(No Model.) 3 Sheets—Sheet 1.

C. M. BARBER.

PROCESS OF AND APPARATUS FOR ELECTROPLATING.

No. 523,099. Patented July 17, 1894.

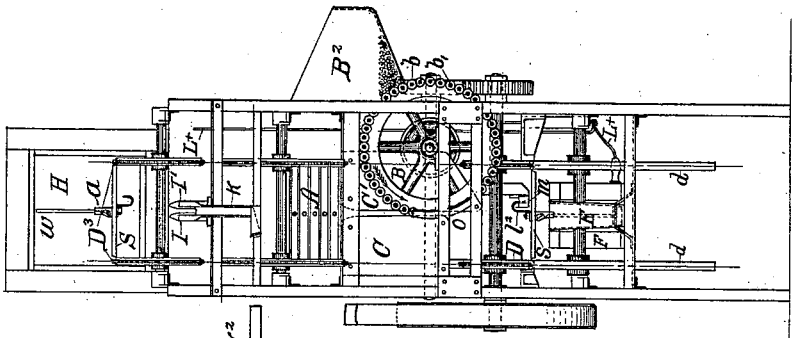

Fig. 1.

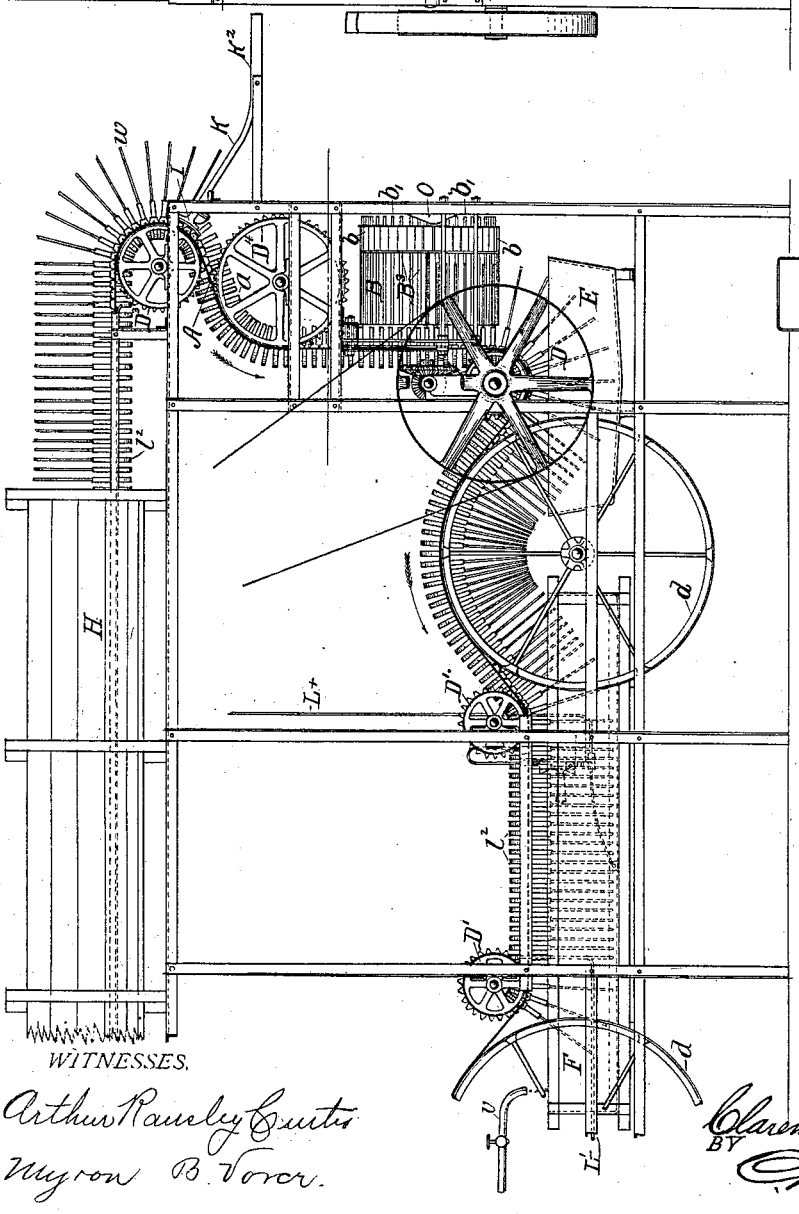

Fig. 2.

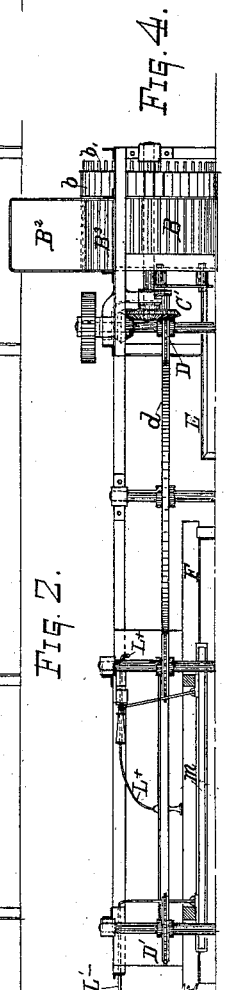

Fig. 4.

