

July 3, 1928.

J. M. FEDDERS

1,675,796

RADIATOR

Filed Feb. 11, 1925

4 Sheets-Sheet 1

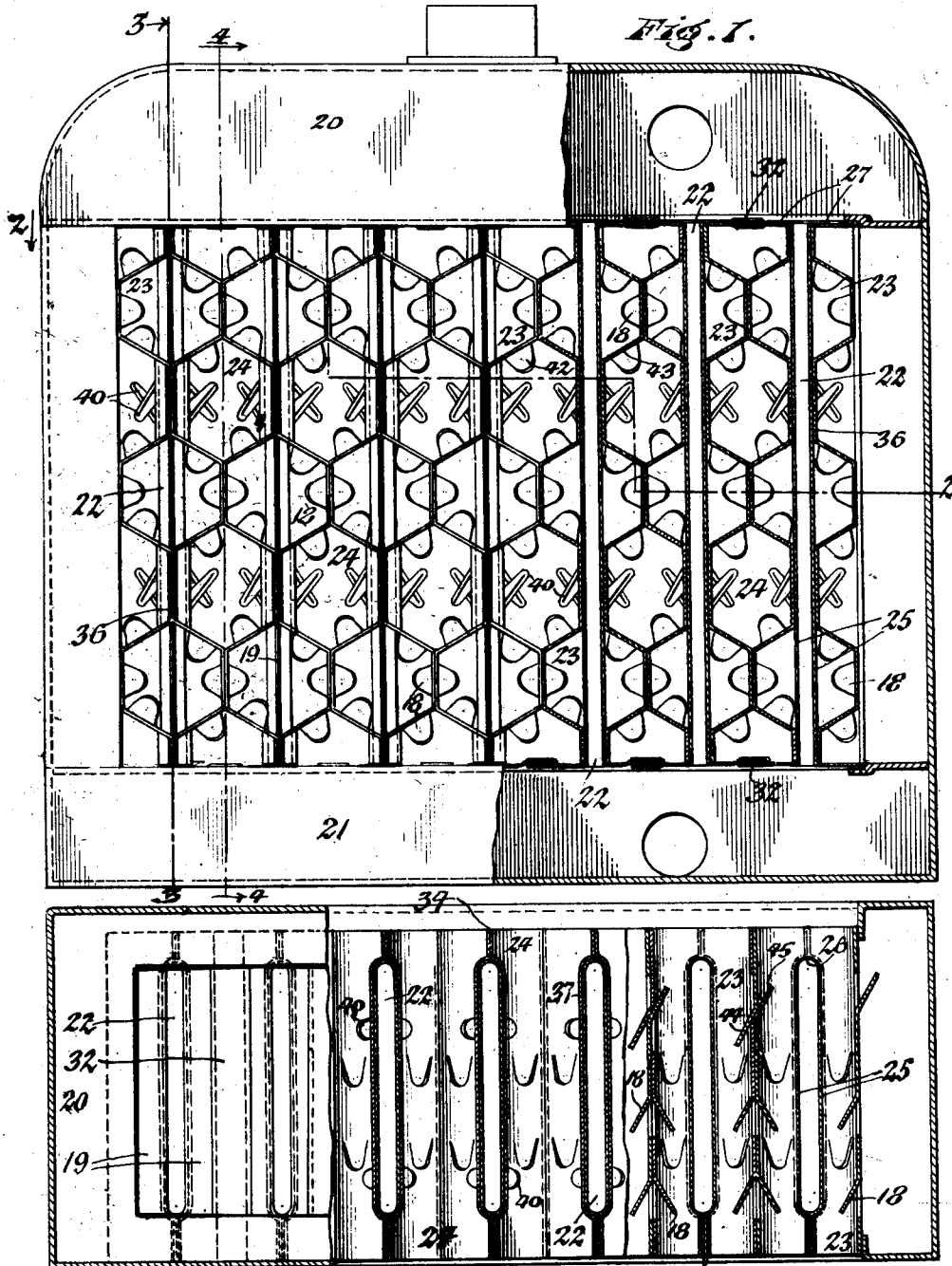


Fig. 2.

