July 6, 1926. 1,591,323

J. KARMAZIN

RADIATOR

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Fig. 1

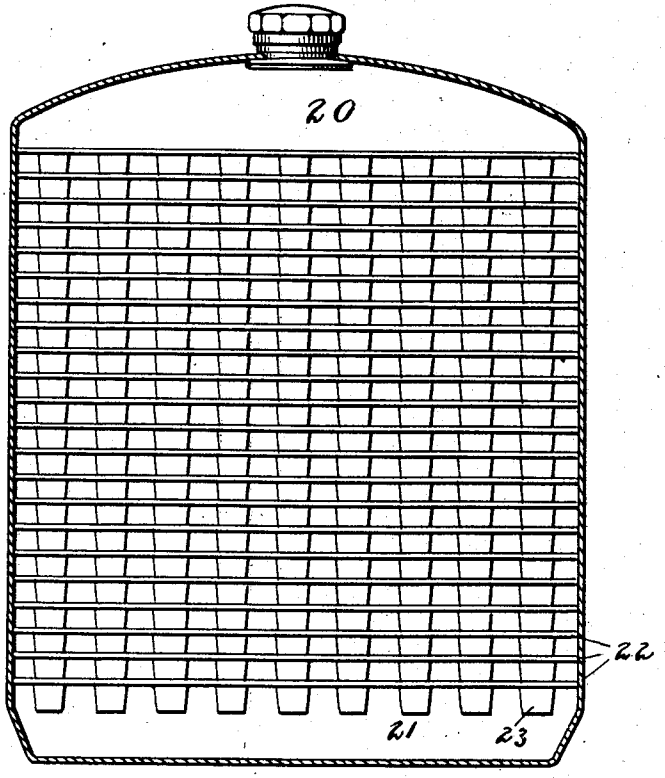


Fig. 3

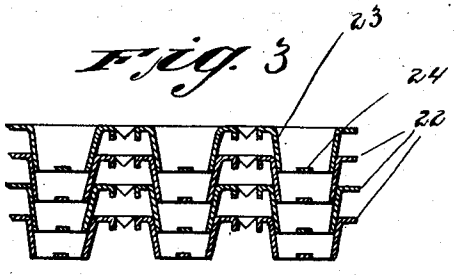


Fig. 2

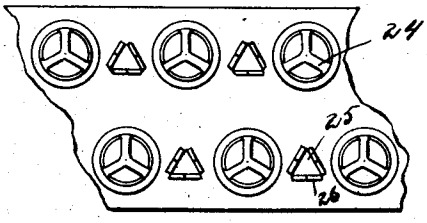


Fig. 4

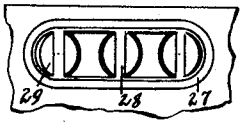
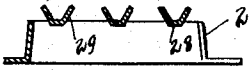