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(No Model.) 3 Sheets—Sheet 2.

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PROCESS OF AND APPARATUS FOR ELECTROPLATING.

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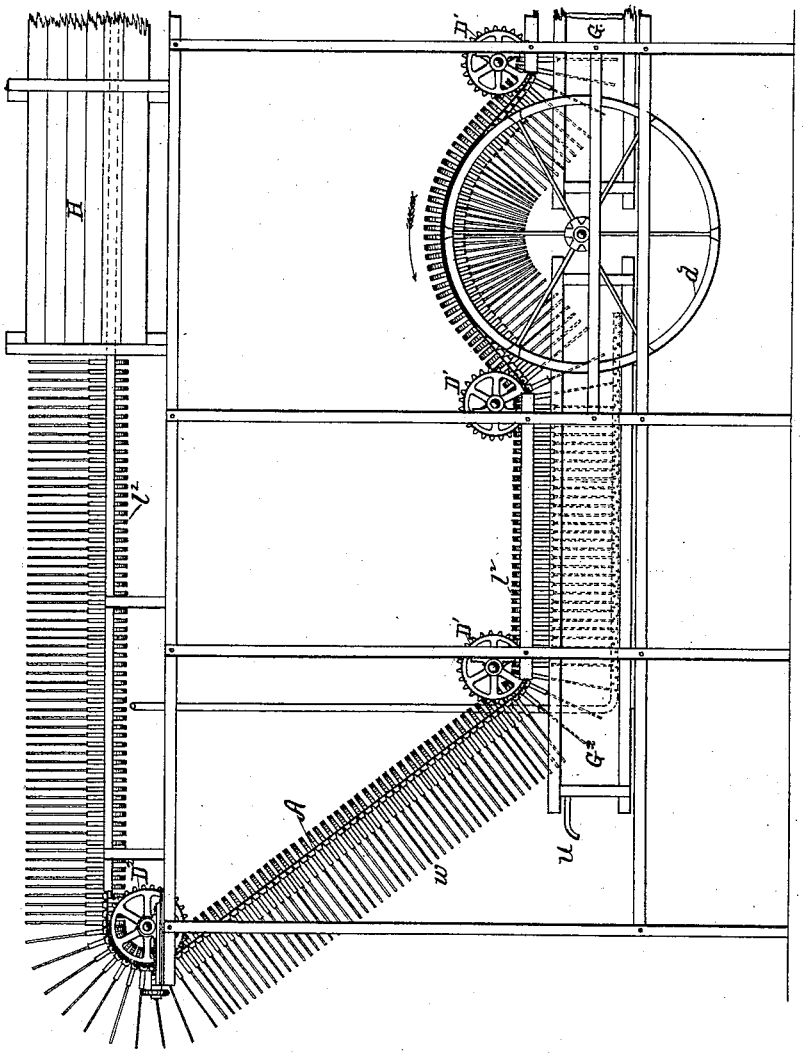

FIG. 3.

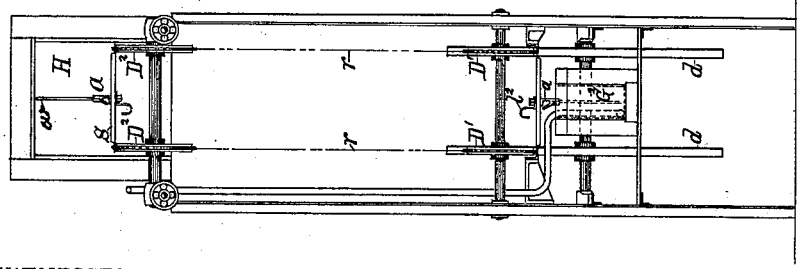

FIG. 5.

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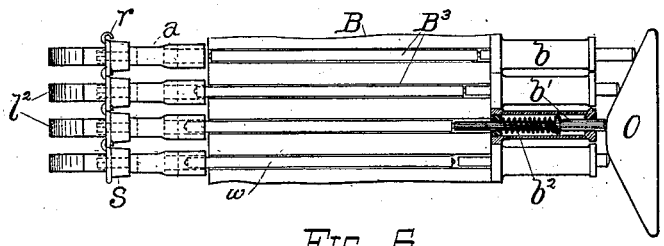


FIG. 6.

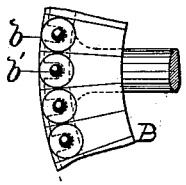


FIG. 7.

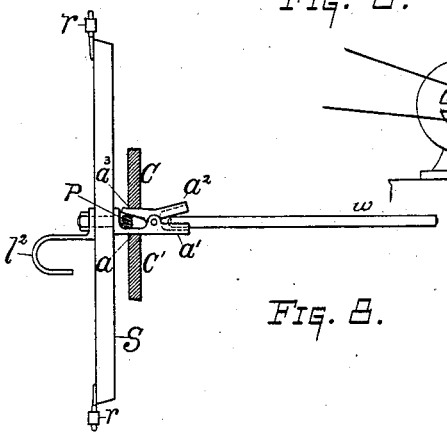
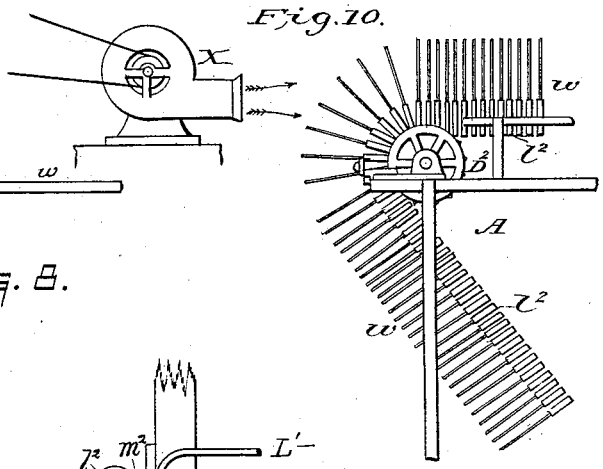


FIG. 8.

