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METHOD FOR TREATING ELECTROTYPE MATRICES

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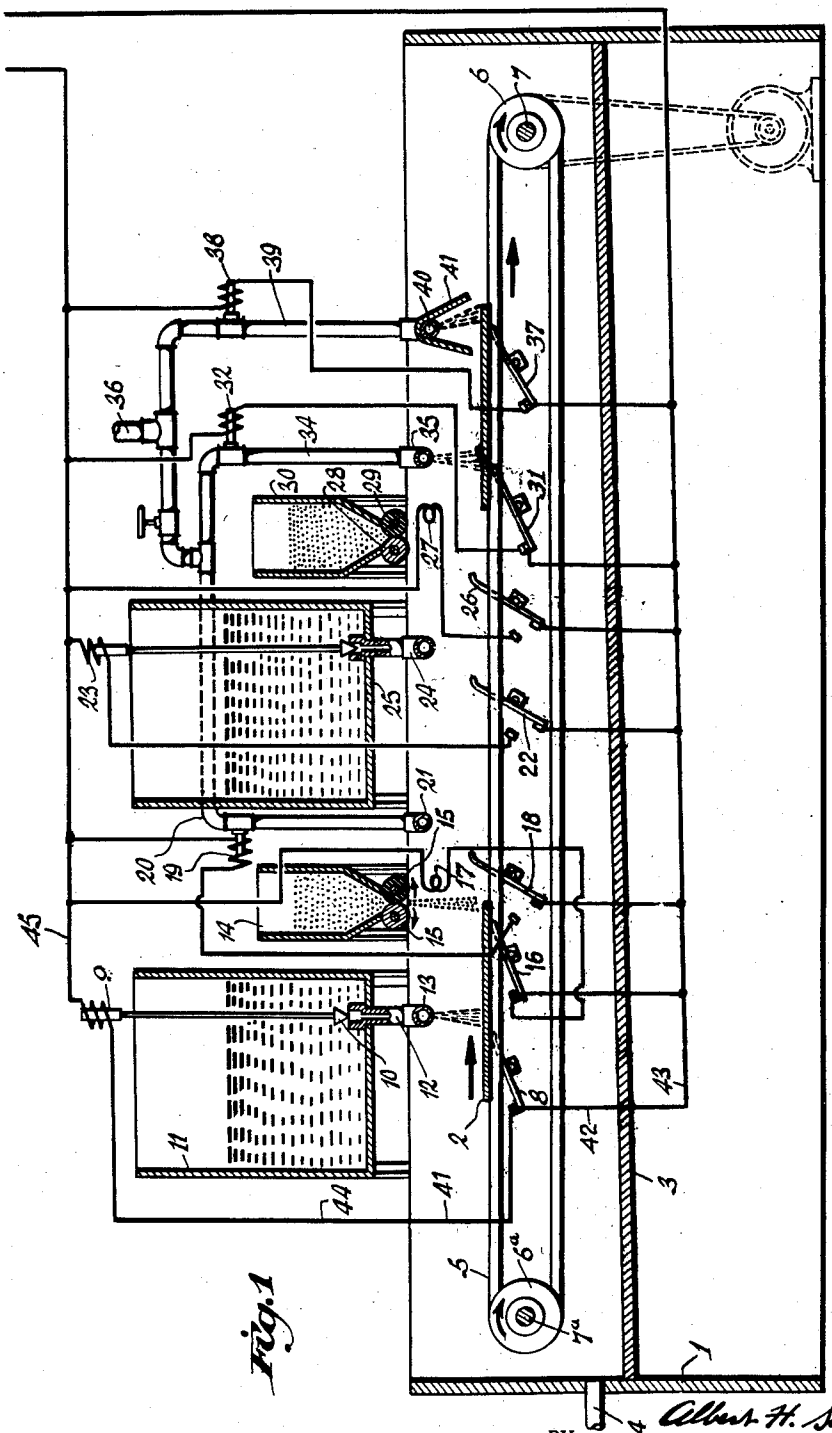

Fig. 1



Fig. 5



Fig. 4



Fig. 3



Fig. 2

INVENTOR.
Albert H. Schomaker

BY
Oliver B. Kaiser

ATTORNEY.

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METHOD FOR TREATING ELECTROTYPE MATRICES

Albert H. Schomaker, Bellevue, Ky., assignor to The Rapid Electrotype Company, Cincinnati, Ohio, a corporation of Ohio

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5 Claims. (Cl. 204—6)

This invention relates to a process and apparatus for metalizing or oxidizing the surface of lead or graphite coated forms or wax electrotype matrices for increasing the conductivity, and as preliminary to the electro deposition of metal thereon to produce an electrotype shell.

