(No Model.) 2 Sheets—Sheet 1.

F. J. SWAINE & C. S. MOODY.

PHOTOGRAPHIC DRY PLATE COATING MACHINE.

No. 426,420. Patented Apr. 22, 1890.

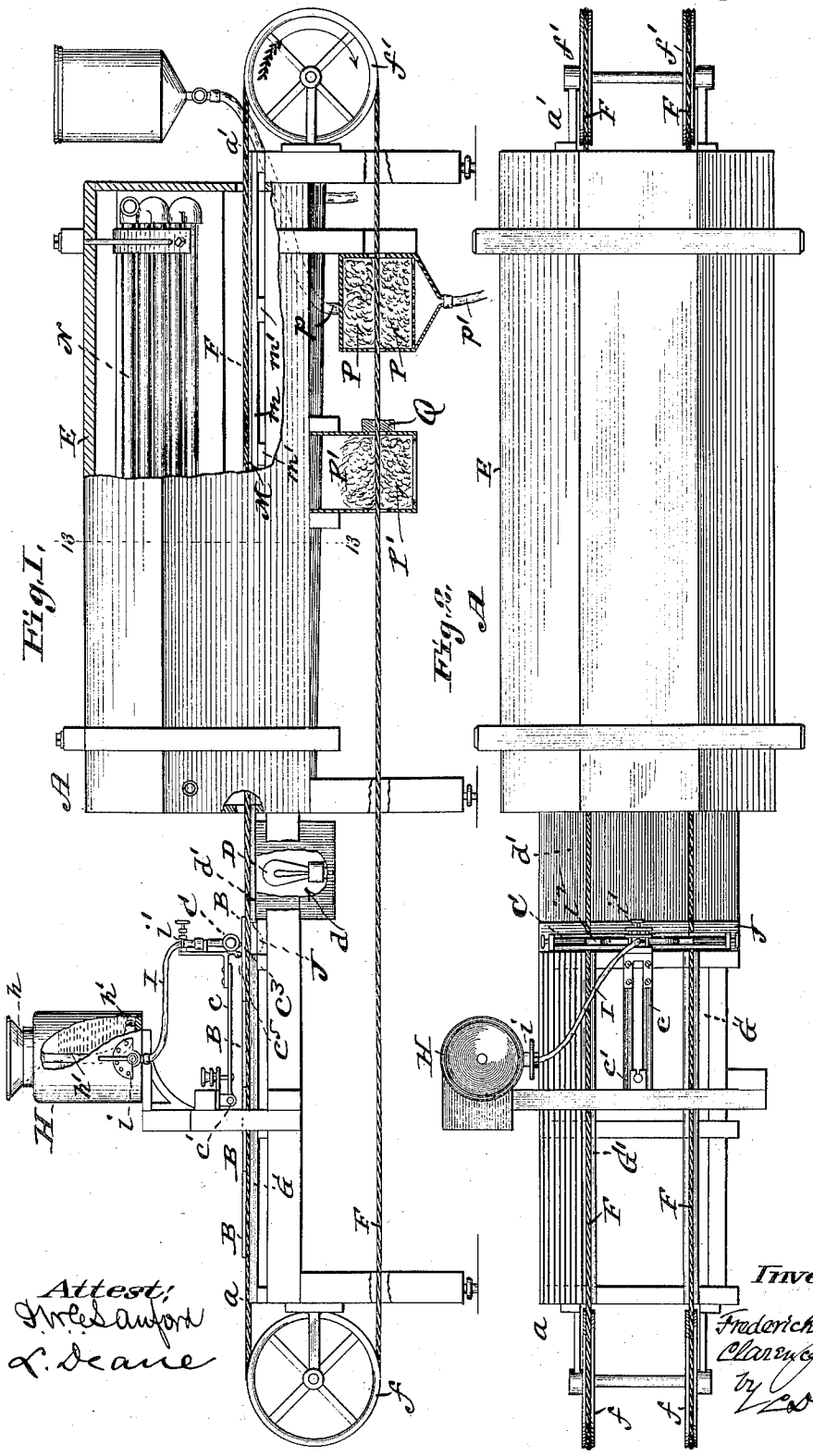


Fig. 1.

