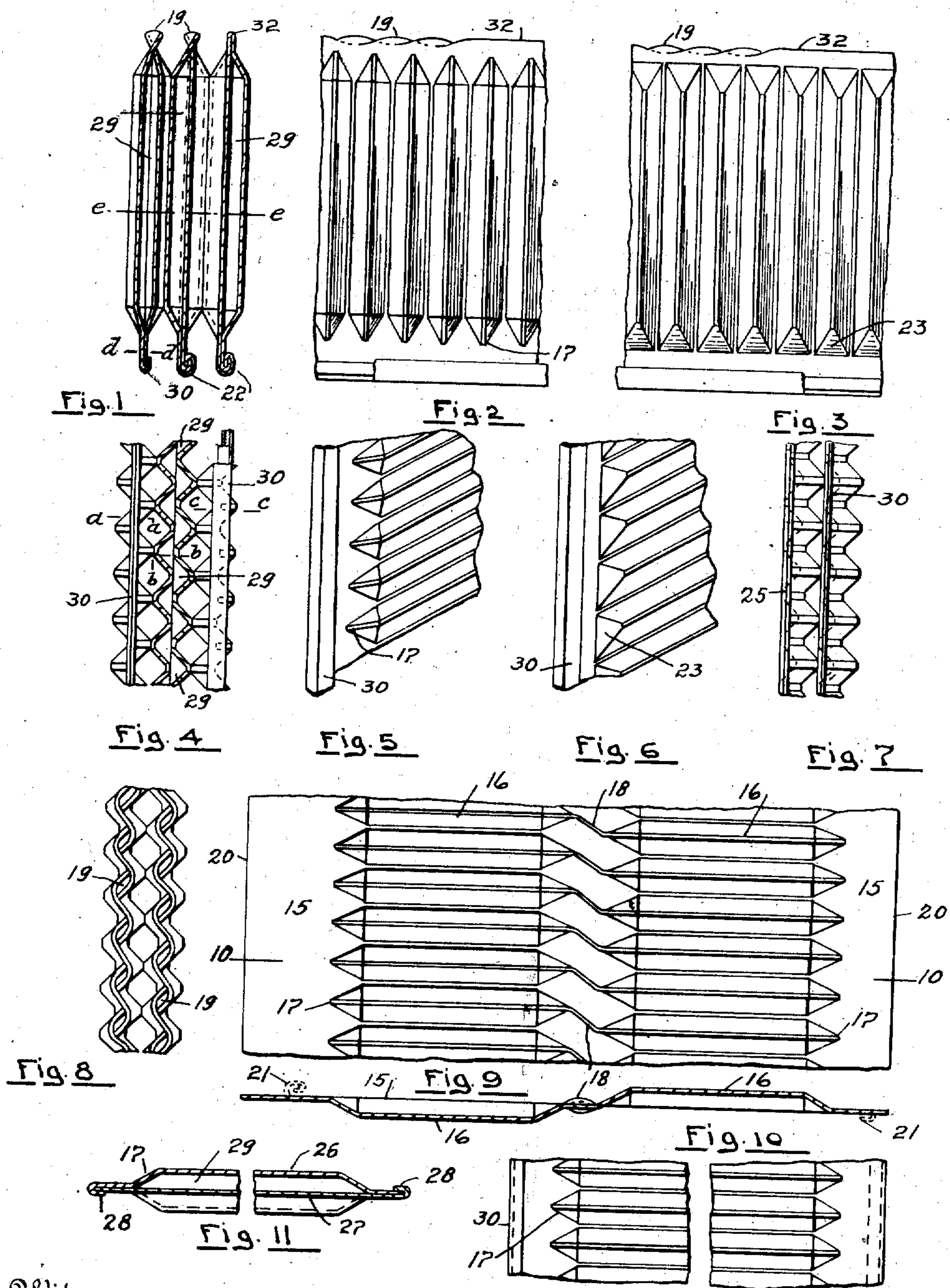


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 AUTOMOBILE RADIATOR COOLING TUBE.
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AUTOMOBILE-RADIATOR COOLING-TUBE.

989,756.

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To all whom it may concern:

Be it known that we, EMIL BEHRINGER and HERMAN BEHRINGER, citizens of the United States, and residents of the borough of Brooklyn, in the county of Kings and State of New York, have invented certain new and useful Improvements in Cooling-Tubes for Automobile-Radiators, of which the following is a full, clear, and exact description, such as will enable others skilled in the art to which our invention appertains to make and use the same, reference being had therein to the accompanying drawings, which illustrate the preferred form of our invention.