It is a common practice to subject a graphited form or the surface of a graphite coated wax electrotype matrix to a preliminary copper coating or oxidizing treatment. The surface generally is treated with a dilute slightly acid solution of copper sulphate and fine iron filings are sprinkled over it, and the surface is gently brushed until it is covered with copper. In this operation numerous cells or couples are produced in which each iron particle acts as an anode, i. e. goes into solution and displaces the copper which deposits upon the graphite film that serves as a cathode. This heretofore has always been a manual operation, and for large size or face dimension electrotype matrices an operator usually treats a small portion of the surface of a matrix plate at a time, and therefore does not produce a uniform and continuous film so that the full advantage and benefit of preliminarily coating or oxidizing to impart an electrically conducting film to the graphited surface of the matrix is not obtained.

It is therefore an object of the invention to provide a simple, cheap and effective means and method for uniformly and completely coating the graphite surface of an electrotype form or matrix to render the same immediately conductive for the electro deposition of metal thereon to produce an electrotype shell.

Another object of the invention is to provide an efficient and speedy method for preliminarily oxidizing or metalizing the surface of an electrotype form or matrix, a treatment performed while a matrix is continuously advanced to receive one of the several different constituents or ingredients applied at successive stages and the application thereof automatically controlled by the advancing matrix stationed upon a conveyor, the method permitting of a plurality of plates in a successive order to be simultaneously treated and supplied upon a conveyor at one end thereof and removed from the opposite end in a condition ready for making a "face" electrical conductor connection and electro deposition to produce an electrotype shell.

Another object of the invention is to control the time or period of successive treatments by the rate of continuous advance or travel of the matrix stationed upon a conveyor to obtain uniformity in the treatment of a plurality of plates and in degree of surface metalizing or oxidizing.

Other advantages and features of the invention will be more fully set forth in the description of the accompanying drawing, in which:

Figure 1 is a central vertical diagrammatic section of the apparatus for practicing the improved method of the present invention.

Figures 2 to 5 inclusive are corresponding sections of an electrotype matrix, each illustrating a stage in the application of one of the several different constituents upon the surface of an electrotype matrix.

With the present method, the well known ingredients of a diluted slightly acid solution of copper sulphate and fine iron filings for metalizing or oxidizing the graphited wax surface of an electrotype matrix are employed. Therefore, the description will be confined to the use of these ingredients or materials, although the element or elements which specifically enter into the constitution of any mixture or compound or the kind and number of materials employed does not form a part of the present invention so that the reference to any specific material is merely given to aid in the understanding and practice of the method and the operation of the apparatus.

As highly efficient and economical results by the preferred method are obtained in the use of diluted slightly acid solution of copper sulphate and fine iron filings for preliminarily coating the graphited surface of an electrotype matrix as a means for increasing its conductivity, no change in material has been necessary.

Briefly, the method consists in continuously conveying a wax electrotype matrix during the period of treatment, and in a horizontal plane, with the graphited surface uppermost, by stationing the same upon the forward run of an endless conveyor. The treatments starting, first by spraying or administering from a nozzle for the full width of the matrix plate, a crosswise stream or drippings of acid solution upon the graphited surface of the matrix, the administration or application commencing at the forward end of the plate and correspondingly continuing to its opposite end. The amount or velocity of the fluid is regulated and controlled according to the needs required to produce the most favorable and efficient results, and this also applies to the rate of plate travel and is readily determined in practice so that specifically described rates of flow of liquid or solid ingredients employed in the treatment and rate of travel of the plate need not be given herein, and which also de-

pends upon the net results desired. This also applies to the relative time or administering points of one material or ingredient from another, and these also can be readily adjusted and altered as conditions may require.