Fig. 10.



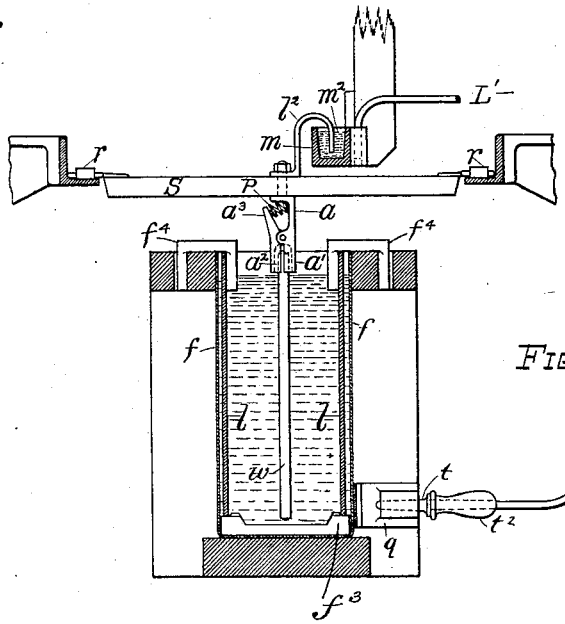


FIG. 9.

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UNITED STATES PATENT OFFICE.

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PROCESS OF AND APPARATUS FOR ELECTROPLATING.

SPECIFICATION forming part of Letters Patent No. 523,099, dated July 17, 1894.

Application filed January 5, 1893. Serial No. 457,304. (No model.)

To all whom it may concern:

Be it known that I, CLARENCE M. BARBER, a citizen of the United States, residing at Cleveland, in the county of Cuyahoga and State of Ohio, have invented certain new and useful Improvements in Processes of and Apparatus for Electroplating; 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.

My invention relates to processes of electroplating and to apparatus for carrying on, automatically and continuously, the operation of electro-plating.

The object of the invention is to cheapen the cost of the electro-plating process and to insure a more uniform product than is at present obtained, and it is designed to accomplish these results, first, by the saving of labor; secondly, by the saving of waste from the breakage and loss incident to the numerous handlings involved in the present methods; thirdly, by the economy of space required for apparatus; fourthly, by the increase of output in a given time; and fifthly, by the greater certainty and facility with which all the adjustments required in the operation of electro-plating can be effected and maintained without disturbing the continuity of the operation.

Broadly stated, the invention consists primarily in automatically conducting by mechanical means the entire series of operations connected with the electro-plating of articles, and secondarily in the combination and arrangement of co-acting mechanism for feeding, conveying, plating, washing, drying, and delivering the articles to be plated. Although it is applicable to a great variety of articles, such as bolt heads, stove knobs, carriage and harness trimmings, &c., my invention has special reference to the electro-plating of arc-light carbons, and for convenience will be described as arranged for the plating of such carbons, it being understood that it is not limited thereto.

In the drawings Figure 1 represents, in end elevation, an apparatus constructed according to my invention as arranged for the electro-plating of arc-light carbons. Figs. 2 and 3 are side elevations of the same, being necessarily broken away on account of the length of the apparatus. Fig. 2 shows the feed-end or "head" end (so called) of the apparatus, and Fig. 3 the opposite or "foot" end, the portion represented as broken away being of the same general construction as the portion shown, and of any desired length. Fig. 4 is a plan-view of the portion of the apparatus shown in Fig. 2, showing only a half-plan from the central longitudinal line, the lateral halves being similar in general construction, differing only, as shown in Fig. 1, in the feeding mechanism, &c., shown in Fig. 4 being located at one side of the central longitudinal line. Fig. 5 is an end elevation showing the end opposite the feed-end shown in Fig. 1. Fig. 6 is a detail showing, partly in elevation and partly in section, the construction and arrangement of the plungers and grooves of the feed drum. Fig. 7 is a detail showing, in end elevation, a portion of the feed drum and the ends of the feeding plungers. Fig. 8 is a detail showing, in plan view and partial section, the mechanism (shown in elevation in Fig. 1) for opening the clamping holders to receive and discharge the carbons or other articles. Fig. 9 is a transverse vertical sectional view through a plating tank, showing the electrical connections with the carbons and the tank. Fig. 10 exhibits an efficient arrangement for drying the carbons by means of a blast of air directed upon them by a blower.