In the said drawings which hereby are made a part of this specification: Figure 1, is a sectional plan view of a group of three tubes embodying our invention, the section of the left hand tube being taken on the line *a—*a** of Fig. 4, the middle section on the line *b—*b** and the right hand tube section with line *c—*c** of the same figure. Fig. 2 is a side view showing a tube having central corrugations with pointed or approximately diamond shaped ends. Fig. 3 is a similar view of a modification in which the corrugations are provided with beveled or triangular shaped ends. Fig. 4 is a composite view wherein the left hand tube is a section taken on the line *d—*d** of Fig. 1, the middle tube is a section taken on the line *e—*e** of the same figure and the right hand tube is shown as a full front view of the corresponding tube of Fig. 1. Fig. 5 is a fragmentary perspective view of the form of tube shown in Fig. 2. Fig. 6 is a similar view of the modified form of tube shown in Fig. 3. Fig. 7 is a front view of a pair of tubes with the seam offset toward one side. Fig. 8 is a rear view of a pair of cooling tubes showing the twisted or chain like folds on the back where the metal is crimped to facilitate the folding operations. Fig. 9 is a top plan view of one form of blank or tube sheet. Fig. 10 is a longitudinal section taken on the line 10—10 of Fig. 9. Fig. 11 is a fragmentary sectional view of a modified form of tube composed of two pieces of material united by single seams at the front and back, and Fig. 12 is a fragmentary side view thereof.

Our invention relates specifically to certain novel features in the construction of

cooling tubes especially designed for automobile radiators.

In cooling apparatus of the class to which our invention particularly appertains, to secure the best practical results it is essential in the first place to utilize comparatively thin sheet metal in the construction of the tube or tubes so as to more efficiently provide for the rapid equalization of varying temperatures of the liquids, gases or vapors under treatment; secondly, it is necessary that the cooling tube or tubes shall have sufficient strength, stiffness and rigidity to resist the normal internal pressure to which they may be subjected; and also the external strains due primarily, to the shocks, jars and concussions inherent in a rapidly moving machine; thirdly, it is desirable that all joints be made absolutely tight, and finally, it is essentially necessary to provide for economy of manufacture.

Our invention is particularly designed to secure the advantageous results just recited and to these ends our invention consists, and its chief characteristics reside in making a cooling tube or tubes of that class defined above, out of comparatively thin sheet metal having two series of differently configured angular corrugations offset relatively to one another and adapted to be brought together in parallelism to form a tube or tubes. The edges of the metal sheet projecting beyond the corrugations are united to form a complete closure and tight joint for each tube. The internal flow of the fluid is intended to traverse the series of corrugations while the external flow of the cooling medium would be parallel thereto.

Our invention as set forth in the subjoined claims includes within its scope and purview the product or article of manufacture resulting from the practice of a certain method of manufacture, which is hereinafter fully disclosed, but claimed only in a separate patent application.

Our invention further includes the novel parts, and combination of novel parts hereinafter described and pointed out in the claims, concluding this specification.

Referring to the drawings, the numeral 15 denotes a sheet metal blank (see particularly Figs. 9 and 10), and 16 a plurality of angular corrugations, preferably terminat-

ing in sharp pointed or diamond shaped ends 17. As shown in Figs. 9 and 10, the sheet metal blank 15 is provided at a medium line between the longitudinal corrugations 16, with a series of diagonal deflections 18, the functions of which are to facilitate the easy folding of the sheet-metal blank so as to bring the corrugations 16 in parallelism and at the same time preclude the liability of weakening the metal when subjected to the bending strain. In Figs. 1, 2, 3 and 8 are indicated a series of angularly disposed crimps 19 which result from the diagonal deflections 18. When the corrugated sheet metal blank 15 is centrally bent and folded over, the said crimps or chain like folds 19 provide means for taking up the surplus metal in the folding operation. The free edges 20 of the blank 15 are brought together when the said blank is folded and these edges are interlocked as indicated by the dotted lines 21 of Fig. 9 or the full lines 22 of Fig. 1, to form a seam or joint of well known construction in the sheet metal workers' art and as an additional precaution to secure a tight seam the joined edges 20 may be suitably sweated or soldered together.