Fig. 2.

Attest:
Fred Sanford
L. Deane

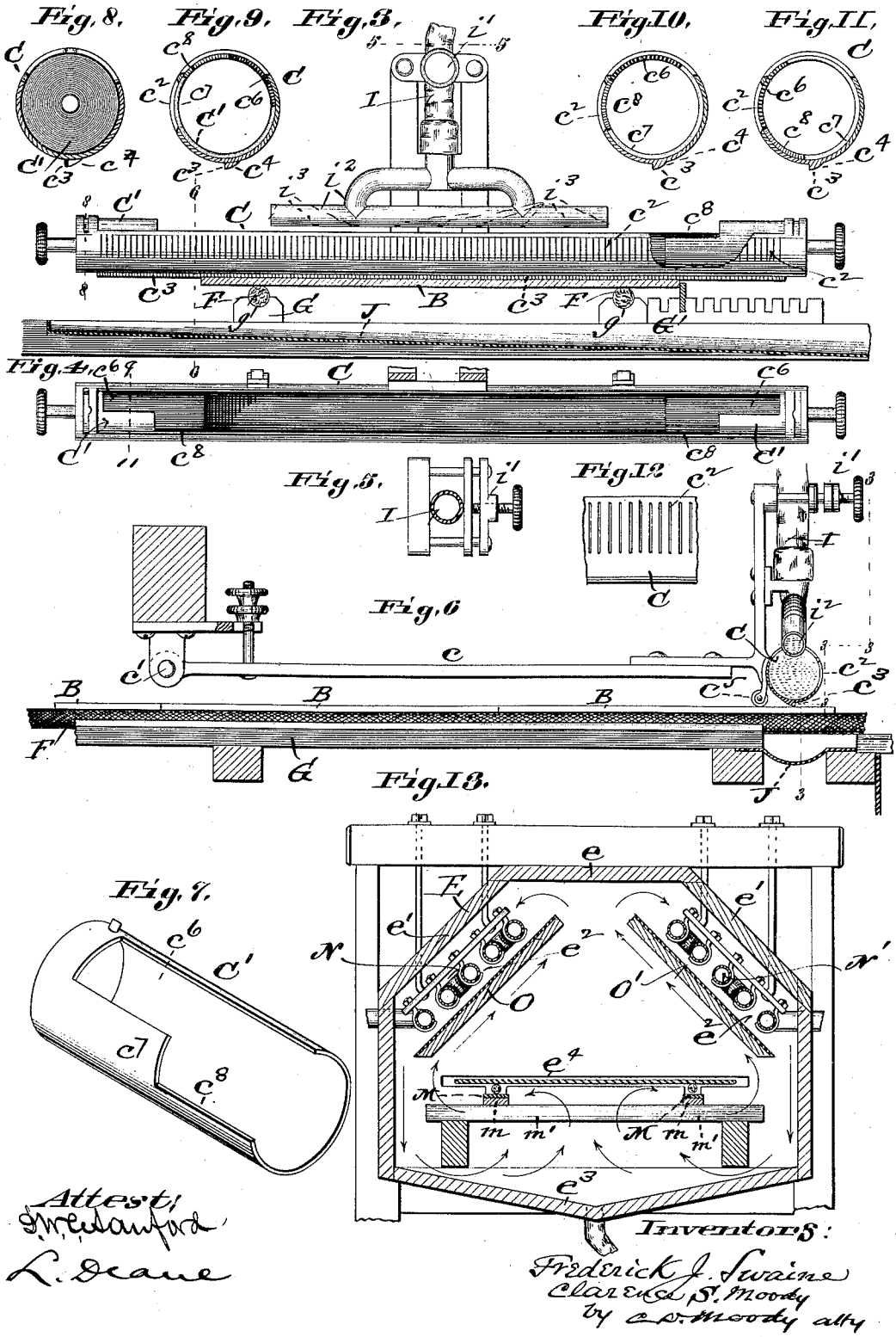
Inventors:
Frederick J. Swaine
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UNITED STATES PATENT OFFICE.

