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Patented Aug. 5, 1902.

G. B. HAMMOND & T. DENNIS.
APPARATUS FOR COATING METAL PLATES.

(Application filed Aug. 23, 1901.)

(No Model.)

3 Sheets—Sheet 1.

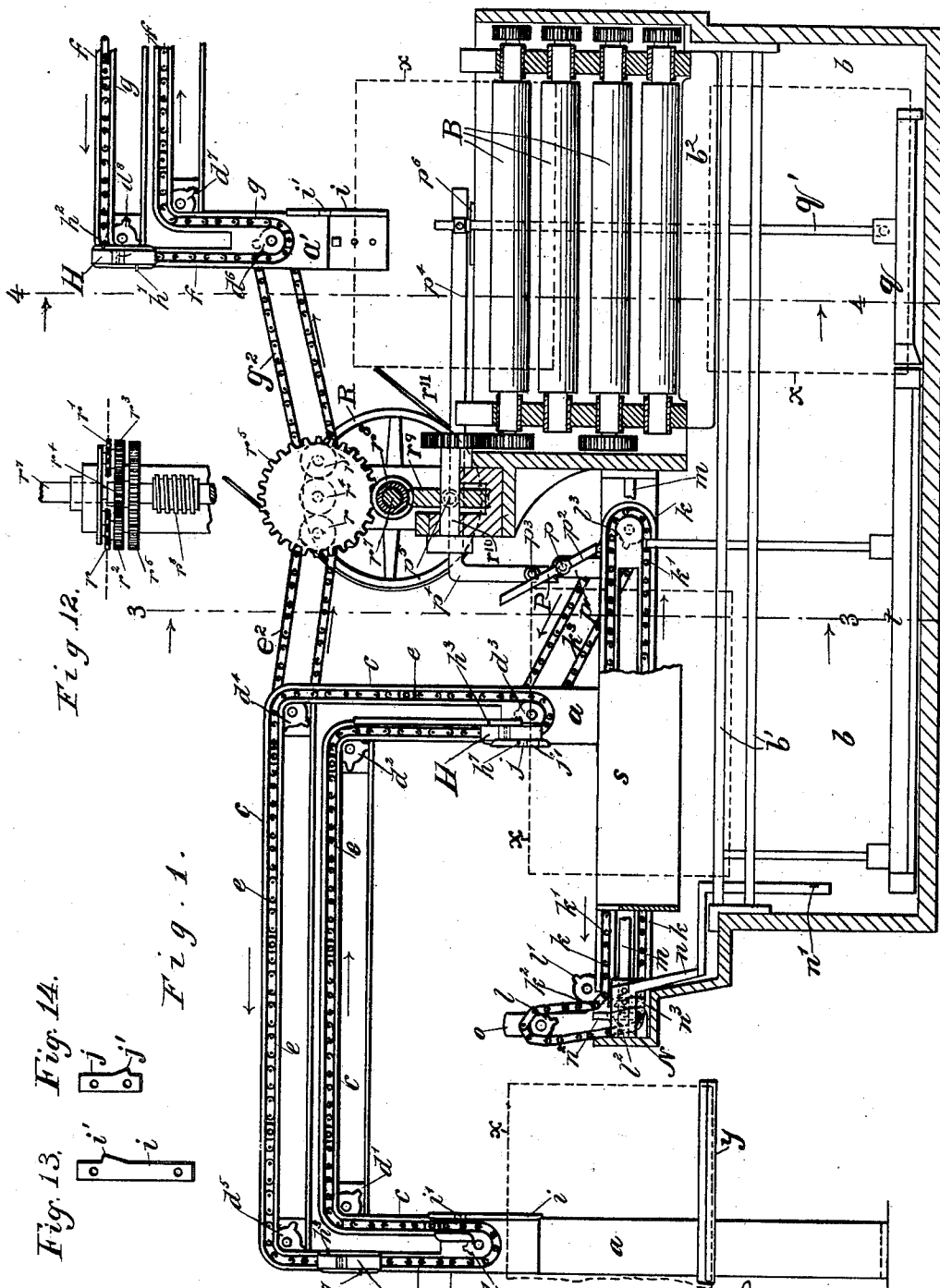


Fig. 12.

Fig. 14.

Fig. 13.

Fig. 1.

