Dec. 8, 1931. J. H. JUERS 1,835,402

APPARATUS FOR SPRAYING GLASS, ETC

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Fig. 1

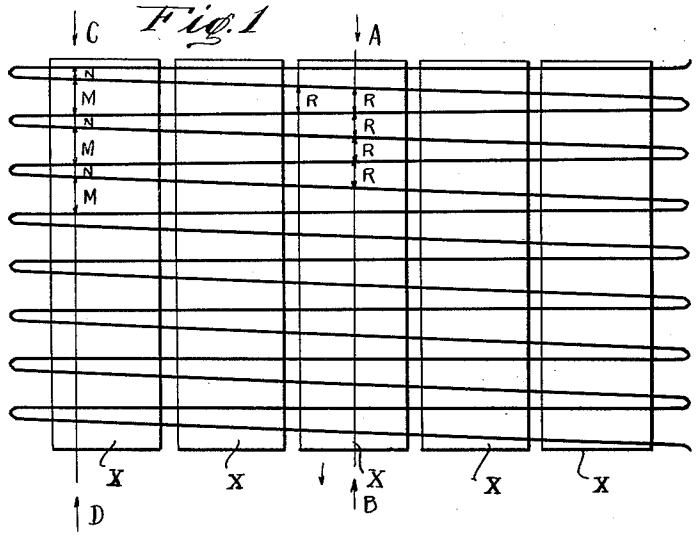


Fig. 3

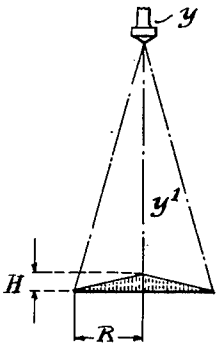


Fig. 2

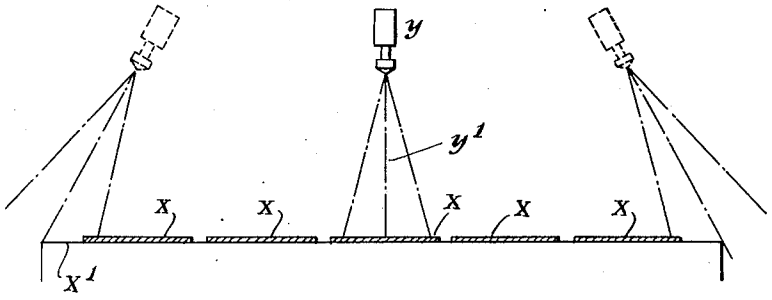


Fig. 4

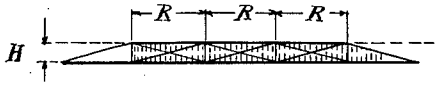
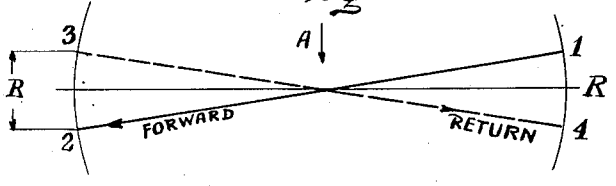


