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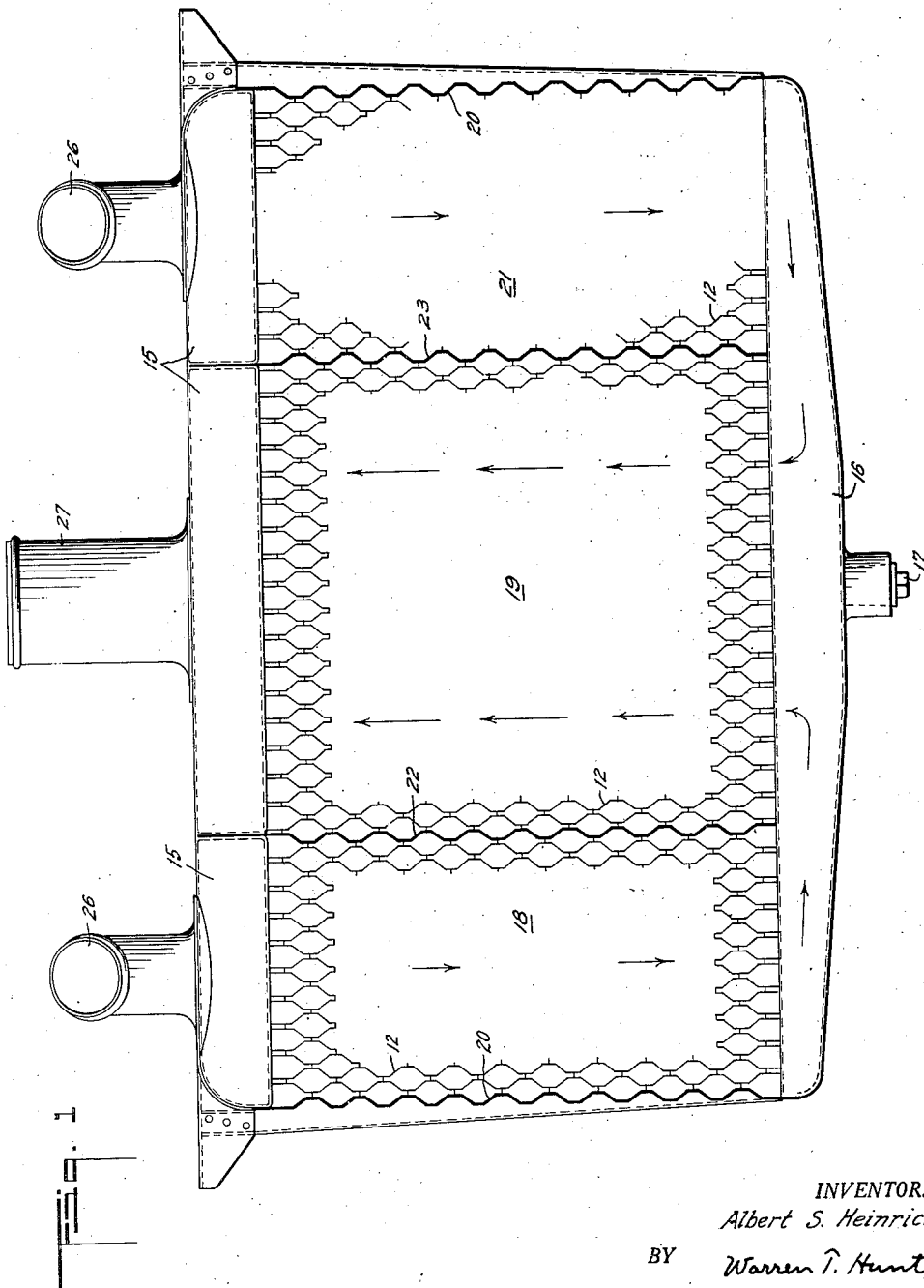
A. S. HEINRICH

1,993,095

RADIATOR

Filed April 19, 1932

2 Sheets-Sheet 1



INVENTOR.

