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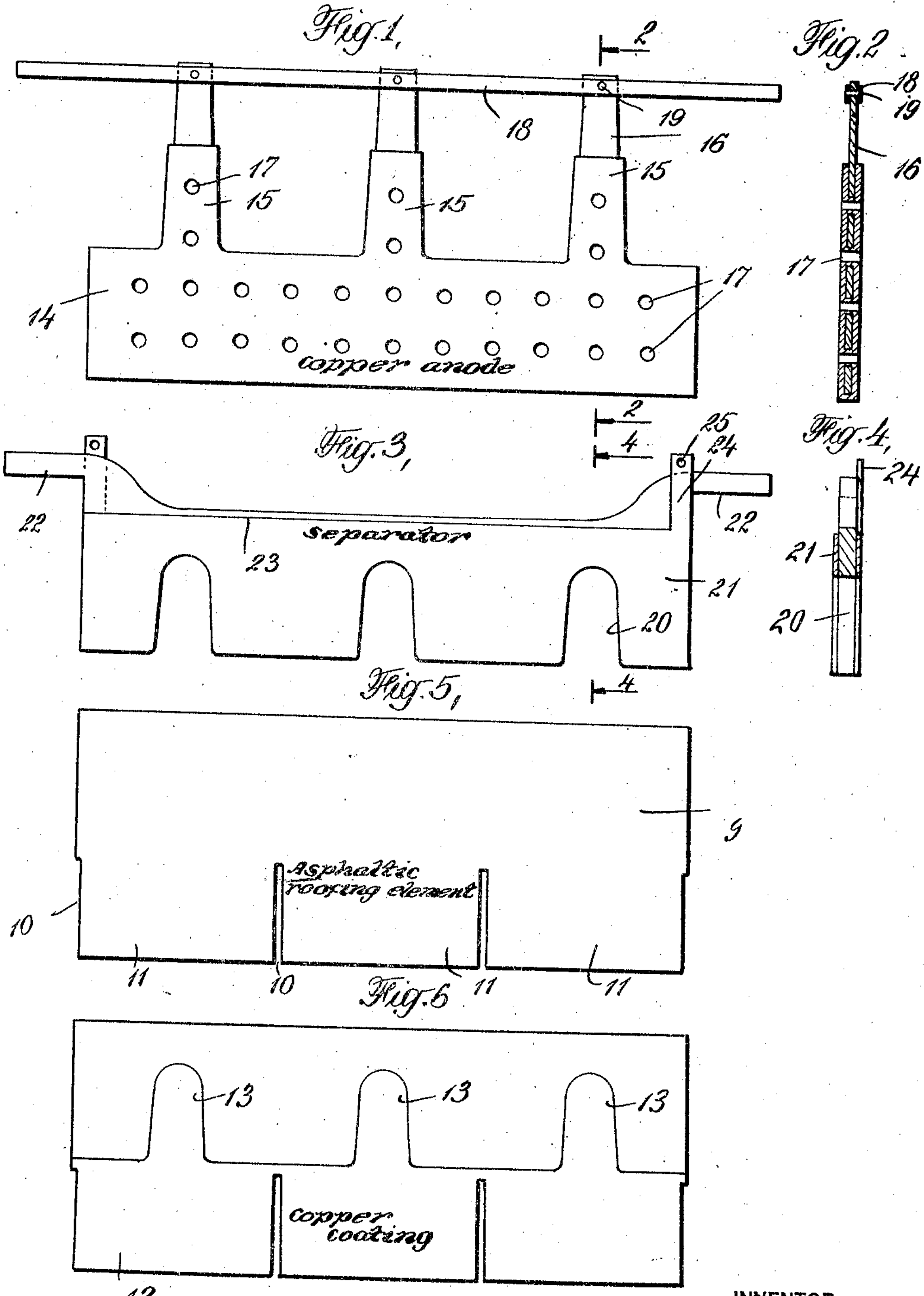
T. ROBINSON