Fig. 5

Fig. 6



Inventor

John H. Juers

By his Attorneys,

Redding, Greeley, O'Shea & Campbell

Dec. 8, 1931. J. H. JUERS 1,835,402

APPARATUS FOR SPRAYING GLASS, ETC

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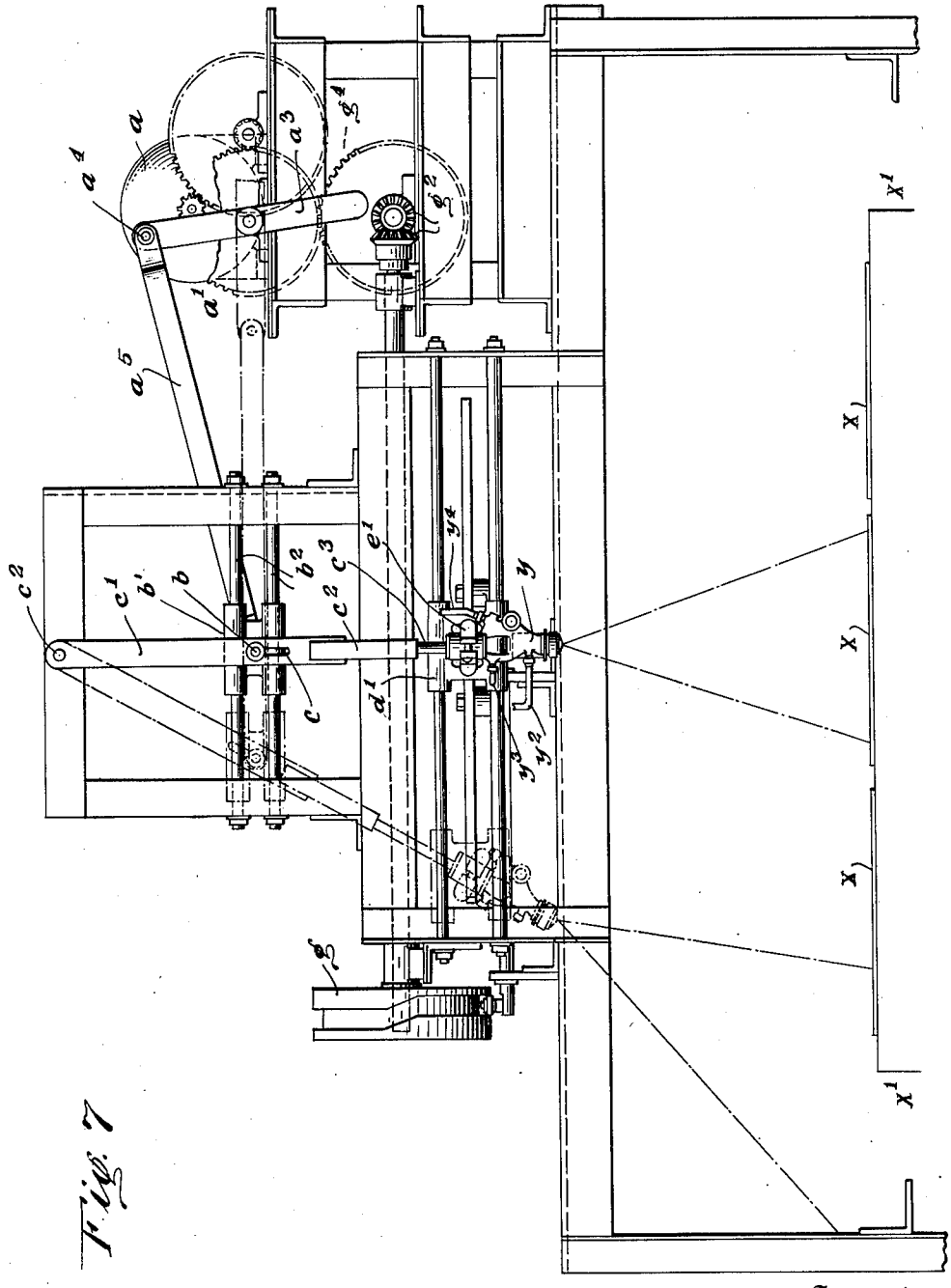

