March 18, 1924. 1,487,148

E. T. CURRAN

LIQUID COOLING RADIATOR

Filed Oct. 21, 1919

Fig. 1.

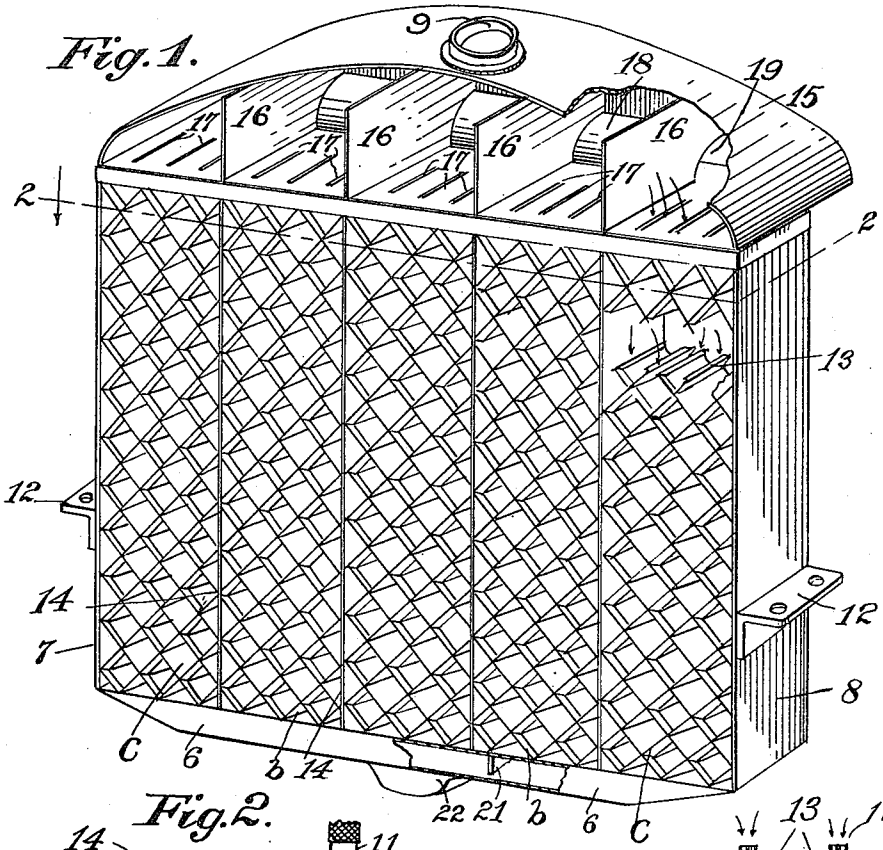
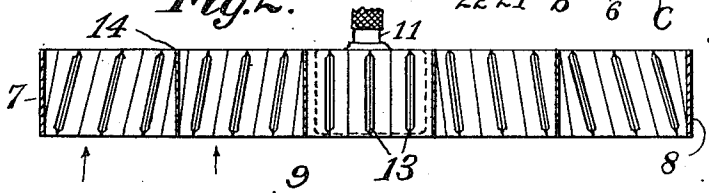


Fig. 2.



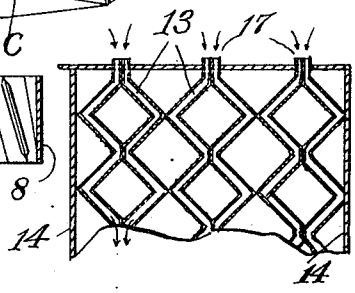


Fig. 3.

Fig. 4.

INVENTOR

E. T. Curran

BY John O. Seifert

ATTORNEY

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EDWARD T. CURRAN, OF DETROIT, MICHIGAN.

LIQUID-COOLING RADIATOR.

Application filed October 21, 1919. Serial No. 332,281.

To all whom it may concern:

Be it known that I, EDWARD T. CURRAN, a citizen of the United States, and a resident of Detroit, in the county of Wayne and State of Michigan, have invented certain new and useful Improvements in Liquid-Cooling Radiators, of which the following is a specification.

