T. A. EDISON.

PRODUCTION OF THIN METAL SHEETS OR FOILS.

APPLICATION FILED AUG. 26, 1920.

1,425,184. Patented Aug. 8, 1922.

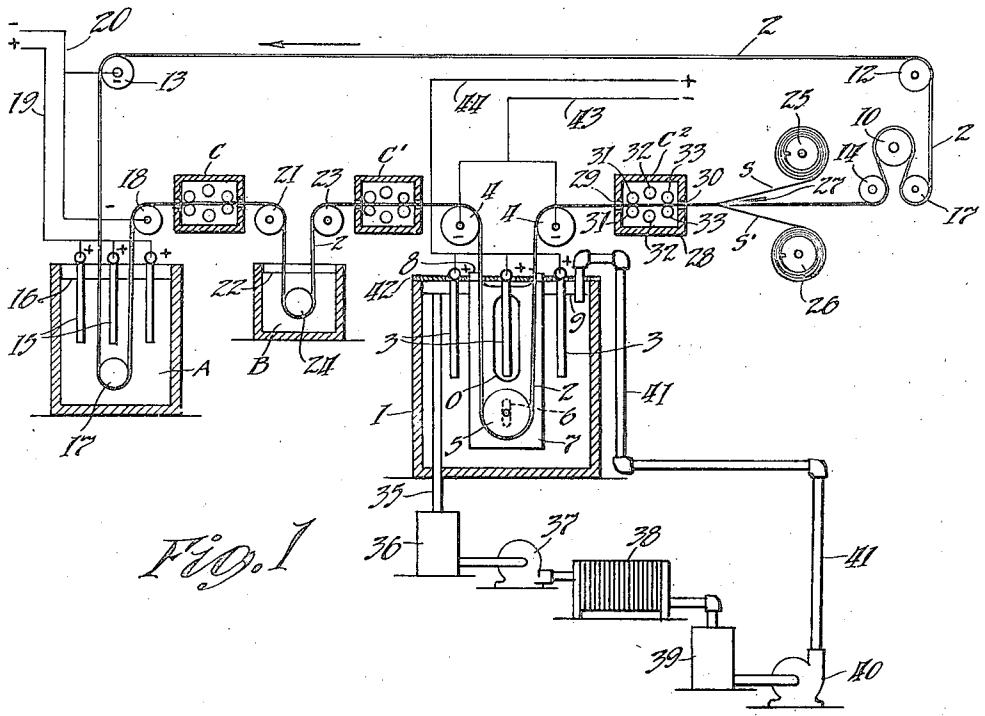

Fig. 1

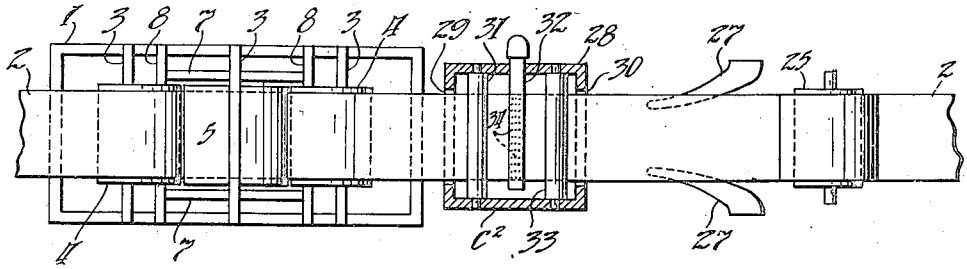

Fig. 2

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UNITED STATES PATENT OFFICE.

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PRODUCTION OF THIN METAL SHEETS OR FOILS.

1,425,184. Specification of Letters Patent. Patented Aug. 8, 1922.

Application filed August 26, 1920. Serial No. 406,044.

To all whom it may concern:

Be it known that I, THOMAS A. EDISON, a citizen of the United States, and a resident of Llewellyn Park, West Orange, Essex County, New Jersey, have invented certain new and useful Improvements in the Production of Thin Metal Sheets or Foils, of which the following is a description.

My invention relates to the production of thin metal sheets or foils of any desired length, and in some aspects is an improvement on the invention described and claimed in my co-pending application Serial No. 396,825, filed July 16, 1920, and entitled Production of thin metal sheets or foils.

