J. M. FEDDERS.

RADIATOR.

APPLICATION FILED SEPT. 29, 1919.

1,368,220. **Patented Feb. 8, 1921.**

2 SHEETS—SHEET 1.

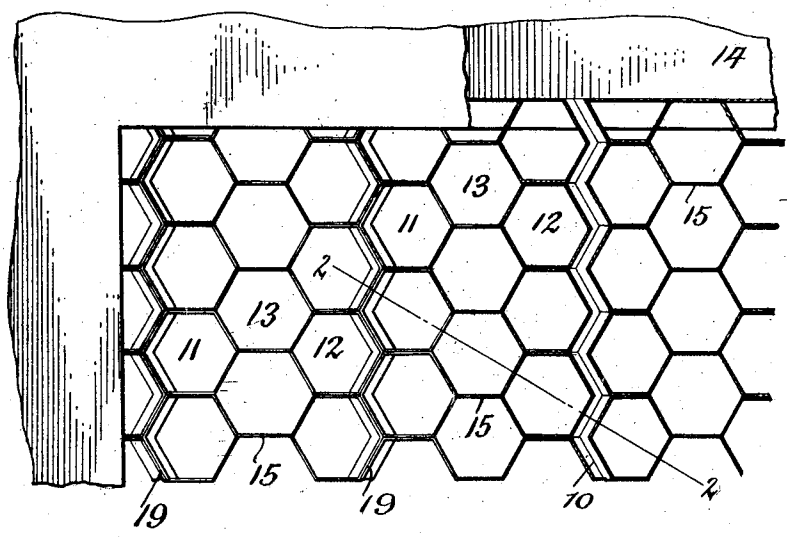


Fig. 1.

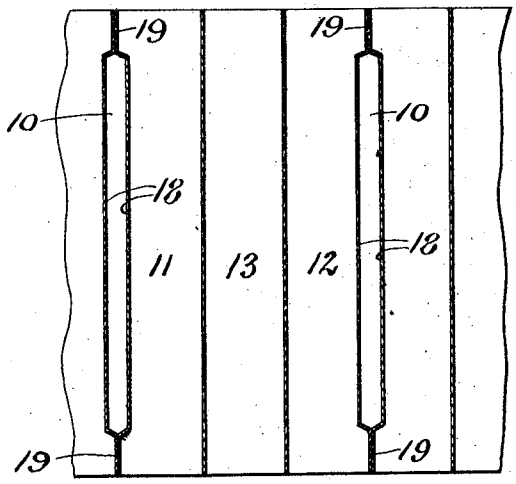


Fig. 2.

Fig. 4.

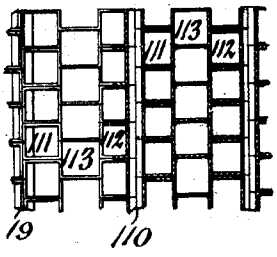
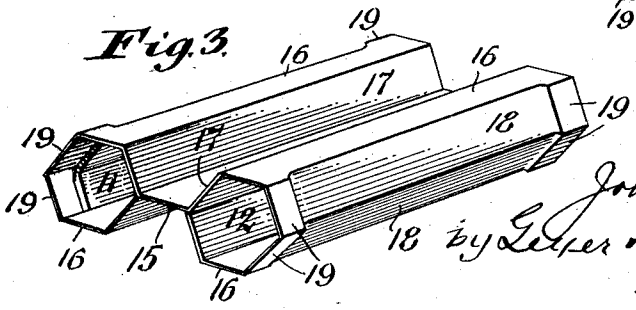


Fig. 3.



Inventor
John M. Fedders
by Geiger & Popple
Attorneys

J. M. FEDDERS.

RADIATOR.

APPLICATION FILED SEPT. 29, 1919.

1,368,220. **Patented Feb. 8, 1921.**

2 SHEETS—SHEET 2.

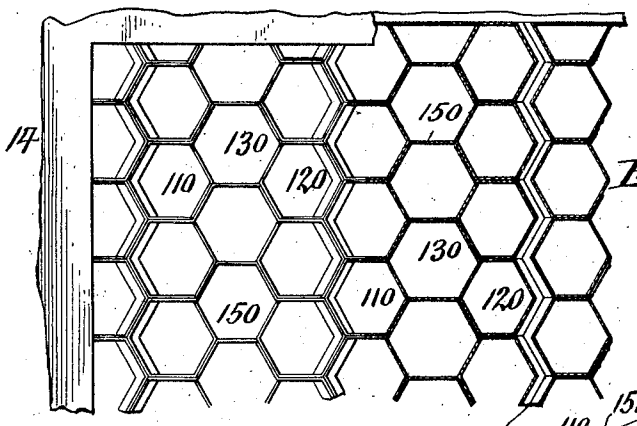


Fig. 5.

