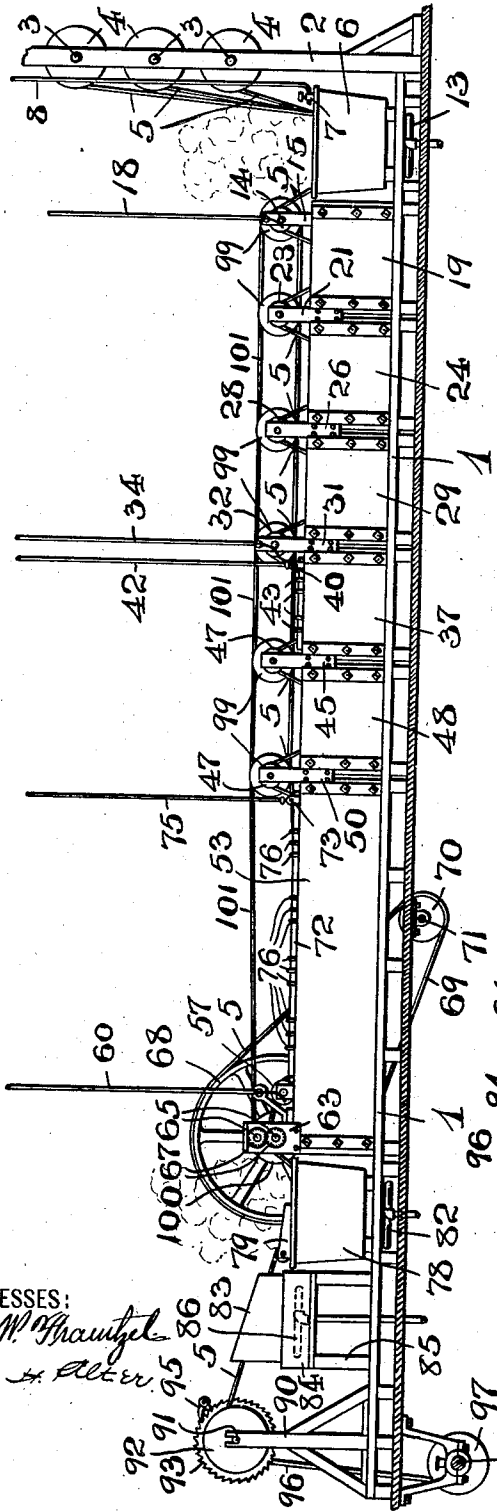
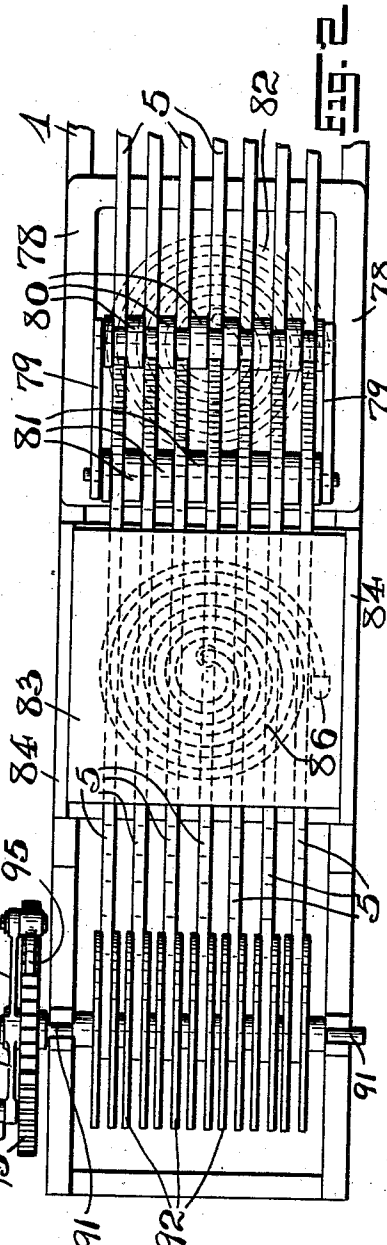


929,312.

Patented July 27, 1909.

5 SHEETS—SHEET 1.

Fig. 1



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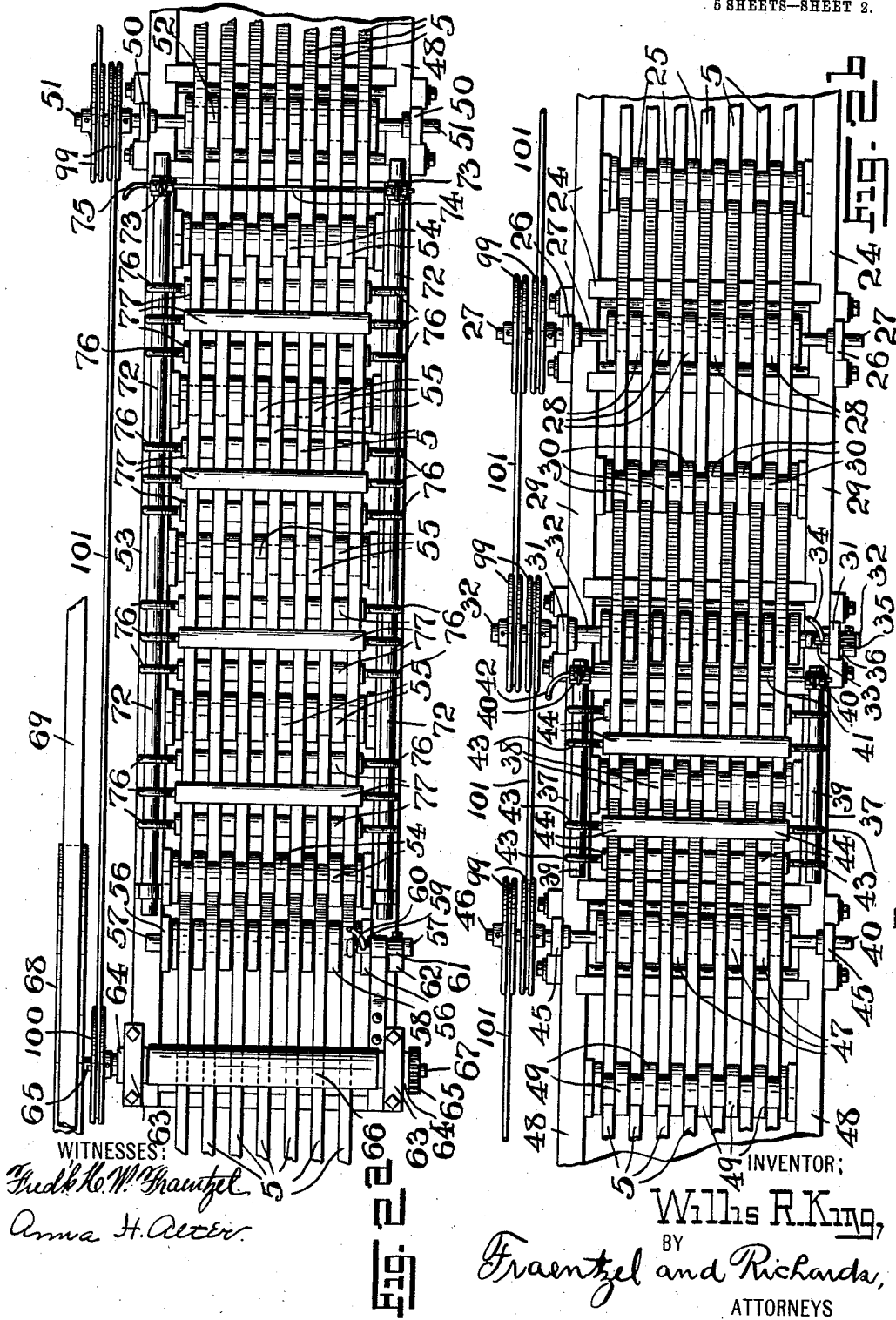
BY
Fraentzel and Richards
ATTORNEYS.

