

F. A. FELDKAMP.
 PROCESS OF MAKING ONE PIECE RADIATOR SECTIONS.
 APPLICATION FILED SEPT. 15, 1910.

997,610.

Patented July 11, 1911.

2 SHEETS—SHEET 1.

FIG. 1

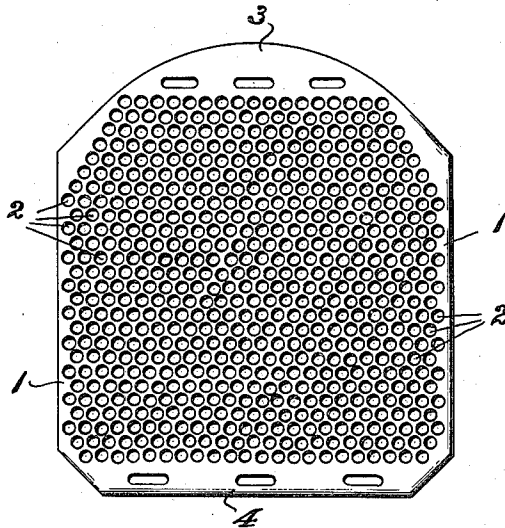


FIG. 2

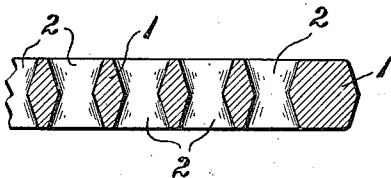


FIG. 3

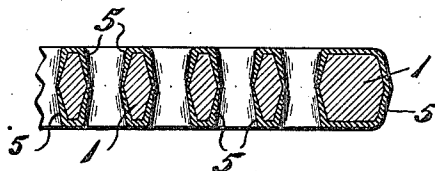


FIG. 4

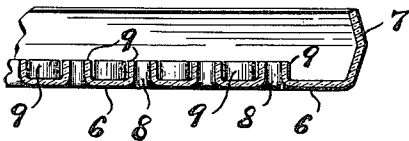
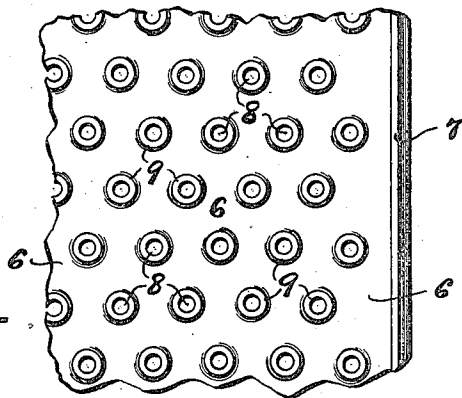


FIG. 5



WITNESSES:

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INVENTOR:

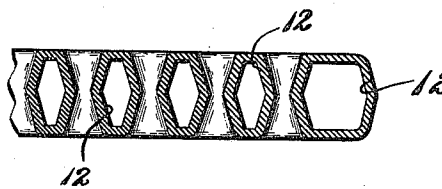
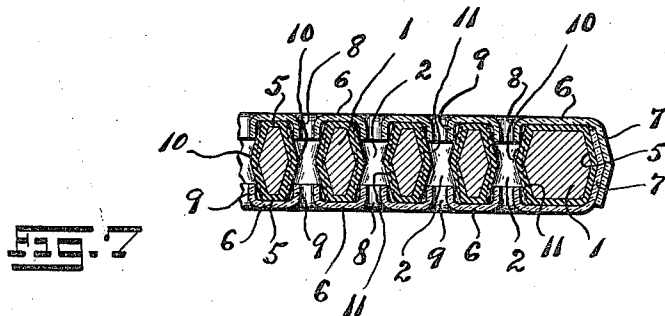
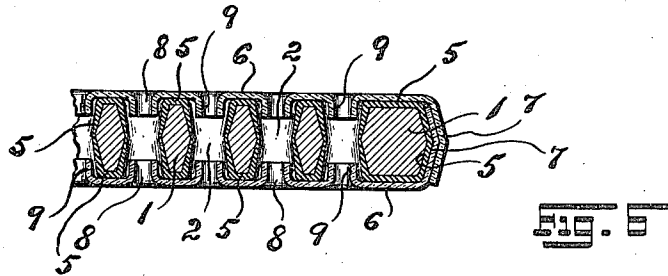
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 ATTORNEYS

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2 SHEETS—SHEET 2.