METHOD AND APPARATUS FOR PRODUCING ROOFING ELEMENTS

Filed Dec. 22, 1923 2 Sheets-Sheet 1



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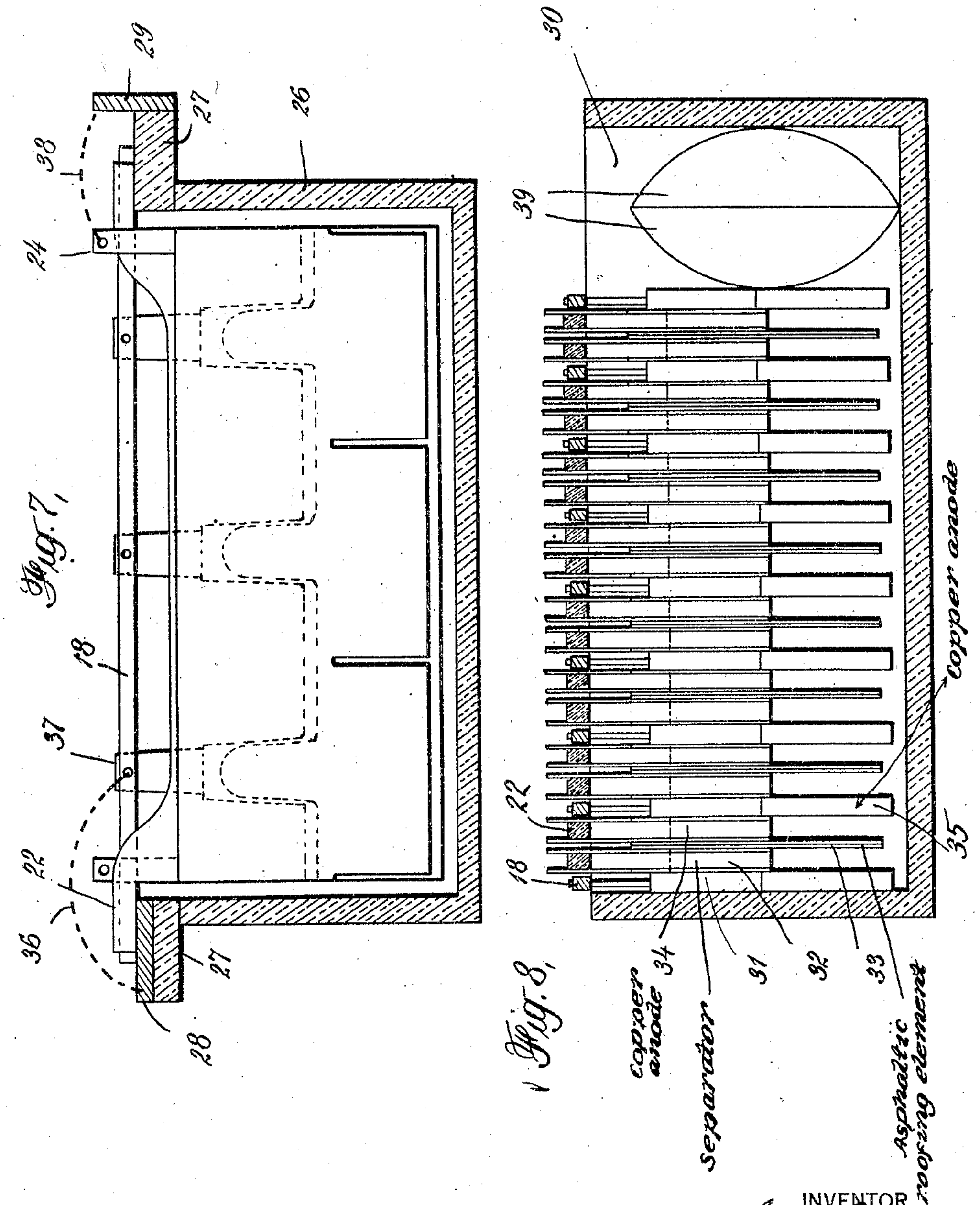

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UNITED STATES PATENT OFFICE.

THOMAS ROBINSON, OF NEW YORK, N. Y., ASSIGNOR TO ANACONDA SALES COMPANY, A CORPORATION OF DELAWARE.

METHOD AND APPARATUS FOR PRODUCING ROOFING ELEMENTS.

Application filed December 22, 1923. Serial No. 682,149.