FREDERIC J. SWAINE, OF ST. LOUIS, AND CLARENCE S. MOODY, OF WOODLAND, ST. LOUIS COUNTY, ASSIGNORS TO THE M. A. SEED DRY PLATE COMPANY, OF ST. LOUIS, MISSOURI.

PHOTOGRAPHIC DRY-PLATE-COATING MACHINE.

SPECIFICATION forming part of Letters Patent No. 426,420, dated April 22, 1890.

Application filed August 12, 1889. Serial No. 320,523. (No model.)

To all whom it may concern:

Be it known that we, FREDERIC J. SWAINE, of St. Louis, Missouri, and CLARENCE S. MOODY, of Woodland, in the county of St. Louis and State of Missouri, have jointly made a new and useful Improvement in Photographic Dry-Plate-Coating Machines, of which the following is a full, clear, and exact description.

This invention is an improved means whereby a photographic emulsion can be expeditiously applied to and set upon the glass, celluloid, or other plates which form the basis of dry-plates, and so as to produce thereon a film of substantially uniform thickness, free from spots, streaks, bubbles, irregularities, and other defects calculated to spoil the negatives ultimately made upon the plates.

The invention consists in the means for inspecting the coating of the plates, in the means for holding the plate-carrying belts laterally in position, in the means for distributing the emulsion in the coater, in the means for delivering the emulsion from the coater onto the plates, in the means for chilling the coated plates, in the means for cleansing the plate-carrying belts, and in minor features of the improved construction, all substantially as is hereinafter set forth and claimed, aided by the annexed drawings, making part of this specification, in which—

Figure 1 is a view, partly in side elevation, partly in vertical longitudinal section, of the improved machine. Fig. 2 is a plan of the machine. Fig. 3 is a vertical cross-section on the line 3 3 of Fig. 6. Fig. 4 is a plan of the coater. Fig. 5 is a horizontal section on the line 5 5 of Fig. 3. Fig. 6 is a vertical longitudinal section of a portion of the machine on the line 6 6 of Fig. 3. Fig. 7 is a view in perspective of one of the plugs used at the ends, respectively, of the coater. Fig. 8 is a section on the line 8 8 of Fig. 3. Figs. 9, 10, and 11 are cross-sections on the line 9 to 11, Fig. 4, and showing, respectively, different adjustments of the plug. Fig. 12 is a detail showing a portion of the coater, and Fig. 13 is a vertical cross-section on the line 13 13 of Fig. 1.

The views are upon various scales, and the same letters of reference denote the same parts.

A, Figs. 1 and 2, represents in a somewhat general way the improved machine. The glass plates B to be coated are delivered thereinto at the receiving end *a* thereof, are carried thence past the emulsion-coater C, by means of which the emulsion is applied to the plates, thence past a ruby-light D, by means of which the operator can inspect the coating operation; thence into and through the refrigerating-chamber E, wherein the emulsion is cooled, dried, and set, and thence to the delivery end *a'* of the machine, at which point the now finished dry-plates are removed from the machine. The operation is necessarily carried on in the dark, and it can be continued as long as is desirable.

The machine in some respects is analogous to those hitherto in use; but it differs from them in important respects, as follows: In the place of transporting the plates upon a flat closed or imperforate belt or series of belts, we employ an open-work construction, and for these reasons: to minimize the extent of the contact of the plate with its support, and thereby prevent as much as is practicable the soiling of the under side or back of the plate with any emulsion, dust, or other thing which may have become attached to the belt; to provide for illuminating the plates from beneath for the purposes of inspection, and to enable the cold air of the chill-box to act freely upon the coated plates from beneath as well as from above them. To these ends, and as the best mode of carrying out this part of the invention, the plate-carrier is made in the form of two round endless belts F F. These belts extend throughout the length of the machine and are each carried around pulleys *f f'* at the ends, respectively, of the machine. An ordinary twisted rope or cord, wire, or fiber is hardly satisfactory, in consequence of its getting out of shape in passing around the pulleys or because of the moisture present. Accordingly we use a woven rope or cord which has been treated with some moisture-repellent, such as paraffine. Such a carrier keeps in form and also takes up but little room, is in contact with the plates to a very limited extent only, and the two cords can be and are spaced far enough apart to expose the central portion of the plate to

view and to the atmosphere. Uniformity of rate of motion throughout the length of the machine is also obtained readily by the use of a single belt, instead of a series of belts, and, further, a round belt can be more readily wiped and cleaned.

