F. A. FELDKAMP.

PROCESS OF MAKING ONE PIECE RADIATOR SECTIONS.

APPLICATION FILED DEC. 5, 1910.

997,768.

Patented July 11, 1911.

2 SHEETS—SHEET 1.

Fig. 1

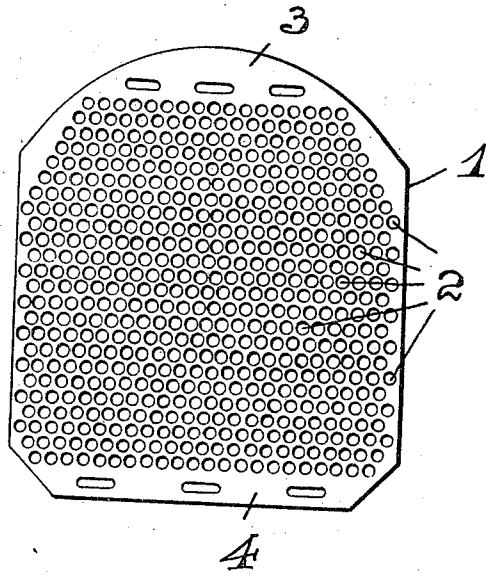
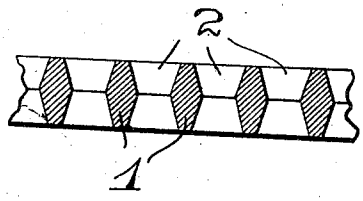


Fig. 2



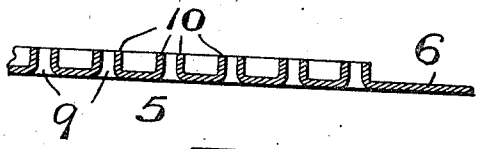


Fig. 4

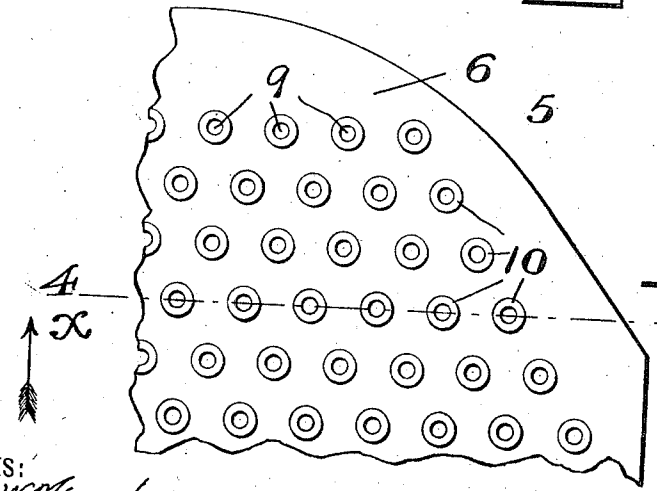


Fig. 3

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2 SHEETS—SHEET 2.