Fig. 5



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Fig. 6

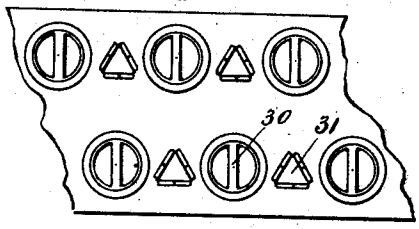


Fig. 7

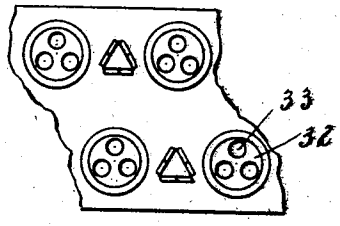


Fig. 8

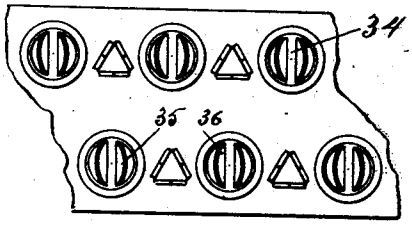


Fig. 12

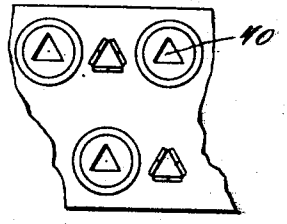


Fig. 9

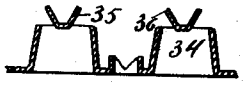


Fig. 13

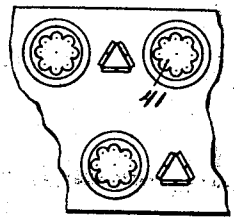


Fig. 10

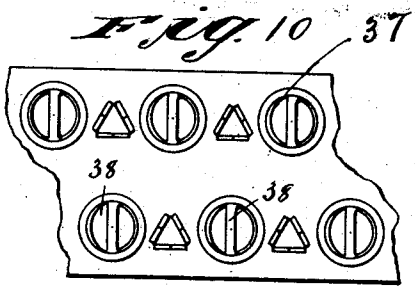


Fig. 14

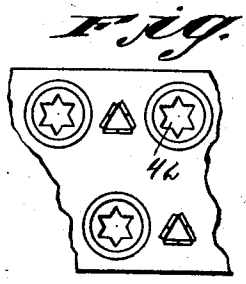
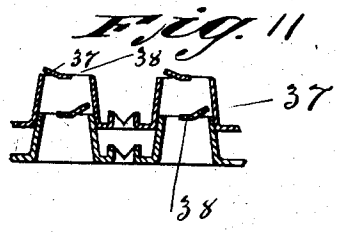


Fig. 11



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Fig. 15

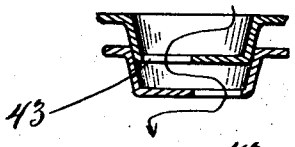


Fig. 17

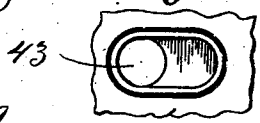


Fig. 16

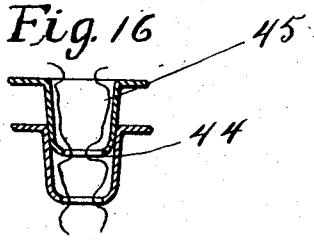


Fig. 19

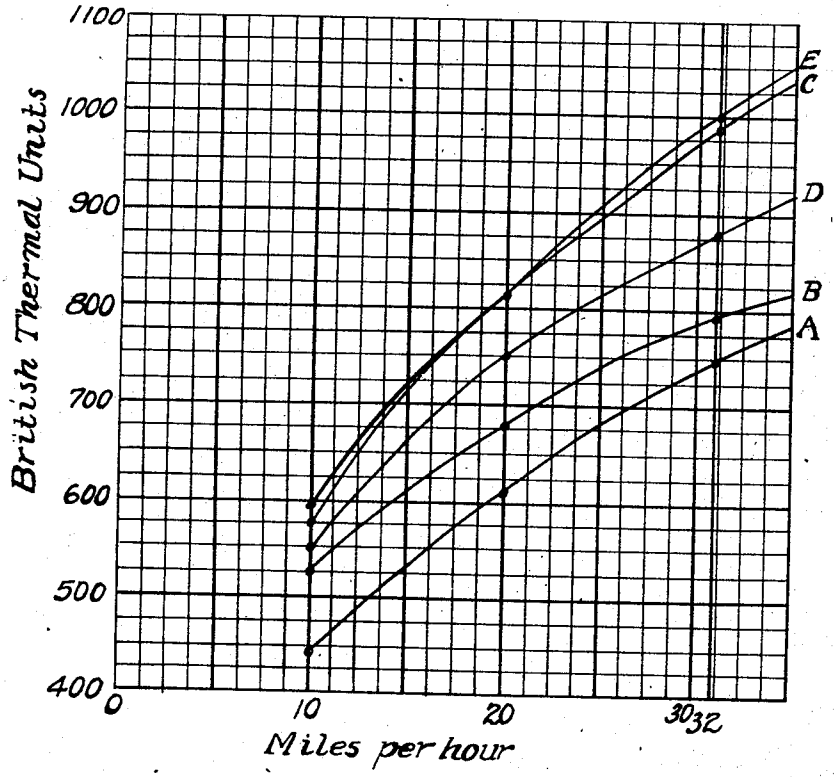
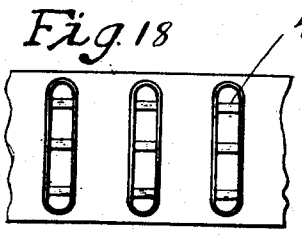


Fig. 18



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Patented July 6, 1926.

1,591,323

UNITED STATES PATENT OFFICE.

JOHN KARMAZIN, OF DETROIT, MICHIGAN.

RADIATOR.

Application filed January 16, 1925. Serial No. 2,742.

This invention relates to radiators, and particularly to radiators of the type shown in my prior co-pending application, Serial No. 579,416, filed August 3, 1922, of which this application is in part a continuation.