To all whom it may concern:

Be it known that I, THOMAS ROBINSON, a subject of the King of Great Britain, residing at New York city, in the county of New York, State of New York, have invented certain new and useful Improvements in Methods and Apparatus for Producing Roofing Elements; 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.

This invention relates to a method and apparatus for electroplating and is intended more particularly for use in the manufacture of roofing elements.

The roofing elements referred to consist of a composition base and a metallic coating electrodeposited thereon. The base employed for this purpose may consist of various compositions, such as felt, burlap, or paper, impregnated with bituminous or asphalt compositions, known generally as asphaltic roofing, or fibrous materials such as asbestos, wood fiber and the like, bound together by a suitable binder. Applied to the surface of this base is a layer of a non-corrodible metal such as copper, and this copper plate or sheathing is limited, in part for reasons of economy, to that surface of the base which is exposed when the elements are in place on the roof.

The particular type of element which is intended to be manufactured by the method and apparatus which will later be described, is the shingle which may be either single or multiple. For single shingles the bases are cut to the appropriate oblong form, and these elements are laid on the roof in overlapping courses in the manner usually employed with wooden shingles. The adjacent shingles of each course are spaced apart to give the roof the desired appearance and not only is a considerable extent of the shingle along one edge exposed to the weather, but there is exposed a narrow area which lies beneath the space between a pair of adjacent shingles of the course next above. The copper plating, therefore, which is intended to cover the weather surface of the element, is applied so as to cover the exposed edge and a tongue which extends backwardly on the surface of the shingle so as to protect that part which is to be exposed between shingles of the course above. In multiple shingles which have a size corresponding to two or more single shingles placed side by side, there are formed cut-outs extending inwardly from the exposed edge for the purpose of giving a series of these multiple shingles laid side by side the same appearance as that of spaced single shingles. The plating on the multiple shingles consequently corresponds to that used on single shingles but has a plurality of tongues extending back from its main area. Various other forms of roofing elements may be employed in addition to the single and multiple shingles described, but in each case the metallic protective layer is designed so as to protect all portions of the elements which would normally be exposed and consequently under normal circumstances this layer will have an irregular area.

The present invention is directed to a method and apparatus for electrodepositing the protective layer of irregular shape on elements of the type generally referred to, and is intended to produce these elements rapidly, at a minimum expense and with the production of a plating of excellent characteristics. In accordance with this method there is employed an electrolytic cell of convenient size which has positive and negative bus bars located along the sides. Suspended in this cell is a plurality of anodes and between each pair of anodes is a pair of insulating separator members. Between the separators are placed the elements which have been given a coating of conducting material over that surface on which the deposit is to be formed. The separators have conducting faces which make contact with the conducting material, and these conducting or contact faces are, in turn, connected to the negative bus bar of the cell and formed so as to shield and mask that part of each element on which no deposit is to take place, and consequently the edge of the separator defines the edge of the deposit. In the manufacture of single or multiple shingles, as described, the separator will, therefore, have cut-out portions which corresponds in shape to the shape of the tongues extending from the main body of the plating.

The anodes used in this process may be made of plates of metal but are preferably of a composite construction consisting of a core or base of a material which is insoluble in the electrolyte and a coating of the metal which is to form the deposit plated on the core. The anode further has a shape which corresponds closely to the shape of the deposit, and, therefore, in making shingles of the type previously referred to the anode will consist of a main body or sheet from which one or more tongues extend. The anode has a plurality of holes formed through it which permit an increased and rapid circulation both in plating the metal on the core and in plating the metal off the core upon the elements. These holes also provide an increased anode surface, while confining the size of the anode within the desired limits. The anodes are mounted in the cell in the usual manner, connected to the positive terminal of a source of current and the metal is plated therefrom upon the surface of the elements. Inasmuch as the anodes conform in their general outlines to the shape desired for the deposit, and since they have an increased surface over that normally employed, and also since a rapid circulation of the electrolyte is permitted, the process of producing the elements may be carried on rapidly with the time required for deposition reduced to a minimum, while the quality of the plate is entirely satisfactory.