W. R. KING.
ELECTROPLATING PLANT.
APPLICATION FILED NOV. 13, 1908.

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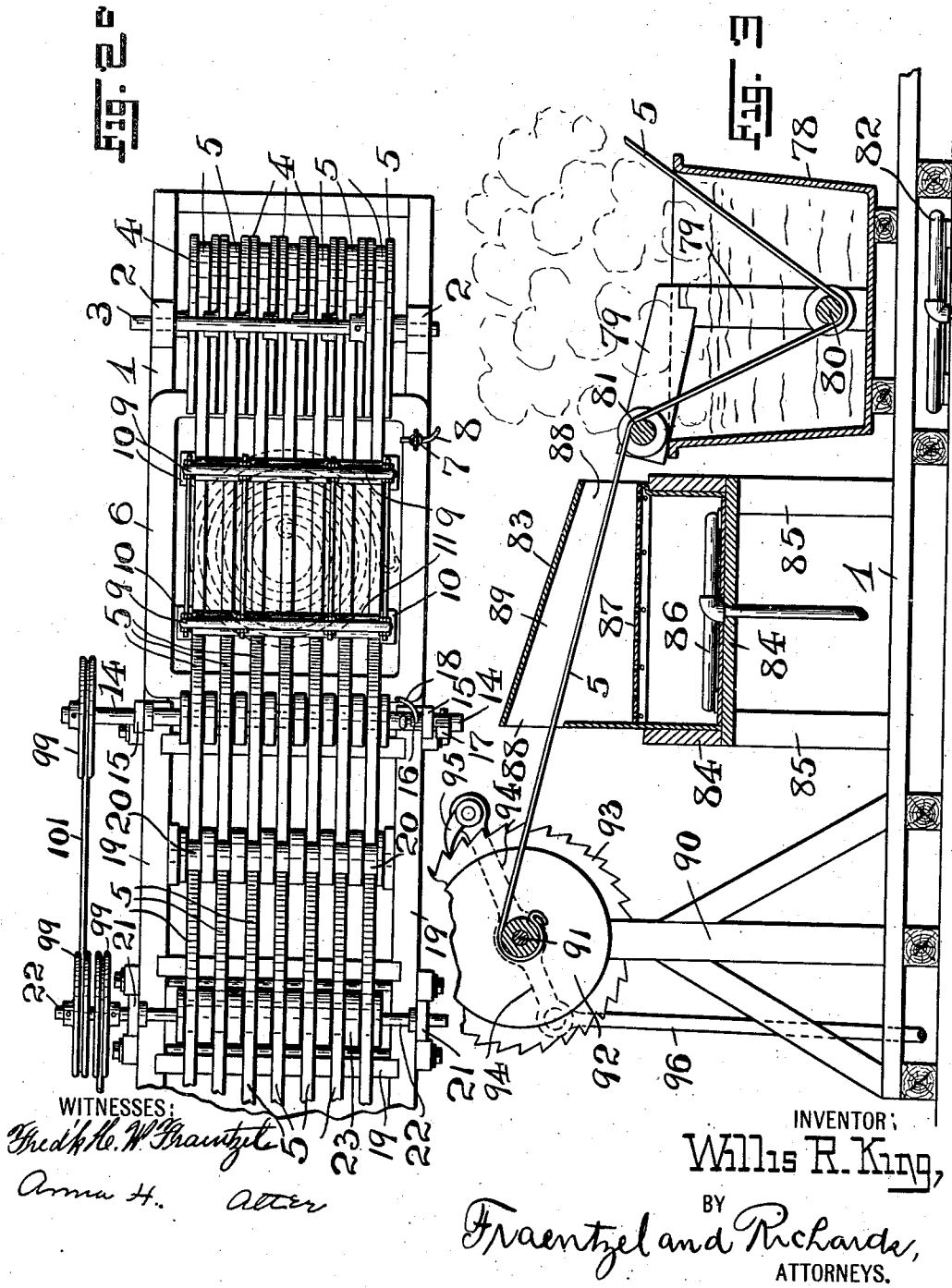
5 SHEETS—SHEET 2.