In general terms the apparatus consists of an endless conveyer or carrier having a series of clamping holders secured thereto, each of which is adapted to receive from the feeding mechanism a single carbon rod or other article, and is provided with means for making electrical connection with the circuit through the plating tank in any suitable way. The carrier is arranged, by means of suitable sprocket gear and guide wheels, to traverse past the feed drum in a line tangential to the periphery of the same, then over a series of vats or tanks in such manner as to carry the carbons or other articles held by the clamps through the tanks, serially; first through a tank or tanks designated as the cleaning or wetting tank or tanks, in which they are treated to a suitable bath or baths to remove any grease, oil, or dirt that may

have got upon them and to leave the surface of the carbons clean and wet when they enter the plating tanks, so as to prevent the formation of air bubbles upon their surface, and the absorption of fluid by the carbons while in the plating tank. From the wetting tank the carbons are carried in the same way through one or more plating tanks, then through a washing tank or tanks, and then through a drying chamber or space and to the point of discharge. For convenience of description that end of the apparatus at which the articles are fed to the carrier, is designated as the head-end and the opposite end as the foot-end; the various parts are referred to in the same manner, the head-end of any part being that end which is directed toward the head-end of the machine, (situate at the right hand in the drawings,) and vice versa.

In the drawings A represents the endless carrier, and *a* the clamping holders secured thereto.

B is the feed-drum by which the carbons are continuously fed from the hopper B^2 and supplied singly to the traversing holders *a*.

C C′ are a pair of vertical plates between which the holders *a* pass, and which are set so far apart that, in passing between them, the clamping jaws of the holders *a* are opened to receive the carbons, as hereinafter more particularly described.

D D′ D^2 D^3 D^4, &c., are sprockets wheels, by means of which the carrier A is moved and guided.

d d d are guide wheels or idlers by passing over which the carrier is caused to raise the carbons out of one tank and pass them into another. Power is applied by belt or gear to the shaft of one of the sprocket wheels, as seen at D in Fig. 2, and one or more of the sprocket wheels is provided with adjustable bearings, as seen at D^2 in Fig. 3, whereby any slack in the carrier may be taken up.

A suitable frame work, as shown in the drawings, supports the various parts.

E represents the cleaning or wetting tank, F F the plating tanks, and G G^2 the washing tanks.

H represents a drying chamber, I I′ are two plates, similar to C C′, arranged to open the holders *a* to discharge the carbons at the desired point.

K^2 represents a table, or shelf, box or other suitable receptacle upon or into which the carbons are discharged, and from which they are taken away in any preferred manner.

L L′ represent respectively the positive and negative sides of the electrical circuit through the plating tanks, *l* represents the anodes, l^2 the contact-piece attached to each of the clamps *a* for making electrical connection with the circuit. The electrical connection is made by a sliding or moving contact between the contact pieces l^2 and a contact piece extending along and above the plating tank and in electrical connection with the negative side of the circuit. By this construction the articles carried by the holders *a* are in circuit only while in the plating tanks, the circuit being of course broken for each carbon as it begins to rise out of the tank when the carrier passes up over one of the guide wheels *d*, and made again as it descends into the next plating tank.

I will proceed now to describe more particularly the construction and operation of the various parts of the apparatus.

The feeding apparatus consists of a rotating drum B, the periphery of which is longitudinally grooved and forms a part or all of the bottom of a hopper B^2 in which the carbons to be plated are placed in large quantity and from which they feed singly in the following manner. The grooves B^3 in the feed drum are each of a depth and width to receive one carbon, and as the hopper is made equal in width to the length of the carbons, the latter must lie parallel with the grooves B^3, into each of which as it comes under the hopper a single carbon falls and is carried forward.

The grooves B^3 extend the entire length of the drum B, which is longer than the width of the hopper, and at the outer or "head-end" of the drum there is located thereon in line with each of the grooves B^3 a casing *b* in which a plunger *b′* is fitted and adapted to slide in the groove B^3 with which it is in engagement.

A spring b^2 in the casing *b* keeps the plunger *b′* normally withdrawn from the groove B^3 in which it plays, or enough so to clear the opening of the hopper, and with the outer end of the plunger protruding from the head-end of the casing, as shown in Fig. 6.

To feed the carbons from the groove B^3 a cam O is employed, which is curved to correspond with a short arc of the periphery of the feed drum, and is located so as to engage the outer ends of the plungers as they approach, touch and recede from the vertical plane tangent to the feed drum which contains the line of movement of the holders *a*.

As the plungers are successively brought by the rotation of the drum B in contact with the cam O they ride up the incline and are forced farther into the grooves B^3, each pushing before it the carbon in the groove in which it lies, and causing the carbon to project from the other end of the groove, as shown in Fig. 6, in which *w* represents the carbon. As the plungers pass over the maximum point of cam O and are carried past the same, the springs b^2 withdraw the plunger and leave the groove clear to receive another carbon, and so on continuously.

The carrying apparatus consists of the endless sprocket belt A, constructed as follows; two sprocket chains *r r* are secured to the ends of a series of bars *s s s*, to the center of which are secured the holders *a*, preferably one to each bar, and insulated from the bar unless the latter is itself a nonconductor of electricity. The holders are of course placed in correct alignment along the carrier, and

project so far therefrom as to immerse the articles carried by them to the desired depth in the various baths. A form of holder which I have found efficient in use is shown in Fig. 8, and consists of a fixed jaw a' having a movable jaw a^2 pivoted thereto and normally held closed against the fixed jaw by a spring P acting against a rearward extension a^3 of the pivoted jaw a^2.

