

May 12, 1925.

S. W. RUSHMORE

1,537,553

RADIATOR

Filed June 10, 1924

Fig. 1.

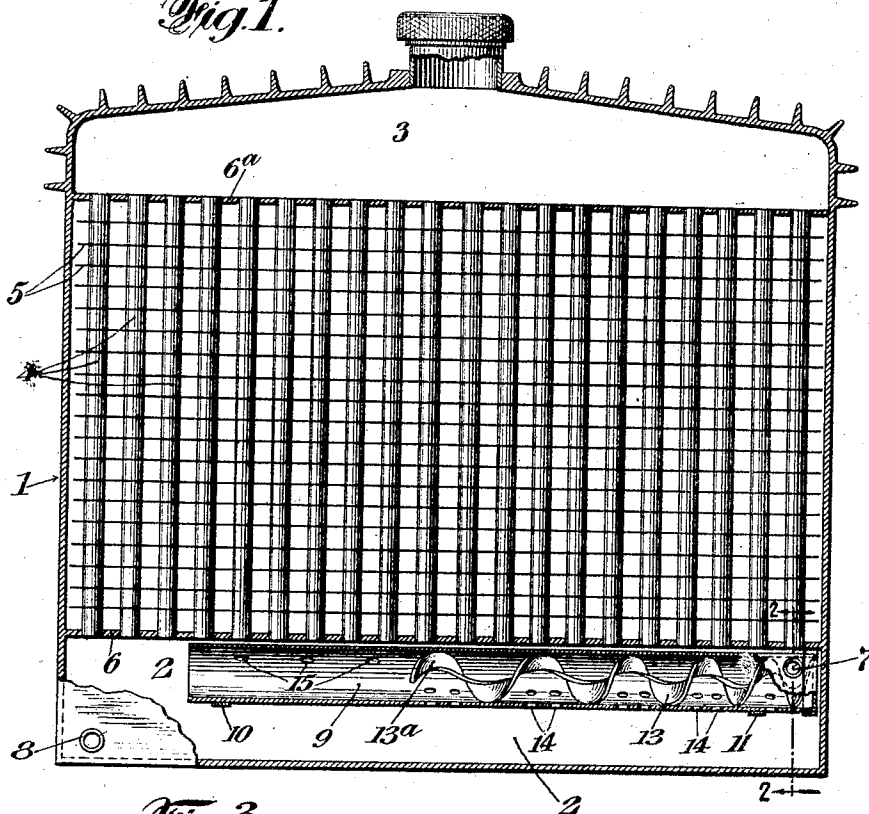


Fig. 3.

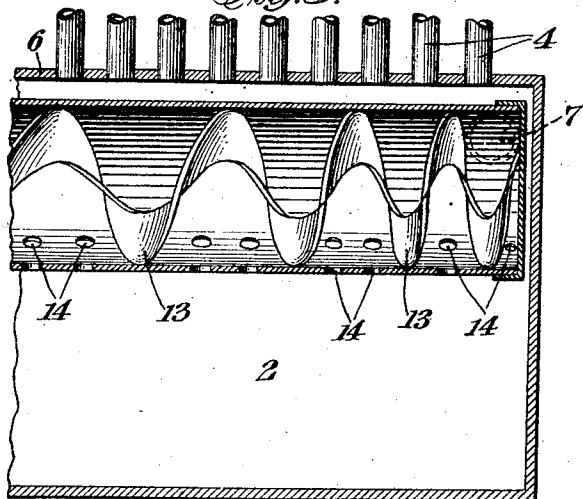
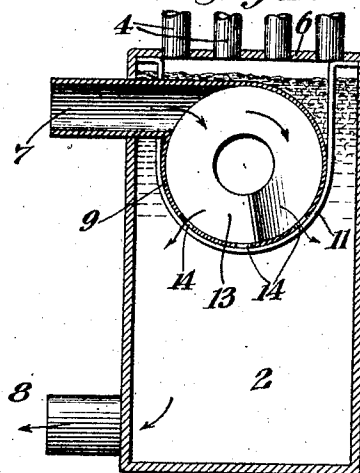


Fig. 2.



INVENTOR

Samuel W. Rushmore

BY

George A. Dean ATTORNEY

Patented May 12, 1925.

1,537,553

UNITED STATES PATENT OFFICE.

SAMUEL W. RUSHMORE, OF PLAINFIELD, NEW JERSEY.

RADIATOR.

Application filed June 10, 1924. Serial No. 719,039.