One of the objects of my invention resides in an improved process and improved means whereby thin sheets or foils of metal, preferably nickel, of any desired length may be electrolytically produced more effectively and economically, and preferably by operations which may be carried on continuously.

A further object of my invention is to produce a plurality of such sheets or foils simultaneously by the use of a single apparatus.

More specifically described, my invention consists in employing an elongated member, preferably having a plurality of plating surfaces, as the electrode on which the metal is to be plated, disposing only a portion of such electrode in the plating bath of an electro-plating cell capable of plating such metal, moving the electrode so that different portions thereof will successively leave the plating bath, and stripping from each plating surface of the electrode at a point in the path of movement thereof beyond the bath the metal deposited thereon in the plating bath, so as to produce a plurality of thin sheets or foils formed of such metal. These operations are continued until the sheets or foils thus produced are of the desired length. I preferably employ a long, flat, flexible strip as the electrode on which the metal is plated, and this strip electrode is preferably, though not necessarily, in the form of an endless belt which is driven by any suitable means so as to be continuously moved in an endless path. The electrode on which the metal is plated is suitably treated so as to facilitate the stripping of the plated metal therefrom, preferably by providing the same with a thin coating or film of a material containing selenium, such as a selenide where the electrode is of copper or nickel, as described in my pending application Serial No. 305,821, filed June 21, 1919 and entitled Electro-plating. This coating or film is preferably applied to the electrode by passing the latter, at a point in the path of movement thereof without the plating bath, through a suitable selenium bath, such as a solution of selenious acid. At a point in the path of movement of the electrode in advance of the selenium bath, this electrode is also preferably passed through a suitable electrolytic cleaning cell so as to thoroughly clean the same; while between the electrolytic cleaning cell and the selenium bath, and between the latter bath and the plating bath, such electrode is preferably washed so as to thoroughly remove therefrom any of the solution of the bath of the cleaning cell and of the selenium bath which may adhere thereto. Suitable means, such as a plurality of winding drums driven in any suitable manner, are also provided for continuously stripping from the said electrode the metal plated on the plating surfaces thereof and to wind up the long thin metal foils or sheets thus produced. The said electrode is also preferably washed at a point in its path of movement between the plating cell and the stripping means so as to remove any of the solution of the plating bath which may adhere thereto. The thickness of the sheets or foils produced may be readily regulated, as, for example, by varying the speed at which the electrode on which the metal is plated is moved.

Other objects and features of my invention will be hereinafter more fully described and claimed.

For a clearer understanding of my invention, attention is directed to the drawing accompanying and forming a part of this specification and in which:

Figure 1 is a view in side elevation, partly in section and partly diagrammatic, of one form of apparatus for producing metal sheets or foils in accordance with my invention; and

Figure 2 is an enlarged plan view, partly in section and partly diagrammatic, of a portion of the apparatus shown in Figure 1.

The electroplating cell of the form of apparatus shown comprises a tank or container 1, a cathode 2, preferably in the form of a long flat endless strip and only a portion of which is immersed in the plating bath. and three spaced anodes 3 suitably supported

in the tank from their upper ends and terminating a considerable distance from the bottom of the tank. The portion of the strip 2 in the plating bath is in the form of a loop, the strip passing over a roller 4 above the cell, then down between one pair of adjacent anodes 3 and up between the other pair of adjacent anodes, and then over another roller 4 above the cell. A weight in the form of a roller 5 is supported in the plating bath beneath the intermediate anode 3 on the loop of the electrode 2. Pins provided on the ends of the roller 5 engage in vertical slots 6 respectively provided in two parallel plates 7 which are suitably suspended in the plating bath from the top of the container 1, as by means of bars 8, closely adjacent the opposite edges of the strip cathode 2. The plates 7 are preferably formed of hard rubber or other substance which will not be affected by the action of the plating cell, and each of these plates is preferably provided with a central vertically extending opening 0 to facilitate the circulation of the electrolyte. The level of the electrolyte or plating bath is represented by referenee character 9.