This invention relates to radiators for cooling liquid, such as the cooling medium, usually water, circulating through the jacket of an internal combustion engine, said radiators comprising a reservoir to receive the liquid to be cooled and a reservoir for the cooled liquid connected in circulation by passageways to conduct the liquid from the one reservoir to the other in thin streams and cool the same during the passage of the liquid therethrough by the impingement of the air against and the radiation of the heat from said passages.

It is an object of the invention to provide a radiator of this type in which the liquid conducting passageways comprise flattened tubes shaped to form air passages of polygonal shape in cross section from the front to the rear of the radiator between the liquid passageways, separating the tubular passages into sectional units by partitions extending between the reservoirs, and to arrange the tubular liquid passageways to present a large surface for the impingement of the air against the same and to cause the air as it passes through said air passages to converge in the rear of the radiator, and whereby the air passing through the air spaces of the radiator will strike against the motor or engine usually in the rear of the radiator, to facilitate the cooling of the engine.

It is another object of the invention to arrange the reservoir for the liquid to be cooled whereby said reservoir is connected in liquid circulation with the reservoir for the cooled liquid by the liquid passageways at the side portions of the radiator when the liquid is at a low temperature, and to increase the radiating surface of the radiator in accordance with the increase of temperature of the liquid by causing the liquid automatically to flow through a less or greater number of the liquid passageways.

It is a further object of the invention to provide means in the reservoir for the cooled liquid whereby the liquid which is adjacent the bottom and the coolest is drawn off first.

Other objects and advantages will hereinafter appear.

With the foregoing objects in view, I have shown an embodiment of the invention in the drawing accompanying and forming a part of this specification in which Figure 1 is a perspective view of the liquid cooling radiator, partly in section, illustrating an embodiment of my invention.

Figure 2 is a sectional view taken on the line 2—2 of Figure 1.

Figure 3 is an enlarged sectional view of a portion of the tubular passageways to connect the reservoirs in liquid circulation to show an arrangement of said passageways; and

Figure 4 is a sectional side elevation taken substantially, centrally through Figure 1.

Similar characters of reference designate like parts throughout the different views of the drawing.

The embodiment of my invention shown in the drawing comprises a reservoir 5 for the warm liquid, a reservoir 6 for the cooled liquid and side members 7, 8, connected to and supporting the reservoirs at opposite ends in spaced relation to provide an open frame structure. The reservoir 5 has a filler opening 9 adapted to be closed by a removable closure and has an inlet 10 adapted to be connected in circulation with the water cooling jacket of an internal combustion engine (not shown) by being connected to the outlet of said jacket to receive the heated cooling medium to be cooled. The reservoir 6 has an outlet 11 adapted to be connected in circulation with the water inlet of the jacket of the engine cylinder. The side members 7, 8 may have brackets 12 secured thereto to support the radiator, such as in the chassis frame of a motor vehicle.

The reservoirs 5, 6 are connected in liquid circulation by a series of passageways or tubes 13. These tubes are preferably flat and connected at the upper ends to the reservoir 5 and at the lower end with the reservoir 6 to conduct the liquid or water in thin streams from the one reservoir to the other and whereby to facilitate the radiating of the heat from said water to cool the same in its passage from the reservoir 5 to