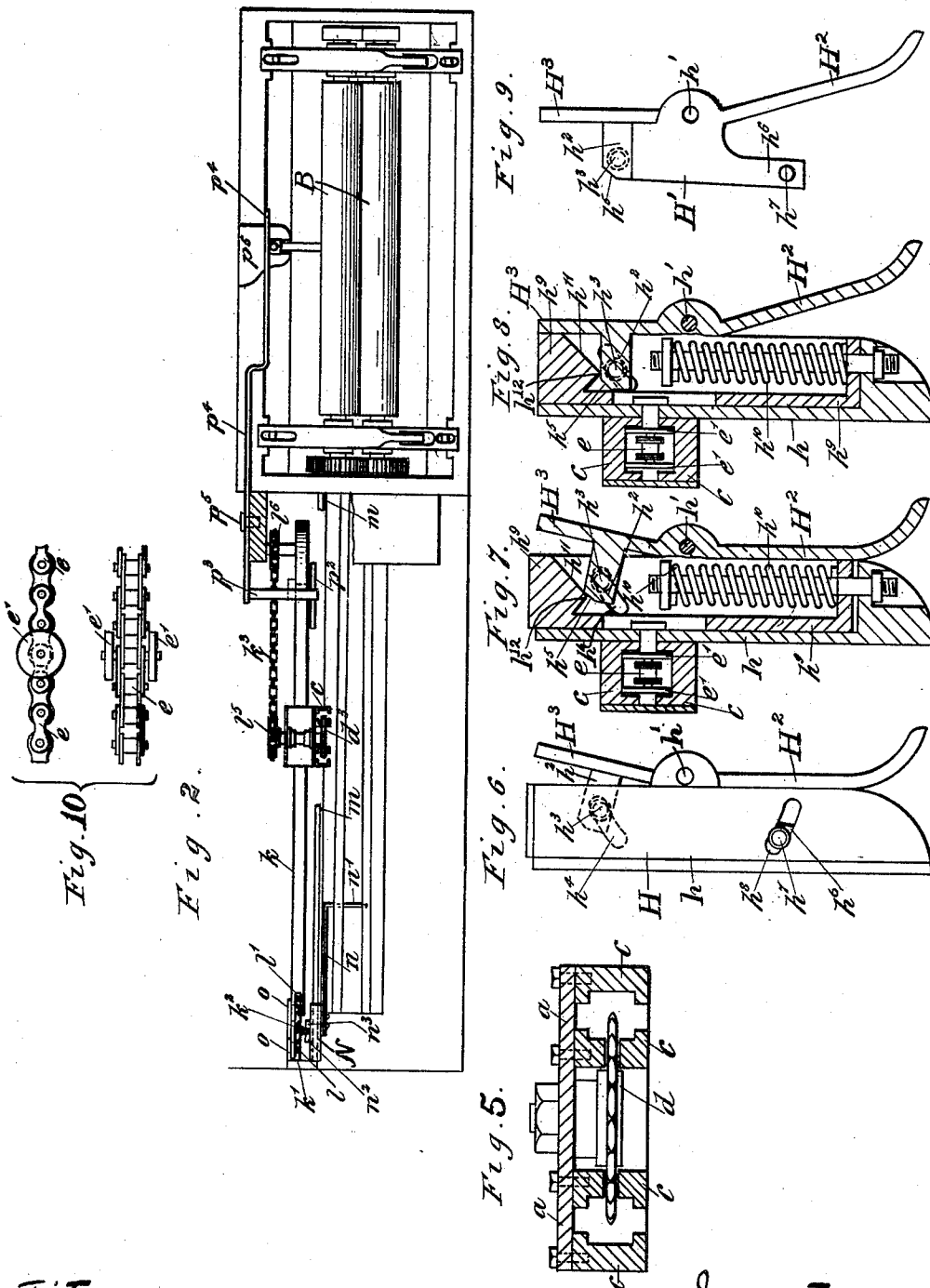
Witnesses:
Fred W. Englebert
Riley B. Bower

Inventors.
G. B. Hammond
T. Dennis.
Mc Williamson & Fisher
Attorneys.

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3 Sheets—Sheet 2.