By making use of anodes of the type described a further economy is effected. In those processes of electrodeposition making use of soluble anodes, the anodes employed are of refined metal. In the case of copper plating the anodes are prepared after the metal has been subjected to certain refining processes. The crude metal taken from the smelter is subjected to electrodeposition upon a starting sheet and the cathodes so produced are then melted up and cast into anodes of a size convenient for use in the particular electrolytic cell in which they are to be employed. The crude copper, therefore, passes through an electrolytic refining process and is then melted and cast to convenient form. With the present type of anode, however, it is possible to shorten this procedure by using the anode base as the cathode in the first electrolytic refining step, and the metal deposited thereon is found to be of sufficient purity for the purpose of making roofing elements. These anodes are, therefore, made directly from the crude metal coming from the smelter without the necessity of first depositing the metal on a starting sheet and then melting this metal and casting it to appropriate form. This elimination of the melting and casting cheapens the production of the anodes considerably and the quality of the plating produced is sufficiently pure for this particular purpose. By making use of a base of a material which is insoluble in the electrolyte, the material deposited on it may be plated off completely and there is thus no loss in scrap and no remelting charge.

In the accompanying drawings there is illustrated a suitable apparatus by which the new process may be practiced, and in these drawings,

Fig. 1 is a face view of an anode in the form used for the production of three-unit shingles,

Fig. 2 is a sectional view on the line 2—2 of Fig. 1,

Fig. 3 is a face view of a separator,

Fig. 4 is a sectional view of the separator on the line 4—4 of Fig. 3,

Fig. 5 is a face view of a three-unit shingle base,

Fig. 6 is a face view of a three-unit shingle showing the deposit formed thereon.

Fig. 7 is a transverse sectional view through an electrolytic cell in which the anodes and separators are used, and

Fig. 8 is a longitudinal sectional view of a cell showing the anodes, separators, and elements in place therein.

Referring to these drawings, the multiple unit shingle is seen to consist of a sheet of base material 9 of a length corresponding to the width of three single shingles and a width corresponding to the length of the ordinary shingle. Along that edge which is to be exposed when the elements are laid in courses are cut-outs 10 which extend into the main body of the base for such a distance that when a series of elements is laid in overlapping courses the forward edges of the elements of the upper course will conceal the rear end of the cut-outs and thus the portions 11 of the shingle between the cut-outs will have the appearance of single shingles. With this arrangement the roof, when covered with such elements laid in the manner described, has the appearance of the ordinary shingled roof. The portions 11 which are to be exposed to the weather are protected by a metallic coating 12 and for purposes of this description the metal used for this purpose will be considered to be copper, although it will be clear that other metals of a similar character could be used for this layer. Since the cut-outs expose portions of the elements beneath them, the protective layer is arranged to cover that surface of the element, and consequently the plating is formed with tongues 13 which extend backwardly from the main body of the plating and are located equidistant between the cut-outs.

Since the deposit to be formed on the base has an irregular outline as illustrated in Fig. 6, the anodes used in the process are given a corresponding shape and as a result greater rapidity in the electrodeposition operation is attained. Such an anode is illustrated in Fig. 1 in the form in which it would be used for making three-unit shingles, and consists of a main body from which extend tongues 15 equal to, or slightly greater in width, than the tongues 13. The anode here shown has three of these tongues 15 which are spaced to correspond to the spacing of the tongues 13. The anode here shown is the composite type and consists of a sheet 16 of insoluble base material, preferably of lead, since the electrolyte used in the cells is ordinarily copper sulphate and the lead is not soluble therein. The base is comparatively thin but since it is used to support the anodes it must have sufficient tensile strength to support the weight of the copper which is to be deposited thereon. Formed through the base are holes 17 which may be arranged in any particular order but which are here illustrated as placed in two rows. These holes may vary in size but are shown as one inch holes on two inch centers. The tongues 15 are also formed with holes 17 similar to the holes previously described. The tongues 15 extend upwardly for a considerable distance and are connected at their upper ends by a bar 18 which is preferably of copper, connected to the tongues in any convenient manner, as by rivets 19. This bar 18 extends beyond the ends of the anode and serves to support the latter in the cell, as will presently be described, and also to provide the electrical connection by which the current is led to the anode.