The strip 2 is formed of a suitable metal, preferably copper or nickel where the metal to be plated thereon is nickel, and is adapted to be continuously driven in an endless path in the direction of the arrow by suitable means, such as a roller 10, operated by any suitable motive means (not shown). From the driving roller 10 the path of movement of the endless strip 2 is as follows: Over the idler pulleys 11 and 12, the pulley 13, through an electrolytic cleaning cell A, a washing device C, a tank or container B containing a selenium bath, through a washing device C′, over one of the rollers 4. through the bath of the electroplating cell and then over the other roller 4, through a washing device C², and then over an idler pulley 14 back to the driving roller 10. The electrolytic cleaning cell A comprises three spaced anodes 15 suitably supported in the electrolyte 16 from the top of the cell container, and a portion of the strip 2 as the cathode. The portion of the strip 2 immersed in the bath of the cleaning cell A is in the form of a loop, the strip extending downwardly from the roller 13 between two adjacent anodes 15 and then up between the two remaining anodes. A weight in the form of a roller 17 is supported on this loop in the cell A beneath the intermediate anode 15. Between the cell A and the washing device C the strip 2 passes over a roller 18 suitably supported above the cell A. The rollers 13 and 18 are formed of metal, preferably nickel, while the roller 17 is preferably formed of hard rubber or other material which will not be affected by the action of the cell A. Current is supplied to the cell A by means of conductors 19 and 20 leading from a suitable source of current (not shown), the conductor 19 being connected to the anodes 15 and the conductor 20 being connected to the rollers 13 and 18 and thereby electrically connected with the strip 2 passing over said rollers. The electrolytic cleaning cell is preferably of the type described in my pending application Serial No. 308,379, filed July 3, 1919 and entitled Cleaning of metallic surfaces, the anodes 15 preferably being formed of graphite, and the electrolyte 16 preferably consisting of a nearly saturated solution of either sodium sulphate or potassium sulphate rendered slightly alkaline by the addition of a sufficient amount of caustic potash or caustic soda. Accordingly, as the strip 2 passes through the cell A, such strip will be effectively and thoroughly cleaned electrolytically. From the roller 18 the strip passes through the cleaning device C, which thoroughly removes all electrolyte of the cleaning cell A which may be adhering thereto. From the washing device C the strip 2 passes over a roller 21, then in the form of a loop through the bath 22 in the container B and over the roller 23, the rollers 21 and 23 being suitably supported above the container B. A weight in the form of a roller 24 is supported on the loop in the bath 22. Rollers 21, 23 and 24 are formed of suitable non-conducting material, preferably hard rubber. Where the strip 2 is of copper or nickel, the bath 22 in the container B preferably consists of a solution of selenious acid, and accordingly, in the passage of the strip through this bath, a very thin coating or film of selenide will be formed on the strip, as described in my pending application Serial No. 305,821, filed June 21, 1919 and entitled Electroplating. From the roller 23 the strip 2 passes through the washing device C′ which thoroughly removes any of the solution of selenious acid which may adhere thereto, and then through the bath of the electroplating cell as hereinbefore described. When it is desired to produce thin sheets or foils of nickel, for which the present invention has been especially designed, the anodes 3 of the plating cell are formed of nickel, and the plating bath or electrolyte of the electroplating cell is preferably of the character described in my pending application Serial No. 324,291, filed September 18, 1919 and entitled Production of nickel, and comprises a suitable nickelplating solution such as a nearly saturated solution of nickel sulphate and a suitable amount of a salt of a fatty acid, such as acetate of nickel or an alkaline acetate, preferably acetate of magnesia. When such a plating bath is employed, the nickel plated on the strip 2 will be substantially pure and malleable, of fine and uniform tex-

ture, and substantially free from brittleness, internal stresses and strains, and moreover, it is possible to impress on the cell a current having a density many times greater, and consequently to plate out the nickel onto the cathode many times faster than is possible in the case of nickel-plating cells the baths of which consist of solutions of the usual salts employed in the nickel-plating industry. In its passage through the electroplating cell, both sides and the edges of the strip 2 will, of course, be completely covered with a coating of nickel. The nickel tends to deposit faster on the edges of the strip, but I find that the use of the plates 7 disposed closely adjacent the edges of the strip prevents this, and that with the arrangement shown, the coating of nickel deposited on the strip will be substantially uniform in thickness. From the electroplating cell, the strip 2 passes through the washing device C^2 where any of the solution of the plating bath which may adhere to the strip is completely removed. Means are provided for continuously stripping from each side of the strip 2 the nickel deposited thereon in the bath of the plating cell, so as to form two long thin sheets or foils S and S'. This stripping means is preferably located between the washing device C^2 and the driving roller 10, and preferably comprises two winding drums 25 and 26 respectively located on opposite sides of the strip and suitably driven, preferably by the same motive means that operates the roller 10.

