

J. M. FEDDERS.

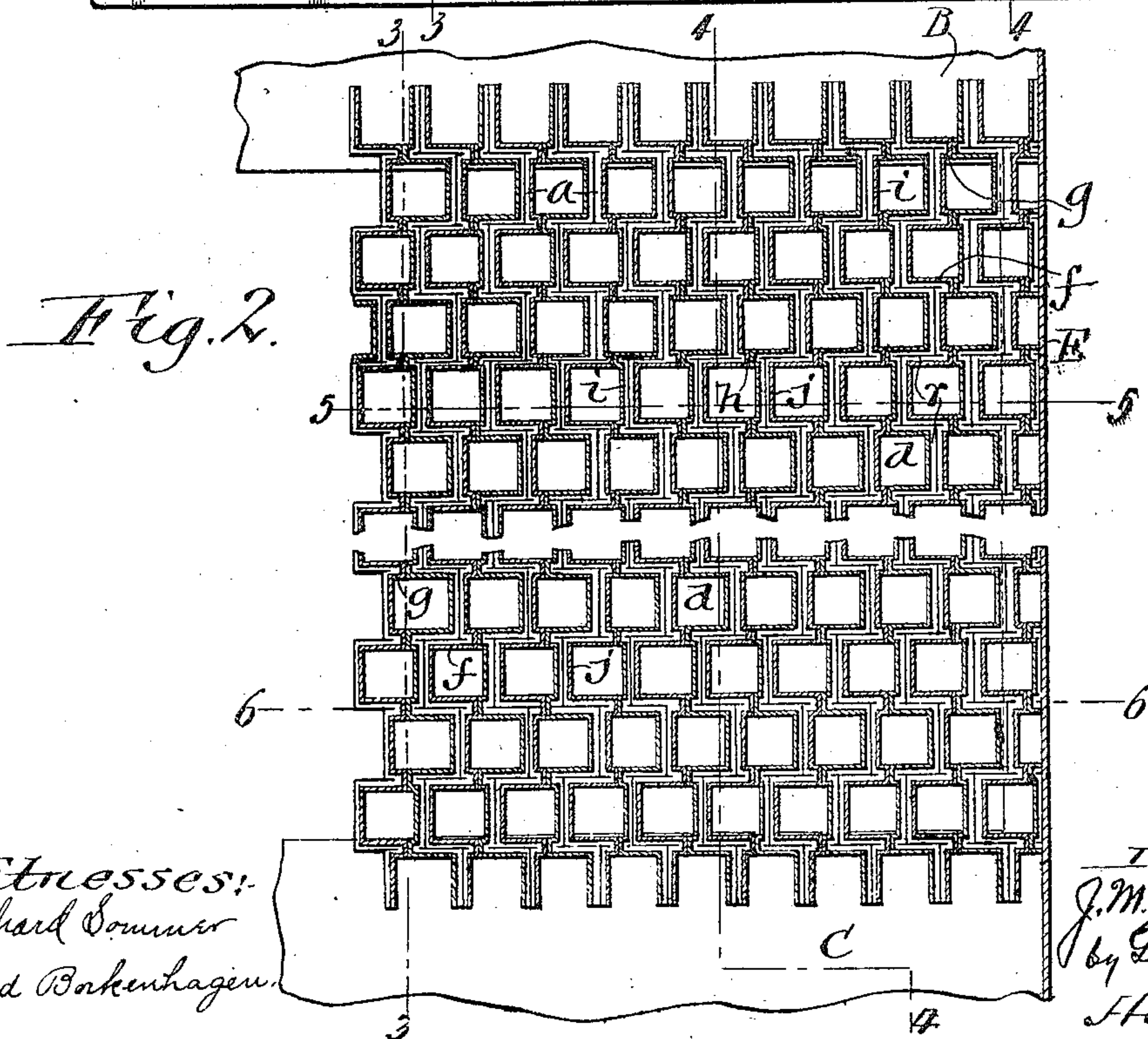