In said application I have shown a radiator of the "tubular" type, formed from a plurality of superposed plates of sheet material having struck therefrom short tubular projections, the projections of one plate being adapted to enter the projections in the adjacent plate, whereby continuous tubes are provided. The tubes open at their ends into the usual headers, which may communicate with the water jacket of a gas engine, or other container of a fluid it is desired to cool.

One object of the present invention is to improve and increase the efficiency of radiators of the type disclosed in my prior application above identified.

A further object of the invention is to increase the efficiency of tubular radiators by providing means whereby the water in the center of the tubes comes in contact with a heat conducting element which is in heat conducting relation with the walls of the tube.

A further object of the invention is to provide carriers or baffles in the fluid passages of a radiator whereby the fluid not in contact with the walls of the fluid passages is deflected toward or into contact with the walls without materially retarding the flow of fluid through said passages.

Another object of the invention is to provide a radiator of the integral fin and tube type having integral baffles extending from the walls of the tube to the interior of the fluid column in the tube, which will leave the majority of the space in the tube open to permit substantially unrestricted flow therethrough.

With these and other objects in view, my invention consists in the novel devices and combinations which are illustrated in the drawings and will be hereinafter described.

In the drawings,—

Fig. 1 is a sectional elevation of a radiator of the type to which my invention is applied.

Fig. 2 is a fragmentary inverted plan view of a radiator element comprising a preferred embodiment of my invention.

Fig. 3 is a fragmentary sectional elevation of a radiator comprising the embodiment of the invention shown in Fig. 2.

Fig. 4 is a fragmentary inverted plan view of a radiator element comprising a modified form of my invention.

Fig. 5 is an inverted sectional elevation of the device shown in Fig. 4.

Fig. 6 is a fragmentary inverted plan view of a further modification of my invention.

Fig. 7 is a fragmentary inverted plan view of a further modification of my invention.

Fig. 8 is a fragmentary inverted plan view of a further modification of my invention.

Fig. 9 is a sectional elevation of the modification shown in Fig. 8.

Fig. 10 is a fragmentary inverted plan view of a further modification of my invention.

Fig. 11 is an inverted sectional elevation of the modification shown in Fig. 10.

Figs. 12, 13 and 14 each show a fragmentary inverted plan view of a radiator element embodying a modified form of my invention.

Figs. 15 and 16 are sectional elevations of other forms of baffles whereby the water is given a tortuous or serpentine flow through the tubes.

Fig. 17 is a plan view of the embodiment of the invention shown in Fig. 15.

Fig. 18 is a plan view of another embodiment of the invention.

Fig. 19 is a graphical illustration showing the comparative efficiency of a number of different types of radiators.

The radiator illustrated in Fig. 1 comprises an upper chamber 20 and a lower chamber 21, with a plurality of tubes extending between the upper and lower chambers. Said tubes are formed by superposing a plurality of elements 22 having integral tubular projections 23 thereon, the ends of the tubular projections associated with each element being adapted to telescope into the projections of the adjacent lower element to form continuous conduits. The top and bottom elements respectively may form the bottom of the upper chamber or header, and the top of the lower chamber or header.

I have found that the provision, within the tubes, of baffles or obstructions which,

at intervals, provide obstructions in the tubes without greatly reducing the effective area of the tubes, greatly increases the efficiency of the radiator. This increase in efficiency may be due, in part to the fact that the baffle forms a heat conductor in direct contact with the center portion of the heated fluid column and tube walls. It may also be due, in part, to the baffles diverting the direct plane of a column of the fluid through the center of the tube, bringing the heated fluid from the center of the tube into contact with the tube walls.

The baffles may be of any desirable shape and formed in the tubes in any desired manner. When the tubular projections on the radiator elements are formed by providing a cup in the element forming sheet, and thereafter removing the bottom of the cup, as described in my application Serial No. 641,850, filed May 28, 1923, the baffles are conveniently associated with the free ends of said projections. A die is provided, which removes only part of the metal forming the bottom of the cup, or merely presses said metal into a suitable shape to provide an opening and at the same time form a baffle, the baffle being integral with the tube walls.

In Figs. 2 and 3, I have illustrated a preferred form of my invention, in which three bars or strips 24 of metal extend from spaced points on the wall of each tubular projection, and meet in the center. The flow of fluid through the center of the tube is thus diverted, and heat is conducted from the center to the tube wall by the bars 24, and the stream is broken up in such a way that the hottest inner portion or center is spread and diverted outwardly by the bars into contact with the cooler tube walls and yet the major portion of the tube is left open for the flow of fluid therethrough. Perforations 25 for the circulation of air may be provided in the fin of the element, these perforations being conveniently formed by a die which bends the metal outward and downward but does not remove it. I have illustrated perforations of triangular shape, surrounded by triangular fins 26 formed in making the perforations. These fins deflect the air currents through the radiator and provide for more cooling.