In applying the liquid ingredients by means of a nozzle disposed and extending transverse to the direction of plate travel and reaching the full width thereof, a determined and uniform application of acid solution is applied. This also follows for the successive applications arranged at points or stages in the progress of the plate with the time of starting and stopping thereof controlled by the moving plate which actuates electric circuit controlling switch means for operating appropriate devices to start and stop the feed of the material applied upon the plate. The switches are disposed in the path of the plate travel so that the time of control is governed by the length of the plate. At a determined interval from commencing administering or treating the plate with the acid solution, a lateral stream or drippings of fine iron filings are delivered upon the acid solution covered surface of the plate commencing at its forward end and uniformly continuing to the opposite end of the plate. The iron filings, after deposit upon the plate, act in conjunction with the acid solution to deposit a copper coating upon the graphited surface of the plate. The action continues and is segmented when the plate reaches a point at which its forward end actuates control means for opening a valve to jet water or blow air upon the surface of the plate, delivered from a nozzle extending transversely of the plate direction of travel. This action agitates the material, acid solution and iron filings delivered upon the plate, and also serves as a cooling agent to prevent breaking down or injury to the wax of the matrix as the electro-chemical action of the acid and iron filings create heat.

The plate then continues in its travel for a repeat operation supplying thereon as previously described acid solution, iron filings, and a sufficient supply of fresh water or air, and finally flushing the surface progressively to a high pressure and volume degree of fresh water from a nozzle extending transverse and in parallelism to the nozzles, previously referred to, to fully and completely wash and rinse off the entire surface of the plate. The plate is then manually removed from the conveyor and is in a condition to receive a face conductor connection or ready for a further processing by electro deposition to produce an electrotype shell.

Referring to the drawing, 1 indicates a tank or container within which the electrotype matrix plates 2 are consecutively conveyed for treatment. The matrix plates are conveyed upon an endless or belt conveyor for translating the same beneath a plurality or series of sprayer nozzles and feed spouts arranged in a sequential order for first supplying the top lead coated surface of a matrix plate with a liquid acid solution, then a fine dry granular product of iron filings following with a spray of clear water or air. Then repeating the operations and finishing with a heavy clear water flushing spray to wash off all of the treatment material that remains free from the preceding operations.

A tank is preferably employed for housing the plates during their period of treatment, as conveyed for the successive steps of the treatment for collecting all discharge from the plates and salvaging some of the materials used in the treatment of the plates. The bottom 3 of the tank is inclined longitudinally for draining the liquid therefrom to and through an outlet pipe 4 installed in the deep end of the tank; and the metallic particles, as for instance iron filings, which are used in connection with an acid solution for treating the top surfaces of the plates, are collected and deposited upon the bottom of the tank to be conserved and removed for reconditioning and reuse.

The conveyor preferably constitutes a pair of belts 5 suitably spaced apart, each at one end engaging respectively over a driving wheel 6 fixed upon a driving shaft 7, and at an opposite end over an idler wheel 6a fixed upon a shaft 7a. The shafts are suitably journalled in bearings mounted upon the opposite side walls of the tank. The belts are preferably of a V-type engaging over grooved pulleys or wheels and of a material, resistant to the acid solution used in the treatment of the matrices, for increased endurance. The conveyor drive shaft 7 extends through one of the side walls of the tank for making an exterior power transmission connection as by means of a sprocket wheel and driving chain in connection with an electric motor or other mode of power transmission.

The forward run of the belt or conveyor for the space required between the driving and idler pulleys, to accommodate for the number of plates that can be operated upon for simultaneous and continuous treatment, and for loading and removal and for a maximum size of plate, can be maintained at sufficient tautness to sustain the plates in a substantially horizontal plane without the provision of guiding instrumentalities. If necessary however, guide rollers or supporting rails may be employed to sustain the upper run of the conveyor or belts against sag. The plates however are sufficiently rigid so that any slight sag in the belts under the weight of the plates which may have a tendency to incline the plates is immaterial, although it is preferred to not too rapidly drain the constituents employed for plate treatment, and therefore for the most efficient results it is preferable to have the plates on as true a horizontal plane as possible.

To insure a treatment of the plates for their full surface width and for convenience in applying or depositing the plates upon the belts or conveyor, and to move the same in a width alignment for registration with nozzles and discharge spouts employed for delivery of the treatment material upon the top surface of the plates, it is preferred to either have the tank of a width sufficient to freely receive a definite size of the plate or to track the same at one or both sides longitudinally by stationary guide rails or bars fixed to the side walls of the tank. The rails provide a spacing or way for tracking the plates. This adds convenience to the operator in loading the plates upon the conveyor as it eliminates any plate adjustment after deposited upon the conveyor, and insures a uniform treatment for the full area or surface of the plates thereof.