the reservoir 6. These tubes may be variously formed, but are shown as constituting a pair of longitudinal sheet metal members secured together at their longitudinal edges as by soldering, (Figure 2), and are shaped to form with adjacent tubes rectangular passages between the tubes 13 from the front to the rear of the radiator to permit of the passage of air between the tubes to facilitate the cooling of such passages and the liquid passing therethrough, as clearly shown in Figure 3. The passageways 13 are arranged in sectional units, *a*, *b*—*b* and *c*—*c* by partitions 14 extending between the reservoirs. The ends of the passageways are removably connected to the reservoirs as by soldering, and by melting the solder at such connection either one of the sections may be removed without disturbing the other sections. Furthermore, the partitions serve as supports to add rigidity to the passageways 13. The passageways 13 in the section *a* at the middle portion of the radiator are arranged so that the walls thereof extend substantially at right angles to the front of the radiator while the passageways in the section *b*—*b* and *c*—*c* are arranged with the walls extending at an acute angle to the front of the radiator, the tubes of the sections *b*, *c* at one side of the middle section *a* extending at an angle opposite to the tubes of the sections *b*, *c* at the opposite side of the middle section *a*. By this arrangement the cooling air currents passing through air passages between the tubes are caused to converge in the rear of the radiator and thereby are directed upon the motor or engine (not shown) in the rear of the radiator and facilitate the cooling thereof. Furthermore, the lateral tubular passageways *bb*, *cc* are provided with enlarged surfaces for the air to strike against in its passage through the air spaces, it having been demonstrated that the force with which the air impacts or strikes against a heated body is an important factor in such air taking up and absorbing the heat radiated from such body.

As is well known a water cooled internal combustion engine will operate at its highest efficiency when the cooling fluid or medium is maintained at a substantially even temperature, and the temperature of the cooling medium will vary with the varying speeds at which the engine is operated. Experience has also shown that the liquid passing through the passageways 13 adjacent the sides of the radiator will cool more quickly than the liquid passing through the tubes centrally of the radiator, and that the cooling efficiency of the passageways or tubes decreases, the farther they are in from the sides with the passageways in the middle portion of the radiator having the lowest cooling efficiency. To cause the liquid or cooling medium to initially flow through the passageways adjacent the sides of the radiator means are provided in the reservoir 5 to automatically increase and decrease the circulating or cooling area of the radiator by and in accordance with the varying engine speeds and consequent variable temperature of the cooling medium. For this purpose the reservoir 5 is provided with a series of partitions 16 extending up from the bottom to adjacent the top of the reservoir and from the front to the rear walls thereof to separate said reservoir into a series of chambers 17 having communication with each other over the partitions 16. The water inlet 10 has a bifurcated portion 18 having an outlet at each end in communication with the outermost chambers 17, as shown at 19. In operation as the engine is started and with the cooling medium or water at a comparatively low temperature the cooling medium will be discharged from the engine jacket to the outermost chambers 17 in the reservoir 5 and will circulate or be restricted to flow through the tubular passageways 13 in communication therewith into the reservoir 6. As the temperature of the cooling medium rises and the consequent expansion of the same takes place and the tubes in communication with the outermost chambers 17 are no longer sufficient to cool the heated and expanding cooling medium such medium will spill over the partitions 16 to the next inner adjacent chamber 17 and will circulate through the tubular passageways 13 in communication therewith. By a further rise in temperature the cooling medium will spill over the next partitions into the middle chamber of the reservoir 5 and circulate through the passageways in communication therewith.

To draw off the coolest portion of the cooling medium in the reservoir 6 the outlet 11 is connected with an enlarged portion 22 of the reservoir arranged substantially centrally and at a point lower than the bottom of said reservoir, and said reservoir is arranged with one or more partitions 21 extending between the front and rear walls of said reservoir and down from the top to adjacent the bottom thereby permitting of free circulation of the coolest portion of the cooling medium.

Variations may be resorted to within the scope of my invention, and portions thereof may be used without others.

Having thus described my invention, I claim:

1. In a liquid cooler, a reservoir for the warmed liquid and a reservoir for the cooled liquid, passageways to connect said reservoirs in liquid circulation, comprising tubes shaped to form air passages of polygonal shape in cross section and certain of the tubes extending from the front to the rear

of the radiator at an acute angle with the front of the radiator for the purpose specified.

2. In a liquid cooler a reservoir for the warmed liquid and a reservoir for the cooled liquid, passageways to connect said reservoirs in liquid circulation comprising flat tubes shaped to form air passages of polygonal shape in cross section, and the tubes at opposite sides of the radiator arranged to form air passages the walls of which converge toward the rear of the radiator.