At the receiving end *a* of the machine the belts F F pass a strip G or bed-plate G', Figs. 1 and 2, and are confined laterally by means of the flanges substantially such as shown at *g*, or, what is the equivalent, the strip or bed-plate is grooved. The object thereof is this: the attendant places the plates upon the belts from the side of the machine, and in so doing is apt to displace the belts or to cause them to vibrate. The described lateral support for the belts prevents this.

The plates are carried by the belts beneath and past the coater C. Unlike other coaters, the present one is substantially an open trough arranged immediately above the level of the plates being coated. While it is a convenience to be able thus to look into the vessel containing the emulsion, and in that respect a device preferable to a closed tube, the main advantage of such a device is that the emulsion can be delivered onto the plates with a more even flow than when the emulsion is supplied from a higher head.

When the emulsion is contained in a vessel extending upward several inches above the level at which the emulsion is delivered upon the plates, the pressure upon the emulsion at such point of delivery is liable to vary to such a degree as to seriously interfere with a uniform delivery. Not only does the head vary, but a difference in temperature is a disturbing element. Accordingly an open vessel—such as the open trough-like coater C—is used in the present machine, into which the emulsion may flow from some reservoir—such as the tank H—but which is not affected by reason of any superior level of such tank or of the height at which the emulsion may stand in the tank. In the present instance the emulsion is delivered into the coater by means of a tube I, leading from the tank. The flow through the tube I may be controlled by means of a suitable cock *i*, and, if desired, an auxiliary cock *i'* may also be employed.

It is quite important that the emulsion be distributed evenly throughout the length of the coater, to which purpose care is taken not to introduce the emulsion into the coater at one end thereof and trust to its flowing along the coater to the opposite end thereof, for when such a method is adopted there is a liability that the emulsion will stand at a higher level at one end of the coater than at the other end thereof, and, further, there is a liability that bubbles will form in the emulsion and find their way ultimately onto the plates. Therefore the supply-tube I terminates in a horizontal pipe i^2, arranged above and extending well throughout the length of the tube and having openings i^3 arranged at intervals throughout its length. By this means the trough C is supplied evenly throughout its length.

As an additional precaution against the forming of air-bubbles in the emulsion, the tank H has a hopper *h*, from whose lower end a tube *h'* leads toward the bottom of the tank. The emulsion flows down through the tube and then wells upward in the tank, and the desired object is thereby promoted.

The coater is by means of an arm *c* hinged at *c'* to a support at or about the level of the coater, the aim and effect of this being to enable the coater, as plates of different thicknesses pass beneath it, to rise and fall as nearly as is practicable in a direction at right angles to the plates, thereby facilitating the movement of the coater and enabling the emulsion to be applied to the plates to better advantage.

The coater in cross-section is substantially round underneath—that is, from the slits c^2 downward and backward to the lowest point thereof. This is important—namely, that the emulsion before it reaches the plates flows in a direction contrary to that in which the line of plates to be coated is moving, as thereby the emulsion is better kept from breaking up into streaks upon the plates. The emulsion leaves the coater C through a series of narrow slits c^2, which extend throughout the length of the coater upon that side thereof that is toward the delivery end of the machine. Such narrow vertically-extended slits are advantageous, partly because they operate to distribute the delivery from the coater throughout its length better than if the delivery were through a continuous opening or over a continuous edge, and because any slight variation in the height of the emulsion in the coater is not so influential in affecting the flow from the coater; but a leading feature of the coater is a provision whereby a reserve or surplus of the emulsion is occasioned immediately at the point of contact with the plate being coated. This is best accomplished by means of the shoulder c^3 at the lowest point of the coater. This shoulder in the direction in which the plates are moving is substantially upright. Its back c^4 is preferably rounded, as shown. The emulsion as it flows downward upon the outside of the coater finally flows backward toward the shoulder. The tendency of the moving plates is to drag the emulsion along with them; hence the current of the emulsion is turned at the point of contact with the plates, and the practical result is the described excess of emulsion and the thorough coating of the plates in distinction from applying the emulsion in lines or streaks upon the plates. This excess of the emulsion is valuable not only in coating any one of the plates, which are quite often more or less concave or otherwise irregular, but also when a thinner plate precedes a thicker plate, for as the coater rises onto the higher succeeding plate a portion of the forward plate would be insufficiently coated but for the described sur-