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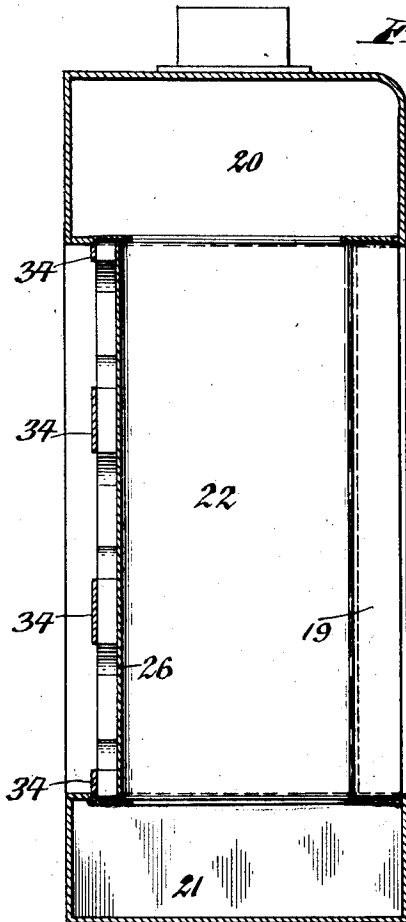
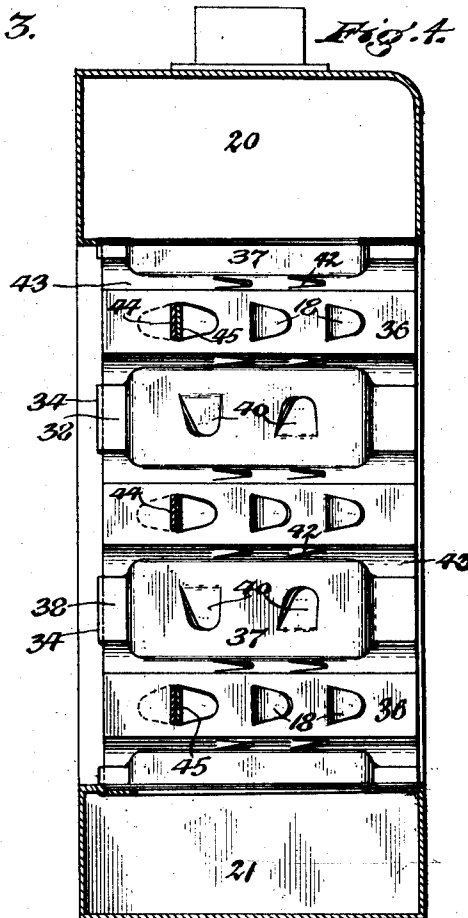
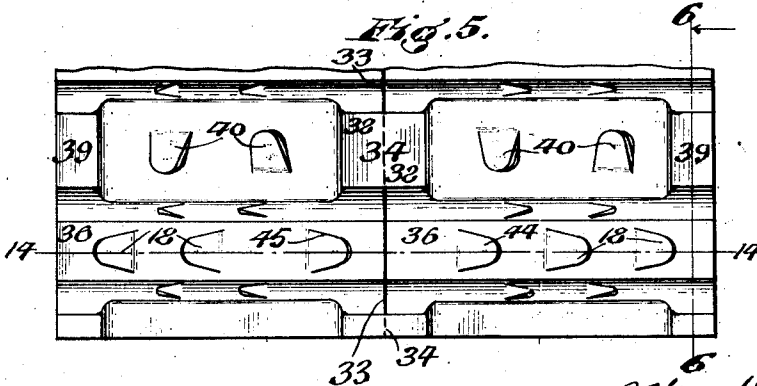
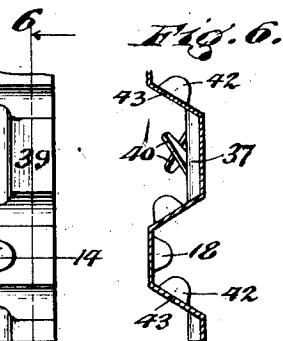
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4 Sheets-Sheet 2