Fig. 7

Inventor

John H. Juers

By his Attorneys

Redding, Greeley, O'Shea & Campbell

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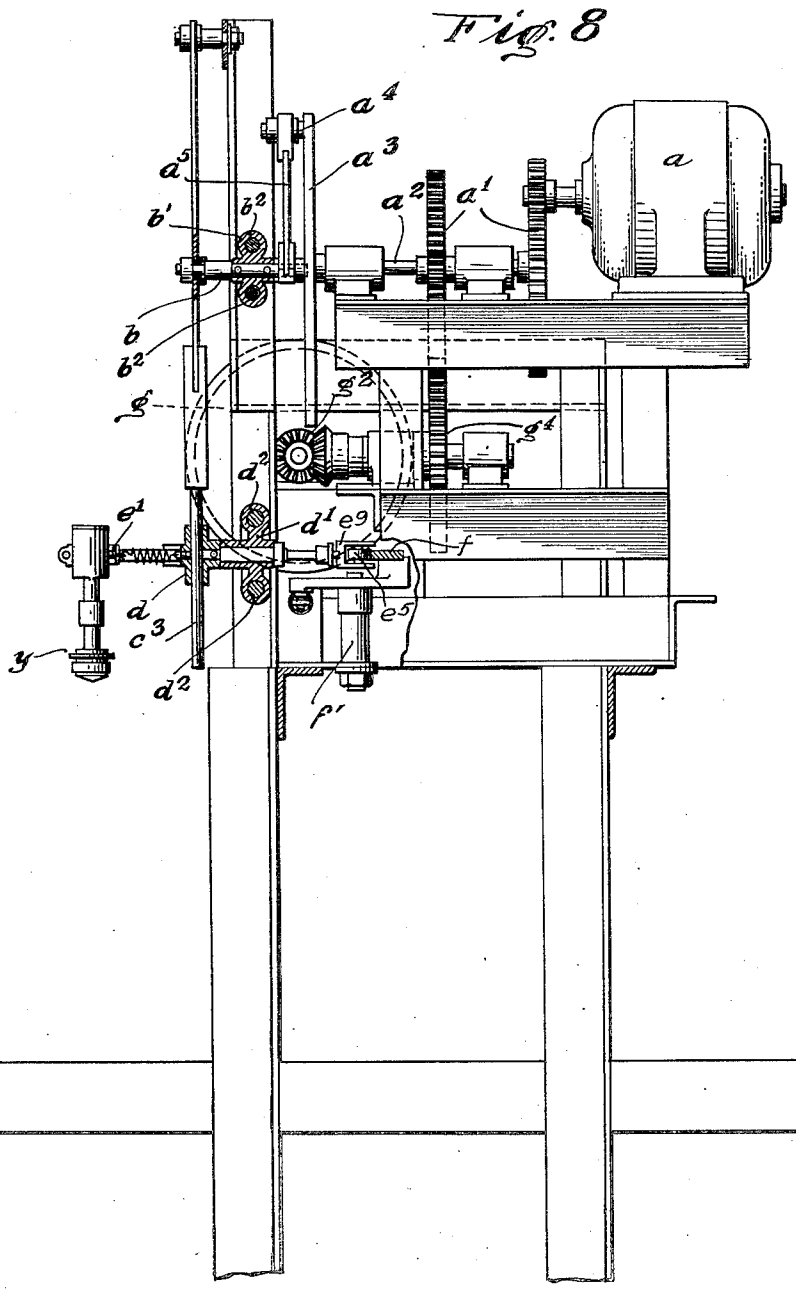
Fig. 8