plus of emulsion, and on the other hand when a thicker plate is in advance the coater is, by reason of the shoulder, enabled to drop directly downward upon the succeeding thinner plate, and the surplus again is useful in causing the coating to be applied to the edge of the thinner plate.

The roller c^5, with which the coater is furnished, and which comes about as low down as is the shoulder c^3, is useful in assisting the coater to ride upon the plates as they pass beneath the coater.

The provision for adapting the coater to wider or narrower plates is as follows: C′ represents a tubular plug adapted to be inserted in the end of the coater. There is a plug at each end thereof. The plug can be turned around in the coater. It is not a perfect cylinder, but is cut away at c^6, and in its lip c^7 are one or more offsets c^8. These openings and offsets are respectively of certain lengths, according to the widths, respectively, of the plates being coated. When the widest plates are being coated, the two plugs are turned around within the coater to present the openings c^6 c^6 to the slits c^2, and the emulsion can now flow out through all the slits c^2. When a narrower plate is being coated, the plugs are turned around to bring the offsets c^8 c^8 opposite the slits and to cut off the flow of the emulsion through those slits which are at the ends of the coater.

The described shoulder upon the bottom of the coater is valuable irrespective of any particular form of orifice through which the emulsion emerges from the coater, and it is especially useful in connection with a trough-like coater bearing the slits c^2, as shown, and the most desirable construction is the one exhibited—namely, an open coater having the slits c^2, being rounded from the slits, or retreating from the slits to the bottom of the coater, and having a projection—such as the shoulder c^3—at the point of contact with the plate for accumulating the emulsion.

To prevent the emulsion from falling from the coater downward through the machine at those times when a plate is not beneath the coater, a gutter J is arranged in the machine beneath the belt and vertically beneath the coater. It receives such emulsion as drips from the coater and conducts it away, and any emulsion which may catch upon the belts at that point is removed therefrom, as presently described.

The provision for inspecting the plates is as follows: D represents a light—say an electric light—inclosed in an opaque compartment d, through whose walls no light can shine, but whose top d', which is immediately beneath the belts upon which the coated plates are resting, is composed of ruby-tinted glass or equivalent material. By this means a light not injurious to the plates and of sufficient strength for the purpose, is directed upward through the plates, and by means of it the operator is enabled to inspect the coating. As it is desirable to do this as soon after the emulsion is applied as is possible, this inspecting device is arranged between the coater and the refrigerating or chill room E, which will now be explained. The leading feature of this part of the machine is the means by which a circulation of cold dry air is caused to pass the plates as they are transported upon the belts to the end a' of the machine. The room E in length is extended in practice, say twenty feet. The upper part of the belt moves longitudinally through it, whereby the coated plates are taken into the room at one end thereof, carried through it, and discharged at the opposite end thereof. Sufficient time is occupied in the transit, and a sufficiently cool temperature is maintained in the room E to cause the emulsion applied to the plates to become properly set thereon.

The room E in vertical cross-section is sufficiently high and wide to provide for the upper part of the belts and their load, the supports for the belts, and the means for cooling the room, as follows: The belts for their immediate support rest upon glass strips M, those strips upon longitudinally-arranged rails m, and m' represent cross-ties which uphold the rails, substantially as shown.