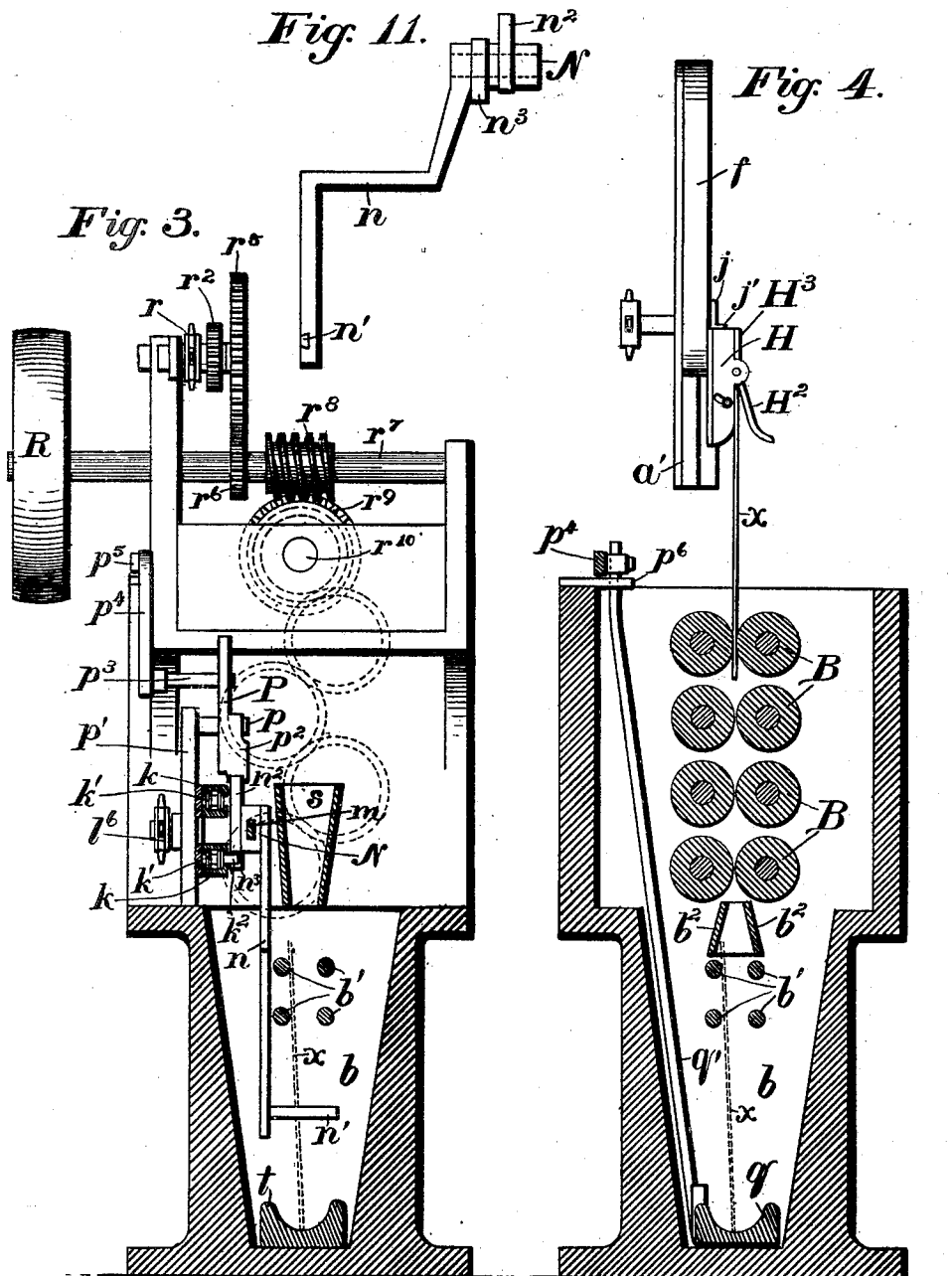


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3 Sheets—Sheet 3.



Witnesses

Riley C. Bowen
Geo. T. Ryne

By

Inventors
George B. Hammond
and *Thomas Dennis*,
Wilkinson & Fisher
Attorneys

UNITED STATES PATENT OFFICE.

GEORGE BROWN HAMMOND AND THOMAS DENNIS, OF NEATH, ENGLAND;
SAID DENNIS ASSIGNOR TO SAID HAMMOND.

APPARATUS FOR COATING METAL PLATES.