Inventor

John H. Juers

By his Attorneys

Redding, Ferdon, O'Brien & Campbell

Dec. 8, 1931. J. H. JUERS 1,835,402

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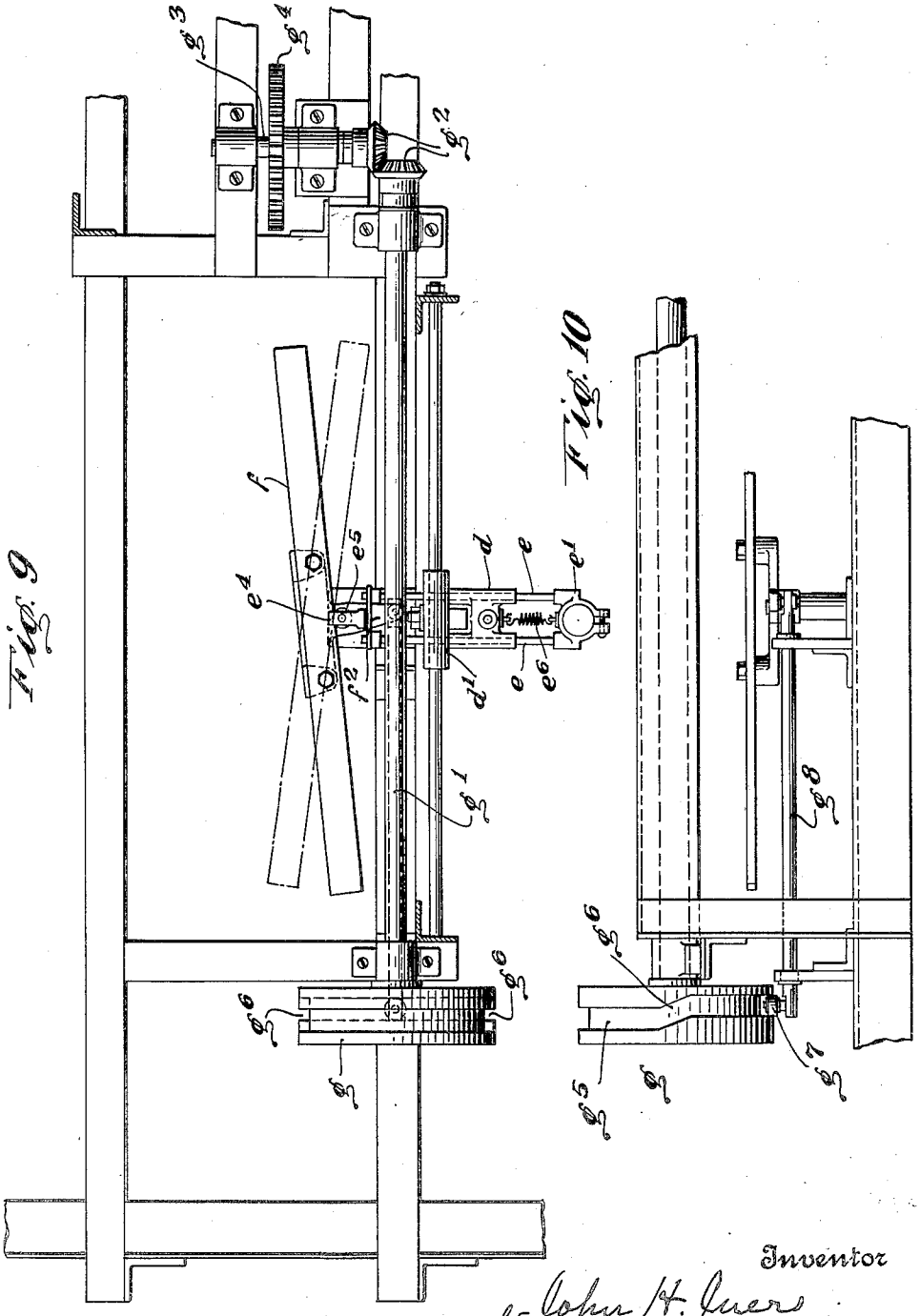