I have illustrated a radiator element comprising two rows of tubes, the tubes of one row being staggered with respect to those of the other row, to more effectively bring all the tubes into contact with the air moving transversely through the radiator. Any desired number of rows of tubes may be used.

In Fig. 4 I have illustrated a tubular projection 27 of oblong shape. Between the lateral walls of said projection, are transverse bars 28, from which segmental baffles or wings 29 extend outward and downward. Thorough mixing of the fluid in the enlarged tube is thus insured, and the baffles and bars conduct the heat to the tube walls.

In Fig. 6, I have shown the round tubes as provided with a single bar 30 which preferably extends directly across the center of the tube. The web intermediate the tubes is provided with perforations 51 similar to those shown in Figs. 2 and 3.

In the form of the invention shown in Fig. 7, the bottom 32 of each tubular cup is perforated with a plurality of small openings 33, which are shown as circular in shape, as in application Ser. No. 579,416, the part of the cup bottom remaining between and around the openings forming the baffle. This construction eliminates entirely the sharp and unprotected rim at the end of the tubular projection, and the attendant danger of injury to the projections and interference with rapid assembly of the elements due to said rim catching on the edge of the opening it is designed to enter. A similar advantage attaches to any form of baffle associated with the end of the tubular projections.

In Figs. 8 and 9, I have shown the ends of the short tubes provided with a single cross bar 34 from which segmental baffles 35 and 36 extend downward and outward on either side. The bar 34 with the baffles may comprise all the material of the bottom of the cup from which the tube is formed, nothing whatever being removed.

The form of the device shown in Figs. 10 and 11 is somewhat similar to that shown in Figs. 8 and 9, but differs therefrom in that a single baffle 37 extends from the cross bar 38, the opening at one side of the cross bar being unobstructed. The tubes are interspaced with the usual perforations in the web or fin portion of the element. If desired, these elements may be assembled with baffles 37 alternately on opposite sides of the tube to give a more tortuous course to the water.

In Figs. 12, 13 and 14, I have shown the baffle plates as surrounding restricted openings 40, 41 or 42 of various shapes. By actual test I have found that the relative positioning of the baffle plates and the openings very greatly affects the efficiency of the radiator.

Fig. 15 illustrates an oblong tube with holes 43 adjacent one end thereof and staggered to give a serpentine course to the cooling fluid, as indicated by the arrow.

Fig. 16 shows a round tube radiator with round holes 44 of reduced diameter therein or with holes of the shape shown in Figs. 12, 13 and 14. In this embodiment the cooling fluid spreads out in the body of the tubes, is constricted at the openings, and

again spreads in the lower tube, as indicated by the lines 45.

Fig. 17 is a plan view of this embodiment of the invention.

Fig. 18 shows an oblong tube provided with a plurality of baffles 46 bridging the bottom walls thereof.

In Fig. 19 I have graphically compared the efficiency of various forms of my improved tubular radiator with a radiator of the same type without baffles of any kind, and with the standard radiator of a well known automobile. The data for the graphs was secured by actual test of the several radiators under standard conditions, and the results illustrated are typical of the results secured in a large number of such comparative tests.

The several curves of Fig. 19 show the amount of heat dissipated in British thermal units, which is radiated by the several radiators at different rates of speed of the car. The axis of abscissas is measured in miles per hour, and the axis of ordinates in the number of British thermal units dissipated from the cooling fluid in the radiator.

Curve A relates to the standard fin and tube radiator placed on a well known automobile by its manufacturers, said radiator comprising five rows of tubes.

Curve B shows the heat dissipated by one of my improved radiators adapted for the same automobile and comprising two rows of tubes, but without baffle plates or bars. It will be noted that at all speeds the efficiency of my radiator greatly exceeds that of the standard radiator.

Curve C represents the heat dissipated by a radiator comprising two rows of tubes provided with the single bar or baffle, diametrically placed, as illustrated in Fig. 6, the radiator being otherwise similar to the one represented by curve B. A truly remarkable increase in efficiency is seen to be secured by the use of the heat conducting and fluid mixing baffle or bar.