A stem from the fixed jaw passes through the bar S, which I prefer to form of non-conducting material, and upon this stem, on the opposite side of the bar, is secured the contact piece l^2, all of which is clearly shown in Figs. 8 and 9.

The manner in which the carrier A is moved by the sprocket wheels is clearly shown by Figs. 2 and 3, and needs no further description.

The carrier is charged in the following manner. The carrier, as is shown in Figs. 1, 2 and 6, is caused to pass the drum B in such manner that the holders move in a plane tangential to the periphery of the drum and parallel to the end of the drum, and so far from the foot-end of the drum that the holders a will pass close to the same without quite touching it. The drum B is so geared from its driving mechanism that its periphery moves at the same speed as the carrier A, and the holders a and grooves B^3 are equally spaced. The plates C C′ are adjusted one on each side of the path traversed by the holders a, and in a plane transverse to the axis of the feed drum, extending each way in a vertical direction from the point where the path of said holders is tangent to the periphery of the drum. The plate C has an inclined camshaped edge, while the edge of C′ is straight and set parallel with and contiguous to the path traversed by the holders a, and on the side occupied by the fixed jaw a'. Plate C is set so far from C′ that as the holders a pass between the plates, the fixed jaw a' will ride on the straight edge of C′ as a guide while the extension a^3 of the pivoted jaw a^2 will ride upon the camshaped edge of C and thus be caused to open the jaw a^2, the widest opening of the jaw occurring of course at the narrowest part of the passage between the two plates C C′, which is located at or just above the point where the path of the holder intersects the plane of rotation of the grooves B^3, and is continued of the same width for a short space sufficient to allow the carbon to be fully thrust into the holder by the plunger in that groove, which occurs opposite the maximum point of the cam O, and at about the point where the path of the holders is exactly tangent to that of the grooves B^3, after which the cam edge of plate C rapidly recedes, allowing the holder to close quickly upon the carbon. The result of this construction is that, as the holders enter the space between plates C C′ above the point at which the cam O begins to act, they are opened before the carbons in the grooves of the feed drum begin to move, and come into line with a groove B^3 just at the time when the carbon therein begins to protrude therefrom under the action of the plunger b' and cam O, and as the carrier A and drum B move at the same speed, the carbon is thrust into the open jaws of the clamp and moves with the latter until it passes below the cam edge of plate C, when the jaws will have closed upon the carbon, and it is held by the clamp and carried out of the groove in which it lay, by following the tangential path of the carrier as the drum rotates away from it.

The cleaning and wetting tanks are made of a depth a little greater than the carbon, and as long as required. The plating tanks are constructed of a like depth, of any desired length, and comparatively narrow. I prefer to form the plating tanks with metal sides f supported by a suitable frame work; the anodes l rest on metal blocks f^3, placed in the bottom of the tank, and are secured at the top by clamps or hooks f^4, which engage the sides or frame work of the tank, as shown in Fig. 9.

The electrical connection is made by connecting the anodes or preferably the metal sides or lining of the plating tanks, with the positive pole of a suitable source of electrical energy, such as a dynamo, while the negative pole may be connected to a metallic bar or contact piece, extending the length of the plating tank and so located as to be engaged in sliding contact with the contact pieces l^2 as they successively pass along. I prefer however the construction shown in the drawings, in which an insulated metallic trough m is arranged over the plating tank, and extending from end to end thereof, or nearly so, the trough being connected with the negative pole and filled with mercury m^2, into which the contact pieces l^2 dip during their passage along the tank. This construction is most clearly shown in Fig. 9, where also is shown the preferred method of connecting the positive pole with the tank. A metal block q is secured to the metal side or lining of the tank, into which a metal plug t is fitted and connected to the positive conductor L, while an insulated or non-conducting handle t^2 may be fixed to the plug t.

When, as is preferred, a number of plating tanks are employed, each tank is provided with a shunt circuit and switch whereby the electric current may be shunted from one tank around the next tank and to the one beyond, in the common method well known to electricians. The purpose of this is to enable any one of the tanks to be removed or cut out of circuit without interrupting in any respect the continuity of operation of the whole apparatus.

It is generally regarded by electroplaters as impracticable to secure a satisfactory coating by depositing it in successive increments, it being supposed that the coating must be uninterruptedly deposited to be wholly co-

herent and homogeneous, and while this may be true of successive deposits in the same bath, I have found the coating deposited in successive increments in a series or succession of baths as above described to be entirely coherent and homogeneous, and more uniform than when all deposited in a single bath. This feature of deposition in successive increments is one of the leading means by which I obtain the advantages of my process of electroplating.

The washing tanks, like the cleaning and wetting tank or tanks, may be of any suitable dimensions or number, but all the tanks are preferably made narrow and more numerous, rather than wider, when it is desired to gain increased capacity. All of the tanks may be supplied with any desired pump connections for filling or emptying.