Fig. 6.

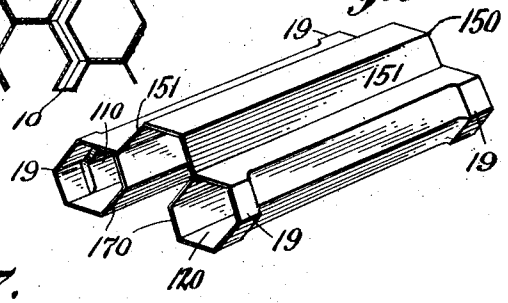


Fig. 7.

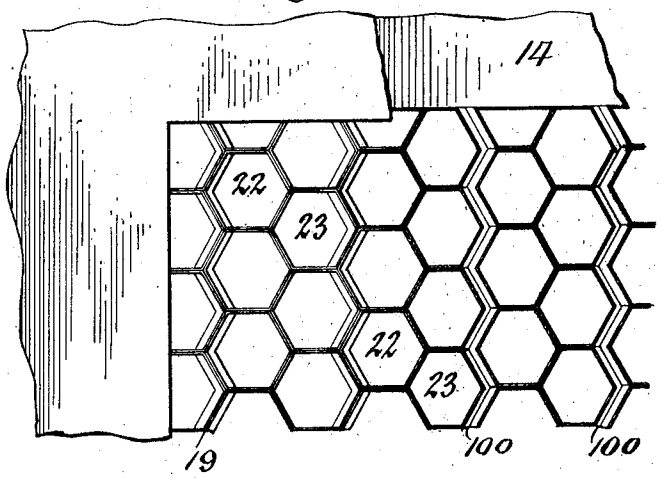
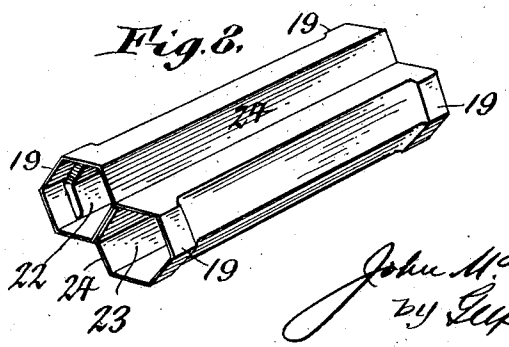


Fig. 8.



Inventor

John M. Fedders

by Geyer & Popp

Attorneys

UNITED STATES PATENT OFFICE.

JOHN M. FEDDERS, OF BUFFALO, NEW YORK, ASSIGNOR TO FEDDERS MANUFACTURING COMPANY, INC., OF BUFFALO, NEW YORK, A CORPORATION OF NEW YORK.

RADIATOR.

1,368,220. Specification of Letters Patent. Patented Feb. 8, 1921.

Application filed September 29, 1919. Serial No. 327,026.

To all whom it may concern:

Be it known that I, JOHN M. FEDDERS, a citizen of the United States, residing in 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 to a radiator which is more particularly designed for cooling the water of explosion engines and it has for its objects the production of a radiator of this character whereby the maximum strength, durability and efficiency is obtained with a minimum use of metal and little liability of leakage while preserving the artistic appearance of tubular or honeycomb radiators now in common use.

In the accompanying drawings:

Figure 1 is a fragmentary sectional front elevation of a radiator embodying one form of my invention. Fig. 2 is a section of the same taken on line 2—2, Fig. 1. Fig. 3 is a perspective view of one of the units which enter into the composition of the radiator shown in Figs. 1 and 2. Fig. 4 is a fragmentary sectional elevation of another form of radiator constructed in accordance with my invention. Fig. 5 is a fragmentary sectional front elevation showing another modified form of radiator containing my improvements. Fig. 6 is a perspective view of one of the units shown in Fig. 5. Fig. 7 is a fragmentary sectional front elevation of still another variation of my invention. Fig. 8 is a perspective view of one of the units employed in Fig. 7.

Similar characters of reference refer to like parts throughout the several views.