A matrix plate, as it is conveyed by the conveyor, at a proper point in its travel has its forward end engage and depress a control electric switch lever 8, as the first of a series, which, when depressed, establishes an electric circuit to a magnetically operated valve 9, opening its valve 10 for a discharge of liquid acid solution from a supply tank or reservoir 11 shown as mounted upon the top of the main tank 1, although the reservoir location could be remote

from the main tank. The valve 10 controls the inlet end or port of a pipe fitting 12 connected to the bottom of the solution reservoir 11, and with a horizontally disposed nozzle tube 13 for delivering the supply of acid solution upon the top surface of the matrix.

The nozzle is disposed crosswise of and for the width of the plate, and its jet apertures are of a determined gauge and spacing apart for delivery of an adequate supply of liquid acid solution uniformly across the full width of the plate, continuously with the advance of the plate and progressively until its entire surface has been supplied. The supply is automatically cut off as soon as the plate advances beyond and releases the control lever 8 at an appropriately timed interval from the time of initiating the liquid solution supply. The surface of the matrix is supplied with metallic or iron filings discharged, in a longitudinal stream, crosswise of the plate, from a reservoir 14 shown as mounted upon the top of the main tank 1. The iron filings as a dry fine granular product are distributed from the funnel shaped bottom of the reservoir 14 by a pair of coacting relatively reversely rotated feed rollers 15, 15. The feed rollers are power driven, the driving mechanism therefor is clutch controlled, preferably by a magnetically operated clutch and in transmission connection with the conveyor shaft 6.

The clutch is operated at and for an appropriate timed interval and period by a switch lever 16 corresponding to the switch lever 8, actuated by an advancing matrix plate 2, for establishing and breaking an electric circuit to the magnetic clutch diagrammatically illustrated and indicated at 17. The deposit of the metallic filings upon the black lead coated surface of the matrix plates with the diluted acid solution results in an electro-chemical reaction producing a metalized surface thereover for developing a metallic flash deposit thereon.

The plate in its advance and at an appropriate point from the point of depositing metallic filings depresses a third switch lever 18, which thereupon establishes an electric circuit to an electromagnetically operated valve 19 for opening a fresh water or air pressure supply line or pipe 20 to a nozzle 21. The nozzle 21 connects with the end of the pipe 20 at an appropriate height from the plate carrying plane of the conveyor and extends crosswise of the tank for discharging or spraying water or air upon the plate 2. The spray continues for the full length of the plate, and is cut off as soon as the rear end of the plate releases the switch lever 18. The spray agitates the material previously delivered upon the plate, and also serves as a cooling agent.

The surface of the plate preferably is subjected to a second treatment, corresponding to the first as a repeat. The plate in its advance and at a proper point or interval after having passed the nozzle 21 actuates a switch lever 22 for establishing an electric circuit to an electromagnetically operated valve 23 as a control for the nozzle 24 in pipe or conduit connection with the reservoir 25, for a second delivery of said solution. Thence the plate actuates a switch lever 26 for the control of an electro-magnetically operated clutch 27 for the transmission of the coacting rotating feed rollers 28, 29, at the base of the reservoir 30 for administering or applying a granular material or iron filings upon the top surface of the plate. Continuing, the plate then actuates a switch lever 31, establishing an electric circuit for an electro-magnetically operated valve 32 in the water line or pipe 34. The pipe 34 carries a sprayer nozzle 35 for administering or applying an air or water supply upon the moving plate. The pipes 20 and 34 are represented as branch lines linking with a water main or service line 36.

Finally the plate actuates a switch lever 37 which establishes an electric circuit with an electro-magnetically operated valve 38 in the water line or pipe 39 as a branch in connection with the main water service pipe 36. The branch line 39 at its lower end is provided with a nozzle 40 for the delivery of a heavy or forceful flushing volume of water or liquid upon the plate to thoroughly wash and cleanse the plate surface of all loose metallic particles deposited thereon in the treatment, and to efficiently cleanse it from the acid or liquid solution administered or developed in the course of treatment.

The nozzle 40 preferably directs the spray or stream forwardly, and is shielded by an inverted V-form of covering 41 so as to avoid delivery of any quenching quantity or spray of water in an advanced stage which may be interfering to the full degree of metalizing action desired.

The several switch levers, 8, 16, 18, etc., are all of spring actuated or counterweighted type to open automatically as the plate retreats therefrom. Each has a conductor 42 connecting with an electric supply line 43 to the movable contact carried by the switch, and a conductor 44 connecting the stationary contact of the switch and in series with the coil of the magnet of the device operated thereby and with a service line 45. As the switch's magnetically operated valves and clutches are of commercial or conventional type, a detailed disclosure thereof is not made herein as it is believed that the construction and operation is well known, and that the invention herein and the method and mode of operation will be fully understood by the diagrammatic illustration of these parts or devices.