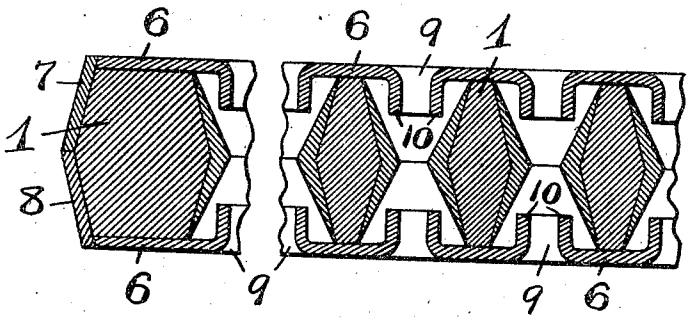

Fig. 5

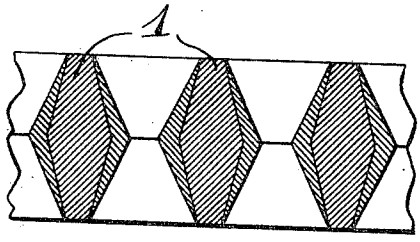

Fig. 6

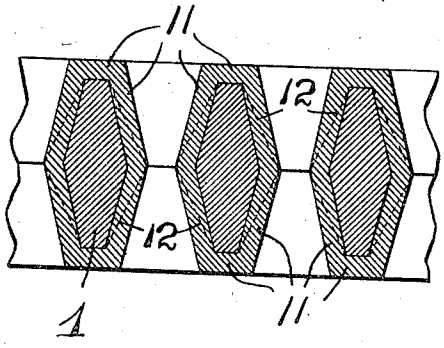

Fig. 7

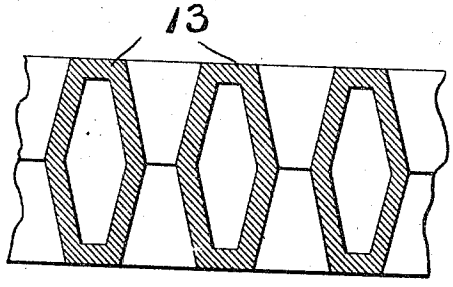

Fig. 8

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UNITED STATES PATENT OFFICE.

FREDERICK A. FELDKAMP, OF VAILSBURG, NEW JERSEY, ASSIGNOR TO ELECTROLYTIC PRODUCTS CO., A CORPORATION OF NEW JERSEY.

PROCESS OF MAKING ONE-PIECE RADIATOR-SECTIONS.

997,768. Specification of Letters Patent. Patented July 11, 1911.

Original application filed September 15, 1910, Serial No. 582,110. Divided and this application filed December 5, 1910. Serial No. 595,831.

To all whom it may concern:

Be it known that I, FREDERICK A. FELDKAMP, citizen of the United States, residing at Vailsburg, in the county of Essex and State of New Jersey, have invented certain new and useful Improvements in Processes of Making One-Piece Radiator-Sections; and I do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same, reference being had to the accompanying drawings, and to characters of reference marked thereon, which form a part of this specification.

The present invention relates, generally, to a novel process or method of producing radiator-sections for automobiles, each section being made by electro-deposition of metal and being formed in a single integral mass of metal in the form of a hollow honey-comb section.

This invention is a division of my former application for Letters-Patent, Serial Number 582,110, and filed in the United States Patent Office, September 15th, 1910.

The principal object of this invention is to provide a novel process or method whereby an automobile radiator-section in the form of a hollow honey-comb section or element may be made, the honey-comb subdivisions of which are very small and are closely spaced togther, so that a maximum of radiating surfaces is exposed to the cooling action of the air.

A further object of this invention is to provide a process of the character hereinafter set forth, in which there is secured by the use of the said process a radiator-section in the form of a finely sub-divided honey-comb section or element having all of its wall-portions of a uniform thickness.

With the objects of this invention in view, the said invention consists, primarily, in a process for producing a hollow honey-comb one-piece radiator-section, in which a core or pattern of a fusible metal is first provided with a multiplicity of small and closely located holes or openings, of any desirable configuration, then by electro-deposition depositing a metal first upon those surface-portions of the core or pattern forming said holes or openings directly within the interior of said holes or openings and outwardly toward the outer faces of the said core or pattern, and then removing the said core or pattern from within the said electrolytically deposited metal.

The said invention consists, furthermore, in adding to the steps of the process just set forth, after the said electrolytic deposition of metal from the interior of the holes or openings of the core or pattern toward the outer surfaces of the core or pattern, a further step of depositing by electro-deposition, metal upon the outer faces of the core or pattern, and inwardly into the said holes or openings and upon the previously deposited metal therein, and then removing the said core or pattern from within the said electrolytically deposited metal.

Other objects of this invention not at this time more particularly mentioned will be clearly understood from the following detailed description of the same.