In the modification of our invention shown in Figs. 3 and 6, the ends 23 of the corrugations 16 are beveled or approximately of triangular shape. In the modification indicated in Fig. 7 the seam 25 is offset to one side but this is merely intended to illustrate another way of securing the best practical results. In the modification illustrated in Figs. 11 and 12 the cooling tube or tubes are made up of two pieces of metal 26 and 27, having corrugations which when the two pieces of metal are joined together by the front and back seams 28 form a continuous passage 29. In the preferred form of our invention the corrugations 16 are struck up from the single sheet metal blank 15. Then this corrugated sheet is folded over centrally and upon itself, and when the free edges 20 thereof are interlocked and suitably united to make a tight joint the corrugations 16 are brought into parallelism with each other to form a continuous passage as indicated at 29, Figs. 1, 4 and 11. It will be seen that the edges of the folded metal sheet will form an extended vertical stiffening and cutting flange 30 which has the natural tendency to promote a constant circulation of air through the straight horizontal open passages between the sides of the adjacent tubes without in any way diminishing the normal water circulating space formed by the sides of the tubes.

The crimps or chain folds 19 can be flattened out if so desired, as shown at 32, Figs. 1, 2 and 3.

It is obvious that a cooling tube or tubes constructed in accordance with our inven-

tion combine all the essential conditions for providing instantaneous equalization of temperatures, strength, stiffness and rigidity, capacity to resist internal pressure or external compression or tensional strains, tight joints, and economy and simplicity of manufacture.

Having described our invention, what we desire to secure by Letters Patent and claim is:—

1. A radiator cooling tube composed of angular corrugations disposed so as to form an internal circulatory passage transversely to said corrugations, the latter being arranged parallel to the external circulation around said tube and having a tight seamed stiffening flange perpendicularly normal thereto.

2. A radiator cooling tube composed of angular corrugations disposed so as to form a circulatory passage transversely to said corrugations, said tube being formed of a single sheet of metal folded over upon itself and having its free edges interlocked and soldered together.

3. A radiator cooling tube composed of oppositely disposed angular corrugations formed of a single sheet of metal, diagonal deflections extending across a median line through said sheet and between said corrugations and interlocking joints at the free ends of said metal sheet.

4. A radiator cooling tube composed of oppositely disposed angular corrugations formed of a single sheet of metal, crimps or chain folds between said corrugations at one end thereof, and interlocking joints at the other end of said corrugations.

5. A radiator cooling tube composed of oppositely disposed angular corrugations formed of a single sheet of metal, said corrugations terminating in bevel ends and means uniting the free ends of said metal sheet on a straight flanged edge.

6. A radiator cooling tube made of sheet metal having parallel corrugations on opposite sides forming together a circulatory passage transverse to said corrugations, the ends of the corrugations being pointed, stopping short of the ends of the tube, and offset with relation to one another on their respective sides.

7. A radiator cooling tube made from a single sheet of metal, comprising oppositely disposed corrugations affording between them a circulatory passage transverse to the same, a seam at one edge of the tube uniting the metal beyond its corrugations, and a crimped flattened out flange at the other edge of the tube.

8. A radiator cooling tube having corrugations arranged in parallel lines on opposite sides thereof and forming an open passageway transverse to the same, the said corrugations terminating short of one edge

of the tube, and a stiffening flange constituting the said edge, which is normally disposed to the longitudinal axes of the corrugations in a median plane passing therebetween.

5 9. A radiator cooling tube including corrugated sides, the corrugations in one side thereof having their innermost angles opposite the inner hollows of the corrugations
10 in the other side of the same, a transverse circuitous passageway between said corrugations being thereby formed, and a straight flange closing the tube beyond the corrugations at one edge, said flange being normal
15 to the ends of the corrugations and offset to one side, substantially as shown.

10. A radiator tube composed of separate sheets of metal similarly corrugated short of both ends, one sheet being superimposed

upon the other so that the corrugations will
be offset relatively to one another on opposite sides of the tube and a circuitous passageway will be formed transverse to the corrugations, one end of each sheet grasping
the opposite end of the companion sheet and
25 forming therewith a tight seam, at each edge of the tube, the arrangement being such that the tube is provided with stiffening flanges normal to the ends of the corrugations at both its edges. 30

Signed at the borough of Manhattan in the county of New York and State of New York this 11th day of April A. D. 1910.

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