WITNESSES:
Frederick W. Fraentzel
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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.

997,610.

Specification of Letters Patent.

Patented July 11, 1911.

Application filed September 15, 1910. Serial No. 582,110.

To all whom it may concern:

Be it known that I, FREDERICK A. FELDKAMP, a 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.

This invention has reference, generally, to an improved process of manufacturing automobile radiators in the form of hollow honey-comb sections, substantially of the character set forth in my former applications for Letters-Patent filed April 10, 1909, Serial Number 489,178, Oct. 12, 1909, Serial Number 525,211, and March 12, 1900, Serial Number 548,756, each section being formed of a single integral mass of metal; and, the present invention relates, more particularly, to a novel process or method of electrolytic deposition, whereby each section of an automobile radiator is formed by depositing a metal upon a core or pattern, of the desired form, and subsequently removing said core or pattern from the integral shell built up thereon.

The present invention has for its principal object to provide a novel process or method whereby an automobile radiator-section in the form of a hollow honey-comb may be made, the honey-comb subdivisions of which are very small and are closely spaced together, so that a maximum of radiating surfaces is exposed to the action of cooling air. It will be readily understood, that the finer the subdivisions of the radiator passages, which fine subdivision permits of the increase in number of air-passages and the locating of the same closer together, the greater the cooling efficiency of the radiator will be.

It is the principal aim of my novel process to provide a method whereby such fine subdivision of air-passages are produced, so as to increase the number thereof; and, the consequent attainment of a maximum cooling surface is secured in the manufacture of a

radiator-section formed of a single integral mass of metal.

I am perfectly aware that radiator-sections can be produced by the simple and well-known processes of electrolytic deposition, but such simple and well-known processes cannot produce a radiator-section of honey-comb form, or any other form, providing an exceedingly fine subdivision of air-spaces, and a consequent increase of air-passages and exposed radiator-surfaces. The old and well-known electrolytic processes can only produce a very coarse and inefficient honey-comb of comparatively limited amount of exposed radiator surfaces, and a radiator in which the volume of water passing there-through is not finely sub-divided and brought in contact with large areas of cooling radiator surface.

A further and a very important object of the present invention is to provide a process of the character herein set forth, in which, in addition to the advantages above mentioned, there is secured by the use of said process a radiator-section in the form of a finely sub-divided honey-comb having its walls at all points of practically uniform thickness.

In radiator-sections made by the simple and well-known electrolytic processes, when the same are of the honey-comb form, in addition to the disadvantages above mentioned, the electrolytic deposit of metal is very uneven, being altogether too heavy on the faces of the honey-comb, which are most nearly adjacent to the anodes, and being very thin or light, to the point of weakness, in the interior of the honey-comb spaces. This is due to the fact, that the deposition of the metal is more active near the anodes, said activity diminishing rapidly with the increase of the distance between the point of deposition and the anode. A radiator-section thus made is subject to cracking and breaking in the interior of the honey-comb sub-divisions, due to the uneven distribution of the strains to which the same is subjected, when put into practical use. It has been sought to overcome this difficulty by providing a process whereby the electrolytic deposition is made more even by inserting a small anode in each sub-division of the honey-comb structure in the course of the electrolytic deposition, but here again such process is of little value since

the sub-division must be made very coarse and large, hence, producing a radiator-section of very low efficiency and of little practical value, for such a process cannot be used where the sub-divisions are closely spaced together and where the same are of very small diameter, since the anodes cannot be made small enough; and, furthermore, being so close together would short-circuit and prevent the proper electrolytic deposition of the metal.

