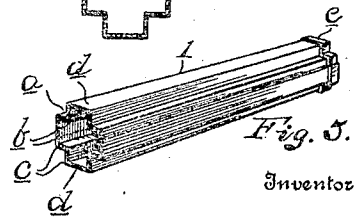
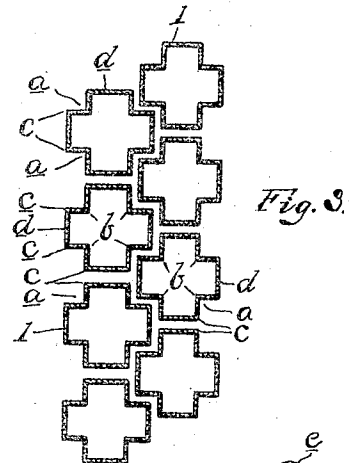
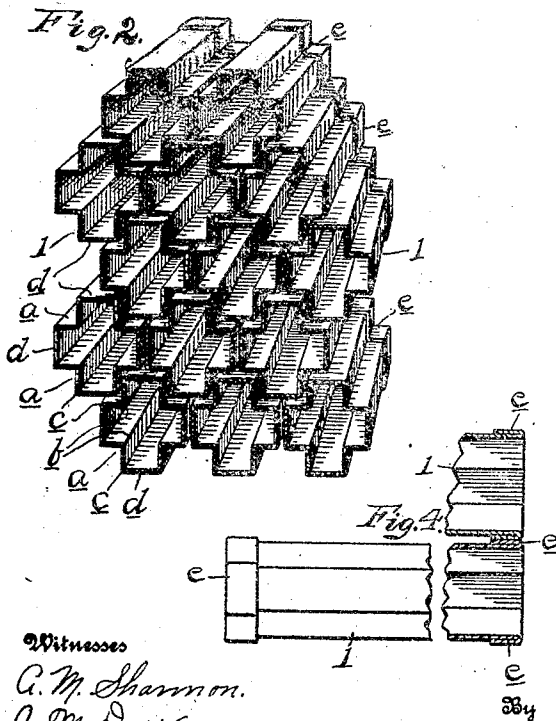
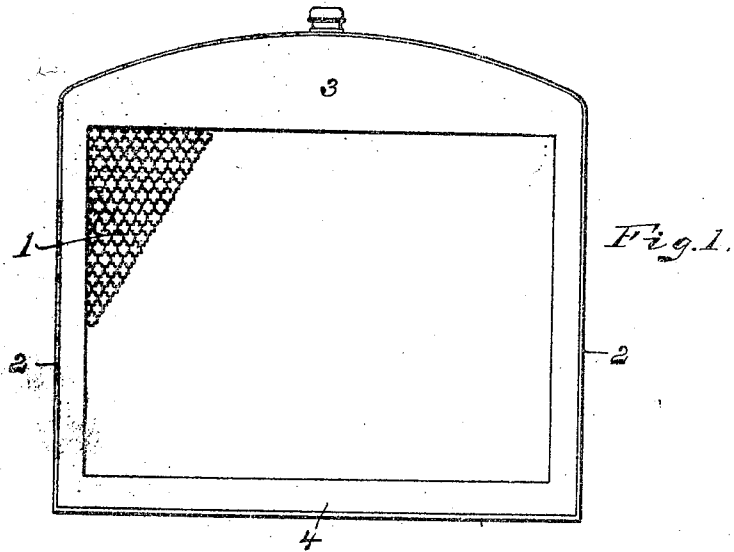


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RADIATOR.
APPLICATION FILED JULY 6, 1908.

943,689.

Patented Dec. 21, 1909.



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RADIATOR.

943,689.

Specification of Letters Patent.

Patented Dec. 21, 1909.

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To all whom it may concern:

Be it known that I, SAMUEL LAVINE, a citizen of the United States of America, residing at Detroit, in the county of Wayne and State of Michigan, have invented certain new and useful Improvements in Radiators, of which the following is a specification, reference being had therein to the accompanying drawings.

10 This invention relates to radiators for cooling circulating fluid and is especially adapted for use upon automobiles and other motor vehicles employing an internal combustion engine as the source of power.

15 The object of the invention is to provide a construction which is cheap to manufacture, is not liable to injury in use and is very efficient in its operation.

To this end the invention consists in the 20 form and arrangement of tubes, which form and arrangement give an increased external surface to the tubes in proportion to their cross sectional area over tubes of devices of this character as ordinarily constructed, and 25 to also form tortuous passages for the fluid having right angle bends to frictionally retard the flow.