The drying apparatus consists preferably of an elevated chamber H, through which the carrier A is caused to pass, and which chamber may be either warmed or supplied with an air blast as preferred. The carbons may be dried by a blast of dry or warm air directed upon them without being in a chamber, or spontaneously without either, and I do not limit myself to the employment of an inclosed chamber, or of an air blast, for drying them. In case an air blast is used, the arrangement shown in Fig. 10 is suitable, a blower X being placed in position to direct a blast of air along the path traversed by the carrier after leaving the washing tanks.

The discharging apparatus consists of two plates I I′, similar to C C′, and operating in the same way. The holders *a* being caused to pass between the plates I I′ are opened as previously described, and as the plates I I′ are arranged to open the holders only when the carbons have commenced to descend as the carrier passes around sprocket wheel D^3, and are below the center thereof, as seen in Fig. 2, the carbons drop upon the inclined trough K and slide down the same to the table K^2 or any receptacle provided to receive them. The empty holders are then carried, by passing the carrier A over the sprocket wheels D^4 aligned with D, past the drum B and refilled as before described, and thus the operation is continued without interruption, the only attention required being to keep the hopper B^2 filled, the anodes and baths in proper condition, and the finished carbons removed, all of which is easily accomplished without interfering in the slightest degree with the continuous operation of the apparatus.

As the carbons in passing out of the tank carry on their surface some of the fluid from which they emerge and transfer it to the next tank, the quantity of bath in the first plating tank would be gradually reduced and would become exhausted unless frequently renewed, which may of course be done by pouring in by hand from time to time fresh solution, as is now commonly done in electroplating establishments. I, however, automatically and continuously replenish the solution by bringing a supply pipe from a tank of fresh solution and arranging it over the first plating tank, with a proper cock which can be adjusted to allow the solution to drip into the tank by drops instead of in a stream, since a continuous stream would ground the electrical circuit. *v* in Fig. 2 shows such a supply pipe and cock. In case a stream is desirable, however, the supply tank itself may be insulated. For the reason stated, the last tank will receive an accession of fluid, and to maintain the proper level therein I provide an overflow *u*, shown in Fig. 3. By this means I accomplish the double purpose of keeping the plating solution at a constant level and effect a circulation of the bath in the tanks, whereby the weakened solution is continually replaced by fresh and the bath maintained at a constant strength, all being done automatically, whereas in ordinary electroplating establishments constant labor and attention are required to effect these results.

What I claim as my invention, and desire to secure by Letters Patent, is—

1. The continuous and automatic process of electro-plating which consists in passing the articles to be plated, in a continuous series and by a continuous and uninterrupted movement, successively through a series of plating baths in each of which the article receives an increment of deposit, causing the articles to complete the electrical circuit as they enter the baths and to break the circuit as they emerge therefrom, then washing, drying and discharging the plated articles without interrupting their motion, substantially as described.

2. The continuous and automatic process of electro-plating which consists in passing the articles to be plated, in a continuous series and by a continuous movement, successively through the proper cleaning, plating and washing baths arranged in their proper order, causing the articles to form part of the electrical circuit while in the plating bath and to be out of circuit while not in the plating bath, then drying and discharging the plated articles without interrupting their motion, substantially as described.

3. The process of continuously and automatically electro-plating articles which consists in passing them by a continuous movement successively through the proper cleaning, plating and washing baths arranged in their proper order, causing the articles to form part of the electrical circuit while in the plating bath, and drying them by a blast of heated air directed upon them while in motion after leaving the washing bath, substantially as described.

4. The process of continuously and automatically electro-plating articles which consists in passing them by a continuous movement successively through the proper cleaning, plating and washing baths, arranged in

their proper order, causing the articles to form part of the electrical circuit while in the plating bath, and drying them while in motion after leaving the washing bath by means of a blast of air directed upon them, substantially as described.

5. In electro-plating apparatus the combination of a series of tanks containing respectively the proper cleaning, plating and washing baths arranged in proper order, an endless carrier adapted to carry the articles to be plated and arranged to traverse over said tanks successively, an electrical circuit in which the plating bath is included, and means for connecting the articles into said circuit while in the plating bath, substantially as described.

6. In electro-plating apparatus the combination of a series of tanks containing respectively the proper cleaning, plating, and washing baths arranged in proper order, an endless carrier arranged to traverse over said tanks successively, conducting holders attached to said carrier and adapted to receive and hold the articles to be plated, an electrical circuit in which the plating bath is included, and means for causing said holders to make connection with the electrical circuit while passing over the plating bath, substantially as described.

7. In electro-plating apparatus the combination of a series of tanks containing respectively the proper cleaning, plating and washing baths arranged in proper order, an endless carrier arranged to traverse over said tanks successively, conducting holders attached to said carrier and adapted to receive and hold the article to be plated, an electrical circuit in which the plating bath is included in connection with the positive pole, and an electrical connection with the negative pole extending along the plating tank contiguous to the path traversed by the holders and with which each holder makes contact while passing the plating tank, whereby the articles carried by the holders are put in circuit during their passage through the plating bath, substantially as described.

8. In electro-plating apparatus the combination of a series of tanks containing respectively the proper cleaning, plating and washing baths arranged in proper order, an endless carrier adapted to carry the articles to be plated and arranged to traverse over said tanks successively, an electrical circuit in which the plating baths are connected in series, means for connecting the articles into said circuit while in the plating baths, and a shunt circuit connection to each of the plating baths whereby any one or more of said plating baths may be cut out of circuit substantially as described.