The separator consists of a plate of insulating material, such as wood, and is of a length equal to the element. In its lower surface the separator has cut-out portions 20 which serve to define the shape of the tongues 13 and, therefore, have a shape and size depending on the shape and size which is to be given these tongues. Either face of the separator is covered with a sheet of metal 21, preferably lead, since this metal does not go into solution in the electrolyte. At its upper outer corner the separator has extending lugs 22, which are mounted to overlie the sides of the cell and thus provide a means for supporting the separator therein. The sheet of metal 21 covering the face of the separator is of such dimensions that when the edge of the element is placed even with the upper edge 23 of this sheet, the element will be in such position that its conducting coating is properly exposed beyond the edge of the separator to receive the plating. The edge of this sheet, therefore, acts as a gauge for positioning the element. Extending upwardly from one corner of the sheet is a strip of metal 24 having a hole 25 therethrough. This strip of metal serves as a terminal for a connector which is connected to the strip and to the negative terminal of the cell.

The cell in which the elements are to be plated is formed of slate or of wood, either with or without a sheathing, or it may be formed of any material such as is commonly used for this purpose, preferably one which is not affected by the electrolyte. The side walls 26 of the cell are spaced apart a distance corresponding to the length of the element and have strips 27 secured to their upper surface and extending beyond the side walls. On the upper surface of one of these strips is mounted the positive bus bar 28, while on the side of the other strip is mounted a bus bar 29 which is connected to the negative terminal of the source of power. The cell is sufficiently deep so that the level of the electrolyte in it will be above the upper edge of that part of the element which is to be covered by the coating. In the cell illustrated there are to be placed a group of nine anodes, sixteen separator members, and sixteen elements. The length of the cell is somewhat greater than the actual amount of space required for this group, and the end space 30 so provided is for the purpose of permitting the various parts to be separated so that the elements may be readily removed.

In setting up the parts for the operation of the cell, an anode 31 is placed in one end of the cell. The ends of the bar 18 of this anode rest on top of the bus bar 28 and the strip 27, and thus support the anode in its proper location within the cell. Placed against the face of the anode which is mounted against the inner face of one end wall of the cell, is a separator 32, the lugs 22 of the separator lying on the bus bar 28 and the strip 27 and thus supporting the separator in proper location. There are next placed in the cell, a pair of roofing element bases 33, placed back to back, so that the conducting coating on one is turned toward the anode and separator which have previously been put in place, while the conducting coating on the other element is turned in the opposite direction. Next to this latter element is placed a second separator 34, beyond which is placed another anode 35. This arrangement is used throughout the cell. In order to insure that a proper connection is made between the bus bars and the anodes and conducting faces of the separator, a suitable connection 36 may be made between the bus bar 28 and the first tongue of each anode at 37, while a similar connector 38 connects the terminal 24 of the separator with the bus bar 29. When the complete group of anodes, separators and elements have been placed in position within the cell, there is inserted between the last anode and the opposite end of the cell a pair of wedges 39, 39, which force the anodes, separators, and elements together, and thus the elements are held by pressure without the necessity of securing them in place by clamps or other similar devices.

With the elements so secured in place the current is led into the anodes through the bus bar 28 and the connections 36. The copper on the face of each anode then goes into solution and is deposited on the conducting surface of the roofing elements. The current is withdrawn from this conducting coating through the conducting sheet on the face of the separator which is in contact with it, thence through the terminals 24, connectors 38, and the bus bar 29.

As has previously been described, the tongues 15 on the anode are similar in size to the tongues 13 which form part of the plating and the anode tongues are located opposite the cut-outs 20 of the separators. The main body of the anode extends below the edge of the separator and lies in proximity to the surface of the conducting coating on the element. With this arrangement it will be seen that all portions of the conducting coating on the element lie at the same distance from the surface of the anode and since the anodes are perforated in the manner described this permits of an active circulation of the electrolyte between the anode and the element. It will be understood that ordinarily a plurality of cells will be set up as a battery, and these cells will be connected together so that the electrolyte may pass from one to another. This flow of electrolyte may be caused by a pump and the connections will be such as to cause the electrolyte to flow successively through the several cells. The perforations in the anodes insure that none of the electrolyte will be pocketed and thus become weak. Consequently, by reason of this increased circulation and the spacing of the anode and the element, and also by reason of the increased area of the anode exposed to the electrolyte by reason of the holes, the plating may be carried on much more rapidly than usual, while the quality of the deposit is in no way impaired. After the electrolysis has been carried on for a length of time sufficient to produce a plating of the desired thickness, the wedges are removed, the members suspended in the cell are separated, and unplated elements substituted for those which have received the plating. The parts are then placed in their original positions, the wedges forced in place, and the deposition continues.