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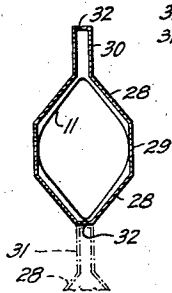
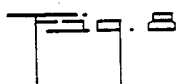
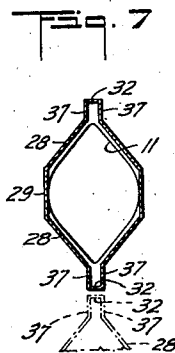
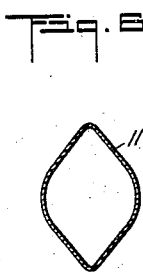
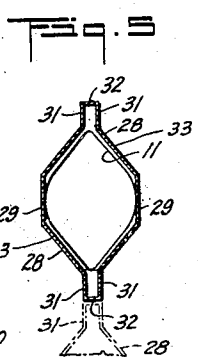
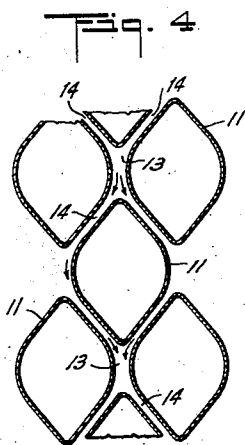
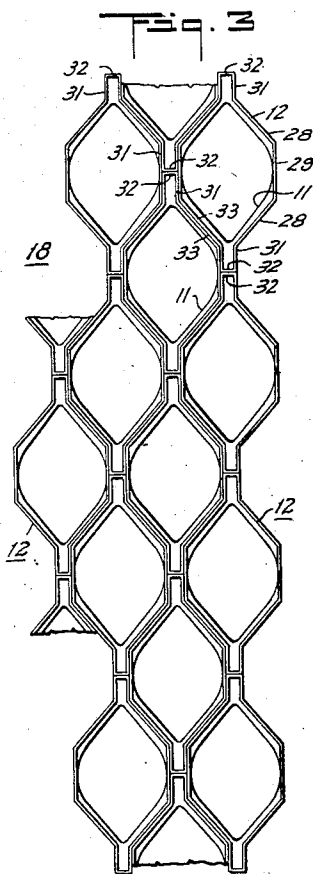
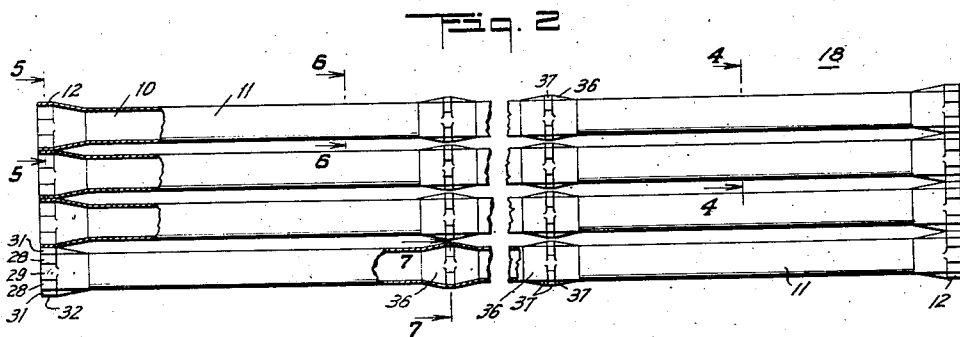
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UNITED STATES PATENT OFFICE

1,993,095

RADIATOR

Albert S. Heinrich, East Orange, N. J.

Application April 19, 1932, Serial No. 606,199

14 Claims. (Cl. 257—128)

This invention relates to radiators or heat exchangers, and particularly to radiators of the tubular type.

An object of the invention is to provide a radiator with passages for a circulating cooling medium in which the velocity of the medium is maintained substantially uniform throughout the radiator passages.

Another object of the invention is to provide a radiator in which a liquid is directed through a maze of passages, certain of which are of greater width or cross section than the others, the larger passages being adapted to receive the liquid from a plurality of smaller passages.

Another object of the invention is to provide a tubular radiator in which the tubes in their assembled relation provide passages of unequal cross section graduated in accordance with the quantity of liquid flowing therethrough.

Another object of the invention is to provide a radiator with a plurality of tube assemblies which are connected at their ends and separated intermediate their ends by baffles which direct the cooling fluid in a plurality of directions through the radiator.

Another object of the invention is to provide a radiator with the inlet and outlet connections on the same side of the radiator, the liquid being prevented from passing directly from the inlet to the outlet without passing through the cooling portion of the radiator.

A feature of the invention relates to the construction of the tubes, which are preferably expanded at their ends and so shaped as to be spaced apart in unequal distances measured on coordinate axes.

In a desirable embodiment of the invention, the tubes are elliptical or lozenge shape throughout their body portions and have expanded polygonal ends of symmetrical form but have sides of unequal length. The general shape of the preferred form of expanded end may be described as an irregular polygonal opening symmetrical about coordinate axes, the narrow portions acting as spacers to increase the distance between tubes in one direction. The expanded ends are also preferably characterized by having flared and unflared sides which, in the assembled relation, cooperate to produce the unequal spacing above described.