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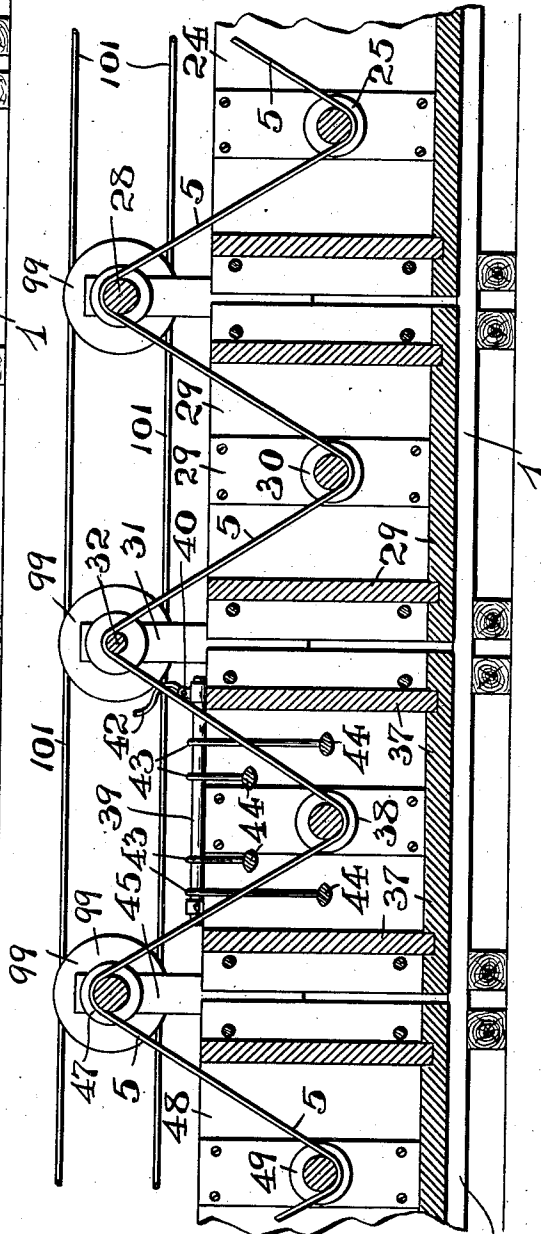
Patented July 27, 1909.

5 SHEETS—SHEET 3.



929,312.

5 SHEETS—SHEET 4.



INVENTOR:

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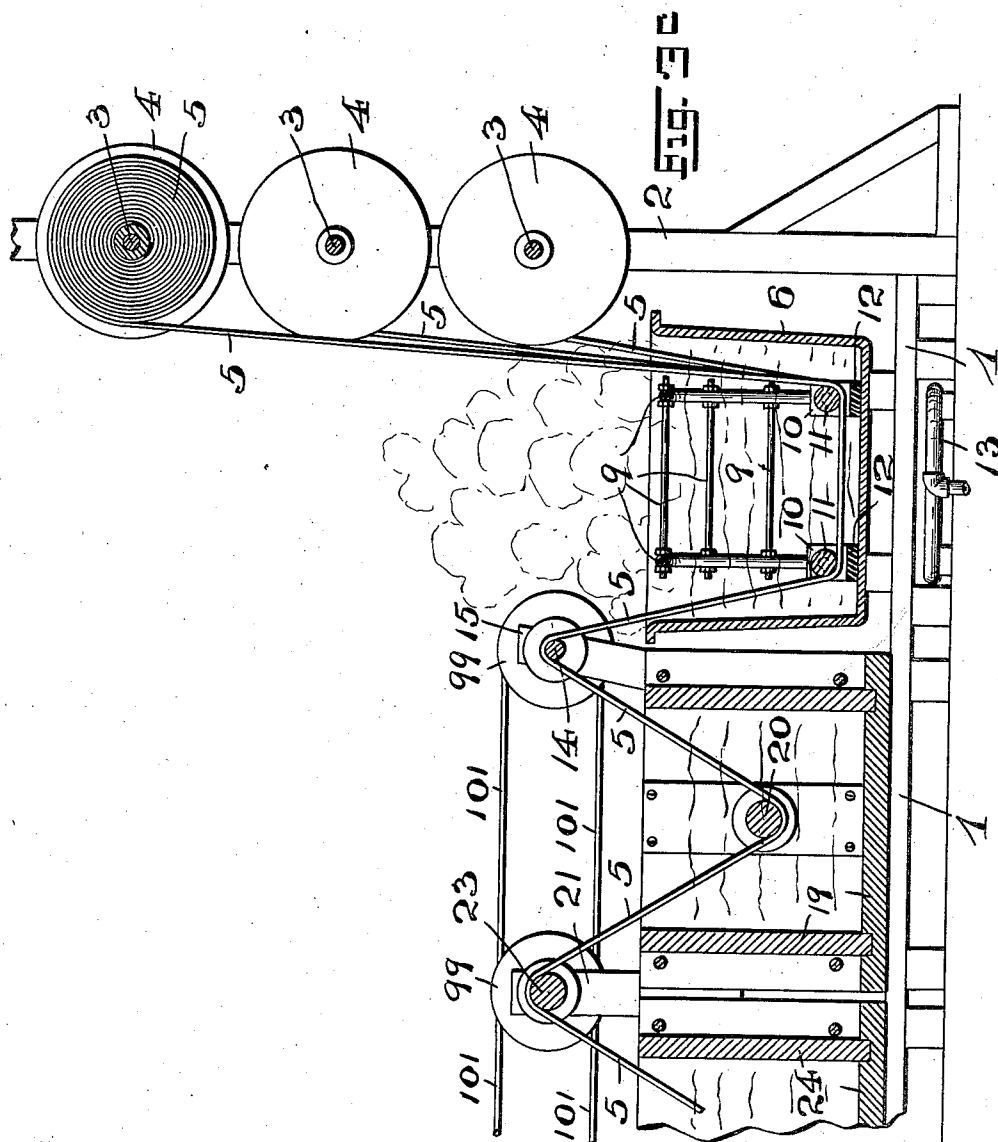
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ELECTROPLATING PLANT.
APPLICATION FILED NOV. 13, 1908.

Patented July 27, 1909.

5 SHEETS—SHEET 5.



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UNITED STATES PATENT OFFICE.

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ELECTROPLATING PLANT.

No. 929,312.

Specification of Letters Patent.

Patented July 27, 1909.

Application filed November 13, 1908. Serial No. 462,375.

To all whom it may concern:

Be it known that I, WILLIS R. KING, a citizen of the United States, residing at Newark, in the county of Essex and State of New Jersey, have invented certain new and useful Improvements in Electroplating Plants; 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 to a novel plant for electroplating hoop-iron, wire, strip-metal, chain, wire-screen, and the like, by means of one continuous step in the process of electro-plating.

The present invention therefore has for its principal object to provide a novel arrangement and combination of electroplating apparatus, cleaning tanks, washing tanks, drying apparatus, driving or conveying apparatus, and take-up reels, all adapted to carry out the various steps and processes incident to the operation of electro-plating, and especially adapted to perform the operation of electroplating, together with the necessary processes precedent and subsequent to the main operation of electroplating long lengths of loop-irons, wire, strip-metal, chains, wire-screen, or other similar material.

It is well known that great difficulty is met with in handling metallic material of extraordinary long lengths, when it is desired to electroplate the same, most of the old methods requiring the treating of such material in sections, whereby each separate section has to be handled several times in carrying out the separate steps of an electroplating process.