The invention is clearly illustrated in the accompanying drawings, in which:—

Figure 1 is a front view of a fusible core or pattern employed in the process or method of making radiator-sections according to the principles of the present invention and Fig. 2 is a horizontal sectional representation, on an enlarged scale, of a portion of said fusible core or pattern. Fig. 3 is a rear face view of a portion of an insulating material or shadower employed with the herein described process; and Fig. 4 is a sectional representation of the same, said section being taken on line 4—4 in said Fig. 3, looking in the direction of the arrow *x*. Fig. 5 is a transverse sectional representation, on a considerably enlarged scale, of a portion of the fusible core or pattern and the shadower, said view showing the manner of using the shadower with said core or pattern, and said view showing in addition, and in section, the first electrolytic deposit of metal, deposited in the interior of the holes or openings of the shadower, and from the interior of said holes or openings toward the outer faces of the fusible core or pattern. Fig. 6 is a similar sectional representation of said portion of the core or pattern and the said first electrolytic deposit of metal after the shadower has been removed. Fig. 7 is a transverse sectional representation of a portion of the fusible core or pattern with the first electrolytic

deposit of metal, and a second electrolytic deposit of metal from the outer faces of the said core or pattern inwardly into said holes or openings and upon the said first electrolytic deposit of metal, said view showing a uniform thickness throughout all the parts of the electrolytically deposited metal. Fig. 8 is a sectional representation of a portion of the finally completed hollow honeycomb and one-piece section or element for an automobile-radiator, said views showing the fusible metal removed from said section.

The herein-above described drawings illustrate the results obtained during the different stages of procedure in carrying out the novel process or method embodying the principles of the present invention, this process or method comprising the following steps:—I first prepare a core or pattern of any suitable configuration and of a suitable metal which is capable of melting or fusing at a comparatively low temperature or degree of heat. The said fusible core or pattern is cast in a suitable mold, and when completed has the general form and appearance, represented in said Figs. 1 and 2 of the drawings, the said core or pattern, in the form of a plate, being indicated by the reference-character 1, and the body-portion of the same being provided with a great many holes or openings, as 2, closely adjacent to one another and arranged in symmetrical lines. These holes or openings 2, as will be seen more particularly from an inspection of Fig. 2 of the drawings, are preferably of smaller cross-sectional area at their inner central portions than at their ends, so that the holes taper in opposite directions, in the manner shown; but, it will be understood that the holes or openings may not necessarily be made tapering as here shown. As illustrated, in proportion to the size of the core or pattern as a whole, the said holes or openings are made quite large, but in practice each hole or opening is small, since in the practical core or pattern, used in my novel process, the body-portion of the core or pattern contains from nine thousand to ten thousand holes or openings, each hole or opening being usually three-sixteenths of an inch in diameter, and the holes or openings being spaced one-quarter of an inch apart, from center to center. It will be understood, however, that by means of the process herein described, the holes or openings may be made even smaller and they may be more closely placed with relation to one another. The upper part of the said core or pattern is formed with a blank space 3 of suitable configuration for providing a top water-collecting space or chamber in the finished radiator-section to be produced; and in like manner, the lower part of the said core or pattern is formed with a blank space 4 of suitable configuration for providing a bottom water-collecting space or chamber in the finished radiator-section. The remaining parts of the body-portion of said core or pattern located between the herein-above mentioned holes or openings 2 provide suitable core-portions or members by means of which are produced the necessary water-conveying channels or ducts of the finished radiator-section. After the core or pattern has thus been produced, the same is ready for its immersion in an electrolytic solution, by thoroughly cleaning its surfaces by mechanical brushing, or otherwise, the application of a chemical wash, and, finally, by rinsing in a water bath to remove all dirt and grease that may adhere to its surfaces.