SPECIFICATION forming part of Letters Patent No. 706,408, dated August 5, 1902.

Application filed August 23, 1901. Serial No. 73,060. (No model.)

To all whom it may concern:

Be it known that we, GEORGE BROWN HAMMOND and THOMAS DENNIS, subjects of the King of Great Britain and Ireland, residing at Neath, in the county of Glamorgan, England, have invented certain new and useful Improvements in Means or Apparatus for Use in Connection with the Coating of Metal Plates or Sheets with Tin, Lead, or other Metals or Alloys; and we 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.

Our invention relates to the coating of metal plates or sheets with tin, lead, or other metals or alloys, and has reference to means for feeding the plates into the coating-bath or pot, moving the plates through the said bath or pot, raising them to the rolls at the delivery end of the pot, and removing them from the said rolls and delivering them where required. According to our invention these operations are mechanically performed.

Referring to the accompanying drawings, in which like letters of reference designate corresponding parts in the several views, Figure 1 represents a side elevation of our apparatus, partly in section and with parts broken away. Fig. 2 represents a plan view of the device, the upper parts being removed. Fig. 3 represents a transverse section, on an enlarged scale, taken on the line 3 3 of Fig. 1 looking in the direction of the arrows. Fig. 4 represents a similar view taken on the line 4 4 of Fig. 1, also looking in the direction of the arrows. Fig. 5 represents a sectional view taken through the guide-rails and showing the shape of the same. Fig. 6 is a side elevation of the gripper, also on an enlarged scale. Fig. 7 is a vertical sectional view through the same, showing it closed. Fig. 8 is a similar view to Fig. 7, but showing the gripper open. Fig. 9 is a side elevation of the gripper-arm detached from the casing. Fig. 10 represents a side view and plan of one of the conveyer-chains. Fig. 11 is a side elevation of the device for pushing the plate through the bath looking at the side opposite to that shown in Fig. 1. Fig. 12 is a plan of a part of the gearing. Fig. 13 is a side elevation of the cam-plate

for closing the grippers, and Fig. 14 is a similar view of the cam-plate for opening the grippers.

The essential features of the invention are a pot or tank *b* for the bath, a conveyer-frame *a*, extending over one end of the pot *b* and supporting the mechanism for conveying the plates to be coated to the bath, a device for pushing the plates through the bath in the pot *b*, means for lifting the plates from the other end of the pot, and a second conveyer for removing the plates therefrom.

To the frame *a* are secured guide-rails *c*, (shown in cross-section in Fig. 5,) the said rails being arranged vertically at each end of the frame *a* and horizontally in the middle thereof. At each end of the guide-rails *c* are arranged sprocket-wheels *d* and *d*³, (shown in dotted lines,) and at each of the angles of the said guide-rails are similar sprocket-wheels *d*¹, *d*², *d*⁴, and *d*⁵. Within the guide-rails *c* and over the said sprocket-wheels pass the conveyer-chains *e*, which are formed as shown in Fig. 10, having antifriction-rollers *e*¹ at suitable intervals along their sides. Pivoted to these chains at suitable intervals are grippers or carriers *H*, consisting of a frame *h*, in which is pivoted at *h*¹ a second frame *H*¹, having the gripper-arm *H*² and the tailpiece *H*³. Within the frame *h* is arranged a sliding frame *h*⁹, within which is arranged a spring *h*¹⁰, tending to press said frame downwardly to the position shown in Fig. 8. In the upper end of the frame *h*⁹ is formed an inclined plane *h*¹¹, terminating in a point *h*¹², which when the parts are in the position shown in Fig. 8 bears upon a block *h*³, extending inward from the tailpiece *H*³, thus holding this block down and the gripper-arm *H*² open, as will be readily understood.

A pin *h*³ extends from one side of the block *h*² through a slot *h*⁴ in the casing *h*, and a similar pin *h*⁷ extends from an arm *h*⁶ on the frame *H*¹ through a slot *h*⁸ in the other side of the casing, by means of which pins the frame *H*¹ may be moved about its pivot *h*¹ to open or close the gripper-arm *H*². When the gripper-arm is closed, as shown in Fig. 7, the inclined plane *h*⁵ on the block *h*³ rests upon the inclined plane *h*¹¹, the spring *h*¹⁰ holding the parts in this position.