Fig. 9

Fig. 10

Inventor

John H. Juers

By his Attorneys

Redding, Greeley, O'Shea & Campbell

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Fig. 11

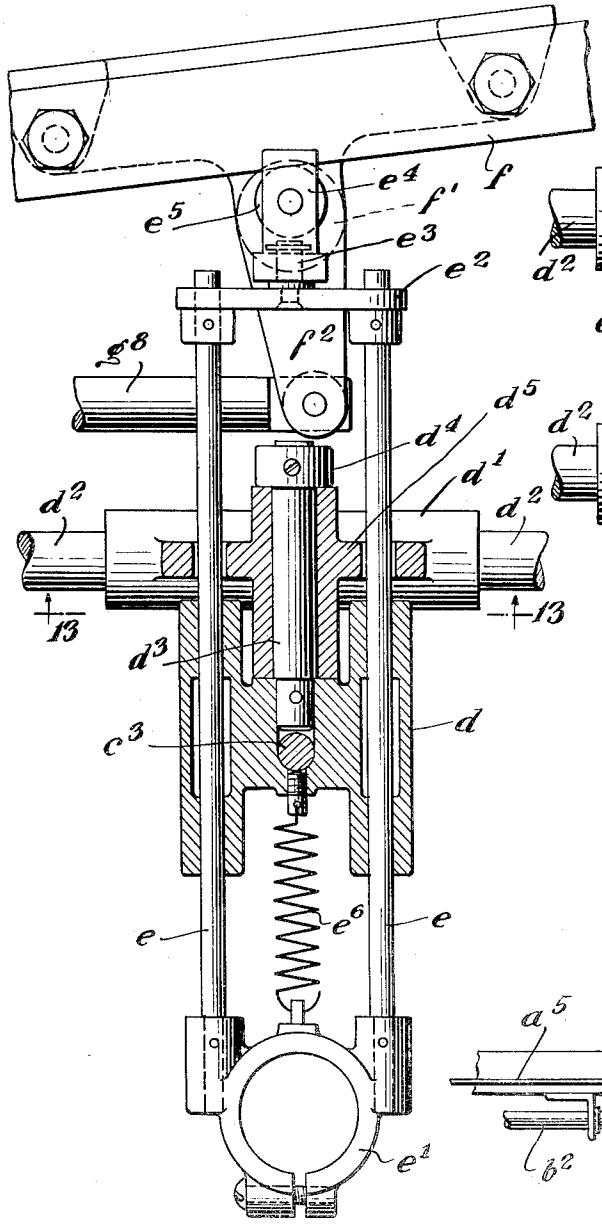


Fig. 13

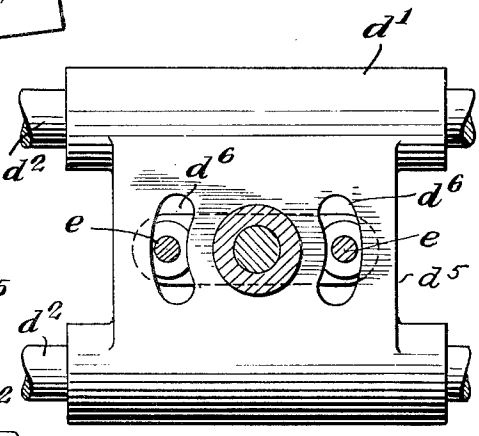
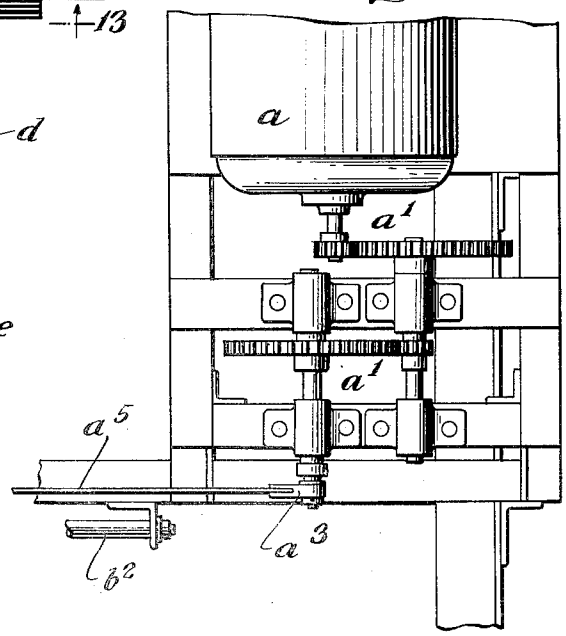


Fig. 12



Inventor

John H. Juers

By his Attorneys

Redding, Greeley, O'Shea & Campbell

Patented Dec. 8, 1931

1,835,402

UNITED STATES PATENT OFFICE

JOHN HENRY JUERS, OF PASSAIC, NEW JERSEY, ASSIGNOR TO TRIPLEX SAFETY GLASS COMPANY OF NORTH AMERICA, OF NEW YORK, N. Y., A CORPORATION OF DELAWARE

APPARATUS FOR SPRAYING GLASS, ETC.

Application filed January 21, 1930. Serial No. 422,283.