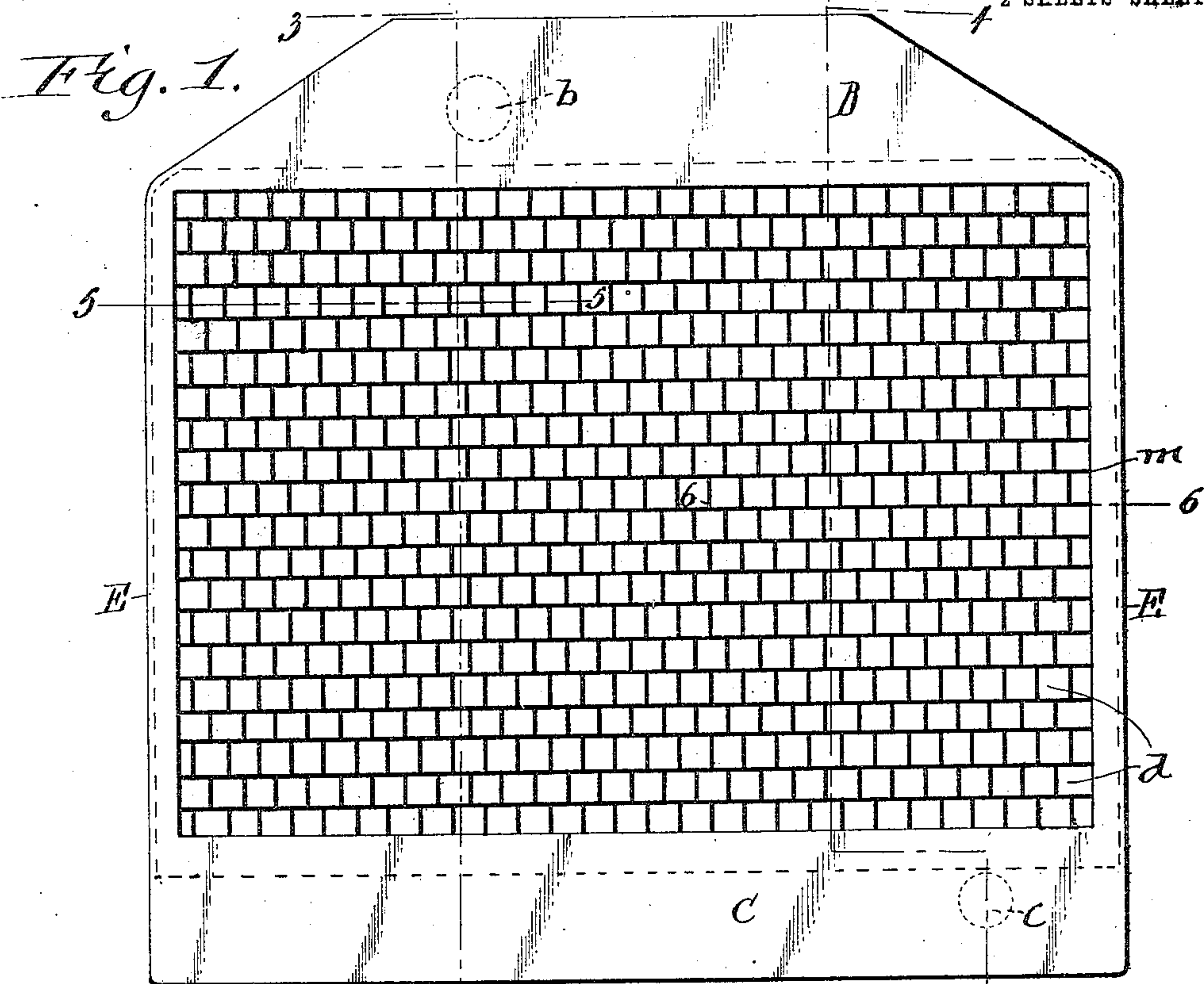
RADIATOR.