By the use of my novel process a hollow radiator-section, of honey-comb form, having walls of uniform thickness, can be made in which the subdivisions or air-passages may be formed three thirty-seconds of an inch in diameter and spaced one-quarter of an inch apart from center to center thereby providing a maximum of radiating surfaces, and a radiator-section of exceedingly high efficiency.

A radiator-section formed of an integral mass of metal, as above described, possesses practical advantages which it is hardly necessary to specifically set forth, and such advantages will readily commend themselves to those making practical use of such a radiator, as well as to those familiar with the art of constructing the same as thus far developed.

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

The accompanying drawings illustrate the results attained at various stages of procedure in the exercise of the novel process embodying the principles of the present invention, and the description of said several figures will appear in proper order in the detail description of my invention contained in the following specification.

Figure 1 is a front view of a fusible core or pattern used for producing a radiator-section, made according to the present invention; Fig. 2 is a horizontal sectional representation, on an enlarged scale of a portion of said fusible core or pattern; and Fig. 3 is a similar sectional representation of the said core or pattern and an electrolytical deposit or plating of metal thereon, said view illustrating the first step of the herein described process of electro-deposition, said Fig. 3 being drawn to an enlarged scale. Fig. 4 is a transverse sectional representation, and Fig. 5 a rear face view of a portion of an insulating plate or shadower employed with the herein described process. Fig. 6 is a transverse sectional representation of the parts represented in said Fig. 3, and a pair of shadowers in place, ready for the next step of the electro-deposition or plating of metal upon the previously deposited metal; and Fig. 7 is a similar sectional representation of all the parts shown

in said Fig. 6, with the said second deposit or plating of metal completed. Fig. 8 is a sectional representation of a portion of the finally plated article made by the herein-described method of electro-deposition, said view showing the fusible metal removed from the section.

My novel process comprises the following steps: I first prepare a core or pattern of a suitable metal adapted to receive upon its surface an electrolytic deposition of metal conforming with its configuration or contour. The said core or pattern is made of a metal capable of melting or fusing at a comparatively low temperature. Said core or pattern is cast in a suitable mold, and when completed has the general form and appearance, shown in Figs. 1 and 2 of the drawings, the same being a plate 1, the body-portion of which is provided with a plurality of perforations 2, closely adjacent to one another and arranged in symmetrical lines. As illustrated, in proportion to the size of said plate as a whole, the perforations are very large, since in the practical core or pattern, as used in my novel process, said plate contains from nine thousand to ten thousand perforations three-sixteenths of an inch in diameter, and spaced one-quarter of an inch apart, from center to center, although said holes may be made even smaller. The upper part of said plate is formed with a blank space 3 of suitable configuration for providing a top-water-collecting space-core pattern; and, similarly, the lower part of said plate is formed with a blank space 4 of suitable configuration for providing a bottom water-collecting space-core or pattern. The said plate 1 is further provided with all the necessary cores or patterns adapted to provide the necessary water-inlets and outlets. After such a core or pattern for a radiator-section is thus prepared, the same is made ready for immersion in an electrolytic solution, by thoroughly cleaning its surfaces by mechanical brushing, the application of a chemical wash, and finally, by a water bath to remove all dirt and grease which may adhere upon the same. The core or pattern thus prepared is now hung in an electrolytic solution, and the same is properly connected in electrical circuit to give it the necessary cathode characteristics.

Anodes are properly distributed in the electrolytic solution, the same being provided with proper electrical circuit-connections. It is found advisable to obtain the best results during the course of the electrolytic deposition, to provide a mechanical means for agitating both said core or pattern (cathode) and said anodes in the electrolytic solution, whereby the same and the said solution are kept in motion, thus permitting the use of a high electrical current-