3. In a liquid cooler a reservoir for the warmed liquid and a reservoir for the cooled liquid, passageways to connect said reservoirs in liquid circulation, comprising flat tubes shaped to form air passages of polygonal shapes in cross section, the tubes at the middle portion of the radiator extending at right angles to the front of the radiator and the tubes at opposite sides of said tubes at the middle portion of the radiator extending at an acute angle to the front of the radiator, with the inclination of the tubes at one side of the middle tubes extending in a direction opposite to the tubes at the opposite side of the middle tubes to cause the air entering the air spaces to strike against the walls of said passages and converge in the rear of the radiator.

4. In a liquid cooler reservoirs for the warmed liquid and the cooled liquid, passageways to connect said reservoirs in liquid circulation, comprising flat tubes shaped to conform to air passages of polygonal shape in cross section extending from the front to the rear of the radiator, said tubes at opposite sides of the radiator being arranged to present a large surface for the impingement of the air; and means in the reservoir for the warm liquid to automatically cause the heated liquid to flow through a less or greater number of the tubes in accordance with the temperature of the liquid for the purpose specified.

5. In a liquid cooler, reservoirs for the warmed liquid and for the cooled liquid, passages to connect said reservoirs in liquid circulation, comprising flat tubes shaped to form air passages of polygonal shape in cross section from the front to the rear of the radiator and certain of the tubes extending from the front to the rear of the radiator at an acute angle; and means in the reservoir for the warm liquid arranged to cause the liquid when at a low temperature to flow through one portion of the passages and by a rise in temperature to flow through a greater number or all of said tubes in accordance with the rise in temperature of the liquid.

6. In a liquid cooling radiator a reservoir for the cooled liquid; a reservoir for the warm liquid; tubular passages to connect said reservoirs in liquid circulation; means in the reservoir for the warm liquid arranged to automatically cause the liquid to pass through the passages at the sides of the radiator when the liquid is at a low temperature and through an increased number of the passages toward the middle of the radiator in accordance with the increase in the temperature of the liquid; and means in the reservoir for the cooled liquid to cause the liquid to be drawn from the bottom of said reservoir for the purpose specified.

7. In a liquid cooling radiator a reservoir for the warm liquid; a reservoir for the cooled liquid; passageways to connect said reservoirs in liquid circulation comprising flat tubes shaped to form air passages of polygonal shape in cross section from the front to the rear of the radiator between the liquid passageways; and partitions extending between the reservoirs to separate the tubular liquid passages into sectional units, with the air passages through the section at the middle of the radiator extending at right angles to the front of the radiator, and the walls of the liquid passageways at opposite sides of said middle section converging from the front to the rear of the radiator for the purpose specified.

8. In a liquid cooler, reservoirs for the warmed liquid and the cooled liquid, passageways to connect said reservoirs in liquid circulation comprising flat tubes shaped to form air passages of polygonal shape in cross section from the front to the rear of the radiator between the liquid passageways, said liquid passageways at opposite sides of the middle portion of the radiator converging from the front to the rear of the radiator; partitions extending from the bottom to adjacent the top of the reservoir for the warm liquid to form a series of chambers having communication over the top of the partitions; and a liquid inlet to the reservoir for the warm liquid arranged to direct the incoming liquid to the chambers at opposite ends of the reservoir.

9. In a liquid cooling radiator, a reservoir for the warmed liquid; a reservoir for the cooled liquid having an outlet; passageways to connect said reservoirs in liquid circulation; vertical partitions in the reservoir for the warm liquid arranged to separate said reservoir into chambers having communication over said partitions; a liquid inlet to said reservoir arranged to direct the incoming liquid to the chambers at opposite ends of the reservoir; and partitions in the reservoir for the cooled liquid extending from the top to adjacent the bottom for the purpose specified.

Signed at Detroit, in the county of Wayne and State of Michigan, this 10" day of October, 1919.

EDWARD T. CURRAN.