arc-shaped means integral with the fins projecting into the spaces forming within the tubes and the fins, said means and tubes converging towards each other.

10. In an automobile radiator of the class described, a plurality of rows of water conduits extending directly through the radiator from the upper to the lower header and means extending transverse to said water conduits, adapted to break up the air flowing through the radiator and to remove the heat from said water conduits including a plurality of fin elements surrounding and in heat conductive contact with said water conduits and a plurality of projecting means integral with said fins and at right angles thereto extending above said fins and arcuately curved to direct the air against said tubes to increase the cooling efficiency of said radiator.

11. In an automobile radiator of the class described a plurality of rows of water conduits extending directly through the radiator from the upper to the lower header, fin elements extending transverse to said water conduits adapted to break up the air flowing through the radiator and to remove the heat from said water conduits, said fin elements surrounding and being in heat conductive contact with said water conduits and a plurality of curved staggered projecting fins integral with said fin elements and extending above said fin elements between said water conduits to direct the air against said tubes to increase the cooling efficiency of said radiator.

12. A radiator of the class described having integral means forming a plurality of liquid conduits and a plurality of air conduits, transverse bars in said liquid conduits adapted to break up the streams of liquid flowing therethrough and to conduct heat from the center of said liquid conduits to the walls thereof, and a plurality of projecting vanes integral with said air conduits to break up the streams of air flowing therethrough and to conduct heat from the walls of said air conduits to the center of the air stream, said vanes being mounted in staggered relation.

13. In an automobile radiator of the class described a plurality of water tubes extending directly through the radiator from the upper to the lower header, transverse fins to space said water conduits and adapted to break up the air flowing through the radiator and to remove the heat from said water conduits, said fin elements being in heat conductive contact with said water conduits, a plurality of upstanding curved vanes projecting from said fin elements mounted in staggered relation between said water conduits and adapted to give the air through said radiator a circuitous path.

In testimony whereof I have affixed my signature to this specification.

JOHN KARMAZIN.