9. In electro-plating apparatus the combination, with a series of tanks, of an endless carrier arranged to traverse over said tanks successively, holders attached to said carrier and adapted to hold the articles to be plated and to immerse them in the baths contained in said tanks, an electrical circuit with the positive pole of which the plating baths are connected and with the negative pole of which the holders make connection while passing over the plating baths and thereby put said articles in circuit while in the plating bath, and means for guiding said carrier so as to cause the same to pass the articles carried by said holders into, through and out of the successive baths in said tanks, substantially as described.

10. In electro-plating apparatus the combination, with a series of tanks, of an endless carrier arranged to traverse over said tanks successively, holders attached to said carrier and adapted to hold the articles to be plated and to immerse them in the baths contained in said tanks, an electrical circuit with the positive pole of which the plating baths are connected and with the negative pole of which the holders make connection while passing over the plating baths and thereby put said articles in circuit while in the plating baths, and means for guiding said carrier so as to cause the same to pass the articles carried by said holders into, through and out of the successive baths in said tanks and thence along a drying space, substantially as described.

11. In electro-plating apparatus the combination, with a series of tanks, of an endless carrier arranged to traverse over said tanks successively, holders attached to said carrier and adapted to hold the articles to be plated and to immerse them in the baths contained in said tanks, an electrical circuit with the positive pole of which the plating baths are connected and with the negative pole of which the holders make connection while passing over the plating baths and thereby put said articles in circuit while in the plating bath, and means for guiding said carrier so as to cause the same to pass the articles carried by said holders into, through and out of the successive baths in said tanks and thence along a drying space supplied with means for artificially drying the plated articles, substantially as described.

12. In electro-plating apparatus the combination, with a series of tanks, of an endless carrier arranged to traverse over said tanks successively, holders attached to said carrier and adapted to hold the articles to be plated and to immerse them in the baths contained in said tanks, an electrical circuit with the positive pole of which the plating baths are connected and with the negative pole of which the holders make connection while passing over the plating baths and thereby put said articles in circuit while in the plating bath, and means for guiding said carrier so as to cause the same to pass the articles carried by said holders into, through and out of the successive baths in said tanks and thence along a drying space supplied with artificial heat, substantially as described.

13. In electro-plating apparatus the combi-

nation, with a series of tanks, of an endless carrier arranged to traverse over said tanks successively, holders attached to said carrier and adapted to hold the articles to be plated and to immerse them in the baths contained in said tanks, an electrical circuit with the positive pole of which the plating baths are connected and with the negative pole of which the holders make connection while passing over the plating baths and thereby put said articles in circuit while in the plating baths, and means for guiding said carrier so as to cause the same to pass the articles carried by said holders into, through and out of the successive baths in said tanks and thence along a drying space wherein an air blast is directed upon the plated articles, substantially as described.

14. In electro-plating apparatus having a series of tanks and an endless carrier adapted to traverse above the same successively and provided with holders adapted to hold the articles to be plated and to immerse them in the baths contained in said tanks, a contact piece in electrical connection with the negative pole of the circuit, extending above and along each plating tank and so located that said holders make contact therewith while passing such tank, substantially as described.

15. In electro-plating apparatus the combination, with a series of tanks, of an endless carrier arranged to traverse over said tanks, means for moving and guiding said carrier, holders attached to said carrier and having spring actuated jaws to grasp and hold the articles to be plated, said holders being provided with means for making electrical connection with the electric circuit while passing over the plating baths, and means substantially such as described for automatically opening the jaws of the holders to enable the same to be charged or discharged.

16. In automatic electro-plating apparatus in combination with the plating bath and electrical circuit and a carrier arranged to traverse over the plating bath and having holders for the articles to be plated the feeding mechanism comprising in combination a hopper, a rotating drum closing the bottom of said hopper, grooves in the face of said drum adapted to each receive a single one of the articles to be fed, a plunger adapted to reciprocate in said groove and normally retracted by a spring, a cam adapted to engage said plungers at a fixed point and force them into said groove to feed out the article therein.

17. In automatic electro-plating apparatus in combination with the plating bath and electrical circuit and a carrier arranged to traverse over the plating bath and having holders for the articles to be plated the feeding mechanism comprising in combination a rotating drum having grooves upon its face parallel with its axis and each adapted to receive one of the articles to be plated, a hopper adjusted against said drum and closed at the bottom thereby, a casing adjusted upon said drum in line axially with each of said grooves, a spring-actuated plunger extending through each casing and having its inner end in one of said grooves, and its outer end projecting from the opposite end of said casing, and a fixed cam located in the path of the outer ends of the plungers to force the same into the grooves against the action of the springs, substantially as described.

18. In automatic electro-plating apparatus in combination with the plating bath and electrical circuit the carrier for the articles to be plated, comprising in combination an endless sprocket belt and means for moving the same, guide wheels for governing and changing the line of movement of said belt, holders attached to said belt and adapted to receive and carry the articles to be plated, and means attached to said belt for making electrical connection with the circuit while passing over the plating baths, substantially as described.