On one side of the frame *a*, near the beginning of the rails *c*, is secured a cam-plate *i*, having the cam *i'* extending outwardly in the proper position to engage the pin *h*³ as the gripper passes this point.

The plate to be coated (shown by dotted lines at *x*) is held in any suitable support *y*, close to the frame *a*. The gripper *H* is open while approaching the plate *x*, the plate passing between the gripper and the arm *H*². As the gripper starts upwardly the cam *i'* engages the pin *h*³, moving the latter outwardly and closing the gripper-arm *H*² upon the plate *x*. This brings the parts of the gripper to the position shown in Fig. 7—*i. e.*, the gripper-arm closed firmly upon the plate *x*. The chain *e* is driven in the direction of the arrow and carries the gripper and plate to the other end of the frame *a*, where it passes down the vertical part of the guide-rails *c*, where there is secured a second cam-plate *j*, having a cam *j'*, adapted to engage the pin *h*² and open the gripper-arm *H*², thus releasing the plate *x*.

Over the end of the pot *b* is arranged the flux-box *s*, into which the plate passes as it comes down the vertical part of the frame *a* and which guides the plate between the guide-rails *b'* in the pot *b*.

Arranged longitudinally over the pot *b*, alongside of the flux-box *s*, is a rail *m*, on which is arranged to slide a block *N*, having a downward and forward extension *n*, with a transverse piece *n'* extending across the path of the plate *x*, as shown in Fig. 3. On one side of the block *N* are arranged a pair of lugs *n*² and *n*³, which extend laterally from the side of the block, leaving a space between the two lugs. The lug *n*² extends somewhat above the block *N*, and the lug *n*³ extends somewhat below the block. A pair of guide-rails *k*, similar to the rails *c*, are arranged parallel with the rail *m*, and a sprocket-chain *k'*, passing over the sprocket-wheel *l* on an upright *O*, and the sprocket-wheels *l'*, *l*², and *l*³ run through these guide-rails *k*. The chain *k'* is provided with a pin *k*², adapted to engage the lugs *n*² and *n*³.

As the chain *k'* is driven in the direction of the arrows the pin *k*² passes downward on the vertical part of the chain beneath the lower end of the lug *n*² and engages the lower end of the lug *n*³, by means of which it pushes the block *N* along the rail *m*, the cross-piece *n'* pushing the plate *x* through the bath-pot *b*. When the chain passes around the sprocket *l*³, the pin passes upwardly between the lugs *n*² and *n*³ and engages the upper part of the lug *n*², thus carrying the block *N* back to the starting-point.

Above the path of the block *N* is pivoted, as at *p*, on an upright *p'* a lever *P*, the lower end *p*² of which is weighted and lies in the path of the lug *n*² on the block *N*.

From an inspection of Fig. 1 it will be seen that when the block moves forward the upper end of the lug *n*² will pass beneath the lever *P*, raising the lower end *p*² thereof,

which lower end will fall back behind the lug *n*², and when the block *N* moves backward the said lug will engage the end *p*² of the lever *P*, moving it backward, thus turning the said lever about its pivot *p* and causing the upper arm thereof to impinge against a stud *p*³ on a lever *p*⁴ and actuate the latter for a purpose to be hereinafter described.

In the bottom of the bath-pot *b* is arranged a trough *t*, in which the lower edge of the plate *x* rests, and adjoining this at one end of the pot is a cradle *q* of the same shape in cross-section as the trough *t* and supported upon a rod *q'*, depending from one end of the lever *p*⁴. This lever *p*⁴ is pivoted above the pot *b* at a point *p*⁵ and has connected to one end thereof the rod *q'*, which passes through a slot in a plate *p*⁶, upon which this end of the lever *p*⁴ may rest, and the other end of this lever *p*⁴ is bent downwardly and provided with a stud *p*³, with which engages one arm of the lever *P*.

Above the end of the pot *b*, in which is situated the cradle *q*, are arranged a set of rollers *B*, which are geared together and driven by a gear-wheel *r*¹¹ on a shaft *r*¹⁰, which latter is provided with a worm-wheel *r*⁹, driven by a worm *r*⁸ on the main driving-shaft *r*⁷ of the machine.