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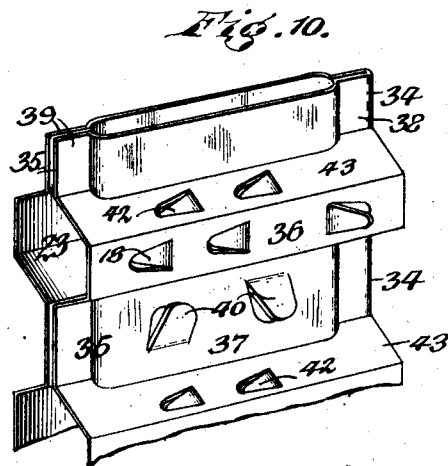
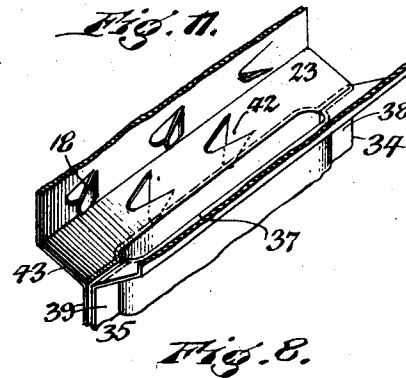
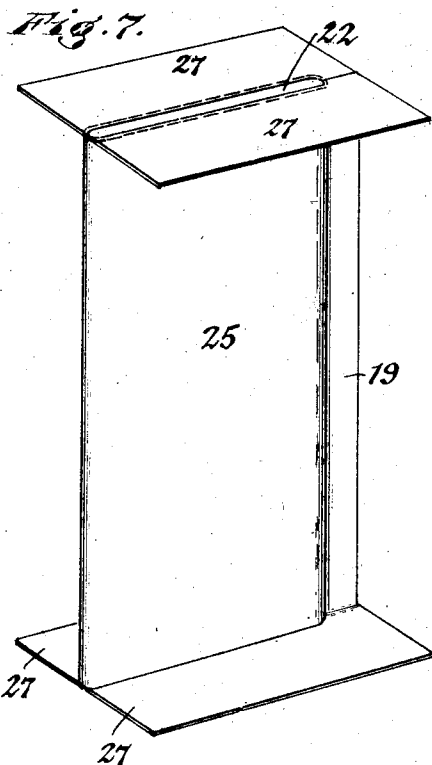
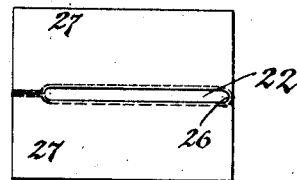
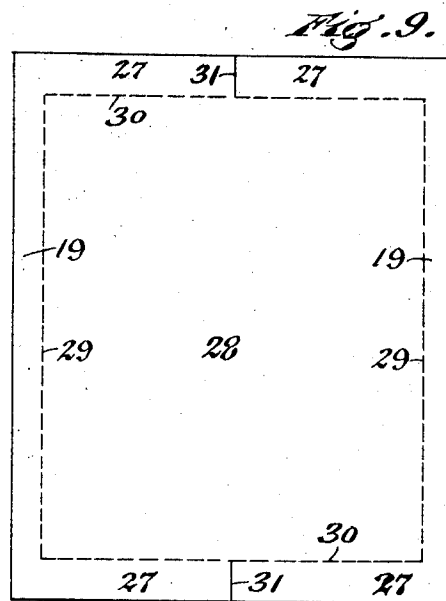
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RADIATOR

Filed Feb. 11, 1925

4 Sheets-Sheet 3



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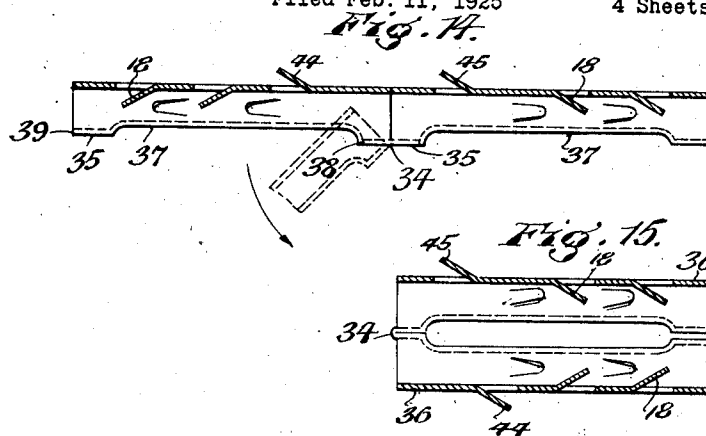
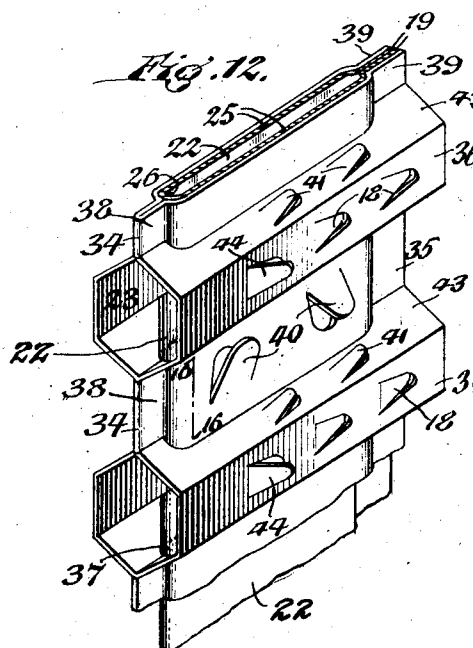
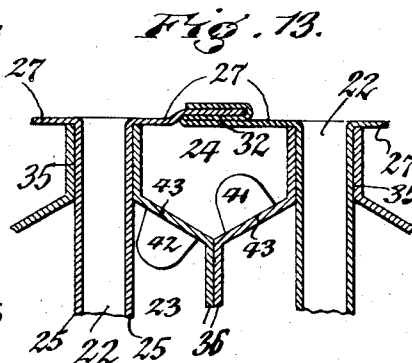
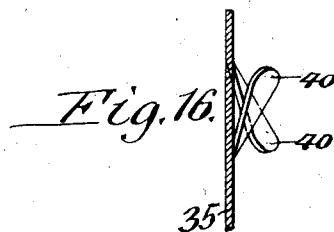
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RADIATOR