This invention has been developed with particular reference to the manufacture of laminated glass in which the proximate surfaces of the two sheets of glass, before they are laid up with the interposed sheet of celluloid, receive a film of gelatine or the like for the purpose of promoting the adhesion of the celluloid and glass. It will nevertheless be understood that the invention is capable of application in other arts wherever it is desirable to apply a film of uniform thickness, although in the manufacture of laminated glass it is particularly important that the film shall be of the same thickness at every point of the surface to which it is applied. The film, whatever its ultimate purpose, is applied in liquid form by means of what is known in the art as a spray gun, by which the liquid is projected in the form of a cone. The glass or other thing to be coated is supported by a conveyor and moves at a uniform rate. The spray gun, supplied from any suitable source with the liquid to be sprayed, is reciprocated transversely with respect to the line of movement of the conveyor and deposits the film upon the material carried by the conveyor. It will be apparent that if both the conveyor and the spray gun were stationary and the spray was stopped for a brief moment the film would be deposited in the form of a cone with a diameter equal to the diameter of the spray cone determined by the distance between the orifice of the spray gun and the glass and with an altitude which would be slight but would nevertheless cause a variation in the thickness of the film increasing from the perimeter to the center of the cone. Heretofore, in apparatus designed for the spraying of glass, in the manufacture of laminated glass, the spray gun has been reciprocated in a fixed line, while the glass moves forward at a uniform rate, with the result that the axis of the spray cone describes on the glass a zigzag line which is slightly curved rather than acute at the points where the spray gun changes direction. The film deposited by the spray gun at any point in such zigzag path may, for all practical purposes, be assumed to be a cone with a radius R and a height H. If the relative motions of the conveyor, of the glass, or other material supported thereby and of the spray gun, are synchronized in such manner that for each full transverse stroke of the spray gun in one direction the conveyor advances a distance equal to the radius R of such cone, successive points of the zigzag path on the center line will be separated by the distance R and as the successive cones formed by the spray gun overlap and are separated by the distance R, the film deposited will be of uniform thickness equal to H all along such center line. It will be obvious, however, that except along the center line, that is, the median line of the reciprocation of the spray gun, the film deposited will not be of uniform thickness for the cones will be separated, as to their centers, by unequal distances which for convenience may be designated as M and N, respectively, and there will be produced a film which has a thickness greater than H in some places and less than H in other places.

It is the object of the present invention to prevent such lack of uniformity in thickness of the film deposited and to secure as nearly as possible absolute uniformity of thickness of the film at all points of the reciprocations of the axis of the spray gun. This is accomplished, as will be described more particularly hereinafter, by causing the spray gun to move in a path which is not at right angles to the line of movement of the conveyor but is at an angle with respect to a line perpendicular to the line of movement of the conveyor and when it reaches the end of its movement to move rearwardly through a distance equal to the distance R and then take up its return reciprocation on a line similarly but oppositely inclined with respect to such line at right angles to the line of movement of the conveyor and, when it reaches the end of its return reciprocation, to move rearwardly again through a distance equal to the distance R to a point from which it begins again its forward reciprocation. In this manner the axis of the spray cone describes on the moving surface upon which the spray is directed a series of lines which are parallel and are separated by the distance R, with the result that the film deposited is practi-

cally uniform in thickness for all points on the surface of the conveyor or of the glass or whatever else may be carried thereby. A suitable means for effecting such movement of the spray gun has been chosen for illustration of the nature of the invention and will be particularly described hereinafter with reference to the accompanying drawings in which:

Figure 1 is a diagrammatic representation of a path described by the axis of a spray gun when it is reciprocated in a path at right angles to the line of movement of the surface to be sprayed, the latter being represented by rectangles which may be taken to be sheets of glass placed side by side upon a conveyor.

Figure 2 is also a diagrammatic view illustrating different positions of a spray gun and of the spray cone formed thereby with reference to the surface sprayed.

Figure 3 is a diagrammatic view representing particularly the formation of a cone of film at any one position of the spray gun.

Figure 4 is a diagrammatic view representing the relations of a successive series of cones forming a film of uniform thickness.

Figure 5 is a view similar to Figure 4, but showing the relations of cones formed when the spray gun reciprocates in a path at right angles to the line of movement of the conveyor.

Figure 6 is a diagrammatic representation of the path of movement of the axis of the spray cone when the movement of the spray gun is effected in accordance with the present invention.

Figure 7 is a view in front elevation of so much of a spray apparatus as is necessary to enable the application of the invention to be understood.