APPLICATION FILED DEC. 29, 1910.

993,354.

Patented May 30, 1911.

2 SHEETS-SHEET 1.



Witnesses:  
Richard Sommer  
Alfred Borkenhagen.

Inventor  
J. M. Fedders  
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Attorneys



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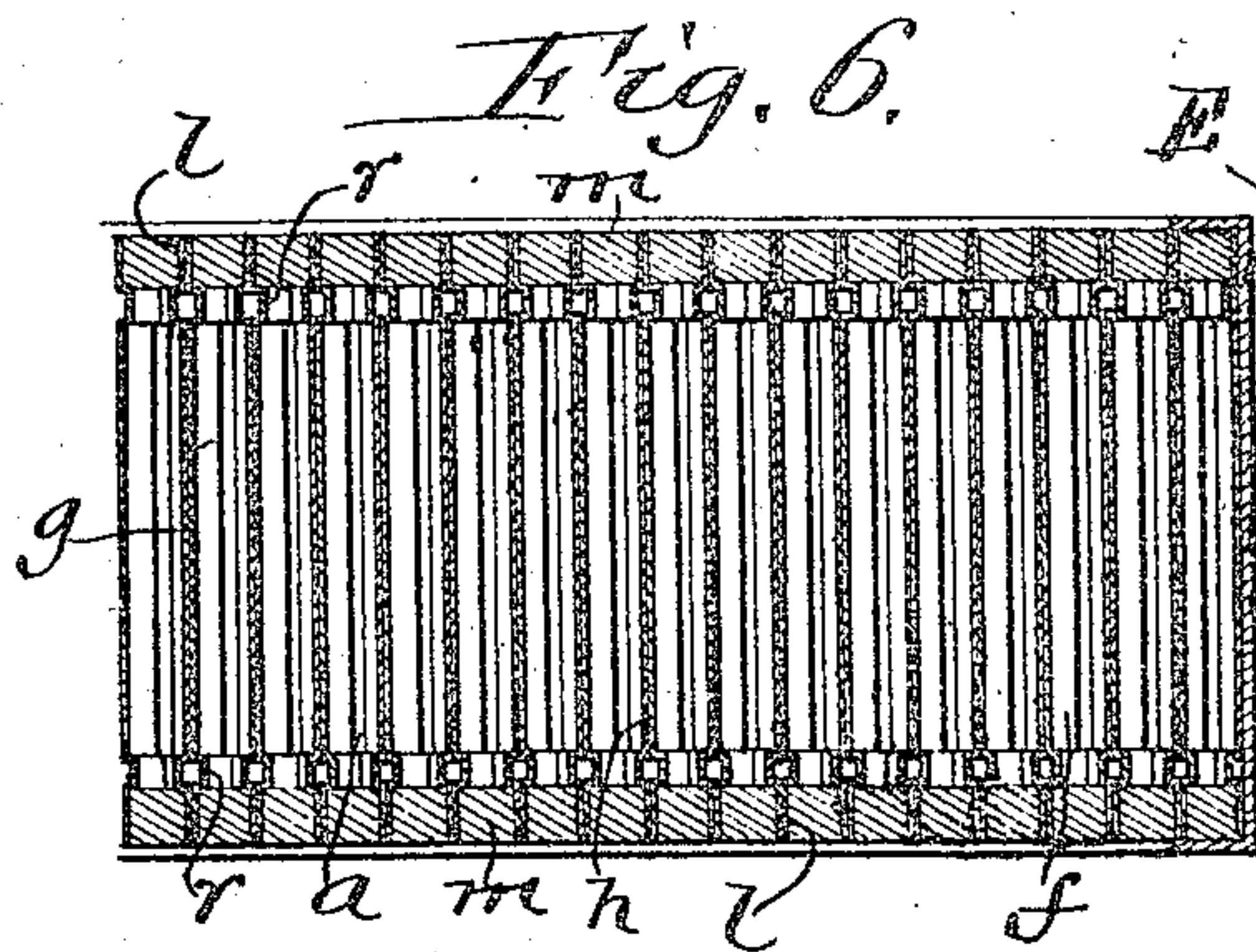
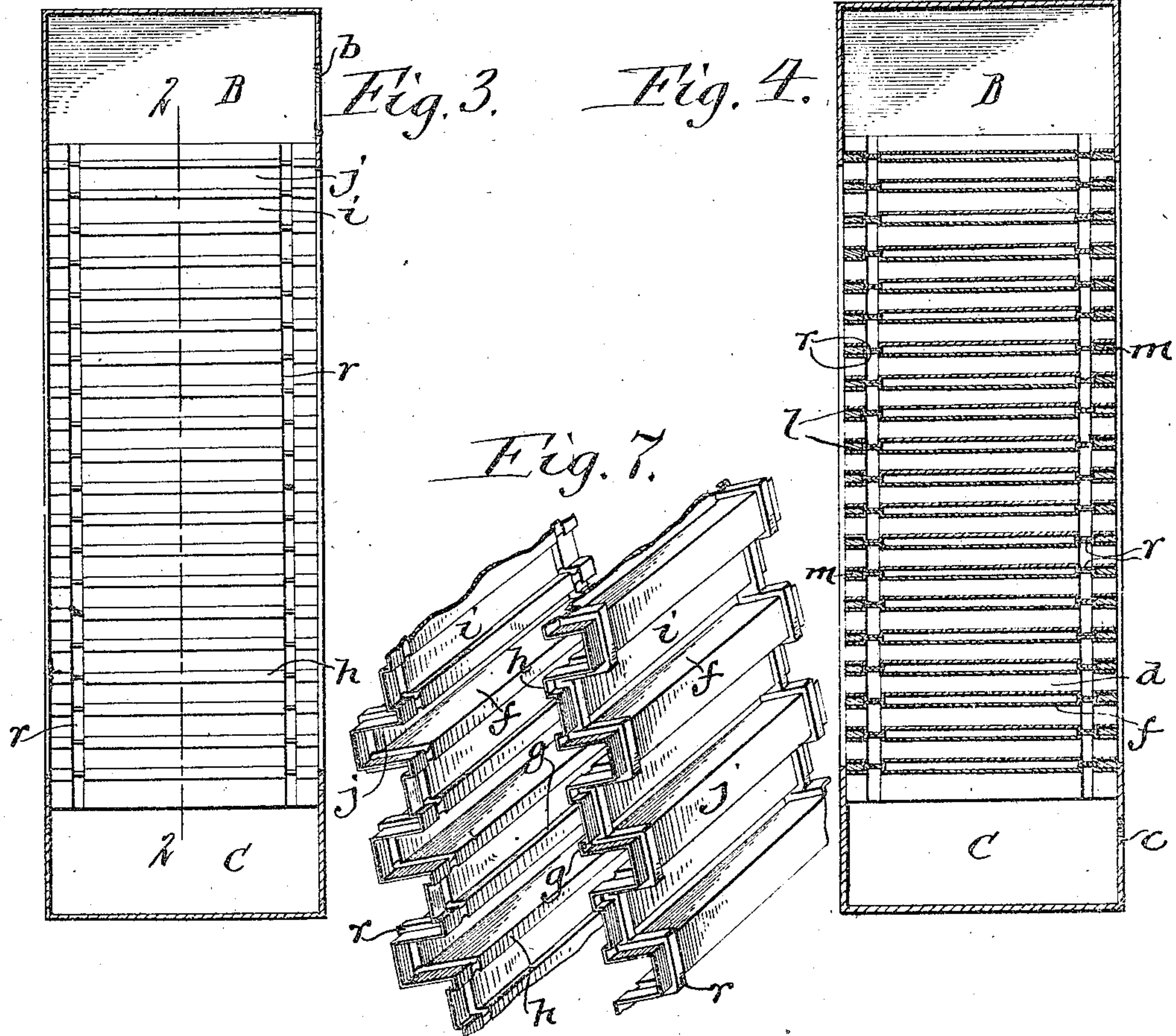
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2 SHEETS—SHEET 2.