The conveyor is operated at an appropriate rate of speed necessary to obtain a proper time allowance for the successive plate treatments. This, however, provides ample time for an operator to deposit manually the plate on one end of the conveyor and remove a treated plate from the opposite or delivery end of the conveyor, and to constantly have a plurality of plates simultaneously undergoing treatment. Aside from the more efficient manner in which the surface of the plates are metalized, the material saving in time is effected over the present hand methods now practiced, thus materially reducing the cost in the production of electrotypes.

Having described my invention, I claim:

1. The method of treating a graphite coated surface of an electrotype matrix with a liquid acid solution and fine metallic granules to produce a metallic film thereon, which consists in transporting the matrix in a horizontal plane continuously at a determined rate for the period of treatment, with the graphite coated side upward, administering thereon from dispensers stationed thereabove, separately and in a consecutive order the liquid solution, fine metallic granules, and a spray for agitating and cooling the solution and granules on the surface of the matrix, delivering said several products and spray from the dispensers onto the surface of the moving matrix crosswise for the full width thereof, effecting thereby together with the travel of the matrix a progressive uniform application and treatment,

and finally administering a liquid under pressure crosswise for the full width of the matrix to progressively with the travel of the matrix cleanse the surface of the solution and loose particles thereon.

2. The method of treating a graphite coated surface of an electrotype matrix with a liquid acid solution and fine metallic granules to produce a metallic film thereon, which consists in transporting the matrix in a horizontal plane continuously at a determined rate for the period of treatment with the graphite coated side upward, administering thereon from dispensers stationed thereabove separately and in a consecutive order the liquid solution, fine metallic granules, and a spray for agitating and cooling the solution and granules on the surface of the matrix, delivering said several products and spray from the dispensers onto the surface of the moving matrix crosswise for the full width thereof, effecting thereby together with and the travel of the matrix a progressive uniform application and treatment, repeating the performance in the continued travel of the matrix, and finally administering a liquid under pressure crosswise for the full width of the matrix to progressively with the travel of the matrix cleanse the surface of the solution and loose particles thereon.

3. The method of treating a graphite coated surface of an electrotype matrix with a liquid acid solution and fine metallic granules to produce a metallic film thereon, which consists in transporting the matrix in a horizontal plane continuously at a determined rate for the period of treatment with the graphite coated side upward, administering thereon from dispensers stationed thereabove separately and in a consecutive order the liquid solution and fine metallic granules, delivering said several products from the dispensers onto the surface of the moving matrix crosswise for the full width thereof, effecting thereby and together with the travel of the matrix a progressive uniform application and treatment, and finally administering a liquid under pressure crosswise for the full width of the matrix to progressively with the travel of the matrix cleanse the surface of the solution and loose particles thereon.

4. The method of treating a graphite coated surface of an electrotype matrix with a liquid acid solution and fine metallic granules to produce a metallic film thereon, which consists in transporting the matrix in a horizontal plane continuously at a determined rate for the period of treatment with the graphite coated side upward, administering thereon from dispensers stationed thereabove separately and in a consecutive order the liquid solution and fine metallic granules, delivering said several products from the dispensers onto the surface of the moving matrix crosswise for the full width thereof, effecting thereby and together with the travel of the matrix a progressive uniform application and treatment, repeating the performance in the continued travel of the matrix, and finally administering a liquid under pressure crosswise for the full width of the matrix to progressively with the travel of the matrix cleanse the surface of the solution and loose particles thereon.

5. The method of treating a graphite coated surface of an electrotype matrix with a liquid acid solution and fine metallic granules to produce a metallic film thereon, which consists in transporting the matrix in a horizontal plane continuously at a determined rate for the period of treatment, with the graphite coated side upward, administering thereon from dispensers stationed thereabove, separately and in a consecutive order the liquid solution, fine metallic granules, and a spray for agitating and cooling the solution and granules on the surface of the matrix, delivering said several products and spray from the dispensers onto the surface of the moving matrix crosswise for the full width thereof, effecting thereby and together with the travel of the matrix a progressive uniform application and treatment, finally administering a liquid under pressure crosswise for the full width of the matrix to progressively with the travel of the matrix cleanse the surface of the solution and loose particles thereon, and automatically individually controlling the delivery of each dispenser by the moving matrix and the period of delivery by the length and rate of travel of the moving matrix.

ALBERT H. SCHOMAKER.