The shadower 5 to be presently described as to its detailed construction, is now arranged upon the various outer faces and the surrounding end-surfaces of the core or pattern, that is the two sides, the top, the bottom, and the two ends, substantially in the manner indicated in Fig. 5 of the drawings. Referring now to said Fig. 5, the said shadower consists of a pair of insulating sheets 6, preferably of celluloid, or some other similar material. These sheets conform at their marginal edges with the conformation of the peripheral edges of the said core or pattern, the said sheets being placed one upon either side of the core or pattern. A pair of band-like members, as 7 and 8, or other suitable means, made also from celluloid, or other similar material, are arranged about the two end-surfaces, and the top and bottom of the core or pattern, as will be evident from an inspection of said Fig. 5 of the drawings, the arrangement of the said sheets 6 and the said band-like members 7 and 8 thus entirely inclosing the said core or pattern. As shown, the said sheets 6 are each provided with a plurality of holes or openings 9 which correspond in number and position to the holes or openings 2 in the core or pattern 1, so that when the said insulating sheets 6 are assembled in the manner stated with relation to the said core or pattern, the said holes or openings 9 of the said insulating sheets 6 will register, respectively, with the corresponding holes or openings 2 in the core or pattern 1. The said holes or openings 9 are smaller than the holes or openings 2, and each hole or opening 7 is surrounded by an inwardly extending annular flange or projection, as 10, so as to provide tubular extensions which, when the said sheets 6 are placed upon the opposite faces of the fusible core or pattern, extend some little distance into the said holes or openings 2, in the manner clearly illustrated in said Fig. 3 of the drawings.

The core or pattern which has thus been inclosed in an insulating jacket or coating, is now ready for the electro-plating bath, in

which the said core or pattern is immersed. The said insulating jacket or coating while it protects the outer surfaces of the fusible core or pattern from receiving a coating of metal by electro-deposition, still permits, by virtue of its holes or openings 9, with their respective tubular portions or projections 10, the passage of the current in the electrolyte into and through said tubular portions or projections 10, so that an electrolytic action may continue and build up a first metallic deposition or plating upon the interiorly exposed surface-portions of the core or pattern 1 from within its holes or openings 2. The said tubular portions or projections 10, tend to concentrate the electrolytic action upon a point centrally located within the said holes or openings 2, so that the plating action of the first metallic deposition or plating is strongest at that point, and continues with decreasing force, in outward directions toward the outer faces of the core or pattern and the respective marginal edges of the said holes or openings 2. In this manner, the hollow shell formed by the metallic deposition or plating is built up within the said holes or openings so that the deposited metal will taper in opposite directions, as shown, being of the heaviest deposit within the interior central part of each hole or opening 2, and being of the least thickness at the marginal edge of the hole or opening. The fusible core or pattern 1, with this first deposit of metal plated thereon, is now taken from the electroplating bath and the core or pattern is stripped of its insulating jacket or cover. The next step in the process is to again immerse the said core or pattern with said first deposit or plating of metal thereon as above described, in the electro-plating bath. The result is that a deposit of metal is now electroplated upon all of the outer exposed surfaces of the core or pattern, the metal deposit building up upon said surface to the required thickness, and at the same time depositing upon the first deposit or plating of metal from the outside and in opposite directions toward the middle of the previously metal-deposited or plated holes or openings 2. The consequence is that the metallic deposition or plating is also built up within said holes or openings from the thinnest portions of the first-deposited metal to the heaviest or thickest portions thereof, and to such an extent, so that when the electro-plating step is finally completed, the combined thicknesses of the two depositing steps of metal within the holes or openings will be uniform throughout, and will be the same as the thickness of the deposited or plated metal upon any part of the outer surface-portions of the core or pattern 1, as clearly indicated in Fig. 7 of the drawings, in which this uniform deposit or plating of metal is indicated by the reference-character 11, the dotted lines 12 indicating the extent of the first metallic deposition or plating.

From the above description of the respective first and second plating steps it must be clearly understood that the first metal deposition or plating extends in directions from within the interior central portions of the holes or openings toward and stopping at the outer surfaces of the sides of the core or pattern, with decreasing electrolytic activity, whereas the second metallic deposition or plating extends from the outer faces of the core or pattern and into the holes or perforations, with decreasing electrolytic activity within and toward the middle portions of said holes or openings, to produce a uniform thickness of the deposited metal, as has been stated, and the said second deposit of metal practically embracing the said first deposit of metal, so that the second deposit of metal forms a lock with relation to said first deposit of metal.