The nickel first plated on the strip 2 in the operation of the apparatus is stripped from each side of said strip and suitably attached to the corresponding winding drums 25 and 26, as by inserting the end portion thereof into slots formed in the drums. The winding drums 25 and 26 are driven at such a speed that the nickel sheets S and S' are constantly maintained at sufficient tension to insure the continuance of the operation of stripping the nickel from the strip 2. The provision of the thin film or coating of selenide on the strip 2 greatly facilitates the stripping of the plated nickel therefrom. In order to prevent the nickel plated on the edges of the strip 2, which of course joins that plated on both sides of the strip, interfering with the stripping of the nickel from said strip and the separation thereof into the two sheets or foils S and S', I preferably provide means, such as a pair of knives 27, suitably supported in a position to cut or shear the plated coating of nickel at the edges of the strip 2 and approximately at the point where the nickel is stripped therefrom.

The washing devices C, C' and C^2 are preferably similar in construction, and, as shown, each comprises a rectangular container 28 provided with openings 29 and 30 through which the strip 2 respectively enters and leaves the container, two pair of squeegee rollers 31 and 33 respectively located adjacent the openings 29 and 30 between which the strip 2 passes, for removing surplus liquid from the latter, and two spraying devices 32 respectively located within the container at opposite sides of the strip intermediate the two pairs of rollers 31 and 33. Each of the spraying devices 32 comprises a pipe extending transversely of the container and connected with a suitable source of water supply (not shown), and is provided with a plurality of small openings 34 directed towards the path of movement of the strip through the container 28, whereby, in the operation of the apparatus, water is sprayed onto both sides of the strip.

Reference character 35 represents an overflow pipe disposed in the container 1 of the electroplating cell and leading therefrom to a suitable container, such as a crock 36. Impurities and the like which are produced in the bath of the electroplating cell during the operation of the latter tend to accumulate on the surface of the bath and accordingly will be carried into the crock 36 with the electrolyte which passes through the overflow pipe 35. A suitably driven pump 37 withdraws the electrolyte from the crock 36 adjacent the bottom thereof and forces the same through suitable cleaning means, such as a filter press 38, where all impurities and the like are removed. From the filter press 38 the filtered electrolyte flows through a suitable pipe into another container or crock 39, and a suitably operated pump 40 withdraws the electrolyte from such container and forces the same through a pipe 41 back into the tank 1. The arrangement is such that there will always be a considerable quantity of electrolyte in each of the containers or crocks 36 and 39, and consequently the level of the plating bath in the tank 1 will be maintained at a substantially fixed point. In order, however, to prevent evaporation of the electrolyte, the tank 1 is provided with a suitable cover 42.

Current is supplied to the electroplating cell by conductors 43 and 44 leading from a suitable source of current (not shown), the conductor 43 being connected to the rollers 4, and the conductor 44 being connected to the anodes 3. The rollers 4 are formed of a suitable metal, preferably nickel, and consequently the conductor 43 is electrically connected to the strip through said rollers.

As previously mentioned, the operation of the apparatus is carried on continuously, that is, the strip 2 is continuously moved and the nickel plated thereon is continuously stripped from each side thereof to produce the thin nickel sheets or foils S, S'. The thickness of these sheets or foils may be readily regulated as, for example, by vary-

ing the speed at which the roller 10 is driven and thereby the speed at which the strip 2 is moved. When the apparatus has once been adjusted, however, the nickel sheets or foils S, S' produced by continuously stripping the plated nickel from the strip 2 will be very uniform in thickness and the length of such sheets or foils will be dependent only on the time during which the apparatus is continuously maintained in operation.

While I have specifically described the preferred method and one form of apparatus for carrying out such method in accordance with my invention, it is to be understood that both the method and apparatus are subject to various changes and modifications without departure from the spirit of the invention and the scope of the appended claims.