The effect of the baffle is even more strikingly illustrated by comparing curve C with curve D, the latter representing my tubular radiator comprising three rows of tubes without baffles. The radiation secured by providing the tubes with the single bar is greater than that secured by adding to the radiator half the original number of tubes with the corresponding increase in cost and weight involved. In other words, the radiation effected by the baffles associated with two rows of tubes is greater than the radiation effected by one additional row of tubes without baffles. Two rows of tubes with baffles effect more radiation than three rows of tubes without baffles.

Curve E represents the heat dissipated by a radiator having tubes provided with the "triple bar" baffle shown in Figs. 2 and 3, the radiator being otherwise similar to the one represented by curves B and C, and the conditions of the test being the same. This radiator shows a very marked increase in efficiency over the open tube radiator of curve B, as well as a very appreciable, though less pronounced, superiority over the single baffle radiator of curve C. As compared with the single bar radiator, the triple bar radiator is more efficient at practically all speeds, and the increase in the heat radiated as the speed increases, is much more uniform, whereby a more even temperature with consequent uniformity and steadiness of performance of the motor at all speeds is insured.

Other variations in structure than those herein illustrated and described may be resorted to, and the baffles may be applied to the tube of the ordinary fin and tube type radiator, the invention being limited only by the scope of the appended claims.

I claim:

1. A radiator element comprising a plurality of tubular sections, each provided with a baffle comprising a transverse bar, and a plurality of wings extending outwardly and downwardly from said bar.

2. A radiator element comprising a plurality of tubular sections, each provided with a baffle comprising a transverse bar, and a wing member extending from said bar.

3. A radiator of the integral fin and tube type comprising an upper header, a lower header, and a core composed of a plurality of fin members each having a plurality of integral tubular projections forming fluid passages through the core communicating with said headers, and means at spaced intervals within said passages for dividing the fluid column flowing therethrough into a plurality of parts and diverting it toward the walls thereof below said dividing means without materially retarding the flow of fluid through said passages.

4. A radiator comprising a plurality of radiator elements each provided with a plurality of tubular projections, with the projections of one element extending into the projections of the adjacent element to form fluid conducting tubes, heat conducting baffles associated with each of said projections, said baffles comprising bars joined to the walls of said projections at spaced intervals, dividing the tubes into a plurality of sector shaped openings whereby the fluid passing through said opening is deflected toward the walls of the next succeeding projection without substantially retarding the flow of liquid therethrough.

5. A radiator comprising an upper header, a lower header, a plurality of tubes intermediate and communicating with said

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headers, there being no obstruction extending longitudinally through said tubes, and relatively narrow heat conducting bars integral with said tubes and arranged to extend transversely of the tubes at spaced intervals therein whereby to divide the water columns and conduct the heat from the center of the water column passing through said tubes without substantially retarding its flow therethrough.

6. A radiator element comprising a fin member having a plurality of tubular projections, each open at each end, said projections having relatively narrow bars at their free ends which deflect and divide the water flowing through said projections without substantially retarding the flow therethrough.

7. In a radiator of the type described, an upper header, a lower header, and a core therebetween comprising a plurality of fin elements with integral tubular projections extending therefrom, the projections of one element extending into the projections of the adjacent element to form fluid passages through the core, the bottoms of said projections being open except for integral baffles extending from the walls of the projections toward the center of the fluid passages to deflect the water passing said baffles toward the walls of the next succeeding projection, the obstructing area of said baffles being substantially less than one half the cross sectional area of said tubes so as to not materially retard the flow of water through the passages.

8. In a radiator of the type described, an upper header, a lower header, and a core therebetween comprising a plurality of fin elements with integral tubular projections extending therefrom, the projections of one element extending into the projections of the adjacent element to form fluid passages through the core, said projections being open at each end except for relatively narrow baffle bars extending across the bottom of said tubular projections to divide the fluid column and deflect the fluid passing through said passages toward the walls of the succeeding projections without substantially retarding the flow of fluid through said passages.

9. In an integral fin and tube type radiator of the type described, comprising a plurality of fluid passages formed of nested tubular projections the center of said passages being unobstructed except for relatively narrow integral heat conducting bars across the center of the water columns at the ends of the projections, said heat conducting bars dividing and deflecting said water columns without materially retarding the flow of water through said tubes.

10. In a radiator of the type described, a radiator core comprising a plurality of fin members each having a plurality of integral tubular projections extending therefrom with the projection of one fin member extending into the projections of the adjacent fin member to form water conduits through the core, heat conducting baffle means comprising relatively narrow metal paths integral with said projections and extending across the same to divide the water column into a plurality of parts without materially retarding the flow through said tubes.

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

JOHN KARMAZIN.