density to the end that the time required for electrolytic deposition may be reduced to a minimum, and also to maintain a uniform composition of the electrolytic solution. In this manner, said core or pattern is allowed to remain in the electrolytic solution to receive the first deposition or plating of metal. The character of said first deposition or plating of metal is illustrated in Fig. 3 of the drawings, and is particularly indicated by the reference-character 5. It will be noticed, from an inspection of said Fig. 3, that said first deposit or plating of metal is heaviest upon the respective faces of said core or pattern than in the interior of the holes or perforations 2 thereof. This is due to two causes; first, the electrolytic action follows the path of least resistance and plates faster at points most directly exposed to the path of the electrical current passing from anode to cathode; and, secondly, the electrolytic action weakens in force or efficiency in ratio to the distance of the point of deposition from the anodes. It will therefore be apparent, that, when the required thickness of metallic deposition is obtained upon the faces of the core or pattern, the thickness of said metallic deposition within said holes or perforations 2 is much less than that required, hence the hollow shell of the radiator-section thus formed is so weak within said holes or perforations, as to be seriously liable to fracture or breakage at such points. To continue the electrolytic deposition until the interior of said holes or perforations are provided with a sufficient thickness of metallic deposition or plating results simply in an untoward increase in the thickness of the hollow shell at the outer surfaces of said core or pattern, which not only causes a waste of metal, but also renders said hollow shell non-uniform in thickness throughout its various parts, and consequently is subjected to disproportionate strains throughout its structure, when put in use, rendering the same liable to breakage, followed by leakage and consequent uselessness. The subsequent steps of my process aim to increase the thickness of said metallic deposition or plating within said holes or perforations 2 of said core or pattern already obtained by said first metallic deposition or plating step, to the end that a uniform thickness of the walls of the hollow shell forming a radiator-section may be obtained, whereby both an economy of metal deposited is obtained, as well as a radiator-section subject to a uniform distribution of stress and strain throughout its structure, when put to the use for which it is designed, is the result. To further this end, the core or pattern with its first metallic deposition or plating is provided with a means known in the art as a shadower, for insulating the faces or outer surfaces thereof against fur-

ther electrolytic action, while permitting a continuation of the electrolytic action within said holes or perforations 2. The means to accomplish this purpose comprises a pair of insulating sheets 6, preferably made of celluloid, or some similar material. The said insulating sheets 6 conform at their outer periphery with the conformation of the peripheral edges of said core or pattern, and the said insulating sheets 6 may be further provided at their peripheral edges with annular flanges 7, adapted to overlap one another when their respective sheets 6 are placed one on either side or face of said core or pattern. This overlapping function of the two insulating plates 6 is in the nature of the closing relation of a box and its cover. The arrangement of the two insulating sheets 6, in the manner just described in connection with the core or pattern, is illustrated more particularly in Fig. 6 of the drawings, while the details of the construction of the respective insulating plates 6 are shown more particularly in Figs. 4 and 5 of the drawings. The said insulating sheets 6 are each provided with a plurality of holes or perforations 8 which correspond in number and position to the holes or perforations 2 in the plate 1 forming said core or pattern, so that when the said insulating sheets 6 are assembled in connection with said core or pattern, in the manner shown in Fig. 6, the said holes or perforations 8 of said insulating sheets 6 will register respectively with the holes or perforations 2 of said core or pattern. The said holes or perforations 8 are smaller in diameter than the holes or perforations 2, and each of said holes or perforations 8 are surrounded by an inwardly projecting tubular portion or projection 9, the same being adapted to extend some little distance into the said holes or perforations 2, as is also particularly illustrated in Fig. 6 of the drawings.

It will thus be seen that the said core or pattern, with its first metallic deposition or plating, is now enveloped in an insulating jacket or coating, which, while it protects the outer surface of said first metallic deposition or plating from any further electrolytic action, still permits, by virtue of its holes or perforations 8 with their respective tubular portions or projections 9, the passage of the current into the interior of the holes or perforations 2, so that an electrolytic action may continue and build up a second metallic deposition or plating upon the first metallic deposition or plating already deposited within said holes or perforations 2. Said tubular portions or projections 9 tend to concentrate the electrolytic action upon a point centrally located within said holes or perforations 2, so that the plating action of this second metallic deposition or plating is strongest at that

point and continues, with decreasing force, in an outward direction to the respective marginal edges of said holes or perforations