To all whom it may concern:

Be it known that I, SAMUEL W. RUSHMORE, a citizen of the United States, and resident of Plainfield, in the county of Union and State of New Jersey, have invented certain new and useful Improvements in Radiators, of which the following is a specification.

My present invention relates more particularly to radiators adapted to operate as upflow condensers according to the principles set forth in certain of my prior patents as, for instance, No. 1,378,724, granted May 17, 1921, and No. 1,455,739, granted May 15, 1923. The devices shown in these patents are radiators of the constructions and proportions commonly used on automobiles, trucks, etc., for cooling the jacket water of internal combustion engines. According to said patents, the cooling jacket circulation is short circuited through what is ordinarily the collector space in the bottom of the radiator and, the honeycomb being empty and above said space is caused to function as an upflow condenser.

In these radiators the chamber below the honeycomb is of limited capacity and in certain cases, particularly radiators of the vertical tube type, particularly when used on trucks where the cooling capacity of the radiating tubes is apt to be overtaxed as by running up long grades on low gear, I find that the increase in the volumes of steam from the water discharged into the lower chamber of the radiator is liable to cause the water to be projected at such high velocity as may be driven up through the tubes by momentum. My present invention involves means for absorbing the kinetic energy and reducing the velocity of the discharge under such conditions.

For the above purpose, I employ means for absorbing the kinetic energy by friction and interference of the discharge currents, preferably also affording, at the same time, means for evolution and disentanglement of the steam from the water.

For this purpose, I arrange a tubular passage of much greater area than the inlet, extending lengthwise of the lower chamber of the radiator, normally submerged or partially submerged in the body of the water in said chamber. Such tubular passage, when supplied with a suitable number of perforations of sufficient area is a satisfactory device for the above purpose under or-

inary conditions and for radiators of maximum cooling capacity, but an important feature of my invention consists in discharging the water into such a chamber tangentially so that it progresses lengthwise and escapes from the tube by spiralling along the same. Preferably, the spiralling is assisted and regularized by means of a spiral fin extending peripherally from the inlet and preferably terminating a substantial distance from the open end of the tubular passage. Apparently the continuous change of direction and developed centrifugal force of the water results in friction which slows down its velocity and the radial perforations afford opportunity for substantial but not too high velocity losses of the water as it traverses its spiral path.

Preferably the spiral is of gradually decreasing pitch, bringing the flow of water down more nearly to parallelism with the axis of the tubular passage as it approaches the outlet end thereof.

Moreover, discontinuing the spiral fin a substantial distance short of the end affords opportunity for such parallelizing of the flow across the entire section of the tubular passage. If the diameter of the tubular passage is, say, three times the diameter of the inlet, its cross section will be nine times that of the inlet and on this basis alone the velocity at the discharge end of the tubular passage should be one-ninth the initial velocity.

However, it is much less than this, because of the friction and leaks and interference along the way. Moreover, the fin does not extend to the axis of the tube but leaves a very substantial straight line axial path of possible flow, which path centrifugal effect tends to keep open for escape of the steam, which latter the friction and interference tends to liberate from the superheated water, thereby bringing its temperature down to the effective boiling point as determined by the pressure which is being maintained in the base of the radiator.

In this way, I find that I can completely obviate the above described difficulty; that even in the case of various small tubes, say, $\frac{1}{4}$ inch or less internal diameter, the water will not be forced through the tubes into the upper chamber, at least not to any objectionable degree.

The above and other features of my invention may be more readily understood

from the following description in connection with the accompanying drawings, in which

Fig. 1 is a conventional vertical section of a radiator of the type shown in my above mentioned Patent No. 1,455,739, having one form of my invention applied thereto;

Fig. 2 is a detailed section on the line 2-2, Fig. 1; and

Fig. 3 is a fragmentary longitudinal section through the bottom of the radiator.

The radiator comprises a casing 1, enclosing a lower chamber 2 and upper chamber 3 and between them, radiating or "honeycomb" elements represented by the tubes 4, 4 and radiating fins 5, 5, extending between lower header 6 and upper header 6^a.

The inlet 7 discharges from the water jacket of the engine and the outlet 8 takes it back to the water jacket.

As shown more clearly in Fig. 2, the inlet 7 discharges tangentially into a cylindrical passageway 9, which is secured in any suitable manner as, for instance, by suspension members 10, 11. While the proportions of design may be varied within wide limits, I have found in some cases that a suitable proportion is say, 3 inches in diameter by 10 inches long, although in Fig. 1 the length is shown as twice as great in proportion to the diameter.