It has been found that there is a tendency to build up a deposit on the edge of the contact face of the separator which lies against the conducting coating of the element, and this deposit, which serves no useful purpose, may in time extend across the lower end of the separator and cause a shortcircuiting of the anode and element. When this deposit on the separator has attained an objectionable size, upon the next assembling of the parts the separators are removed from the cell and reversed, whereupon the face on which the deposition has occurred now lies in contact with the anode and this deposit will thereupon go into solution. It has been found that this solution or deplating of the deposit occurs much more rapidly than the deposit is built up, and consequently by this reversal of the separators they are kept clean without the necessity of withdrawing them from the cell from time to time and removing the deposit by mechanical means. In this way the separators are kept from injury and may be used for an indefinite period.

When all of the copper on the lead base of the anode has gone into solution new anodes must be substituted. The old anode bases are simply removed from the cell, new ones slipped into place, and then the old bases are taken to the copper refining cell and used as cathodes therein. They are built up to their original condition and in this way the bases may be used indefinitely, since when the base is exposed by the plating-off of the copper the lead is not soluble in the electrolyte.

The separators have been described as having contact faces made of sheets of metal, but if desired it is possible to make use of contact strips which are preferably located so as to extend along the edge of the cut-out portions of the separator, making contact there with the upper edge of the contact coating on the element. The use of this separator with its entire face covered with a sheet of metal not only serves the purpose of withdrawing current from the elements, but it has been found that the deposit has a cleaner boundary since the metal is ordinarily a better conductor than the conducting material applied to the element, and the current does not flow in the conducting coating above the line of contact and, therefore, no deposit will take place above this line.

By the use of the anode having a base corresponding to the shape of the deposit and formed of the plating material deposited on a base, it will be seen that all soluble portions of the anode may be used without waste and consequently there is no scrap nor are there any remelting charges. The correspondence in shape of the anode and the deposit and the use of perforations through the anode greatly improve the quality of the deposit and permit of much greater current densities than are ordinarily permissible, while the plating applied to the element is kept from being powdery.

While the apparatus here illustrated has been found to provide a convenient means of practicing the process, it will be clear that various other forms of apparatus would be equally useful for this purpose. Also the shape of the anode, the separator, and the dimensions of the cell will depend on the shape of the element which is being treated. In case a single unit shingle is being made, then the anode will have a body portion corresponding to the shape of the deposit, and only a single tongue 15 extending therefrom. The separator, accordingly, will have but a single cut-out portion 20 and various other changes incidental to the use of the apparatus for elements of different forms will be clear from a consideration of the purposes for which the apparatus is designed.

The several steps of the process will remain the same regardless of the shape of the element which is being produced. The anodes are placed in the cell, the separators placed against their faces, and between a pair of separators is placed a pair of elements back to back with their conducting coatings facing the anodes. The wedges are then inserted, forcing the different members together and thus supporting the elements in place and further insuring that a good contact will be made between the contact faces of the separators and the conducting coatings of the elements. While the anodes are preferably made of an insoluble core or base on which is plated the copper to be deposited, it is also possible to use cast anodes of the same general form; that is, a form corresponding to the shape of the deposit to be made. When the anode is made by plating the metal on the core it may be used until the plating has completely gone into solution, whereupon the cores will be removed and another deposit of metal formed thereon. This type of anode is superior in the respect that there is no scrap and no expense involved in remelting the scrap material. By substituting anodes from time to time as is required, and by reversing the separators in the manner described, the cell may be operated without substantial interruption for indefinite periods. It is necessary to refresh the electrolyte periodically, as is customary in plating processes, and for this purpose a portion will be removed and the entire quantity of electrolyte in the several cells brought up to the normal quality by the introduction of fresh electrolyte.