N N′ respectively represent coils of pipe through which a cold liquid—such as ammonia—circulates. These coils are arranged, respectively, toward opposite sides of the room and above the level of the plates. O O′, respectively, are guards interposed between the coils and the plates. Their function is mainly to prevent drip from the coils from encountering the plates. They also promote a circulation of air favorable to the operation, in that they, in conjunction with the roof e and walls e' of the room, form flues e^2 e^2, through which cold air descends. To this end these flues and respectively above and beneath the coil are open to the interior of the room, thereby permitting the warmer, more moist air to enter the flues at the upper end thereof and pass to the coils, and the cooler drier air to pass out from the flues at the lower end thereof and thence into the region of the plates, whereby the plates are cooled and dried and the air made warmer again and caused to ascend through the central portion of the room and to re-enter the flues and so on around and around. The coils are preferably made to overhang the plates; but the coils and guards at the upper end thereof are sufficiently spaced apart to provide space through which the air can ascend from the vicinity of the plates and enter the flues e^2 e^2 at the upper end thereof. The coils and also the guards extend substantially throughout the length of the room E, and the best arrangement of them is shown, the coils being respectively at opposite sides of the room toward the upper part thereof and inclined to bring the upper end of the coil nearer to the center of the room than is the lower end thereof, and the guards are respectively arranged parallel to

the coils, substantially as shown. Any drip from the coils onto the guards finds its way thence onto the bottom e^3 of the room, and is therefrom drained off by any suitable means. The bottom is preferably made trough-like, as shown. The walls, roof, and bottom of the box are made suitably non-heat conducting, and it is better to similarly construct the guards. The cold air coming from the flues e^2 e^2 finds its way into the lower portion of the room, where it comes in contact with the under side of the plates, and it works upward between the plates and the guards, and also through any openings between the adjoining plates and comes in contact with the coating upon the plates. Owing to the open-work nature of the belt and its support the air has free access to the plates. The room at its ends is suitably slit, c^4, Fig. 13, to provide for the belts and plates in their movement.

It being important to keep the emulsion or other undesirable material from getting onto the under side of the plates, provision is made for thoroughly cleaning the belts at every revolution thereof. This is accomplished as follows: The lower part of the belts is carried through a set of sponges P P P′ P′. The first set of sponges P P are—say by means of a current of hot water entering the sponge-chamber at p and leaving it at p'—kept wet, whereby the belts are washed as they are drawn between the sponges. The next set P′ P′ of sponges are kept dry, and they serve to wipe the washed belts as they pass on between the last-named sponges; but to better insure the cleaning of the belts they are subsequently drawn through rubber dies Q, whereby the belts are thoroughly rubbed and stripped.

The die or dies Q are useful for the purpose in question irrespective of the sponges.

The frame of the machine is of any suitable form, substantially as shown.

We claim—

1. A dry-plate coating-machine having the ruby-light in a chamber beneath the plate-support, as described.

2. The combination of the belts F F and their lateral supports, substantially as and for the purpose described.

3. The combination of the open coater and the horizontal distributing-pipe i, said pipe extending well throughout the length of said coater, as described.

4. The combination of the tank H, the hopper h, and the tube h', as and for the purpose described.

5. The coater having the shoulder at the bottom thereof, as and for the purpose set forth.

6. The coater, made open, as described, having the slits c^2, and the shoulder at its bottom and from said slits extending externally downward and backward, as described.

7. The coater C, having the roller c^5 and the shoulder c^3, as described.

8. The chill-room E, having the coils N N′ and the flues e^2 e^2, in combination with the plate-carrying belts, as described.

9. The chill-room E, having the coils and the guards, in combination with the belts F F, as described.

10. The chill-room having the coils and the guards, in combination with the belts, said coils and guards overhanging said belts, but arranged to form the flues e^2 e^2, as described.

11. A dry-plate-coating machine having a chill-room and a plate-support, in combination, said room being cooled and dried by means of cooling-coils, and the plate-support being an open-work one, as and for the purpose described.

12. The combination, in a dry-plate machine, of the belts F F and the dies Q, as described.

Witness our hands this 27th day of July, 1889.

FREDERIC J. SWAINE.
CLARENCE S. MOODY.

Witnesses:
C. D. MOODY,
D. W. A. SANFORD.