Above the set of rollers *B* is arranged a frame *a'*, similar to the frame *a*, having guide-rails *f*, similar to the guide-rails *c*, and chains *g*, similar to the chains *e*, run over the sprocket-wheels *d*⁶, *d*⁷, and *d*⁸ and pass through the guide-rails *f*. These chains are also provided with grippers *H*, and the vertical part of the frame *a'* has a cam-plate *i*, with a cam *i'* placed in position to close the said gripper *H* as the latter starts upward. The horizontal portion of the frame *a'*, the rails *f* and chains *g* are broken away; but the outer ends of the frame and rails terminate in a vertical portion, like the inner end of the frame *a*, provided with a cam-plate *j* and cam *j'* for opening the grippers *H* when they pass the outer end of the frame.

The machine is driven from a main shaft *r*⁷, having a pulley *R*, to which motion is transmitted from any suitable source of power and which is provided with a pinion *r*⁶ and a worm *r*⁸, the latter driving the worm-wheel *r*⁹ and shaft *r*¹⁰ and the former meshing with the gear-wheel *r*⁵, which turns the small gear-wheel *r*⁴, meshing with the gear-wheels *r*² and *r*³. The gear-wheel *r*² turns the sprocket-wheel *r* and the gear-wheel *r*³ turns the sprocket-wheel *r'*. (See Fig. 12.) The sprocket-wheel *r* drives the chain *e*², which drives through any suitable gearing the chain *e*, and the sprocket-wheel *r'* drives the chain *g*², which drives the chain *g*. The chain *k'* is driven by a chain *k*³ from a sprocket-wheel *l*⁵ on the shaft of the wheel *d*³, which chain turns a sprocket-wheel *l*⁶ on the shaft of the wheel *l*⁵.

The operation of the machine is as follows: The plates to be coated are taken from a rack

7 by the grippers H and are carried over the frame *a* by the chains *e*, being released at the inner vertical end of the frame by the cam *j'*, which opens the gripper H, thus allowing the plate to slide through the flux-box *s* between the guide-rods *b'* and drop into the trough *t* at the bottom of the pot *b*, which contains the bath for coating the plates. The movements of the several chains are so timed that when the plate drops into the trough *t* the pin *k*³ on the chain *k'* will engage the lug *n*³ on the block N and push the latter along the guide-rail *m*, the extensions *n* and *n'* of the block N pushing the plate *x* through the bath in the pot *b* until it rests in the cradle *q*. At the end of the forward movement of the block N the lug *n*³ passes beneath the weighted end of the lever P, and at the beginning of its return movement it actuates the said lever, causing it to impinge against the pin *p*³ on the lever *p'* raising the end of the latter, to which is connected the rod *q'*. This will raise the cradle *q*, and with it the plate *x*, the upper end of which passes between the guide-plates *b*² and between the lower pair of rollers B, which are turning in the direction to carry the plate upward between the other pair of rollers B. These rollers continue to move the plate upward until the upper edge thereof enters beneath the open arm H² of the gripper H, which is descending on the chain *g* at this time and reaches its lowest position at the time the plate enters beneath the arm H². As the gripper begins its upward movement the arm H² is closed by the cam *i'*, thus gripping the plate *x* and carrying it up and away on the chain *g*. The chain *g* may be arranged to deliver the plate to any suitable place, where a cam similar to the cam *j'* is arranged to open the gripper-arm. The delivery end of the chain *g* is not shown, as the arrangement of such end is the same as at the end of the chain *e*, which delivers the plates to the bath-pot *b*.

The grippers are so arranged upon the chains that they act in harmony with the pusher, so that the cycle of operations is carried on continuously. The position of the grippers can be changed according to their number and to the sizes of the plates to be coated.

Having thus described our invention, what we claim, and desire to secure by Letters Patent of the United States, is—

1. In a machine for coating plates, the combination with a bath-pot and means for conveying plates to and from same, of means movable longitudinally of said bath-pot for pushing the plates therethrough, and means engaging said pushing means for alternately moving the same forward and back again to its initial position.

2. In a machine for coating plates, the combination with a bath-pot, of conveyer-chains and means coöperating with said conveyer-chains for automatically delivering the plates

to the bath-pot, moving the same longitudinally therethrough, and delivering the plates to one of said conveyer-chains.

3. In a machine for coating plates, the combination with a bath-pot, of conveyer-chains for conveying the plates to and from said bath-pot, means for pushing said plates longitudinally through said bath-pot, means for elevating said plates from said bath-pot, and means coöperating with said conveyer-chains, engaging and automatically operating said pushing and elevating means.