Other objects and features of the invention will be apparent from the following description, in connection with which a preferred embodiment of the invention has been illustrated in the accompanying drawings, in which:

Fig. 1 is a somewhat diagrammatic front elevation of a radiator constructed according to the invention;

Fig. 2 is a longitudinal view partly in section showing a group of assembled tubes;

Fig. 3 is an enlarged end view of a group of assembled tubes similar to that shown in Fig. 2;

Fig. 4 is an enlarged sectional view taken along the line 4—4 of Fig. 2;

Fig. 5 is an enlarged sectional view of one end of a single tube taken along the line 5—5 of Fig. 2;

Fig. 6 is a sectional view taken along the line 6—6 of Fig. 2;

Fig. 7 is a sectional view taken along the line 7—7 of Fig. 2 showing the relation of the spacers which act as stops to limit displacement of the tubes intermediate their ends; and,

Fig. 8 is a view of a slightly different form of the invention.

The radiator is preferably constructed of a number of individual tubes having elliptical or lozenge shaped body portions and irregular polygonal expanded ends, the tubes being assembled as shown in Figs. 1 and 3 and 4 whereby fluid passages are provided around the body portion of the tubes and which are interconnected at the top and bottom of the radiator assembly by tanks or conduits having their outer walls connected by plates. If desired, a removable clean-out plug may be provided in the bottom tank.

The radiator is preferably divided into a plurality of cooling assemblies, which are separated from each other by baffles which extend from the top of the upper tank down to the lower part of the tube assembly, care being taken to have the baffles spaced from the bottom wall of the lower tank, whereby the fluid may flow around the lower end of the baffle from one cooling assembly to the other. Inlet and outlet connections are secured to the upper tank, but it is realized that the location of the inlet and outlet connections may be placed upon the bottom tank, in which case the baffles will be reversed and will extend to the bottom of the lower tank and be cut off at the top portion of the cooling tube assembly.

In the form shown in Fig. 1, two inlet connections are provided through which the liquid flows downwardly in cooling assemblies and around the baffles to the lower tank and around the baffles and from thence upwardly to the center portion of the radiator, and from thence through outlet to the source of supply (not shown).

It is obvious that only two sections may be used, in which case only one inlet is needed, and the radiator may be equally divided as to downward and upward flow.

5 It may be noted by an inspection of Fig. 4 that the passages between the tubes are of X form and that passages 13 receive the flow from a pair of passages 14 and, therefore, the passage 13 should be substantially twice the capacity of pas-
10 sages 14 in order to provide a uniform flow throughout the radiator. This arrangement is obtained in the present and preferred construction by a novel form of expanded end 12 which has the general shape shown symmetrical about
15 coordinate axes or, in other words, has the form of an irregular polygon, certain sides of which form projections on opposite sides of the larger central portion. The construction of a preferred expanded end is clearly shown in Fig. 5, which
20 is in the form of a twelve sided polygon, the sides 28 of which are flared outwardly from the body portion 11 of the tube and adapted to contact similar flared sides of adjacent tubes. The sides
25 29 are unflared and normally in a plane tangent to the sides of the body portion 11. Sides 31 and 32 are formed and project outwardly from the body portion 11 to form spacing projections, and sides 31 are preferably one-half the length of sides
30 29 whereby, in the assembled relation, the spaces around the expanded ends are completely filled and the tubes may be secured in their assembled
35 relation by soldering or other suitable means. If desired, only a single projection may be used, as shown in Fig. 8, in which case the elongated sides 30 are made the same length as sides 29.

It will be noted in the radiator assembly as shown in Fig. 3 that the sides 28 have their flared portions 33 in contact with a corresponding flared
40 portion 33 of an adjacent tube and that the space between the unflared sides 29 is occupied by the projections formed by the unflared sides 31 and 32, and that, as sides 31 are one-half the length of sides 29, the sides 32 are in abutting relation
45 and the projections so space the tubes that the passages 12 are substantially twice the width of passages 13.

Enlargements or spacers 36 are preferably secured to tubes 10 at points intermediate their ends, which enlargements in the embodiment
50 shown are of substantially the same form as the expanded ends 12, but the sides 37 which form the projections are somewhat shorter than the sides 31, whereby the tubes are unsupported intermediate their ends for ordinary positions, but
55 the projections will act as a stop to prevent distortion of the tubes beyond a predetermined amount measured by the clearance between adjacent projections. If desired, the sides 37 may be of the same length as sides 31, in which case
60 the tubes will be supported intermediate their ends in the nominal assembled relation, but it is preferred to give a slight spacing, as indicated in Fig. 7, to permit a free circulation of fluid around the enlargements as well as the tubes and
65 to allow for expansion thereof.