19. In automatic electro-plating apparatus in combination with the plating bath and electrical circuit the carrier for the articles to be plated, comprising in combination an endless sprocket belt, sprocket wheels operated by driven gear for moving said belt, guide wheels for governing and changing the line of movement of said belt, and holders secured to said belt for receiving and conveying the articles, each of said holders being adapted to effect electrical connection with the circuit while passing over the plating baths, substantially as described.

20. In automatic electro-plating apparatus in combination with the plating bath and electrical circuit the carrier for the articles to be plated, comprising in combination an endless sprocket belt composed of two sprocket chains attached to the ends of transverse bars, sprocket wheels operated by driven gear and engaging said chains for moving said belt, guide wheels for governing and changing the line of movement of said belt, and holders secured to said transverse bars, each of said holders being adapted to receive and transport one of the articles to be plated and to effect electrical connection with the circuit while passing over the plating baths, substantially as described.

21. In automatic electro-plating apparatus in combination with the plating bath and electrical circuit the carrier for the articles to be plated, comprising in combination an endless sprocket belt composed of two sprocket chains attached to the ends of transverse bars of non-conducting material, sprocket wheels operated by driven gear and engaging said chains for moving said belt, guide wheels for governing and changing the line of movement of said belt, and holders of conducting material secured to said bars and adapted to receive and to transport the articles to be plated and to effect electrical connection with the circuit while passing over the plating baths, substantially as described.

22. In automatic electro-plating apparatus in combination with the plating bath and electrical circuit, the carrier for the articles to be plated comprising in combination an endless sprocket belt of two endless sprocket chains secured to the ends of non-conducting bars, holders attached to said bars and having spring-actuated clamping jaws to receive and hold the articles to be plated and contact pieces to make electrical connection and put said holders in circuit while traversing over the plating tanks, sprocket wheels and guide wheels for controlling the line of movement of said carrier, and means for imparting motion thereto, substantially as described.

23. In automatic electro-plating apparatus the combination of a series of tanks, an endless carrier arranged to traverse over said tanks, means for moving and guiding said carrier, holders attached to said carrier and adapted to receive and hold the article to be plated and to make connection with the electric circuit while traversing over the plating tanks, an automatic feeding apparatus comprising a grooved drum, a hopper, feeding plungers and means for actuating them, a cam for automatically opening the holders, and means for moving the carrier and feeding drum at corresponding speed, substantially as described.

24. In automatic electro-plating apparatus the combination of a series of tanks, an endless carrier arranged to traverse over said tanks, means for moving and guiding said carrier, holders attached to said carrier and adapted to receive and hold the articles to be plated and to make connection with the electric circuit while passing over the plating baths, an automatic feeding apparatus comprising a grooved drum, a hopper, feeding plungers and means for actuating them, a cam for automatically opening the holders, means for moving the carrier and feeding drum at corresponding speed, and a cam for opening the holders to discharge the plated articles, substantially as described.

25. In automatic electro-plating apparatus the combination of a series of tanks containing the proper cleaning, plating and washing solutions, an endless carrier arranged to traverse over said tanks, means for moving and guiding said carrier, holders attached to said carrier and adapted to receive and hold the articles to be plated, a contact piece attached to each of said holders, a connection of the positive pole of the circuit with each of the plating tanks, and a contact piece in connection with the negative pole of the circuit and extending over each plating tank contiguous to the path of the contact pieces of the holders and in position to be engaged in electrical connection therewith while said holders are passing the plating tank, substantially as described.

26. In automatic electro-plating apparatus the combination of a series of tanks containing the proper cleaning, plating and washing solutions, an endless carrier arranged to traverse over said tanks, means for moving and guiding said carrier, holders attached to said carrier and adapted to receive and hold the articles to be plated, a contact piece attached to each of said holders, a connection of the positive pole of the circuit with each of the plating tanks, and a negative contact piece consisting of a metal trough above each plating tank said trough being in electrical connection with the negative pole of the circuit and containing mercury into which the contact pieces of the holders dip while passing the plating tank, substantially as described.

27. In electroplating apparatus, the combination with the plating bath, a negative contact piece arranged above the same and electrically connected with the negative pole of the circuit, and a carrier arranged to traverse above the bath, of the holder having a spring-actuated clamping jaw and a contact piece adapted to make contact with the negative contact piece and to move along the same as the holder traverses above the bath, substantially as described.

28. In electro-plating apparatus in combination with the plating bath and a mercury trough electrically connected with the negative pole of the circuit, the holder for the articles to be plated comprising a spring-actuated clamping jaw and a hooked contact piece adapted to dip into the mercury trough, substantially as described.

29. In electroplating apparatus, in combination with the plating bath and a carrier arranged to traverse over the bath and having holders for the articles to be plated each of which holders has a projecting contact piece, the negative contact piece, extending above and along the bath in position to be engaged in moving contact by the contact pieces of the holders while they are passing the bath, and in electrical connection with the negative side of the circuit, substantially as described.

30. In electro-plating apparatus a plating tank having a metallic side or sides electrically connected with the circuit, in combination with the anode and a conducting support for the anode in contact with the metallic side of the tank, substantially as described.

In testimony whereof I hereto affix my signature in presence of two witnesses.

CLARENCE M. BARBER.

Witnesses:

MINNIE B. BARBER,

L. J. RONEY.