After the second deposition or plating of the metal has been finished, the core or pattern with the completed metallic deposition thereon is removed from the electroplating bath, is washed so as to remove any adhering electrolyte, and is then dried. The final step of the process is to subject the said core or pattern with the completed metallic deposition to the action of heat, by placing the same in a suitable gas-chamber or oven; or, by other suitable means, for producing the required temperature, for melting out the fusible core and leaving the hollow and honey-combed shell of the radiator-section. The melting or fusing point of the metal of which the core or pattern is made, is such that it melts at a low degree of heat, the melting or fusing metal running out of and away from the completed metallic deposition without in any way injuring said deposition of metal, and thus leaving the hollow and honey-comb shell 13, indicated more particularly in Fig. 8 of the drawings.

To recapitulate the various steps of my novel process hereinabove described in detail, the same consists;—first, of preparing a core or pattern of metal capable of receiving electrolytic deposition, and capable of melting or fusing at a low temperature; secondly, providing the same with a perforated insulating jacket or envelop; thirdly, immersing the same in an electro-plating bath and depositing by electro-deposition metal within the holes or openings with which the core or pattern has been provided, said electro-deposition of metal decreasing in thickness or amount from the central interior portions of said holes or openings toward the outer edges of the holes or openings; fourthly, removing the core or pattern and the metal deposited or plated thereon

from the electro-plating bath, and stripping off the insulating jacket or envelop; fifthly, re-introducing said core or pattern in the electro-plating bath for a deposition or plating of metal upon the outer and exposed surfaces of the core or pattern, and a second deposition or plating of metal upon said first deposition or plating of metal within the holes or openings from the outer edges of said holes or openings toward the middle of the holes or openings, to produce a final deposit of metal of uniform thickness; sixthly, removing the core or pattern with its uniform thickness of deposited metal from the electro-plating bath; and finally, washing said metallic deposition or plating of metal, and subjecting the same with its fusible core therein to the action of heat, so as to melt said core or pattern and removing it from the hollow shell formed by said metal depositions or platings.

I claim:—

1. A process for producing hollow honeycomb one-piece radiator-sections consisting of first preparing a core or pattern of a fusible metal with openings, then by electro-deposition depositing a metal first upon the surface-portions of the core or pattern within the said openings and outwardly toward the outer faces of said core or pattern, and then removing said core or pattern from said electrolytically deposited metal.

2. A process for producing hollow honeycomb one-piece radiator-sections consisting of first preparing a core or pattern of a fusible metal with openings, then by electro-deposition depositing a metal first upon the surface-portions of the core or pattern within the said openings and outwardly toward the outer faces of said core or pattern; then producing a second electrolytic deposition of metal from the outer edge-portions of the said openings toward the middle-portion of each opening, and finally removing said core or pattern from said electrolytically deposited metal.

3. A process for producing hollow honeycomb one-piece radiator-sections consisting of first preparing a core or pattern of a fusible metal with openings, then by electro-deposition depositing a metal first upon the surface-portions of the core or pattern within the said openings and outwardly toward the outer faces of said core or pattern, then producing an electrolytic deposition of metal upon the outer surface-portions of the said core or pattern and from the opposite faces thereof into the said openings from the marginal edge-portions thereof to the middle portion of each opening, and finally removing said core or pattern from said electrolytically deposited metal.

4. A process for producing hollow honeycomb one-piece radiator-sections consisting in first preparing a core or pattern of a fusible metal with a series of openings, then producing electrolytically a deposit of metal into the interior of said openings and outwardly therefrom toward the outer faces of said core or pattern, then producing electrolytically another deposit of metal upon the outer faces of the core or pattern and inwardly into and toward the middle of said openings, and finally removing said core or pattern from said electrolytically deposited metal.

5. A process for producing hollow honeycomb one-piece radiator-sections consisting in first preparing a core or pattern of a fusible metal with a series of openings, then producing electrolytically a deposit of metal into the interior of said openings and outwardly therefrom toward the outer faces of said core or pattern, then producing electrolytically another deposit of metal upon the outer faces of the core or pattern and inwardly into and toward the middle of said openings, and finally applying heat for melting said core or pattern out of said electrolytically deposited metal.