4. In a machine for coating plates, the combination with a bath-pot; of a rail above said bath-pot, a block on said rail, an extension on said block for pushing plates through said bath-pot, and means for propelling said block along said rail, substantially as described.

5. In a machine for coating plates, the combination with a bath-pot; an endless chain arranged to travel above said pot, grippers upon said chain, means for closing said grippers upon a plate, and means for opening said grippers when over said pot to drop said plate in the pot; of a rail above said pot, a block sliding on said rail, an extension on said block for pushing said plate, and means for propelling said block along said rail, substantially as described.

6. In a machine for coating plates, the combination with a bath-pot; and a cradle in said bath-pot; of means for conveying plates to said bath-pot, means for pushing said plates through said bath-pot into said cradle, means for raising said cradle, a set of rolls for lifting the plate from said cradle, and a conveyer for removing the plate from said rolls, substantially as described.

7. In a machine for coating plates, the combination with a bath-pot; a conveyer for placing the plates to be coated in said pot, of a block arranged to slide above said pot, an extension on said block for pushing said plates through said pot, a cradle in said pot for receiving the plates, a lever operated by said sliding block for lifting said cradle, a set of rolls for lifting the plate from the cradle, and a conveyer for removing the plates from said rolls, substantially as described.

8. In a machine for coating plates, the combination with a bath-pot, a conveyer for placing the plates to be coated in the pot, a block arranged to slide above said pot, an extension on said block for pushing said plates through said pot, a cradle in said pot, a lever *p*⁴ to which said cradle is attached, a weighted lever in the path of said sliding block adapted to act on the lever *p*⁴ to lift said cradle, a set of rolls for lifting said plate from said cradle, and a conveyer for removing said plates from said rolls, substantially as described.

9. In a machine for coating plates, the combination with a bath-pot, a flux-box above said bath-pot, guide-bars, and a cradle in said bath-pot; of means for conveying plates to said bath-pot, means for pushing said plates through said bath-pot into said cradle, means

for raising said cradle and means for removing the plate from said cradle, substantially as described.

10. In a machine for coating plates, the combination with a bath-pot, of a rail above said pot, a block arranged to slide on said rail and having an extension extending into said pot, lugs on said block extending above and below the same, a chain running and returning parallel with said rail and having a pin adapted to engage said lugs and move said block forward and backward along said rail, substantially as described.

11. In a machine for coating plates, the combination with a bath-pot, of a rail above said pot, a block arranged to slide on said rail and having an extension extending into said pot, lugs on said block extending above and below the same, a chain running and returning parallel with said rail and having a pin adapted to engage said lugs and move said block forward and backward along said rail, a lever p^4 connected with the said cradle, a lever P arranged in the path of one of the lugs on said sliding block and adapted to actuate the lever p^4 to raise said cradle, substantially as described.

12. In a machine for coating plates the combination with a bath-pot; of conveying means operating adjacent thereto, comprising a movable frame, a gripping-jaw pivoted thereto, provided with an inwardly-projecting lug, and a sliding lock adapted to engage said lug for holding said jaw in its open or closed po-

sition; and means located in the path of said movable frame for opening and closing said gripping-jaw.

13. In a machine for coating plates, the combination with a bath-pot; of conveying means operating adjacent thereto, comprising a movable frame, a gripping-jaw pivoted thereto, provided with an inwardly-projecting lug having a beveled end, and a sliding lock provided with a beveled point adapted to alternately engage said lug on its upper and beveled face for holding said gripping-jaw open and closed, respectively; and means located in the path of said movable frame for opening and closing said gripping-jaw.

14. In a machine for coating plates, the combination with a bath-pot and conveyer-chains located adjacent thereto; of gripping devices carried by said conveyer-chains comprising a slotted frame, a gripping-jaw pivoted thereto and provided with pins operating in said slots, and a sliding lock for holding said jaw in its open or closed position; and means located adjacent the path of said conveyer-chains adapted to engage said pins for opening and closing said gripping-jaw.

In testimony whereof we affix our signatures in presence of two witnesses.

GEORGE BROWN HAMMOND.
THOMAS DENNIS.

Witnesses:

H. P. CHARLES,
J. W. PHILLIPS.