Having now described my invention, what I claim as new and desire to secure by Letters Patent of the United States is as follows:—

1. The method which consists in moving an elongated strip comprising an electrode of an electrolytic cell through and then out of the bath of the cell, and stripping from both sides of said strip at a point in the path of movement thereof beyond said bath, the metal deposited thereon in the bath, substantially as described.

2. The method which consists in continuously moving an elongated strip comprising an electrode of an electrolytic cell through and then out of the bath of the cell, and continuously stripping from both sides of said strip at a point in the path of movement thereof beyond said bath, the metal deposited thereon in the bath, substantially as described.

3. The method of producing metal foils or sheets of any desired length which consists in providing an elongated strip comprising an electrode of an electrolytic cell capable of plating such metal with a coating of a material containing selenium, moving said strip in a path through and then out of the bath of the cell, and stripping from both sides of said strip at a point in the path of movement thereof beyond said bath, the metal deposited thereon in the bath, substantially as described.

4. The method which consists in moving an elongated strip comprising an electrode of an electroplating cell through an electrolytic cleaning bath, then through a bath in which a coating of a material containing selenium is applied to the strip and then through and out of the bath of the electroplating cell, and stripping from both sides of said strip at a point beyond the bath of the plating cell, the metal deposited thereon in said cell, substantially as described.

5. The method which consists in moving an elongated member comprising an electrode of an electro-plating cell through an electrolytic cleaning bath, then through a bath in which a coating of a material containing selenium is applied to said electrode, and then through and out of the bath of the electro-plating cell, washing the said electrode between the selenium bath and the bath of the plating cell, and stripping from said electrode at a point beyond the bath of the plating cell, the metal deposited thereon in said cell, substantially as described.

6. The method which consists in moving an elongated member comprising an electrode of an electro-plating cell through an electrolytic cleaning bath, then through a bath in which a coating of a material containing selenium is applied thereto, and then through and out of the bath of the electro-plating cell, washing the said electrode between the plating bath and the selenium bath, and stripping from said electrode at a point beyond the bath of the plating cell the metal deposited thereon in said cell, substantially as described.

7. The method which consists in moving an elongated member, comprising an electrode of an electrolytic cell and having a plurality of plating surfaces, through and then out of the bath of the cell, and simultaneously stripping from the plating surfaces of said electrode at a point in the path of movement thereof beyond said bath the metal deposited thereon in the bath, substantially as described.

8. The method of producing metal foils or sheets of any desired length, which consists in providing an elongated member, comprising an electrode of an electrolytic cell and having a plurality of plating surfaces, with a coating of a material containing selenium, moving said electrode in a path through and then out of the bath of the cell, and stripping from the plating surfaces of said electrode at a point in the path of movement thereof beyond said bath the metal deposited thereon in the bath, substantially as described.

9. The method which consists in moving an elongated member, comprising an electrode of an electro-plating cell, through an electrolytic cleaning bath, then through a bath in which a coating of a metal containing selenium is applied to the electrode, and then through and out of the bath of the plating cell, and stripping from said electrode at a point beyond the bath of the plating cell, the metal deposited thereon in said cell, substantially as described.

10. The method which consists in moving an elongated member, comprising an electrode of an electro-plating cell, through an electrolytic cleaning bath, then through a bath in which a coating of a material containing selenium is applied thereto, and

then through and out of the bath of the electroplating cell, washing said electrode between the successive baths, and stripping from said electrode at a point beyond the bath of the plating cell the metal deposited thereon in said cell, substantially as described.

11. The method which consists in moving an elongated member, comprising an electrode of an electro-plating cell, through an electrolytic cleaning bath, then through a bath in which a coating of a material containing selenium is applied thereto, and then through and out of the bath of the electroplating cell, stripping from said electrode at a point beyond the bath of the plating cell the metal deposited thereon in said cell, and washing said electrode between the successive baths and also between the plating cell and the point at which the metal deposited thereon is stripped therefrom, substantially as described.

12. In apparatus for producing metal sheets or foils of any desired length, an electrolytic cell capable of plating such metal and comprising an elongated electrode partially immersed in the bath of said cell and having a plurality of plating surfaces, means for moving said electrode so that different portions thereof will successively leave said bath, and means for stripping from the plating surfaces of said electrode at a point without said bath the metal deposited thereon in the bath, substantially as described.