Filed Feb. 11, 1925

4 Sheets-Sheet 4



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UNITED STATES PATENT OFFICE.

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RADIATOR.

Application filed February 11, 1925. Serial No. 8,556.

This invention relates to a radiator which is more particularly designed for cooling the water of a gas engine although the same may be used on a heat exchanging device in other installations.

The object of this invention is to produce a radiator for this purpose at low cost which is efficient in operation, strong and durable in construction and capable of being easily repaired and in which the spacing elements between the water tubes are constructed of strips of sheet metal which are corrugated to give the appearance of a honey-comb radiator and firmly connected with each other and with the water tubes so that the core is of maximum strength.

In the accompanying drawings:

Figure 1 is a front elevation, partly in section of a radiator embodying my improvements.

Figure 2 is a horizontal section of the same taken on line 2—2, Fig. 1.

Figures 3 and 4 are vertical longitudinal sections taken on the correspondingly numbered lines in Fig. 1.

Figure 5 is a fragmentary side view of a sheet of metal which has been bent and slitted to form two corrugated spacing strips adapted to be arranged on opposite sides of a water tube and form a unit therewith which contains a row of air passages.

Figure 6 is a vertical section taken on line 6—6, Fig. 5.

Figure 7 is a perspective view of one of the water tubes.

Figure 8 is a top plan view of the same.

Figure 9 is a side view of the blank from which the water tube is made.

Figure 10 is a fragmentary perspective view of a pair of integral sheet metal corrugated strips adapted to be folded around a water tube and form a row of air passages which is traversed by a water tube.

Figure 11 is a sectional fragmentary perspective view of the same showing the interior of one of the air passages.

Figure 12 is a sectional perspective view of a water tube showing the same enveloped by the two integral corrugated sheet metal spacing strips which form a unit therewith containing a row of air passages.

Figure 13 is a fragmentary vertical trans-

verse section, on an enlarged scale, of the upper ends of two adjacent water tubes and parts of the adjacent spacing strips.

Figure 14 is a horizontal section of the bent and slitted sheet of metal from which two integral corrugated spacing strips are formed, this section being taken on line 14—14 of Figure 5.

Figure 15 is a similar view but showing the sheet of metal doubled or folded so that the two integral corrugated strips face each other ready to receive a water tube between them.

Figure 16 is a fragmentary vertical section, on an enlarged scale taken on line 16—16, Fig. 12 and showing the form of the radiating wings or tongues on the inner summits of the corrugated spacing strips.

Similar characters of reference indicate like parts throughout the several views.

The numerals 20 and 21 represent the upper and lower water boxes or headers which may be connected with the supply and return pipes of the gas engine cooling system in any suitable and well known manner.

Between the headers is arranged the cooling core of the radiator which consists essentially of a plurality of upright water tubes 22 communicating at their upper ends with the bottom of the upper header and at their lower ends with the top of the lower header, and a plurality of horizontal air passages 23, 24 arranged between adjacent water tubes and extending from the front side to the rear side of the radiator.