Figure 8 is a view of the same in sectional elevation as seen from the righthand in Figure 7.

Figure 9 is a partial sectional view of the same as seen from above.

Figure 10 is a view in front elevation of some of the parts shown in Figure 9.

Figures 11, 12 and 13 are detail views on a larger scale of some parts of the apparatus, Figure 13 being a view in section on the plane indicated by the broken line 13—13 of Figure 11.

In order that the nature of the invention may be more readily explained reference will be had first to the diagrammatic representations shown in Figures 1–6.

Let it be assumed, with reference to Figures 1 and 2 that the surface or surfaces to be sprayed are represented by sheets of glass laid side by side upon a conveyor, sufficiently indicated at x^1, which moves at uniform rate in the direction indicated by the arrows at A and B, the line A—B being also the median line of the apparatus and the median line of the reciprocations of the spray gun indicated at y. The reciprocations of the spray gun and the forward movement of the conveyor being properly synchronized the axis y^1 of the spray gun and of the spray cone formed thereby will describe on the surface to be sprayed a zigzag line substantially as represented in Figure 1. At any point in such path the spray will be deposited in a circle which has a radius R. The thickness of the deposit increasing from nothing at the perimeter to a maximum at the center where it has a thickness H. Under the prescribed conditions of synchronization it will be obvious that the points at which successive reciprocations of the cone axis intersect the median line A—B will be separated from each other by the distance R and that at such points each deposited cone will overlap the next so that along the median line the deposited film will be of uniform thickness H, as represented in Figure 4. On longitudinal lines remote from the median line A—B, such as the line C—D of Figure 1, the points of intersection will be separated alternately by distances M and N with the result that the deposited material will attain a thickness greater than H at certain points and less than H at intermediate points, as represented in Figure 5.

It has been assumed above that the spray gun reciprocates in both directions, in a path which is at right angles to the line of movement of the conveyor. If, however, instead of being moved in a path at right angles to the line of movement of the conveyor, the spray gun is moved in a path at an angle determined by the distance R, in such manner, as indicated in Figure 6, that the point where the axis of the spray cone strikes the surface of the conveyor, starting at the righthand point arrives at the point 2, at the end of its lefthand movement and is there moved rearwardly, with reference to the direction of movement of the conveyor, through the distance R, to the point 3, and then moves to the right in a path similarly but oppositely inclined to the point 4, where it is again moved rearwardly, through the distance R, to the point 1, the path of the axis, as described on the moving surface, instead of being the zigzag line of Figure 1, will be practically a series of parallel lines separated by the distance R, so that at every point in every longitudinal line the deposited cone will overlap the next by the distance R and a film of uniform thickness at every point on the moving surface will be formed.

In the apparatus which has been chosen for illustration of the invention a motor a is shown as connected through a train of gears a^1 with a crank shaft a^2 to which is secured a crank arm a^3 having a crank pin a^4. The latter is operatively connected by a link a^5 with a pin b of a cross-head b^1 which is arranged to slide freely on rods b^2. The pin b engages a longitudinal slot c in a

swinging arm c^1, pivoted at c^2, and thereby the arm c^1 receives a movement of oscillation in a plane transverse to the median line of the apparatus. At its lower end the arm c^1 has an extension c^3 which moves freely in a guide piece d swiveled on a second cross-head d^1 which slides freely on rods d^2. The guide piece d receives freely horizontal rods e which at their outer ends carry the holder e^1 of the spray gun y, the latter being provided, as indicated at y^2, y^3 and y^4, with connections to sources of liquid and air supply as usual in devices of this character.

Since the cross-head d^1 reciprocates in a right line and the arm c^1, c^3, swings in an arc and the axis of the spray gun is always parallel with the arm c^1, c^3, the spray gun holder e^1, the rods e and the guide piece d must be capable of swiveling with respect to the cross-head d^1. Accordingly, the guide piece d is mounted on one end of a spindle d^3 which is received freely in a seat formed therefor in the cross-head d^1, being retained in place by a collar d^4 secured fast upon the other end of the spindle d^3. The web d^5 of the cross-head d^1 is also formed with arc-shaped slots d^6 so that the rods e, which pass through the slots may have the required swiveling movement.