I claim:

1. A method of making roofing elements comprising the steps of mounting an anode in a cell, this anode having a shape corresponding to the shape of the deposit to be made, placing a separator in contact with the face of the anode, placing a base having a conducting coating formed thereon against the surface of the separator, holding these parts together by pressure, and connecting the anode and the conducting coating of the base to the positive and negative terminals respectively of a source of current.

2. A method of making roofing elements comprising the steps of plating copper on a base to form an anode, mounting this anode in a cell containing an electrolyte in which the anode base is insoluble, mounting a base having a conducting coating in the cell in spaced relation to the anode, and connecting the anode and the coating to the positive and negative terminals respectively of a source of electric current.

3. A method of making roofing elements comprising the steps of plating copper on a base to form an anode, this base having a shape corresponding to the shape of the deposit to be made, mounting this anode in a cell containing an electrolyte in which the anode base is insoluble, mounting a base having a conducting coating in the cell, and connecting the anode and the coating to the positive and negative terminals respectively of a source of electric current.

4. A method of making roofing elements comprising the steps of plating copper on a base to form an anode, this anode having a shape corresponding to the shape of the deposit to be made, mounting this anode in a cell containing an electrolyte in which the anode base is insoluble, placing a separator of insulating material between the base and the anode, this separator having a shape defining the shape of the deposit to be made, and connecting the anode and the coating on the base to the positive and negative terminals respectively of a source of electric current.

5. A method of making roofing elements comprising the steps of mounting an anode in an electrolytic cell, this anode having a shape corresponding to the shape of the deposit to be made, mounting a separator adjacent the anode, mounting a base having a conducting coating against the face of the separator with the conducting coating turned toward the anode, holding the element in place against the separator by pressure, and connecting the anode and the conducting coating of the base to the positive and negative terminals respectively of a source of electric current.

6. A method of making roofing elements comprising the steps of mounting a plurality of anodes in an electrolytic cell, between the faces of adjacent anodes placing a pair of separators, between the opposed faces of the separators placing a pair of bases each having a conducting coating on one face, back to back with the coated faces turned toward the anodes, holding the anodes, separators and bases together by pressure, and connecting the anodes and the conducting coatings on the bases to the positive and negative terminals respectively of a source of electric current.

7. A method of making roofing elements comprising the steps of plating copper on

a base to form an anode, mounting a plurality of these anodes in an electrolytic cell, between the opposed faces of each pair of anodes placing a pair of separators, between the separators placing bases having conducting coatings on one surface thereof with the coatings turned toward the anodes, holding the anodes, separators and bases together by lateral pressure, and connecting the anodes and the coatings to the positive and negative terminals respectively of a source of electric current.

8. Apparatus for making roofing elements comprising an electrolytic cell, having positive and negative bus bars mounted thereon, an anode supported in the cell and having a terminal connected with the positive bus bar, this anode having a shape corresponding to the shape of the deposit to be made, a separator mounted in the cell adjacent the face of the anode, this separator being formed to define the shape of the deposit, and means for holding a roofing element base having a conducting coating formed on the surface thereof against the face of the separator with the conducting coating turned toward the anode.

9. Apparatus of the class described comprising an electrolytic cell, an anode supported therein, this anode having a shape corresponding to the shape of the deposit to be made, a separator mounted against the face of the anode and composed of insulating material having a conducting face mounted thereon, this separator having a shape serving to define the shape of the deposit, and a base having a conducting coating on one surface thereof, this base being supported against the separator and extending beyond the edge thereof.

10. Apparatus of the class described comprising an electrolytic cell, a pair of anodes mounted therein, these anodes having a shape corresponding to the shape of the deposit and having a plurality of perforations formed therethrough, a pair of separators formed of insulating material and having conducting surfaces disposed thereon, the separators being placed between the anodes with their conducting faces opposed, a pair of roofing element bases disposed between the separators in contact with each other, the outer surface of each element having a conducting coating thereon lying against the conducting surface of the adjacent separator, and means for holding the anodes, separators and elements in contact to support the elements in place between the separators.