It is one of the main objects of the present invention, to provide a plant, in which such material may be passed through the various steps of an electroplating process, continuously, without the necessity of the frequent handling of the same; and, consequently the great expenditure of labor and time incident to such separate handling is obviated.

One of the main purposes of the present invention is to provide a plant for electroplating great lengths of metallic material,

whereby the said metallic material may be continuously fed from reels, drums, or the like, and passed continuously from apparatus to apparatus, by means of which each separate step of the electroplating process is performed, as said metallic material passes therethrough, and finally winding or taking up said metallic material in its finished state upon reels, drums or the like.

The plant is arranged in such a manner, so that each step of the electro-plating process is completed in its proper order, and means are provided for carrying the metallic material from apparatus to apparatus, whereby the several steps are performed in sequence, until the material is finally completed and in its finished state is finally deposited upon the receiving reels, drums, or the like.

The invention is clearly illustrated in the accompanying drawings, in which is represented the most complete arrangement of the apparatus and devices comprising the novel plant for the electroplating of extraordinary long lengths of metallic material, such as hoop-iron, wire, strip-metal, chain, wire-screen, and the like.

In the said drawings, Figure 1 illustrates a side elevation of the novel plant embodying the principles of the present invention. Figs. 2, 2^a, 2^b and 2^c, represent in top or plan view, portions of said novel plant, said views being made on an enlarged scale. In like manner, Figs. 3, 3^a, 3^b and 3^c, represent central vertical longitudinal sections of the parts represented in said Figs. 2^a, 2^b, and 2^c.

Similar characters of reference are employed in all of the above described views, to indicate corresponding parts.

Referring now to the said drawings, the reference-character 1 indicates any desirable form of supporting frame-work or foundation upon which the various apparatus may be arranged.

The reference-character 2 indicates the standards between which are mounted the shafts 3, bearing the reels or drums 4 upon which the long lengths of metallic material 5 are carried. The said lengths of metallic material 5 are first carried into a cleaning apparatus, which comprises a metallic-tank 6 provided with a binding-post 7 to which is attached a wire 8 of an electrical circuit. Arranged within said tank 6 is a frame-work 9 which is provided with bearings 10,

in which are suitably mounted rollers 11. The said frame-work is supported upon the bottom of the tank 6 by means of insulating blocks 12. The said tank 6 is filled with a solution of potash which is kept hot by means of a steam-coil 13, or the like, arranged beneath said tank. This potash solution cleanses the metallic material as it is passed therethrough, from all grease and foreign material which may cling to the surface of the same. The metallic material is drawn from the reels or drums 4 and passed under the rollers 11 so as to submerge the same in the potash solution, and upon emerging from said solution of potash, the strips of metallic material pass over a contact-rod 14 mounted rotatably between standards 15. The said contact-rod 14 is arranged in the electrical circuit, by means of a binding-post 16, one end of which carries a brush 17 which rides in contact with said contact-rod 14, and the said binding-post being connected with an electrical conductor 18, whereby the circuit is established and completed through the tank 6, the potash-solution to the strips 5 in contact with the contact rod 14, and through the brush 17 and binding-post 16 to said conductor 18. Arranged adjacent to said tank 6 is a tank 19 and rotatably arranged in the interior thereof is a guide-roller 20. The tank 19 is filled with cold water and the metallic material is carried from said contact-rod 14, beneath said guide-roller 20, so as to submerge the same in the said water, whereby the potash-solution clinging thereto is rinsed or washed off, as will be clearly evident. Mounted between a pair of standards 21 is a shaft 22 upon which is secured a driving or conveying roller 23, over which the metallic material 5 is carried after emerging from the water in said tank 19. Arranged adjacent to said tank 19 is a tank 24 also provided with an internally arranged guide-roller 25, said tank 24 being filled with a pickling solution for the purpose of removing any scale or the like, which, in cases where the metallic material to be plated has been annealed, may cling to the surface of said metallic material. The metallic material is carried from said driving or conveying roller 23 beneath the said guide-roller 25, so as to submerge the same in the said pickling solution. Mounted between a pair of standards 26 is a shaft 27 upon which is secured a driving or conveying roller 28, over which the metallic material 5 is carried after emerging from the said pickling solution. Arranged adjacent to said tank 24 is a tank 29 which is provided with an internally arranged guide-roller 30, said tank 29 being filled with cold water, and the metallic material 5 is carried from said driving or conveying roller 28 beneath said guide-roller 30, so as to be sub-

merged in the water, and whereby the pickling solution clinging thereto is rinsed or washed off of the same. Mounted between a pair of standards 31 is a contact-rod 32, and arranged upon one of said standards 31 is a binding-post 33, to which is secured one end of an electrical conductor 34 of an electrical circuit. Connected with said binding-post is a brush-holder 35 in which is arranged a suitable brush 36, the free end of which is adapted to be maintained in electrical contact with said contact-rod 32. The strips of metallic material 5 upon emerging from said cold water tank 29 pass over said contact-rod 32 and are thus brought in electrical contact therewith. Arranged adjacent to said tank 29 is another tank 37 which is provided with an internally arranged guide-roller 38. This tank 37 is filled with a solution of copper or other salts so as to provide a copper or other suitable bath, and the metallic material 5 is carried from said contact-rod 32 beneath said guide-roller 38, so as to submerge the same in the said bath. Secured upon the upper edges of the sides of said tank 37 are contact-rods 39 which are provided with binding-posts 40, a connecting conductor 41 being arranged between said binding-posts 40. One of said conductors is connected with an electrical conductor 42 of an electrical circuit. Suspended from said contact-rods 39, by means of suitable hangers, as 43, are a plurality of anodes 44, so arranged that one group is placed adjacent to the upper surfaces of said strips of metallic-material 5, and the other group are arranged adjacent to the under surfaces of said strips of metallic material 5. Mounted between a pair of standards 45 is a shaft 46 upon which is secured a driving or conveying roller 47, over which the said strips of metallic material 5 are carried after emerging from the said copper-bath; and, adjacent to said tank 37 is another tank 48 which is provided with an internally arranged guide-roller 49. This tank 48 is filled with cold water and the strips of metallic material 5 are carried from said driving or conveying roller 47 beneath said guide-roller 49 so as to be submerged in the said water, whereby any portion of the solution still clinging thereto may be rinsed or washed off. Mounted between a pair of standards 50 is a shaft 51 upon which is secured a driving or conveying roller 52, over which the said strips of metallic material 5 are carried after emerging from the cold water tank 48, and adjacent to said cold water tank 48 is a long trough-like plating-tank 53, adapted to be filled with any desirable electroplating solution. This tank 53 is provided at each end with internally arranged guide-rollers 54, and suitably disposed within said plating-tank 53, between the said guide-rollers 54 and on a slightly

lower plane than said guide-rollers 54, are a plurality of supporting or carrying rollers 55. Mounted between a pair of standards 56 is a contact-rod 57. Secured to the upper edge of one side of said tank 53 is a supporting bracket 58, in the free end of which is arranged a binding-post 59, to which is secured one end of an electrical conductor 60 of an electrical circuit. Connected with said binding-post 59 is a brush-holder 61 in which is arranged a brush 62, the free end of which is adapted to be maintained in electrical contact with said contact-rod 57.