At their inner or rearward ends the rods e are received in a cross-bar e^2 which has swiveled thereon, as at e^3, a yoke e^4 in which is supported a roller e^5, all as shown in Figures 8 and 9 and in detail in Figure 11. A tension spring e^6, connected at one end to the spray gun holder e^1 and at the other end to the guide piece d, continually urges the spray gun, the holder, the rods e, the cross-bar e^2 and the roller e^5 to the rear, holding the roller in contact with a track f which is mounted on an axis f^1 to swing in a horizontal plane so that its angular position, with reference to the median line of the apparatus, may be shifted through an angle determined by the radius of the spray cone, as represented diagrammatically in Figure 6. The axis of the spray cone will therefore move in oblique paths, as represented in Figure 6.

The shifting of the angular position of the track f takes place at the end of each transverse reciprocatory movement of the spray gun and is effected, in the construction shown, by a peripherally grooved cam g which is rotated in synchronism with the movements of the crank arm a^3, being conveniently mounted on one end of a shaft g^1 which is mounted in suitable bearings on the frame and is driven by bevel gears g^2 from a shaft g^3 which carries a gear g^4 in mesh with a corresponding gear of the train a^1. The groove g^5 of the cam wheel g, stepped in opposite directions at the opposite ends of a diameter, as at g^6, is engaged by the roller g^7 of a connecting rod g^8 which is suitably supported and is engaged at its other end with an arm f^2 of the track f. At the end of each transverse reciprocation of the cross-head d^1 the track f therefore has its angular position shifted from one to the other of the two positions of obliquity, indicated by a full line and a broken line in Figure 9, and the path of the spray gun, which is necessarily parallel with the track f, is also shifted in angular position from one to the other of the positions indicated by the full line and the broken line in the diagrammatic Figure 6. In this manner the film cones, such as that represented in Figure 3, deposited by the spray gun upon the surface to be coated, are caused to overlap to an extent measured at every point by the radius of the circular base of the spray cone not only at the median line of the apparatus, but in the extreme positions at each side and in every intermediate position, with the result that a film of the same thickness at every point is deposited upon the surface coated. Thus, there is avoided formation or ridges or inequalities in thickness of the film which, in the manufacture of laminated glass, it is particularly desirable to avoid, even though the variation may be less than one one-thousandth of an inch.

It will be obvious that various changes in detail of construction and arrangement can be made to suit different conditions of use and the application of the invention to different specific purposes and that, except as pointed out in the accompanying claims, the invention may be realized in different forms of apparatus and is not restricted to the particular construction and arrangement shown and described herein.

I claim as my invention:

1. In a spray apparatus, the combination of a support for the material to be sprayed, a spray gun, movable in a transverse direction and movable also in a longitudinal direction, means to reciprocate the spray gun transversely, a track toward which the spray gun is pressed yieldingly, and means to change the angular position of the track at each reciprocation of the spray gun.

2. In a spray apparatus, the combination of a swinging arm, means to oscillate the arm, a spray gun carried with the arm and movable in a direction at right angles to the plane of oscillation of the arm, a track toward which the spray gun is pressed yieldingly, and means to change the angular position of the track, whereby the angular position of the path of movement of the spray gun is changed in each oscillation.

3. In a spray apparatus, the combination of a spray gun, a movable support for the spray gun, means to reciprocate the support, the spray gun being movable with respect to the support in a direction at right angles to the plane of the reciprocations, a track, means to press the spray gun yieldingly toward the track, and means to change the angular posi-

tion of the track at each reciprocation, whereby the angular position of the path of movement of the spray gun is changed in each reciprocation.

4. In a spray apparatus, the combination of a spray gun, a support for the spray gun, means to reciprocate the support, a spray gun holder, a rod to which the holder is connected, a tension spring connected to the holder, a pivotally mounted track toward which the rod is pressed by the spring, and means to shift the angular position of the track at each reciprocation, whereby the angular position of the path of movement of the spray gun is shifted during each reciprocation.

This specification signed this 17th day of January, A. D. 1930.

JOHN HENRY JUERS.