13. In apparatus for producing metal sheets or foils of any desired length, an electrolytic cell capable of plating such metal and comprising an electrode in the form of a long flat strip partially immersed in the bath of said cell, means for moving said strip electrode so that different portions thereof will successively leave said bath, and means for stripping from both sides of said strip electrode at a point without said bath the metal deposited thereon in the bath, substantially as described.

14. In apparatus for producing metal sheets or foils of any desired length, an electrolytic cell capable of plating such metal and comprising an electrode in the form of a long flat endless strip partially immersed in the bath of said cell, means for continuously moving said strip electrode in an endless path so that different portions thereof will successively leave said bath, and means for continuously stripping from each side of said electrode at a point beyond said bath the metal deposited thereon in the bath, substantially as described.

15. In apparatus for producing metal strips or foils of any desired length, an electrolytic cell capable of plating such metal and comprising an electrode in the form of a long flat strip partially immersed in the bath of said cell, means for moving said strip electrode so that different portions thereof will successively leave said bath, means for retarding the plating of metal on the edges of said strip while in said bath, and means for stripping from both sides of said strip electrode at a point without said bath the metal deposited thereon in the bath, substantially as described.

16. In apparatus for producing metal sheets or foils of any desired length, an electrolytic cell capable of plating such metal and comprising an electrode in the form of a long strip only a portion of which is immersed in the bath of said cell, means for moving said strip so that different portions thereof successively leave said bath, means for applying to said strip at a point in the path of movement thereof in advance of the plating bath a coating of material containing selenium, and means for stripping from both sides of said strip electrode at a point beyond said bath the metal deposited thereon in the bath, substantially as described.

17. In apparatus for producing metal sheets or foils of any desired length, an electrolytic cell capable of plating such metal and comprising an electrode in the form of a long flat strip partially immersed in the bath of said cell, means for moving said strip electrode so that different portions thereof will successively leave said bath, means for stripping from both sides of said strip electrode at a point without said bath the metal deposited thereon in the bath, and means for cutting the metal plated on said strip at the edges of the latter and approximately at the point where such metal is stripped, whereby such metal is divided into two sheets or foils, substantially as described.

18. In apparatus for producing metal sheets or foils of any desired length, an electrolytic cell capable of plating such metal and comprising an electrode in the form of a long strip only a portion of which is immersed in the bath of said cell, means for moving said strip so that different portions thereof successively leave said bath, means for applying to said strip at a point in the path of movement thereof in advance of the plating bath a coating of material containing selenium, means for stripping from both sides of said strip electrode at a point beyond the bath the metal deposited thereon in the bath, and means for washing said strip between the plating bath and the point where said coating is applied thereto, substantially as described.

19. In apparatus for producing metal sheets or foils of any desired length, an electroplating cell capable of plating such metal and comprising an electrode in the form of a long strip partially immersed in the bath of said cell, the portion of the strip immersed

in said bath being in the form of a loop, a weight in the form of a roller supported in said bath by said loop, means for moving said strip electrode so that different portions thereof will successively leave said bath, and means for stripping from said strip electrode at a point without said bath the metal deposited thereon in the bath, substantially as described.

20. In apparatus for producing metal sheets or foils of any desired length, an electrolytic cell capable of plating such metal and comprising an electrode in the form of a long flat strip partially immersed in the bath of said cell, means for moving said strip electrode so that different portions thereof will successively leave said bath, means for stripping from both sides of said strip electrode at a point without said bath the metal deposited thereon in the bath, and means for washing said strip between said plating bath and the point where the metal is stripped therefrom, substantially as described.

21. In apparatus for producing metal sheets or foils of any desired length, a cleaning bath, a selenium bath, an electroplating cell capable of plating such metal and comprising an electrode in the form of a long strip, said strip being partially immersed in each of said baths and the bath of said cell, means for moving said strip in a given path and so that each portion of the same will pass successively through and out of the cleaning bath, the selenium bath and the plating bath, and means for stripping from said strip electrode at a point beyond said cell the metal desposited thereon in the cell, substantially as described.

22. In apparatus for producing metal sheets or foils of any desired length, a cleaning bath, a selenium bath, an electroplating cell capable of plating such metal and comprising an electrode in the form of a long strip, said strip being partially immersed in each of said baths and the bath of said cell, means for moving said strip in a given path and so that each portion of the same will pass successively through and out of the cleaning bath, the selenium bath and the plating bath, means for washing said strip between the successive baths, and means for stripping from said strip electrode at a point beyond said cell the metal deposited thereon in the cell, substantially as described.