Secured upon one end of said plating-tank 53 are a pair of standards 63 in each of which are arranged a pair of sliding journal-boxes 64. Journalled in said boxes 64 are shafts 67, and suitably mounted or secured upon said shafts are resilient rollers 66. Secured to the outer ends of said shafts 67 are gears 65 which are in mesh with each other and are adapted to drive the said rollers in opposite directions. One of said shafts 67 is provided upon one end with a driving wheel 68 of large diameter, said driving-wheel 68 being connected by means of a belt 69, or the like, with a small pulley 70 on a main power shaft 71. The said strips of metallic material 5 are carried from said driving or conveying roller 52, beneath one of said guide-rollers 54, and then extend longitudinally through said plating-tank 53, being supported by said supporting or carrying rollers 55 and submerged in said electro-plating solution, said metallic material then extending beneath the other of said guide-rollers 54, at the opposite end of said tank 53, emerging from the said electro-plating fluid or solution and then passing over said contact-rod 57, being in electrical contact therewith, and thence through or between the said resilient rollers 66. Secured upon the upper edge-surfaces of the sides of said plating-tank 53 are contact-rods 72, provided with binding-posts 73, a connecting conductor 74 being secured to and joining in electrical circuit both of said contact-rods 72, one of said binding-posts being connected with an electrical conductor 75 of an electrical circuit. Suspended from said contact-rods 72, by means of hangers 76, are a plurality of anodes 77, which are arranged so as to be grouped between the said guide-rollers 54 and each of the said supporting or carrying rollers 55. The said anodes 77 are further arranged in such a manner so that some of the same extend laterally across said plating-tank 53, adjacent to the upper surfaces of said strips of metallic material 5, and other anodes extending laterally across said tank, adjacent to the under surfaces of said strips of metallic material 5. Arranged adjacent to said plating tank 53 is a metallic-tank 78, which is provided with frame-members 79 between which are mount-

ed an internal guide-roller 80 and an outer guide-roller 81. This tank 78 is adapted to be filled with hot water, which is kept hot by means of a steam-coil 82, or any other desirable heating unit, said coil being arranged beneath the bottom of said tank 78. The strips of metallic material pass from said resilient rollers 66, beneath the said internally arranged guide-roller 80, so as to submerge the said strips of metallic material 5 therein, for the purpose of thoroughly cleansing and washing off of the same any of the electro-plating solution still clinging thereto, the said strips 5 then being carried over said outer guide-roller 81, and thence through the hood 83 of a drying apparatus, said drying apparatus being arranged adjacent to the end of said metallic tank 78. This drying apparatus comprises a box-like compartment 84, supported upon a frame-work or legs 85, and arranged therein is a steam-coil 86, or any other desirable heating unit. Connected with the compartment 84 and arranged above said steam-coil 86 is a perforated plate 87, over which is arranged the said hood 83, the same being provided with openings 88 at each end for the entrance and exit of said strips 5, the said hood 83 forming a drying chamber 89.

Mounted between a pair of standards 90, which are located adjacent to the drying apparatus, is a shaft 91 upon which are secured suitable receiving reels or drums 92, upon which the said strips of metallic material 5 are rolled or wound after passing through said drying apparatus. Secured upon one end of said shaft is a ratchet-wheel 93, and pivotally arranged upon said shaft, adjacent to said ratchet-wheel 93, is a vibrator-arm or lever 94, the free end of which is provided with a stud to which is pivotally connected a pawl 95 which is adapted to engage with the teeth of said ratchet-wheel 93. The means for operating said vibrator-rod or lever 94 and the pawl 95, to turn or drive the said ratchet-wheel 93, comprises a crank-shaft 96, one end of which is pivotally connected with said vibrator-rod or lever 94, and the other end of which is connected eccentrically with the side or plane-surface of a pulley 97 secured to a main power-shaft 98. The reciprocating action of said crank-shaft 96, by means of said vibrator-rod or lever 94 and its pawl 95 thus imparts to said ratchet-wheel 93 and the shaft 91 a rotary motion as will be clearly evident. This motion is slow but very positive and assures the drawing of the said metallic strips 5 through the various devices of the apparatus hereinabove described, and it is finally reeled or rolled in its finished condition upon said reels or drums 92. To further aid the drawing or passage of said strips of metallic material through the said various devices of the apparatus, the said shafts 22, 27, 46 and 51,

upon which are mounted or secured the said driving or conveying rollers 23, 28, 47 and 52, as well as the various revolving contact rods 14, 32 and 57, are all provided with pulleys 99, and are operatively connected with a pulley 100 secured upon one of said shafts 65, so as to pass the driving power from one to the other of said shafts and contact rods 57, 51, 46, 32, 27, 22 and 14, by means of belt-connections 101, thereby reducing the friction and aiding materially in passing the said metallic-strips 5 through the various devices of the whole apparatus.

From the foregoing description of the novel plant for electro-plating extraordinary long lengths of metallic material, it will be readily seen, that such material is easily manipulated for the purpose of carrying out the various steps of a perfect electro-plating process, regardless of the length of the material to be plated. The material is passed through the various devices and tanks of the apparatus, such as the potash-tank, the pickling-tank, the copper-bath tank, and their intermediate cleansing tanks, continuously without the necessity of frequent handling. As one portion of material is treated to one step of the process, it passes on to the next device, there to be further treated, and another portion follows, in sequence, until the plating-tank is reached, where the metal is deposited on said material in carrying out the actual plating step, and then the finished portion is drawn through the resilient rolls 66 which squeeze off the solution from the finished or plated surface. The further cleansing of said finished or plated surface is accomplished in the hot-water tank, and thence the material passes to the drying apparatus and is finally reeled upon the receiving reels or drums in its finished or plated state. The movement of said metallic material through the various apparatus, while it is continuous is nevertheless very slow, so that sufficient time is allowed to permit of the completion of each preparatory step, as well as of the main plating-step of the electro-plating process; and each portion of said metallic material is evenly and perfectly treated to the final completion of the said process.