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# UNITED STATES PATENT OFFICE.

JOHN M. FEDDERS, OF BUFFALO, NEW YORK, ASSIGNOR TO THEODORE C. FEDDERS,  
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## RADIATOR.

993,354.

Specification of Letters Patent.

Patented May 30, 1911.

Application filed December 29, 1910. Serial No. 599,860.

*To all whom it may concern:*

Be it known that I, JOHN M. FEDDERS, a citizen of the United States, residing at Buffalo, in the county of Erie and State of New York, have invented new and useful Improvements in Radiators, of which the following is a specification.

This invention relates more particularly to a radiator which is designed to cool the water which is used in the cooling system of gasoline engines or the like for automobiles.

One of the objects of this invention is to produce a radiator of this character which has a maximum cooling efficiency and which can be produced at comparatively low cost.

Another object of this invention is the production of a radiator of this character which will present comparatively heavy dividing walls between the several cells or conduits for the air at the ends thereof and still permit of employing comparatively thin metal in the body of the cells so as to obtain the highest cooling efficiency of the radiator.

In the accompanying drawings consisting of 2 sheets: Figure 1 is a front elevation of my improved radiator. Fig. 2 is a fragmentary vertical transverse section thereof, on an enlarged scale, taken in line 2—2, Fig. 3. Figs. 3 and 4 are vertical longitudinal sections, taken in the correspondingly numbered lines in Figs. 1 and 2. Figs. 5 and 6 are fragmentary horizontal sections taken in the correspondingly numbered lines in Figs. 1 and 2. Fig. 7 is a fragmentary perspective view showing two corrugated strips, plates or sections preparatory to assembling the same for producing a vertical row or set of tubes.

Similar letters of reference indicate corresponding parts throughout the several views.

This radiator comprises generally a heat exchanging field containing a plurality of upright tortuous water channels, conduits or spaces *a* which connect at their upper ends with a water inlet manifold or header B, and at their lower end is a water outlet manifold or header C, a plurality of horizontal air tubes *d* arranged between the water channels and extending from the front to the rear side of the radiator, and two upright side walls E arranged on opposite sides of the mass of tubes and connecting the upper and lower headers.

The upper or inlet header is provided on its rear side or wall with the usual inlet opening *b* connected with one side of the cooling system of the engine and the rear wall of the lower header is provided with an outlet opening *c* which is adapted to be connected in any suitable way to the other side of said cooling system.

The air tubes are arranged in vertical rows, the several tubes in each row being staggered laterally, preferably half way with reference to the adjacent rows of tubes so that the several tubes of the radiator present an appearance at the front and rear of the radiator resembling that of radiators in which the cooling field is produced by assembling a plurality of individual square tubes which are staggered with reference to each other and produce between them tortuous or zigzag water channels the turns of which are at right angles.

In the present radiator a plurality of pairs of upright strips, sheets or plates of thin metal are so corrugated that by assembling a complementary pair of such strips in register with each other an upright tier or row of horizontal air tubes will be produced which are staggered with reference to each other. Each of the sheet metal plates or strips of each pair is so corrugated as to form a plurality of pairs of wide horizontal walls *f*, a plurality of narrow horizontal walls *g*, the pairs of wide walls alternating with the pairs of narrow walls and one of the edges of the several horizontal walls being vertically in line while the other longitudinal edges of the several narrow walls are arranged on a vertical line between the longitudinal edges of the wide walls, a plurality of short vertical webs *h* which are arranged vertically in line and each of which connects the corresponding longitudinal edge of one of the wide walls and the companion longitudinal edge of the adjacent narrow wall which is vertically in line therewith, a plurality of upright walls *i* which are arranged in line vertically and each of which connects those longitudinal edges of a pair of narrow horizontal walls opposite to the webs and a plurality of vertical walls *j* which are arranged in line vertically and alternate with the vertical walls *i* and each of which connects those longitudinal edges of a companion



ion pair of wide horizontal walls opposite to said webs. Each of the narrow horizontal walls  $g$  is separated from the adjacent wide horizontal wall by an intervening space  
 5 equal to the length of the companion web and the several corrugated strips or plates are so assembled that the webs thereof engage with each other and each narrow horizontal wall of one strip is in line horizon-  
 10 tally with one of the wide horizontal walls of the other strip. It follows from this that a tortuous passage or channel is formed between adjacent rows or tiers of tubes  
 15 through which the water passes in serpentine fashion from the upper header to the lower header, thereby subjecting the same to the cooling effect of the air passing horizontally through the tubes.