The spiral fin 13 is of relatively low pitch where it first engages and starts deflection of the water from discharge pipe 7, in a direction for travel longitudinally of the tube. As shown, the fin extends approximately one-third of the diameter from the walls, leaving a free longitudinal passage along the axis equal to about one-third the diameter. The successive turns of the spiral rapidly increase in pitch and the end turns 13^a may approach parallelism with the axis as nearly as may be desired.

Preferably perforations 14, 14 are arranged in the bottom segment of the tubular passage between the turns of the spiral fin and beyond the fin similar perforations 15, 15 may be arranged in the top of the tubular passage.

In the above the operation of the device will be obvious. Under conditions of normal operation, the flow retarder will be of advantage for distributing the flow of water and evolving the steam therefrom and under such conditions may be so effective that the volume of velocity of flow at the end of the tube will be slight. Under emergency conditions, however, the water from inlet 7 being circulated at much higher velocity and being charged with much greater quantities of steam, will be driven through the first two turns of the spiral, at high velocity, its quantity being decreased by centrifugal discharge through outlets 14,

14 and its velocity by the increasing cross section of the spiral which it traverses. Being submerged in the water, particularly at the outlets 14, 14, discharge cannot be violent. The centrifugal effect will serve to maintain the water near the periphery so long as it has high velocity, leaving the axial passage as the natural path of escape for the steam.

I claim:

1. A radiator of the type comprising a lower chamber, an upper chamber and intermediate cooling passages, in combination with inlet and outlet passages for short-circuit flow of steaming liquid through said lower chamber and a flow retarding passage of greater cross-section than the inlet into which the inlet discharges.

2. The combination specified by claim 1, with the further feature that the inlet discharges into the flow retarding passage tangentially.

3. A radiator of the type comprising a lower chamber, an upper chamber, and intermediate cooling passages in combination with inlet and outlet passages for short circuit flow of steaming liquid through said lower chamber, and a flow retarding passage into which the inlet discharges tangentially, said flow retarding passage being of greater cross section than the inlet and being circular in cross section so that the tangential discharge progresses spirally there-through.

4. The combination specified by claim 1, with the further feature that the flow retarding passage is circular in cross-section, and is provided with deflecting means causing the circularly flowing liquid to progress longitudinally of the flow retarding passage.

5. A radiator of the type comprising a lower chamber, an upper chamber, and intermediate cooling passages in combination with inlet and outlet passages for short circuit flow of steaming liquid through said lower chamber, a flow retarding passage of circular cross section and greater cross section than the inlet into which the inlet passage discharges tangentially and deflecting means in the flow retarding passage causing the circularly flowing liquid to progress longitudinally of the flow retarding passage, said deflecting means comprising a spiral element of progressively increasing pitch toward the discharge end of the flow retarding passage.

6. A radiator of the type comprising a lower chamber, an upper chamber, an intermediate cooling passages in combination with inlet and outlet passages for short circuit flow of steaming liquid through said lower chamber, a horizontal flow retarding passage of circular cross section and of greater cross section than the inlet into which the

inlet passage discharges tangentially, deflecting means in the passage causing the circularly flowing liquid to progress longitudinally thereof and said passage having radial openings therein for the escape of liquid.

7. A radiator of the type comprising a lower chamber, an upper chamber, and intermediate cooling passages in combination with inlet and outlet passages for short circuit flow of steaming liquid through said lower chamber, a horizontal flow retarding passage of circular cross section and of greater cross section than the inlet into which the inlet passage discharges tangentially, deflecting means in the passage causing the circularly flowing liquid to progress longitudinally thereof and said passage having normally submerged radial openings therein for the escape of liquid.

8. A radiator of the type comprising a lower chamber, an upper chamber, and inter-

mediate cooling passages, in combination with inlet and outlet passages for short-circuit flow of steaming liquid through said lower chamber and a flow retarding passage in which the cross-section of the flow path of the liquid is of progressively increasing cross section toward its outlet end.

9. A radiator of the type comprising a lower chamber, an upper chamber and intermediate cooling passages in combination with inlet and outlet passages for short circuit flow of steaming liquid through said lower chamber, a flow retarding passage of greater cross section than the inlet into which the inlet discharges tangentially and a plurality of openings in the walls of the flow retarding passage permitting escape of the liquid.

Signed at Plainfield, in the county of Union and State of New Jersey, this 29th day of May, A. D. 1924.

SAMUEL W. RUSHMORE.