I claim:—

1. In a plant for electro-plating extraordinary long lengths of metallic material, the combination of a pair of standards, reels or drums for carrying said metallic material mounted between said standards, a metallic potash-tank connected with one pole of an electrical circuit, a steam-coil beneath said potash-tank, a cold water-tank, standards between said potash-tank and said cold water tank, a contact-rod rotatably mounted in said standards, means for connecting said contact-rod with the opposite pole of said electrical circuit, means for passing said metallic

material through said potash-tank and said cold water tank and over said contact-rod, a pickling tank, a second cold water tank, means for passing said metallic material through said pickling and said second cold water tank, a copper-bath tank, standards between said copper-bath tank and said second cold water tank, a contact-rod rotatably mounted between said standards, means for connecting the same to one pole of an electrical circuit, contact-rods connected with said copper-bath tank, means for connecting said contact rods with the other pole of said electrical circuit, anodes suspended from said contact-rods which are connected with said copper-bath tank, a third cold water-tank, means for passing said metallic material over said rotatable contact-rod in electrical contact therewith and through said copper bath-tank and said third cold water tank, an electro-plating tank, contact-rods connected with said electro-plating tank, and means for connecting said contact rods with one pole of an electrical circuit, a second set of anodes suspended from said contact-rods, said anodes extending into said electro-plating tank a rotatable contact-rod, means for connecting the same with the other pole of said electrical circuit, means for passing said metallic material through said electroplating tank and over said rotatable contact-rod, a hot water tank, a steam coil beneath said hot water tank, a drying apparatus provided with a drying chamber, a steam coil arranged in said drying apparatus, means for passing said metallic material through said hot-water tank and said drying chamber of said drying apparatus, reels or drums mounted upon standards, and means for rotating said reels or drums to wind up said metallic material thereon, substantially as and for the purposes set forth.

2. In a plant for electro-plating extraordinary long lengths of metallic material, the combination of a pair of standards, reels or drums for carrying said metallic material mounted between said standards, a metallic potash tank, a pickling tank, a copper bath-tank, an electro-plating tank, intermediate cold water tanks, a metallic hot water tank, a drying apparatus, reels or drums mounted on standards adapted to reel up the plated metallic material, means for revolving said reels or drums, internally arranged guide rolls in each of said tanks, suitable shafts mounted upon standards, driving or conveying rolls secured upon said shafts, a pair of resilient rolls secured upon shafts mounted in adjustable journal boxes of a pair of standards secured to one end of said plating-tank, intermeshing gears on the outer ends of said shafts, a driving wheel connected with one of said shafts, a driving pulley connected with the same shaft, pulleys secured

upon the shafts of said conveying rolls, driving belts interconnecting said driving pulley and the several pulleys of the said shafts of said conveying rolls, all adapted to pass said metallic material from tank to tank and through said drying apparatus successively and continuously, to said reels or drums for reeling up the plated metallic material, substantially as and for the purposes set forth.

3. In a plant for electroplating extraordinary long lengths of metallic material, the combination of a pair of standards, shafts mounted between said standards, reels or drums for carrying said metallic material secured upon said shafts, a metallic potash tank, a steam-coil arranged beneath the same, a pickling tank, a copper-bath tank, an electro-plating tank, intermediate cold water tanks, a metallic hot water tank, a steam coil arranged beneath the same, a drying apparatus provided with a drying chamber, a steam coil arranged within said drying apparatus, a pair of standards, a shaft rotatably mounted thereon, reels or drums adapted to reel up the plated metallic material, internally arranged guide rolls in each of said tanks, a plurality of supporting or carrying rolls in said electro-plating tank, shafts mounted on standards, driving or conveying rolls secured upon said shafts, pulleys secured upon said shafts, a pair of resilient rolls secured upon shafts mounted in sliding journal boxes carried in standards secured to one end of said electro-plating tank, intermeshing gears upon the outer ends of said shafts, a driving wheel secured to one of said shafts, a driving pulley secured to the same shaft, belts connecting said driving pulley with the several pulleys of said driving or conveying roll shafts, rotatable contact-rods mounted upon standards, means for connecting said rotatable contact-rods in a proper electrical circuit, pulleys on said contact rods, inter-connecting belts for operatively connecting the same with the proper pulleys of said driving or conveying roll shafts, an electrical connection connecting said metallic potash tank in a proper electrical circuit, a removable frame-work provided with guide-rolls in said potash tank, means for insulating said frame-work and its rolls from electrical contact with said potash tank, all adapted to pass said metallic material from tank to tank and through the drying chamber of said drying apparatus successively and continuously to said reels or drums, for reeling up the plated metallic material, contact-rods secured to said copper-bath tank, means for connecting the same in a proper electrical circuit, anodes suspended from said contact-rods which are connected with said copper-bath tank, so as to be adjacent to both the upper and under surfaces of said metallic material passing there-through, contact-rods secured to said elec-

tro-plating tank, means for connecting the same in a proper electrical circuit, and a second set of anodes suspended from said contact rods said anodes extending into said electro-plating tank so as to be adjacent to both the upper and under surfaces of said metallic material passing therethrough, substantially as and for the purposes set forth.

4. In a plant for electroplating extraordinary long lengths of metallic material, the combination of a pair of standards, shafts mounted between said standards, reels or drum for carrying said metallic material secured upon said shafts, a metallic potash tank, a steam-coil arranged beneath the same, a pickling tank, a copper-bath tank, an electro-plating tank, intermediate cold water tanks, a metallic hot water tank, a steam coil arranged beneath the same, a drying apparatus provided with a drying chamber, a steam coil arranged within said drying apparatus, a pair of standards, a shaft rotatably mounted thereon, reels or drums adapted to reel up the plated metallic material, internally arranged guide rolls in each of said tanks, a plurality of supporting or carrying rolls in said electroplating tank, shafts mounted on standards, driving or conveying rolls secured upon said shafts, pulleys secured upon said shafts, a pair of resilient rolls secured upon shafts, mounted in sliding journal boxes carried in standards secured to one end of said electroplating-tank, intermeshing gears upon the outer ends of said shafts, a driving wheel secured to one of said shafts, a driving pulley secured to the same shaft, belts connecting said driving pulley with the several pulleys of said driving or conveying roll shafts, rotatable contact-rods mounted upon standards, means for connecting said rotatable contact-rods in a proper electrical circuit, pulleys on said contact-rods, inter-connecting belts for operatively connecting the same with the proper pulleys of said driving or conveying roll shafts, an electrical connection connecting said metallic potash-tank in a proper electrical circuit, a removable frame-work provided with guide-rolls in said potash tank, means for insulating said frame-work and its rolls from electrical contact with said potash tank, all adapted to pass said metallic material from tank to tank and through the drying chamber of said drying apparatus successively and continuously to said reels or drums, for reeling up the plated metallic material, contact-rods secured to said copper-bath tank, means for connecting the same in a proper electrical circuit, anodes suspended from said contact-rods which are connected with said copper-bath tank, so as to be adjacent to both the upper and under surfaces of said metallic material passing therethrough, contact-rods secured to said electro-plating tank, means for con-