Each of the water tubes is constructed of a single sheet of metal which is bent to form two upright flat parallel longitudinal walls 25, a rear turn 26 connecting the rear edges of said walls, two inwardly off-set flanges 19 arranged at the front edges of said walls and connected together by soldering or otherwise to form a water tight joint therebetween, and horizontal end flanges 27 arranged at the upper and lower ends of the walls and offset flanges and projecting laterally from opposite sides of the tube. This tube is made from a rectangular blank 28 of sheet metal, shown in Fig. 9, which is doubled midway of its width, and bent along the longitudinal lines 29 to form the offset

vertical flanges and along the transverse lines 30 to form the horizontal flanges and which is slitted at 31 between the inner ends of each pair of horizontal flanges to permit the metal to be separated at this point and bent in opposite directions.

A plurality of tubes of this character are arranged in a transverse row between the upper and lower headers and spaced suitable distances apart. The upper and lower flanges of each tube have their longitudinal edges connected with the corresponding edges of the upper and lower flanges of adjacent water tubes so as to form in effect a plate at the upper end of the tubes which is secured by soldering or otherwise to the upper header and closes the bottom thereof and a plate at the lower ends of the tubes which is secured by soldering or otherwise to the lower header so as to form the top thereof. The connection between the horizontal flanges of adjacent tubes is preferably effected by a seamed joint, as best shown at 32 in Fig. 13, supplemented by soldering if desired.

Along opposite outer sides of the walls of each water tube are arranged two spacing strips of sheet metal which are corrugated and form a unit with the respective tube. The two strips are formed of a single sheet of metal which is provided lengthwise and midway between its opposite longitudinal edges with a succession of short slits 33 which alternate with unslitted or hinge portions 34 along this line, as shown in Fig. 5. This sheet is bent so that the two sections on opposite sides of the slits 33 form two corrugated strips which are folded or doubled so that the same are arranged side by side and are connected at one pair of their corresponding longitudinal edges by the unslitted parts 34 which act as hinges while the opposite pair of their corresponding longitudinal edges are disconnected but oppose each other. When the metal sheet is thus folded each of its corrugated strips forms an inner set of corrugations and an outer set of corrugations and the summits 35 of the inner set of corrugations oppose each other so as to form a vertical row of said air passages 23 while the summits 36 of the outer set of corrugations engage with the corresponding summits of the outer corrugations of spacing strips associated with adjacent water tubes and form therewith vertical rows of said air passages 24.

The central or intermediate parts of the summits 35 of the inner set of corrugations are offset laterally, as shown at 37, so that such offsets on companion summits 35 together form a tubular seat while the end portions 38 of these summits next to the hinge connections 34 between the two spacing strips and the end portions 39 of these summits at the disconnected edges of these

strips are in line and oppose each other in rear and in front of the respective water tube.

One of these water tubes is seated at intervals throughout its length in the tubular seats between the opposing summits of the inner corrugations of the two strips arranged on opposite sides of this tube and the latter also traverses the air passages 23 formed between these strips so that the air in passing through said passages will come in direct contact with the portions of the tube exposed in said passages and carry away the heat which is transmitted to the same from the water passing through the tubes.

The disconnected front edges of the two spacing strips associated with each water tube are preferably connected by soldering with the outer sides of the longitudinal flanges of this tube, this being preferably effected at the same time that these flanges are soldered together by dipping the front side of the completely assembled core in a solder bath. Soldering together of the rear longitudinal edges of the companion spacing strips and connection between the rear edges of the latter and the rear edge of the tube is unnecessary inasmuch as the rear edges of these strips are integrally connected by the hinges 34 and the same are thereby secured to the adjacent part of the respective water tube, thereby effecting a considerable economy in labor and consumption of solder and reducing the cost of the radiator accordingly without impairing its strength or cooling efficiency.

The spacing strips by reason of their contact with the water tubes operate to carry away heat from the water passing through the tubes and dissipate it in the air which passes through the air passages. In order to increase the transmission of heat to the air in its passage through the core obstacles or baffles are formed on the various parts of the corrugations of the spacing strips which obstruct the free passage of the air and compel the latter to absorb or take up the maximum amount of heat and thus increase the capacity of the radiator. For this purpose radiating wings, tongues or baffles 18, 40, 41, 42 are struck out of the body of the sheet metal forming these strips so that the same project laterally from these strips into the path of the air as the same passes through the air passages and intercepts the air. As shown in the drawings the wings 18 are stamped out of the summits of the outer set of corrugations and project lengthwise into the air passages 23, the wings 40 are stamped out of the summits of the inner corrugations and project transversely into the air passages 24, and the wings 41, 42 on the slopes or webs 43 of the corrugations are stamped out of these slopes so that