2. In this manner, the hollow shell formed by the metallic deposition or plating is built up within said holes or perforations 2 to an extent sufficient to make the thickness of the metal at this point correspond with the thickness of the metal deposited at the outer surfaces or faces of said core or pattern, and it will thus be seen that a hollow shell, forming a radiator-section, of uniform thickness throughout its various parts is obtained. The effect of this second metallic deposition or plating may be readily understood from an inspection of Fig. 7 of the drawings, in which the same is indicated by the reference-character 10, the dotted line 11 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 metallic deposition or plating extends in directions from the outer surfaces of said core or pattern with said holes or perforations 2, with decreasing electrolytic activity whereas the second metallic deposition or plating extends in directions from the point centrally located within said holes or perforations 2 outwardly in both directions toward the respective outer faces or surfaces of said core or pattern, with decreasing electrolytic activity.

After the second metallic deposition or plating has been completed the core or pattern with the completed metallic deposition thereon is removed from the electrolytic solution, is washed so as to remove the adhering electrolyte, and 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, oven, or other means for producing the required temperature. The melting or fusing point of the metal of which this said core or pattern is made, being reached at a very low temperature, the said core or pattern is thus fused or melted out so that the same runs out of and away from the completed metallic deposition without in any way injuring said metallic deposition, thus leaving the hollow shell 12 forming the desired radiator-section, as illustrated in Fig. 8 of the drawings.

To recapitulate the various steps of my novel process as above 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, inserting said core or pattern in an electrolytic bath, properly connecting the same electrically to receive a first metallic deposition or plating, the electrolytic action

of which tends to form a deposition of metal, decreasing in thickness or amount, from the outer surfaces to points within the holes or perforations of said core or pattern; thirdly, the removal of said core or pattern with the first metal deposition or plating thereon from said electrolytic bath, and providing the same with a perforated insulating envelop; fourthly, reintroducing said core or pattern into the electrolytic bath for a second metallic deposition or plating, the electrolytic action of which tends to form deposits of metal, decreasing in thickness or amount, from the inner central part of said holes or perforations toward the outer edges of said holes or perforations; fifthly, removing said core or pattern with the complete metallic deposition or plating from the electrolytic bath; and, finally, removing said insulating envelop, washing said metallic deposition or plating, and subjecting the same with said core or pattern therein to the action of heat, so as to melt said core or pattern and to remove it from the hollow shell formed by the first and second metallic deposition or plating.

While I have in this application set forth a process for producing hollow honey-comb one-piece radiator-sections, in which the plating steps are performed by first depositing electrolytically, metal upon the outer face of the core or pattern and inwardly into the openings in said core or pattern, and then producing electrolytically, a second deposit of metal into the interior of said openings and outwardly therefrom toward the outer surfaces of the core or pattern, I am fully aware that these steps for electrolytically depositing the metal upon the fusible core or pattern may be reversed; and, therefore, I have filed contemporaneously herewith a second application for a patent, the serial number of which is 595,831, filed December 5, 1910, in which I have set forth a claim showing this method or process covering the reversal of such electroplating steps.

I claim:

1. A process for producing hollow honey-comb 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 first deposit of metal upon the outer face of said core or pattern and inwardly into the openings in said core or pattern, and then producing electrolytically a second deposit of metal into the interior of said openings and outwardly therefrom toward the outer surfaces of said core or pattern, and finally removing said core or pattern from said electrolytically deposited metal.

2. A process for producing hollow honey-comb 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 first deposit of metal upon the outer face of said core or pattern and inwardly into the openings in said core or pattern, and then producing electrolytically a second deposit of metal into the interior of said openings and outwardly therefrom toward the outer surfaces of said core or pattern, and finally applying heat for melting said core or pattern out of said electrolytically deposited metal.

3. A process for producing hollow honeycomb one piece radiator sections consisting in first preparing a core or pattern of a metal fusible at low temperature with a plurality of small holes or perforations, treating the same electrolytically to produce a first metallic deposition thereon, then protecting the outer surface of said first metallic deposition against further electrolytic action, then further treating the same to permit a continued or second metallic deposition within said holes or perforations, and finally melting out said core or pattern to leave a hollow honeycomb shell.