In its general organization the radiator shown in Figs. 1, 2 and 3 comprises a plurality of upright water passages 10 and a plurality of horizontal air tubes 11, 12, 13 said passages communicating at their corresponding ends with a water box or head of which one is shown for example at 14 in Fig. 1, while the air tubes open at their opposite ends to the external atmosphere to permit the passage of air through the same for cooling the water in the water tubes. The core or heat exchanging section of the radiator comprises a plurality of units each of which is constructed from a single strip of sheet metal so as to form two integral air tubes 11 and 12 and a straight web 15 arranged between the tubes 11, 12 and formed integrally therewith. The air tubes of the units shown in Figs. 1 and 3 are hexagonal in cross section and the web 15 connects the opposing salients midway between opposite sides of the companion air tubes. In assembling a plurality of such units the top and bottom facets of the several air tubes 11 engage with each other and form one row or tier of integral air tubes, the top and bottom facets of the several air tubes 12 engage each other and form another row or tier of integral air tubes, and the webs 15 of the several units in coöperation with each other and with the adjacent facets of the tubes 11 and 12 form another row or tier of non-integral air tubes 13, each of these integral and non-integral air tubes being of hexagonal form in cross section. The top and bottom facets 16 of the integral air tubes of each unit are straight and flat throughout the length of the same, so that when these facets engage corresponding facets of adjacent units they may be reliably soldered together or otherwise connected to produce a water tight joint therebetween. The inner facets 17 of the integral air tubes and the webs 15 are also for convenience and economy made perfectly flat and straight throughout the length of the same but they may be otherwise formed if desired. The outer facets 18 of the integral air tubes are provided at their opposite ends with lateral off-sets 19 so that when these off-sets on the outer sides of one group of units engage corresponding off-sets on the outer sides of the integral air tubes of adjacent groups of units water passages 11 will be formed between the same which are of serpentine or zig-zag form. The coöperating surfaces of the off-sets of adjacent groups of units are united by solder to prevent leakage of water therefrom.

In this manner a cellular radiator core is produced in which a plurality of rows of air tubes are formed between every pair of water passages in a manner which requires a minimum of metal but insures a maximum radiating efficiency and preserves the desirable cellular appearance of the core.

As shown in Fig. 4, the air tubes 111, 112, 113 may be made square in cross section, and the water passages 110 straight, the construction being otherwise in all respects substantially like that shown in Figs. 1, 2 and 3.

Instead of extending the web between the

two integral air tubes of a unit directly across from one to the other, as shown in Figs. 1–4, the web 150, as shown in Figs. 5 and 6, may be constructed to form one-half of a non-integral air tube 130 which is hexagonal in cross section. A plurality of units of the character shown in Fig. 6 are assembled so that the convex side of the web 150 of one of such units engages with the inner facets 170 of the integral air tubes 110, 120 of a similar unit on that side thereof opposite to where the integral air tubes of the same are connected by the web 150, thereby producing a row of non-integral air tubes 130, and two rows of integral air tubes 110, 120 by superposing a plurality of units like that shown in Fig. 6. When assembled, the several units in each group may be connected with each other and with other groups of units to produce water tight joints between the same.

If desired the web between adjacent integral air tubes may be omitted, as shown in connection with the air tubes 22, 23 in Figs. 7 and 8. In this construction the two air tubes are formed integrally of a single strip of sheet metal, each tube being of hexagonal form in cross section and engaging one of its inner facets 24 with one of the inner facets 24 of the companion air tube, so that these tubes are staggered relatively to each other and permit of interlocking adjacent units against lateral displacement when assembled to form two rows of air passages between adjacent water passages 100, as shown in Fig. 7.

In the construction shown in Figs. 1–4 a double thickness of metal occurs only where the facets of adjacent units engage with each other to prevent leakage of water from the water passages into the air tubes, and the same is therefore most efficient in radiation and most economical in the use of metal.

In the construction shown in Figs. 5 and 6, a double thickness of metal occurs between adjacent inner facets 170 of the integral air tubes and the outer facets 151 of the non-integral air tubes which facets however, need not be united to prevent leakage, and in the construction shown in Figs. 7 and 8 the several units are separated from each other on four sides by walls having a double thickness of metal.

By means of this construction of the tubes the same may be made much smaller than usual and thus increase the cooling efficiency of the radiator without employing an undue amount of metal. Furthermore by making the tubes in this manner the strength of the radiator core as a whole is materially increased.

In each of the several constructions shown however, a considerable saving in cost of manufacture is effected by making a plurality of air tubes as a unit which can be assembled with other units to form a plurality of rows of air tubes.

I claim as my invention:

1. A radiator comprising a plurality of rows of parallel tubes composed of a plurality of units, each unit having two complete tubes arranged side by side but spaced apart and a web connecting said complete tubes and said complete tubes engaging other complete tubes to form rows and said webs forming with the adjacent walls of complete tubes additional rows of tubes.

2. A radiator comprising a plurality of rows of parallel tubes composed of a plurality of units, each unit having two integral tubes arranged side by side and a web connecting the opposing inner sides of said integral tubes, the integral tubes of each unit being arranged in different rows and the webs of the several units forming non-integral tubes with the adjacent parts of the walls of the several integral tubes.

3. A radiator comprising a plurality of units each of which consists of a pair of parallel integral tubes and a web connecting said tubes and formed integrally therewith, one integral tube of each unit being assembled with corresponding tubes in other units to form a row and the webs of several units together with parts of adjacent integral tubes forming a row of non-integral tubes which is arranged between two rows of integral tubes.

JOHN M. FEDDERS.