While a preferred embodiment of the invention has been illustrated and described, it is understood that this showing and description are illustrative only and that this invention is not
70 regarded as limited to the form shown and described, or otherwise, except by the terms of the following claims.

What is claimed is:

75 1. A radiator comprising a plurality of elliptical tubes, the end portions of said tubes being

expanded and formed into a symmetrical irregular polygonal shape having two opposite parallel sides of the same width as the narrow diameter of the ellipse and provided with spacing projections, said tubes being sealed at their end portions to enclose a fluid space.

2. A radiator comprising a plurality of tubes having their body portions symmetrical in cross section about coordinate axes, said tubes having their ends expanded in a polygonal shape with certain of the sides being flared, and at least two sides being unflared, said flared sides of adjacent tubes being contiguous, said tube ends having means thereon for filling the space between the unflared sides of other adjacent tubes, and said tubes having their end portions sealed to enclose a fluid space.

3. A radiator comprising a plurality of tubes having their body portions symmetrical in cross section about coordinate axes, said tubes having their ends expanded in a polygonal shape with certain of the sides being flared, and at least two sides being unflared, said flared sides of adjacent tubes being contiguous, said tube ends having projections for filling the space between the unflared sides of adjacent tubes, and said tubes having their end portions sealed to enclose a fluid space.

4. A radiator comprising a plurality of substantially elliptical shaped tubes forming combined and divided liquid spaces therebetween, said tubes being arranged to have the combined space of substantially twice the width of the divided space, said tubes having expanded ends for permanently securing the tubes in position, said ends having flared sides, unflared sides and projections, said expanded ends cooperating to define the divided space, and said projections cooperating with the unflared sides of other tubes to define the combined space.

5. A radiator comprising a plurality of substantially elliptical shaped tubes forming combined and divided liquid spaces therebetween, said tubes being arranged to have the combined space of substantially twice the width of the divided space, said tubes having expanded ends for permanently securing the tubes in position, said ends having flared sides, unflared sides and projections, said flared ends cooperating to define the divided space, and said projections cooperating with the unflared sides to define the combined space, said expanded ends being in the shape of an irregular polygon symmetrical about coordinate axes.

6. A tube for a radiator having a central portion and an expanded end portion in the form of a polygon having flared and unflared sides, and a projection.

7. A radiator comprising an assembly of tubes, the end portions of each tube being expanded to an irregular polygonal shape, said tubes being arranged to space the body portions unequally about coordinate axes and to have their sides about the sides of adjacent tubes in sealing relation, and means for limiting movement of the tubes intermediate their ends.

8. A radiator comprising a plurality of tubes, said tubes having expanded ends in the form of an irregular polygon for providing a fluid space between the bodies of the tubes, said polygon having flared and unflared sides and spacing projections, the adjacent unflared sides of one pair of tubes being contiguous to the spacing projections of another pair of tubes.

9. A radiator comprising a plurality of tubes, 75

said tubes having expanded ends in the form of an irregular polygon for providing a fluid space between the bodies of the tubes, said polygon having flared and unflared sides and spacing projections, the adjacent unflared sides of one pair of tubes being contiguous to the projections of another pair of tubes, the projections of the second pair being one-half the length of the contiguous unflared sides of the first pair and filling the space therebetween.

10. A radiator comprising an assembly of tubes, the end portions of said tubes being expanded and formed into polysided figures comprising flaring and unflaring sides with the flaring sides of adjacent tubes abutting each other and means for spacing the unflaring sides of adjacent tubes from each other to cause the body portions of the tubes to be spaced unequally about co-ordinate axes.

11. A radiator comprising a nest of tubes, the end portions of said tubes being expanded to form an irregular polygon, said expanded portions including a projection for laterally spacing tubes adjacent thereto, and means for sealing the contiguous portions of the ends of adjacent tubes, whereby a liquid space is formed between the body portions thereof.

12. A radiator comprising a nest of tubes having expanded ends, the ordinates of the expanded end portions of said tubes, measured from a central horizontal axis, being greater than corresponding ordinates of the body portions thereof, said axis being equal for all portions of said tubes, and said expanded end portions being adapted to space tubes adjacent thereto, and means for sealing the contiguous sides of said end portions, whereby a fluid space is formed between the body portions of said tubes.

13. A radiator comprising a nest of tubes having expanded end portions, one of the coordinate axes of said end portions being equal to the corresponding axis of the body portions of said tubes, said expanded portions being adapted to space tubes adjacent thereto with respect to said axes, and means for sealing the contiguous sides of said end portions, whereby a fluid space is formed between said body portions.

14. In a radiator of the character set forth in claim 10 wherein each tube carries means projecting between two adjacent tubes for the purpose set forth.

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