4. A process for producing hollow honeycomb one piece radiator sections consisting in first making a core or pattern provided with a plurality of small holes or perforations, treating the same electrolytically to produce a first metallic coating thereon, then insulating the outer faces or surfaces of said core or pattern and its first metallic coating, then again treating the same electrolytically to produce a second metallic coating in the interior of said holes or perforations to provide a complete metallic coating of uniform thickness, and finally separating said core or pattern from said metallic coating to leave a hollow honeycomb shell.

5. A process for producing hollow honeycomb one piece radiator sections consisting in first making a core or pattern provided with a plurality of small holes or perforations, then electroplating the same with a first metallic deposition, providing the same with a means for insulating the outer surfaces while leaving the interior of said holes or perforations subject to electrolytic action, then electroplating the same with a second metallic deposition, then removing said core or pattern with its complete metallic deposition from said electrolytic bath and separating said core or pattern from the metallic deposition to leave a hollow honeycomb shell of uniform thickness throughout its walls.

6. A process for producing hollow honeycomb one piece radiator sections consisting in first making a core or pattern of a metal fusible at low temperature, providing the same with a plurality of small holes or perforations, then electroplating the same so that the electrolytic action operates with diminishing efficiency inwardly from the

outer surfaces or faces of said core or pattern to a point within said holes or perforations, then providing a means for reversing said electrolytic action so that the same operates with diminishing efficiency outwardly from a point within said holes or perforations to the respective outer surfaces or faces of said core or pattern, then removing said core or pattern with said complete metallic deposition thereon and melting out said core or pattern to leave a hollow honeycomb shell.

7. A process for producing hollow honeycomb 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 perforations set close together, then electroplating the same with a first metallic deposition or plating so that the electrolytic action operates with diminishing efficiency inwardly from the outer surfaces or faces of said core or pattern to a point within said holes or perforations, providing an insulating covering provided with holes or perforations corresponding in position with said holes or perforations of said core or pattern, arranging said insulating covering upon the respective faces of said core or pattern to protect said first or metallic deposition or plating upon said faces of said core or pattern from further electrolytic action, providing means in connection with each hole or perforation of said insulating covering for directing the operation of electrolytic action to a central point within said holes or perforations of said core or pattern to cause said electrolytic actions to operate with diminishing efficiency outwardly from said central point within said holes or perforations of said core or pattern toward the outer surfaces or faces of the latter, continuing said electrolytic action under such conditions to provide a second or continued metallic deposition or plating within said holes or perforations, and finally removing said core or pattern from said electrolytic solution and melting out said core or pattern to leave a hollow honeycomb shell.

8. A process for producing hollow honeycomb 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 perforations set close together, then electroplating the same with a first metallic deposition or plating so that the electrolytic action operates with diminishing efficiency inwardly from the outer surfaces or faces of said core or pattern to a point within said holes or perforations, providing an insulating covering provided with holes or perforations corresponding in position with said holes or perforations of said core or pattern, further providing said insulating covering with inwardly

extending tubular members or projections of
smaller diameter than said holes or perfora-
tions of said core or pattern, arranging said
insulating covering upon the respective faces
5 of said core or pattern to protect said first
metallic deposition upon said faces of said
core or pattern from further electrolytic ac-
tion and at the same time permitting said
tubular portions or projections to extend in-
10 wardly into each hole or perforation of said
core or pattern from each face of the latter,
continuing said electrolytic action so that by
said means its operation is directed from a
central point within said holes or perfora-
15 tions of said core or pattern outwardly with

diminishing efficiency toward the respective
faces of the latter to provide a second or con-
tinued metallic deposition or plating with-
in said holes or perforations, and finally
removing said core or pattern from said 20
electrolytic solution and melting out said
core or pattern to leave a hollow honey
comb-shell.

In testimony, that I claim the invention
set forth above I have hereunto set my hand 25
this 8th day of September, 1910.

FREDERICK A. FELDKAMP.

Witnesses:

FREDK. C. FRAENTZEL,

FREDK. H. W. FRAENTZEL.