necting the same in a proper electrical circuit, and a second set of anodes suspended from said contact rods said anodes extending into said electro-plating tank, so as to be adjacent to both the upper and under surfaces of said metallic material passing there-
 5 through, and means for revolving said reels or drums for reeling up the plated metallic material, substantially as and for the purposes set forth.

10 5. In a plant for electroplating extraordinary long lengths of metallic material, the combination of a pair of standards, shafts mounted between said standards, reels or drums for carrying said metallic material
 15 secured upon said shafts, a metallic potash tank, a steam-coil arranged beneath the same, a pickling tank, a copper-bath tank, an electro-plating tank, intermediate cold water tanks, a metallic hot water tank, a steam
 20 coil arranged beneath the same, a drying apparatus provided with a drying chamber, a steam coil arranged within said drying apparatus, a pair of standards, a shaft rotatably mounted thereon, reels or drums
 25 adapted to reel up the plated metallic material, internally arranged guide rolls in each of said tanks, a plurality of supporting or carrying rolls in said electro-plating tank,
 30 shafts mounted on standards, driving or conveying rolls secured upon said shafts, pulleys secured upon said shafts, a pair of resilient rolls secured upon shafts mounted in sliding journal boxes carried in standards secured
 35 to one end of said electroplating-tank intermeshing gears upon the outer ends of said shafts, a driving wheel secured to one of said shafts, a driving pulley secured to the same shaft, belts connecting said driving
 40 pulley with the several pulleys of said driving or conveying roll shafts, rotatable contact-rods mounted upon standards, means for connecting said rotatable contact-rods in a proper electrical circuit, pulleys on said
 45 contact-rods, interconnecting belts for operatively connecting the same with the proper pulleys of said driving or conveying roll shafts, an electrical connection connecting said metallic potash tank in a proper elec-
 50 trical circuit, a removable framework provided with guide-rolls in said potash tank, means for insulating said frame-work and its rolls from electrical contact with said potash tank, all adapted to pass said metallic
 55 material from tank to tank and through the drying chamber of said drying apparatus successively and continuously to said reels or drums, for reeling up the plated metallic material, contact-rods secured to said copper-
 60 bath tank, means for connecting the same in a proper electrical circuit, anodes suspended from said contact-rods which are connected with said copper-bath tank, so as to be adjacent to both the upper and under surfaces
 65 of said metallic material passing there-

through, contact-rods secured to said electro-plating tank, means for connecting the same in a proper electrical circuit, and a second set of anodes suspended from said contact-rods said anodes extending into said electro-plating tank, so as to be adjacent to both the upper and under surfaces of said metallic material passing therethrough, and means for revolving said reels or drums for reeling up the plated metallic material, comprising
 70 a ratchet-wheel secured to the shaft upon which said reels or drums are mounted, a vibrator-arm pivotally secured upon said shaft, a pawl connected with one end of said vibrator-arm, said pawl being adapted to engage with the teeth of said ratchet wheel,
 75 and a crank-shaft connected with the other end of said vibrator-arm, the opposite end of said crank shaft being connected eccentrically with a wheel or pulley secured to a main power shaft, substantially as and for the purposes set forth.

6. In a plant for electro-plating extraordinary long lengths of metallic material, the combination of a pair of standards, reels or drums for carrying said metallic material
 80 mounted between said standards, a metallic potash-tank connected with one pole of an electrical circuit, a steam-coil beneath said potash-tank, a cold water-tank, standards between said potash-tank and said cold water-tank, a contact-rod rotatably mounted in said standards, means for connecting said
 85 contact-rod with the opposite pole of said electrical circuit, means for passing said metallic material through said potash-tank and said cold water tank and over said contact-rod, a pickling tank, a second cold water tank, means for passing said metallic material through said pickling and said second
 90 cold water tanks, a third cold water-tank, means for passing said metallic material over said rotatable contact-rod in electrical contact therewith and through said copper bath-tank and said third cold water tank, an electroplating tank, contact-rods connected with
 95 said electro-plating tank, and means for connecting said contact rods with one pole of an electrical circuit, anodes suspended from said contact-rods, a rotatable contact-rod, means for connecting the same with the other pole of said electrical circuit, means for passing said metallic material through said
 100 electroplating tank and over said rotatable contact-rod, a hot water tank, a steam coil beneath said hot water tank, a drying apparatus provided with a drying chamber, a steam coil arranged in said drying apparatus, means for passing said metallic material through said hot-water tank and said drying
 105 chamber of said drying apparatus, reels or drums mounted upon standards, and means for rotating said reels or drums to wind up said metallic material thereon, substantially as and for the purposes set forth.

7. In a plant for electro-plating extraordinary long lengths of metallic material, the combination of a pair of standards, reels or drums for carrying said metallic material mounted between said standards, a metallic potash tank, a pickling tank, an electro-plating tank, an intermediate cold water tank, a metallic hot water tank, a drying apparatus, reels or drums mounted on standards adapted to reel up the plated metallic material, means for revolving said reels or drums, internally arranged guide rolls in each of said tanks, suitable shafts mounted upon standards, driving or conveying rolls secured upon said shafts, a pair of resilient rolls secured upon shafts mounted in adjustable journal boxes of a pair of standards secured to one end of said plating-tank, intermeshing gears on the outer ends of said shafts, a driving wheel connected with one of said shafts, a driving pulley connected with the same shaft, pulleys secured upon the shafts of said conveying rolls, driving belts inter-connecting said driving pulley and the several pulleys of the said shafts of said conveying rolls, all adapted to pass said metallic material from tank to tank and through said drying apparatus successively and continuously, to said reels or drums for reeling up the plated metallic material, substantially as and for the purposes set forth.