In order to close the water channels at  
 20 opposite ends of the tubes each metal strip is provided on its outer side with an outwardly bulging bead  $r$  which extends from the upper to the lower end of the strip and follows the contour thereof in a direction at  
 25 right angles to the corrugations. The beads of the strips of adjacent rows of tubes abut against each other and are connected by solder or otherwise to seal the joint between the same and prevent leakage. The beads  
 30 of the tube sheets or strips are preferably arranged a short distance inwardly or back from the vertical edges of the tube strips, so that upon assembling the several rows of tubes tortuous outwardly opening grooves  
 35  $l$  are formed between adjacent rows of tubes. Into these grooves is placed a filling  $m$  consisting preferably of solder which may be placed in the grooves in any suitable way but preferably by dipping the ends of the  
 40 tube strips in molten solder. By this means the several rows of tubes are not only reliably connected and leakage prevented but a wide line or heavy division between the several tubes is produced which is very much  
 45 sought after for the purpose of giving the radiator a very substantial and heavy appearance notwithstanding that the same is comparatively light, has a large cooling capacity and can be produced at low cost compared with a radiator built up of individual  
 50 tubes.

I claim as my invention:

1. A radiator comprising a plurality of upright rows of horizontal tubes which are  
 55 separated to form tortuous upright channels between the rows of tubes, each row of tubes being staggered and constructed of two sheet metal strips each of which is corrugated to form alternating pairs of narrow horizontal  
 60 walls and wide horizontal walls, said horizontal walls being vertically in line at one of their corresponding edges, upright webs each connecting the longitudinal edge of one narrow horizontal wall and the correspond-  
 65 ing longitudinal edge which is vertically in

line therewith of an adjacent wide horizontal wall, a plurality of upright walls arranged vertically in line and each connecting a pair of narrow horizontal walls at their corresponding longitudinal edges opposite  
 70 said web, and a plurality of upright walls arranged vertically in line and each connecting a pair of wide horizontal walls at their corresponding longitudinal edges opposite  
 75 said web, the companion strips of a row of tubes having their webs engaging with each other and the narrow horizontal walls of each strip being in line with the wide horizontal walls of the other strip.

2. A radiator comprising a plurality of  
 80 upright rows of horizontal tubes which are separated to form tortuous upright channels between the rows of tubes, each row of tubes being staggered and constructed of two sheet metal strips each of which is cor-  
 85 rugated to form alternating pairs of narrow horizontal walls and wide horizontal walls, said horizontal walls being vertically in line at one of their corresponding edges, upright webs each connecting the longitudinal edge  
 90 of one narrow horizontal wall and the corresponding longitudinal edge which is vertically in line therewith of an adjacent wide horizontal wall, a plurality of upright walls arranged vertically in line and each con-  
 95 necting a pair of narrow horizontal walls at their corresponding longitudinal edges opposite said web, a plurality of upright walls arranged vertically in line and each connecting a pair of wide horizontal walls at  
 100 their corresponding longitudinal edges opposite said web, the companion strips of a row of tubes having their webs engaging with each other and the narrow horizontal walls of each strip being in line with the  
 105 wide horizontal walls of the other strip, and beads arranged on the outer sides of said strips and engaging with each other.

3. A radiator comprising a plurality of  
 110 upright rows of horizontal tubes which are separated to form tortuous upright channels between the rows of tubes, each row of tubes being staggered and constructed of two sheet metal strips each of which is corrugated to  
 115 form alternating pairs of narrow horizontal walls and wide horizontal walls, said horizontal walls being vertically in line at one of their corresponding edges, upright webs each connecting the longitudinal edge of one narrow horizontal wall and the correspond-  
 120 ing longitudinal edge which is vertically in line therewith of an adjacent wide horizontal wall, a plurality of upright walls arranged vertically in line and each connecting a pair of narrow horizontal walls at  
 125 their corresponding longitudinal edges opposite said web, a plurality of upright walls arranged vertically in line and each connecting a pair of wide horizontal walls at  
 130 their corresponding longitudinal edges op-



posite said web, the companion strips of a  
row of tubes having their webs engaging  
with each other and the narrow horizontal  
walls of each strip being in line with the  
5 wide horizontal walls of the other strip and  
beads arranged on the outer sides of said  
strips near opposite ends thereof and the  
beads of adjacent strips engaging with each

other forming tortuous grooves, and a filling  
arranged in said grooves.

Witness my hand this 23rd day of Decem-  
ber, 1910.

JOHN M. FEDDERS.

Witnesses:

THEO. L. POPP,  
ANNA HEIGIS.