6. A process for producing hollow honeycomb one-piece radiator-sections consisting in first preparing a core or pattern of a metal fusible at a low temperature with a multiplicity of small holes or openings, protecting the outer surface-portions of the core or pattern against electrolytic action, then producing electrolytically a deposit of metal within the holes or openings in said core or pattern and toward the marginal edge-portions of said holes or openings, then removing from the outer surface-portions of the core or pattern the protecting means against plating, then producing electrolytically another deposit of metal upon the outer surface-portions of the core or pattern and inwardly and toward the middle of said holes or openings, and finally removing said core or pattern from said electrolytically deposited metal so as to leave a hollow honeycomb shell.

7. A process for producing hollow honeycomb one-piece radiator-sections consisting in first preparing a core or pattern of a metal fusible at a low temperature with a multiplicity of small holes or openings, protecting the outer surface-portions of the core or pattern against electrolytic action, then producing electrolytically a deposit of metal within the holes or openings in said core or pattern and toward the marginal edge-portions of said holes or openings, then removing from the outer surface-portions of the core or pattern the protecting means against plating, then producing electrolytically another deposit of metal upon the outer surface-portions of the core or pattern and inwardly and toward the middle of said holes or openings, and finally applying heat for melting said core or pattern out of said elec-

trolytically deposited metal so as to leave a hollow honey-conb shell.

8. A process for producing hollow honey-comb one-piece radiator-sections consisting in first making a core or pattern of a metal fusible at low temperature, providing the same with small holes or openings set close together, providing an insulating covering formed with holes or openings corresponding in position with the holes or openings in said core or pattern, arranging said covering upon the outer exposed surface-portions of said core or pattern to protect the said exposed surface-portions of the core or pattern against electrolytic action, providing means in connection with each hole or opening in said insulating covering for directing the operation of the electrolytic action to a central point within the holes or openings in said core or pattern to cause the electrolytic action to operate with diminishing efficiency outwardly from the central inner portion of each hole or opening of the core or pattern toward the outer marginal edge-portions of said holes or openings, continuing said electrolytic action under such conditions to provide a continued metallic deposition within the holes or openings of said core or pattern, then removing said insulating covering, then producing electrolytically another deposit of metal upon the outer surface-portions of the core or pattern and inwardly into the said holes or openings in said core or pattern with diminishing efficiency inwardly toward the inner central portion of each hole or opening of the core or pattern and upon the first electrolytic deposit of metal within said holes or openings, and finally removing said core or pattern from said complete electrolytic deposition, so as to leave a hollow honey-comb shell of a uniform thickness of metal throughout any parts of its wall-portions.

9. A process for producing hollow honey-comb one-piece radiator-sections consisting in first making a core or pattern of a metal fusible at low temperature, providing the same with small holes or openings set close together, providing an insulating covering formed with holes or openings corresponding in position with the holes or openings in said core or pattern, arranging said covering upon the outer exposed surface-portions of said core or pattern to protect the said exposed surface-portions of the core or pattern against electrolytic action, further providing said insulating covering with inwardly extending tubular members or projections of smaller diameters than those of the said holes or openings in the core or pattern, arranging said insulating covering upon the respective faces of the core or pattern with the said tubular members or projections extending inwardly into the said holes or openings in the core or pattern, for directing the operation of the electrolytic action to a central point within the holes or openings in said core or pattern to cause the electrolytic action to operate with diminishing efficiency outwardly from the central inner portion of each hole or opening of the core or pattern toward the outer marginal edge-portions of said holes or openings, continuing said electrolytic action under such conditions to provide a continued metallic deposition within the holes or openings of said core or pattern, then removing said insulating covering, then producing electrolytically another deposit of metal upon the outer surface-portions of the core or pattern and inwardly into the said holes or openings in said core or pattern with diminishing efficiency inwardly toward the inner central portion of each hole or opening of the core or pattern and upon the first electrolytic deposit of metal within said holes or openings, and finally removing said core or pattern from the electrolytic solution and melting out said core or pattern, so as to leave a hollow honey-comb shell of a uniform thickness of metal throughout any parts of its wall-portions.

In testimony, that I claim the invention set forth above I have hereunto set my hand this 2nd day of December, 1910.

FREDERICK A. FELDKAMP.

Witnesses:
FREDK. C. FRAENTZEL,
FREDK. H. W. FRAENTZEL.