some of these wings project laterally into the air passages 23 and some into the air passages 24. If desired the wings may be slightly twisted into propeller shape, as shown with reference to the wings 40 in Fig. 16 for the purpose of causing the same to further churn or deflect the air as it passes through the core and thereby insure its taking up the maximum amount of heat from the water before it escapes from the rear side of the core. For the purpose of holding the several water tubes and spacing strips in position relative to each other at the rear of the core and increasing the strength of the same so that it is capable of sustaining the shock and strain to which it is subjected while in use, means are provided for connecting the opposing spacing strips of adjacent water tubes. This is preferably accomplished by providing the rear parts of the summits of the outer corrugations with lips, wings or tongues 44, 45, which preferably incline in opposite directions, the lips 44 in this instance inclining forwardly and the lips 45 backwardly, and the lip 44 on the spacing strip associated with one water tube interlocking by a wedging engagement with the lip 45 on the spacing strip of an adjacent water tube, as shown in Fig. 2. By this means the rear parts of the spacing strips on adjacent tubes are firmly drawn against each other and secured together mechanically without the use of solder. These interlocking lips or wings further add to the baffling effect on the air to induce the latter to absorb the greatest amount of heat contained in the water. These improvements result in the production of a radiator core at comparatively low cost which is strong and durable and has the maximum radiating capacity for the amount of metal used.

In stamping the spacing strips from a single sheet of metal to form the corrugations and locking lips 44, 45 thereon, these lips project in the same direction while the spacing strips are still arranged edge to edge, as shown in Figs. 5 and 14, but when this sheet is folded so that the spacing strips are arranged side by side, as shown in Fig. 15, then each locking lip on one spacing strip projects rearwardly and each locking lip on the companion spacing strip projects forwardly. By this means each pair of spacing strips is provided with right and left locking lips which can be readily interlocked by a wedging engagement with corresponding locking lips of adjacent radiator core units.

Furthermore by this construction of radiator core units it is possible in case of a damaged radiator to take out any unit from the core and repair or replace the same by a new unit without disturbing the remaining units or dismantling the radiator for this purpose.

In the drawings the air tubes are represented of hexagonal form in cross section but the same obviously may be of other forms in cross section without effecting the present improvements.

I claim as my invention:—

1. A radiator comprising a plurality of water tubes and a plurality of air passages arranged between adjacent water tubes, each of said water tubes having opposite sheet metal walls, and two spacing strips of corrugated sheet metal arranged on opposite sides of each water tube and having the intermediate parts of one set of alternate corrugations engaging with the outer sides of said walls and the opposite end portions thereof opposing each other, said corrugations thus forming a plurality of air passages which are traversed by the respective water tube, and the other set of alternate corrugations engaging the corresponding corrugations associated with an adjacent tube and forming therewith a row of air passages which are not traversed by a water tube, each of said spacing strips having laterally projecting wings which interlock with the corresponding wings of the spacing strips of adjacent water tubes.

2. A radiator comprising a plurality of water tubes and a plurality of air passages arranged between adjacent water tubes, each of said water tubes having opposite sheet metal walls, and two spacing strips of corrugated sheet metal arranged on opposite sides of each water tube and having the intermediate parts of one set of alternate corrugations engaging with the outer sides of said walls and the opposite end portions thereof opposing each other, said corrugations thus forming a plurality of air passages which are traversed by the respective water tube, and the other set of alternate corrugations engaging the corresponding corrugations associated with an adjacent tube and forming therewith a row of air passages which are not traversed by a water tube, each of said spacing strips having laterally projecting inclined wings which are struck out of the same and the wings on the strips of adjacent tubes being inclined in opposite directions and interlocking with each other.

3. A radiator comprising a plurality of water tubes and a plurality of air passages arranged between adjacent water tubes, each of said water tubes having opposite sheet metal walls, and two spacing strips of corrugated sheet metal arranged on opposite sides of each water tube and having the intermediate parts of one set of alternate corrugations engaging with the outer sides of said walls and the opposite end portions thereof opposing each other, said corrugations thus forming a plurality of air passages which are traversed by the respective

water tube, and the other set of alternate corrugations engaging the corresponding corrugations associated with an adjacent tube and forming therewith a row of air passages which are not traversed by a water tube, the spacing strips on opposite sides of each water tube having laterally projecting wings, the wings on one side being inclined in one direction and the wings on the other side in the opposite direction, and the wings of each strip of one water tube interlocking with an oppositely inclined wing on a spacing strip of an adjacent water tube. 10

In testimony whereof I affix my signature.

JOHN M. FEDDERS.