The invention further consists in certain other new and useful features, all as hereinafter more fully described reference being 30 had to the accompanying drawing in which,

Figure 1 is a front elevation of a radiator embodying the invention and illustrating the manner in which the tubes are assembled; Fig. 2 is an enlarged perspective detail of a number of tubes arranged in assembled position and showing the tubes in cross section; Fig. 3 is a sectional detail of a series of tubes showing a modified arrangement of the same within the radiator; Fig. 40 4 is a detail of the ends of the tubes showing the one end in longitudinal section and the other end in elevation; and Fig. 5 is a perspective detail of one of the tubes detached and showing one end of the same in section.

As shown in Fig. 1, the body of the radiator is made up of a series of horizontally extending tubes 1, inclosed within a frame or casing 2 with a tank 3 at the top and a 50 tank 4 at the bottom communicating with the spaces between the tubes so that water in the upper tank may pass downward through the tortuous passages formed between the tubes into the lower tank, said tanks being connected in use with the water

jacket of the engine in the usual manner to complete the circuit. The tubes 1 are set in the radiator in a horizontal position so that the air may pass freely through them 60 and in passing quickly cool the thin stream of water trickling downward over their outer surfaces. These tubes are cruciform in cross section each being formed with four grooves *a* the walls of which meet at right 65 angles forming four inwardly projecting right angle corners *b* and eight outer right angle corners *c* the spaces between the grooves *a* forming the four sides *d* of each tube. These tubes may be formed with a 70 continuous wall, or as shown in Fig. 5 they may be made from a flat sheet of metal folded into tubular form and the longitudinal edges of the metal overlapped and soldered together. The metal at each end of 75 each tube is folded back upon the tube, as shown at *e* and when the tubes are assembled they are placed one upon another with their intumed flanges *e* in contact, and these flanges securely soldered together. The 80 flanges thus serve to space the intermediate portions of the tubes one from another providing a water space entirely around each tube and the inturning or folding of the metal at the ends of the tubes also strengthens the device materially preventing the same 85 from being easily damaged and preventing the radiator from leaking when struck a severe blow on the end of the tubes. These tubes are set in the radiator in rows with 90 spaces between the adjacent sides of the tubes forming each row and the tubes of one row are so set relative to the tubes of the adjacent row and said tubes are so proportioned that the projecting side *d* of one row 95 will extend into the spaces in the adjacent side of the next row which spaces are formed by the grooves *a*, and the space between said side *d* and the walls of the grooves will be equal to the space between 100 the tubes forming each of the rows, thus providing a uniform water space entirely around each of the tubes. The angles *c* of the tubes being right angles, the bends of the passages for the water between the tubes 105 are right angle bends and the water flowing downward through these tortuous passages from the upper to the lower tank is thus retarded by the many sharp angles over which it must flow. 110

The tubes are preferably set or arranged as shown in Fig. 2, being placed in horizon-

tal rows with spaces between the adjacent sides *d* of the tubes of each row and the tubes of the next adjacent row above or below are placed opposite these spaces, and thus the water entering the spaces from the upper tank flows into each space between the tubes of one row then divides and flows each way around the opposing tube of the next row below. The tubes may, however, be set in the radiator as illustrated in Fig. 3 being arranged in vertical rows with spaces between the tubes of each row, but in this construction the water may pass down the tortuous passage between adjacent rows without passing entirely around each tube, I therefore prefer the arrangement shown in Fig. 2, but do not wish to limit myself to said arrangement.

Having thus fully described my invention what I claim is:—

1. A radiator comprising tubes of cruciform in cross section arranged in rows with the laterally projecting portions of the tubes of one row projecting into the spaces between the laterally projecting portions of the tubes of the adjacent rows with spaces between the rows forming tortuous passages.

2. A radiator comprising tubes each grooved longitudinally to form projecting portions between, said projecting portions forming the four sides of the tube, and said tubes being spaced apart to form tortuous passages between the tubes.

3. A radiator comprising tubes each grooved longitudinally, forming four inwardly projecting right angle corners and

eight outer right angle corners, the spaces between the grooves forming the four sides of the tube and said tubes being spaced apart to form tortuous passages between the tubes, the turns of which passages are right-angle bends.

4. A radiator comprising tubes each grooved longitudinally to form projecting portions between the grooves, which projecting portions form the four sides of the tube, and said tubes set with spaces between the corresponding projecting adjacent portions and spaces of an equal width between the walls of the grooves and the projecting portions of tubes adjacent to said walls.

5. A radiator comprising a series of tubes each formed with longitudinal grooves forming four inwardly projecting right-angle corners and eight outer right-angle corners, the projecting portions between the grooves forming the four sides of the tube, and said tubes secured together at their ends with a space of uniform width entirely around each tube, said tubes being arranged in rows with spaces between the tubes of each row, and the projecting portions of the tubes of each row projecting laterally from said rows into adjacent grooves of adjacent rows with a space between said portions and the walls of said grooves.

In testimony whereof I affix my signature in presence of two witnesses.

SAMUEL LAVINE.

Witnesses:

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