8. In a plant for electroplating extraordinary long lengths of metallic material, the combination of a pair of standards, shafts mounted between said standards, reels or drums for carrying said metallic material secured upon said shafts, a metallic potash tank, a steam-coil arranged beneath the same, a pickling tank, an electroplating tank, an intermediate cold water tank, a metallic hot water tank, a steam coil arranged beneath the same, a drying apparatus provided with a drying chamber, a steam coil arranged within said drying apparatus, a pair of standards, a shaft rotatably mounted thereon, reels or drums adapted to reel up the plated metallic material, internally arranged guide rolls in each of said tanks, a plurality of supporting or carrying rolls in said electro-plating tank, shafts mounted on standards, driving or conveying rolls secured upon said shafts, pulleys secured upon said shafts, a pair of resilient rolls secured upon said shafts mounted in sliding journal boxes carried in standards secured to one end of said electro-plating-tank, intermeshing gears upon the outer ends of said shafts, a driving wheel secured to one of said shafts, a driving pulley secured to the same shaft, belts connecting said driving pulley with the several pulleys of said driving or conveying roll shafts, rotatable contact-rods mounted upon standards, means for connecting said rotatable contact-rods, in a proper electrical circuit, pulleys on said contact-rods, inter-

connecting belts for operatively connecting the same with the proper pulleys of said driving or conveying roll shafts, an electrical connection connecting said metallic potash tank in a proper electrical circuit, a removable frame-work provided with guide-rolls in said potash tank, means for insulating said frame-work and its rolls from electrical contact with said potash tank, all adapted to pass said metallic material from tank to tank and through the drying chamber of said drying apparatus successively and continuously to said reels or drums, for reeling up the plated metallic material, contact-rods secured to said electro-plating tank, means for connecting the same in a proper electrical circuit, and anodes suspended from said contact rods so as to be adjacent to both the upper and under surfaces of said metallic material passing there-through, substantially as and for the purposes set forth.

9. In a plant for electroplating extraordinary long lengths of metallic material, the combination of a pair of standards, shafts mounted between said standards, reels or drums for carrying said metallic material secured upon said shafts, a metallic potash tank, a steam-coil arranged beneath the same, a pickling tank, a copper-bath tank, an electro-plating tank, an intermediate cold water tank, a metallic hot water tank, a steam coil arranged beneath the same, a drying apparatus provided with a drying chamber, a steam coil arranged within said drying apparatus, a pair of standards, a shaft rotatably mounted thereon, reels or drums adapted to reel up the plated metallic material, internally arranged guide rolls in each of said tanks, a plurality of supporting or carrying rolls in said electroplating tank, shafts mounted on standards, driving or conveying rolls secured upon said shafts, pulleys secured upon said shafts, a pair of resilient rolls secured upon shafts, mounted in sliding journal boxes carried in standards secured to one end of said electroplating-tank, intermeshing gears upon the outer ends of said shafts, a driving wheel secured to one of said shafts, a driving pulley secured to the same shaft, belts connecting said driving pulley with the several pulleys of said driving or conveying roll shafts, rotatable contact-rods mounted upon standards, means for connecting said rotatable contact-rods, in a proper electrical circuit, pulleys on said contact-rods, inter-connecting belts for operatively connecting the same with the proper pulleys of said driving or conveying roll shafts, an electrical connection connecting said metallic potash-tank in a proper electrical circuit, a removable framework provided with guide-rolls in said potash tank, means for insulating said frame-work and its rolls from electrical contact with said

potash tank, all adapted to pass said metallic material from tank to tank and through the drying chamber of said drying apparatus successively and continuously to said
 5 reels or drums, for reeling up the plated metallic material, contact-rods secured to said electro-plating tank, means for connecting the same in a proper electrical circuit, and anodes suspended from said contact rods
 10 so as to be adjacent to both the upper and under surfaces of said metallic material passing therethrough, and means for revolving said reels or drums for reeling up the plated metallic material, substantially as and for
 15 the purposes set forth.

10. In a plant for electroplating extraordinary long lengths of metallic material, the combination of a pair of standards, shafts mounted between said standards, reels
 20 or drums for carrying said metallic material secured upon said shafts, a metallic potash tank, a steam-coil arranged beneath the same, a pickling tank, a copper-bath tank, an electro-plating tank, an intermediate cold water
 25 tank, a metallic hot water tank, a steam coil arranged beneath the same, a drying apparatus provided with a drying chamber, a steam coil arranged within said drying apparatus, a pair of standards, a shaft rotatably mounted thereon, reels or drums adapted
 30 to reel up the plated metallic material, internally arranged guide rolls in each of said tanks, a plurality of supporting or carrying rolls in said electroplating tank, shafts
 35 mounted on standards, driving or conveying rolls secured upon said shafts, pulleys secured upon said shafts, a pair of resilient rolls secured upon shafts mounted in sliding journal boxes carried in standards secured to one
 40 end of said electroplating-tank, intermeshing gears upon the outer ends of said shafts, a driving-wheel secured to one of said shafts, a driving pulley secured to the same shaft, belts connecting said driving pulley with the
 45 several pulleys of said driving or conveying

roll shafts, rotatable contact-rods mounted upon standards, means for connecting said rotatable contact-rods in a proper electrical circuit, pulleys on said contact-rods, interconnecting belts for operatively connecting
 50 the same with the proper pulleys of said driving or conveying roll shafts, an electrical connection connecting said metallic potash tank in a proper electrical circuit, a removable frame-work provided with guide-rolls
 55 in said potash tank, means for insulating said frame-work and its rolls from electrical contact with said potash tank, all adapted to pass said metallic material from tank to tank and through the drying chamber of said drying
 60 apparatus successively and continuously to said reels or drums, for reeling up the plated metallic material, contact-rods secured to said electro-plating tank, means for connecting the same in a proper electrical
 65 circuit, and anodes suspended from said contact-rods so as to be adjacent to both the upper and under surfaces of said metallic material passing therethrough, and means for revolving said reels or drums for reeling up
 70 the plated metallic material, comprising a ratchet-wheel secured to the shaft upon which said reels or drums are mounted, a vibrator-arm pivotally secured upon said shaft, a pawl connected with one end of said
 75 vibrator-arm, said pawl being adapted to engage with the teeth of said ratchet wheel, and a crank-shaft connected with the other end of said vibrator-arm, the opposite end of said crank shaft being connected eccentrically with a wheel or pulley secured to a
 80 main power shaft, substantially as and for the purposes set forth.

In testimony, that I claim the invention set forth above I have hereunto set my hand
 85 this 12th day of November, 1908.

WILLIS R. KING.

Witnesses:

FREDK. C. FRAENTZEL,
 FRED'K. H. W. FRAENTZEL.