23. In apparatus for producing metal sheets or foils of any desired length, a cleaning bath, a selenium bath, an electroplating cell capable of plating such metal and comprising an electrode in the form of a long strip, said strip being partially immersed in each of said baths and the bath of said cell, the portion of the strip electrode in each bath being in the form of a loop, and weights in the form of rollers respectively supported on said loops, means for moving said strip in a given path and so that each portion of the same will pass successively through and out of the cleaning bath, the selenium bath and the plating bath, and means for stripping from said strip electrode at a point beyond said cell the metal deposited thereon in the cell, substantially as described.

24. In apparatus for producing metal sheets or foils of any desired length, a cleaning bath, a selenium bath, an electrolytic cell capable of plating such metal and comprising an electrode in the form of a long endless strip, said strip being partially immersed in each of said baths and the bath of said cell, means for continuously moving said strip in an endless path so that each portion of the same will pass successively through and out of the cleaning bath, the selenium bath and the plating bath, and means for stripping from both sides of said strip electrode at a point beyond the plating bath the metal deposited thereon in the latter, substantially as described.

25. In apparatus for producing metal sheets or foils of any desired length, an electrolytic cleaning cell, a selenium bath, an electroplating cell capable of plating such metal, a long flat endless strip partially immersed in the selenium bath and the bath of each of said cells, the strip comprising an electrode of each of said cells, means for continuously moving said strip so that each portion of the same will pass successively through and then out of the bath of the cleaning cell, the selenium bath and the bath of the plating cell, and means for continuously stripping from both sides of said strip at a point beyond the plating cell the metal deposited thereon in the latter, substantially as described.

26. The method of producing metal foils or sheets, which consists in treating an elongated member comprising an electrode of an electro-plating cell and having a plurality of plating surfaces so as to facilitate the stripping of electrolytically deposited metal from said surfaces, moving said member in a path through and then out of the bath of the cell, and then stripping from the plating surfaces of said member the metal deposited thereon in said bath, substantially as described.

27. The method which consists in cleaning an elongated member comprising an electrode of an electro-plating cell, then treating said member so as to facilitate the stripping of electrolytically deposited metal therefrom, moving said member through and out of the bath of the plating cell, and stripping from said member the metal deposited thereon in said bath, substantially as described.

28. In apparatus for producing metal

strips or foils, an electro-plating cell comprising an electrode in the form of an elongated member having a plurality of plating surfaces, means for moving said member so that different portions thereof will successively pass through and out of said bath, and means for retarding the plating of metal on said member between adjacent plating surfaces thereof while the member is in said bath, substantially as described.

29. In apparatus for producing metal sheets or foils, an electro-plating cell comprising an electrode in the form of an elongated member having a plurality of plating surfaces and only a portion of which is immersed in the bath of said cell, means for moving said member so that different portions thereof successively leave said bath, means for treating the plating surfaces of said member at a point in the path of movement of the latter in advance of the plating bath so as to facilitate the stripping therefrom of metal plated thereon, and means for stripping from the plating surfaces of said member the metal deposited thereon in said bath, substantially as described.

30. In apparatus for producing metal sheets or foils, an electro-plating cell comprising an electrode in the form of an elongated member having a plurality of plating surfaces, means for moving said member so that different portions thereof will successively pass through and out of said bath, means for cutting the metal plated on said member between adjacent plating surfaces, and means for stripping from the plating surfaces of said member the metal deposited thereon in said bath, substantially as described.

31. In apparatus of the character described, an electro-plating cell comprising an electrode in the form of a long strip partially immersed in the bath of said cell and adapted to be moved so that different portions thereof will successively leave said bath, the portion of the strip immersed in said bath being in the form of a loop, and a weight supported on said loop, substantially as described.

32. In apparatus of the character described, an electro-plating cell comprising an electrode in the form of a long strip, a plurality of baths including the bath of said cell, said strip being partially immersed in each of said baths and being adapted to be moved through the latter, that portion of said strip in each bath being in the form of a loop, and weights respectively supported on said loops, substantially as described.

This specification signed this 23rd day of August 1920.

THOS. A. EDISON.