11. Apparatus of the class described comprising an electrolytic cell, an anode mounted in the cell and consisting of a plate having a tongue extending therefrom, the plate and the tongue being formed to correspond with the shape of the deposit to be made, a separator placed against the face of the anode and consisting of a sheet of insulating material having a contact surface mounted on one face thereof, this separator having a boundary serving to define the shape of the deposit, and an element having a conducting coating formed thereon held against the face of the separator with the coating in contact with the contact surface.

12. In an electrolytic cell, the combination of an anode consisting of a plate of the material to be deposited, a tongue extending from the plate, the shape of the plate and tongue corresponding to the shape of the deposit to be made and the plate having a plurality of perforations therethrough, an insulating separator disposed against one face of the anode, a contact surface disposed on the face of the separator, and a roofing element base having a conducting coating held against the separator with the conducting coating in contact with the contact surface.

13. In an electrolytic cell, a soluble anode composed of the material to be deposited and comprising a plate and a tongue extending therefrom, the shape of the plate and tongue corresponding to the shape of the deposit to be made and the plate having a plurality of perforations therethrough, a bar attached to the tongue and serving as a support for the anode and as an electrical terminal therefor, a separator formed of insulating material mounted against the face of the anode, this separator having a boundary serving to define the shape of the deposit, a contact surface mounted on the separator, and a roofing element base held against the surface of the separator, this base having a conducting coating in contact with the contact surface.

14. In an electrolytic cell, an anode consisting of a core of insoluble material having a plating of the material to be deposited on the core, this anode having a shape corresponding to the shape of the deposit to be made, a separator of insulating material held against the face of the anode, a contact surface formed on the separator, and a roofing element base held against the separator and having a conducting coating in contact with the contact surface thereon.

15. In apparatus of the class described, an electrolytic cell having positive and negative bus bars disposed along the sides thereof, an anode in the cell consisting of a plate of the material to be deposited, a tongue extending from the plate and a bar supported by the walls of the cell and making contact with the positive bus bar of the cell, the plate and tongue having a shape corresponding to the shape of the deposit to be made, a separator formed of insulating material having a contact surface on one face thereof, this contact surface being electri-

cally connected to the negative bus bar of the cell, the separator having a shape serving to define the deposit to be made, and a roofing element having a conducting coating disposed on the face thereof, this conducting coating being in contact with the contact surface of the separator.

16. Apparatus of the class described comprising an electrolytic cell having positive and negative terminals disposed therein, a plurality of anodes mounted in the cell, each anode consisting of a plate, a tongue extending therefrom, and a bar secured to the tongue and serving as a means for supporting the anode in the cell and also being electrolytically connected to the positive terminal of the cell, the plate and the tongue having a shape corresponding to the shape of the deposit to be made, a plurality of separators mounted in the cell in pairs between adjacent anodes, each separator consisting of a plate of insulating material and a contact surface mounted on the plate, the plate having a boundary serving to define the deposit, a plurality of roofing element bases mounted in pairs between the members of each pair of separators, each roofing element base having a conducting coating in contact with the contact surface of the separator, electrical connections between the contact surface of the separators and negative terminals of the cell, and means located at an end of the cell and serving to hold the anodes, separators, and elements in place.

17 In apparatus of the class described, a soluble anode having a shape corresponding to the shape of the deposit to be made.

18. In apparatus of the class described, an anode consisting of a core of insoluble material and a deposit thereon of the material to be deposited, the core having a shape corresponding to the shape of the deposit to be made and having a plurality of perforations formed therethrough.

19. In apparatus of the class described, a soluble anode consisting of a plate and a tongue extending therefrom, the plate and tongue having a shape corresponding to the shape of the deposit to be made and being formed with a plurality of perforations therethrough.

20. In apparatus of the class described, an anode consisting of a core of insoluble material having a plating thereon of the metal to be deposited, the anode consisting of a plate and a tongue extending therefrom, the shape of the plate and tongue corresponding to the shape of the deposit to be made, and a bar connected to the tongue and serving as a means for supporting the anode and also as an electrical terminal therefor.

In testimony whereof I affix my signature.

THOMAS ROBINSON.