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METHOD AND APPARATUS FOR APPLYING FLUID MATERIALS TO MOVING SURFACES

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This invention relates to methods and apparatus for applying fluid materials to surfaces, and in its more particular aspects to the application of fluid materials to moving surfaces.

An object of the invention is to provide an improved method for applying fluid materials to surfaces.

A further object is to provide an improved method for spraying moving surfaces of relatively large area.

Another object is to provide improved means for applying fluid materials to surfaces.

A further object is to provide means for progressively spraying a surface in a particularly uniform manner.

A still further object is to provide improved means for applying a fluid to surfaces of relatively large area.

Another object is to provide means adapted to spray moving articles in a particularly effective manner.

An additional object is to provide apparatus of the character under consideration which is simple in construction and economical to manufacture, which may be readily assembled and operated, and which will effectively perform the functions for which it is intended.

Other objects of the invention will in part appear hereinafter.

The invention accordingly comprises the several steps and the relation and order of one or more of such steps with respect to each of the others, and the apparatus embodying features of construction, combinations of elements and arrangement of parts, all as exemplified in the following detailed disclosure, and the scope of the application of which will be indicated in the claims.

For a fuller understanding of the nature and objects of the invention reference should be had to the following detailed description taken in connection with the accompanying drawings, in which:

Fig. 1 is a perspective rear view of a form of apparatus embodying the invention;

Fig. 2 is a partly sectional plan view with the front of the machine toward the bottom of the sheet;

Fig. 3 is a vertical section along the line 3—3 in Fig. 2;

Fig. 4 is a partly sectional plan view showing the tracks in a diagonal position;

Fig. 5 is a partial vertical section along the lines 5—5 in Fig. 2;

Fig. 6 is a diagrammatic showing of the course followed by the spraying means;

Figs. 7a, 7b, 7c and 7d illustrate the progressive coating of a surface by means of apparatus such as shown;

Fig. 8 is an enlarged view of the exemplified spraying gun; and

Fig. 9 is a plan view of the cam, showing the manner of plotting the curves for its periphery.

The invention contemplates the provision of means for applying any of a large number of fluid substances, including gases, liquids, and comminuted solids, to articles of a wide variety of different natures for any of a number of purposes. It is especially intended, however, for use in the solution of numerous problems which present themselves in cases where it is desired to apply a uniform and even spread of fluid material to a surface. One such case is found in the adhesive art where a plasticizing agent for an adhesive material should be applied to a surface, such, for example, as the surface of a veneer sheet, in an especially uniform and even manner in order that the plasticizing effect will not be exerted so irregularly as to cause such irregularities in adhesion as will militate against the production of glued structures, such, for example, as plywood, of particularly high quality. Again, in the application of liquid adhesive materials there are similar desiderata, and it is of particular importance that, while a sufficient quantity of glue should be supplied at all points, an excess of glue at any point should be avoided so far as possible in order not only to prevent gluing troubles but also to prevent a wastage of glue. The prevention of such wastage is of special importance in the use of relatively expensive glues certain of which have been utilized to a relatively small extent in spite of their desirable qualities because of the difficulties involved in applying them without waste.

The invention also has many applications in the coating art wherein in many cases the desirability for a uniform and even spread is also present.

The invention is designed for the application of powdered materials as well as liquid materials, and also for the application of gaseous materials, such as may have a desirable effect in the treatment of wood, for example. Such application may be accomplished by spraying the materials against the surface. In this connection, it is to be noted that the word "spraying" as used herein is intended to include all modes of projection of...
a substance and that all expressions including the term "spray" are to be similarly understood. In many cases, and particularly where a fluid material is to be applied to relatively large surfaces, there are many difficulties in the utilization of a spray which is sufficiently wide so that the entire surface may be sprayed at a single stroke of movement, either substantially perpendicular to the direction of movement of a moving surface or with respect to the direction of movement of a spray carriage. Ordinarily the simpler procedure is to move an article to be sprayed, and preferably a series of such articles, along a path beneath a spraying means, and the invention is particularly exemplified as embodied in a spraying means adapted to move back and forth above the path of movement of articles carried on a conveyor.

The form of apparatus particularly exemplified comprises a conveyor 10 above which spraying mechanism 11. The spraying mechanism comprises a gun 12 provided with a nozzle portion 13 from which a liquid or other material of a sufficiently fluid nature to be sprayed is directed downwardly. By means of flexible conduits 14, in the present instance, the liquid from a fluid pressure means are conducted to the gun.

The gun is carried on a carriage 15 riding on a pair of track members 16 by means of rollers 17. In order to cause a timed reciprocation of the carriage and to control the acceleration and deceleration thereof to avoid jerkiness of the movement, the exemplified apparatus comprises a chain extending about sprockets 18 and 19 and carrying a roller 20. This roller is held between bars 21 and 21a extending transversely of the chain and forming a part of the gun carriage 15, so that, as the roller moves with the chain, the carriage will be moved first in one direction and then in the other, with gradual deceleration and acceleration movements of the roller caused through a semi-circular course about each sprocket 18 and 19. With each change of movement the gun will move first in one direction and then in the other across the conveyor.

In order to avoid undesirable irregularities in the application of the material sprayed on a surface moving on the conveyor, there are provided means to cause the gun to follow, during each of its movements transverse to the conveyor, a diagonal course which carries it toward the output end of the conveyor. To this end the track members 16, in the present instance, are adjustably mounted and means are provided for causing them to swing upon a vertical axis in synchronism with portions of the carriage movement. In the exemplified form of apparatus the tracks are supported on course members 22 by means of rollers 22a carried on braces 22 extending between the center of the tracks and the frame members 22 each comprising an annulus 23 against which the outside of a track member rests. These supporting members are preferably arranged so as to permit of rotation, and there is provided at each side of the center of the tracks a member 224 each comprising an annulus 25 against which the outside of a track member rests. These supporting members are preferably arranged so as to permit of rotation, and there is provided at either side of the center of the tracks holding members 24 each comprising an annulus 225 against which the outside of a track member rests. These supporting members are preferably arranged so as to permit of rotation, and there is provided at either side of the center of the tracks a member 224 each comprising an annulus 225 against which the track member rests. These supporting members are preferably arranged so as to permit of rotation, and there is provided at either side of the center of the tracks a member 224 each comprising an annulus 225 against which the outside of a track member rests. 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These supporting members are preferably arranged so as to permit of rotation, and there is provided at either side of the center of the tracks a member 224 each comprising an annulus 225 against which the outside of a track member rests. These supporting members
The direction of the movement of the gun carriage is illustrated diagrammatically in Fig. 6. It will be observed that from the point E to the point F the gun carriage moves along a straight line extending diagonally across the plane of the conveyor and inclined in the direction of movement of the conveyor; that from the point F to the point G the gun carriage reverses its direction of movement and moves rearwardly with respect to the direction of movement of the conveyor; that from the point G to the point H the gun again moves in a straight line in a diagonal direction inclined toward the direction of movement of the conveyor; and that from the point H to the point E the gun again reverses its direction and moves rearwardly with respect to the direction of movement of the conveyor. Accordingly, if the spray gun is arranged to lay down a band the width of which is twice the distance from E to H or from G to F, the relative speeds of the conveyor and the sprocket 37 may be so arranged that the conveyor will move the surface of the member to be coated a distance equal to the distance between E and H or G and F, at each quarter rotation of the cam.

For example, if the mechanism is timed so that the cam rotates once in two seconds,—I.e., so that each of the four phases of the cycle is one-half second in duration, and if the conveyor is arranged to move an article, such as a veneer sheet, six inches a second, the sprocket wheel will move three inches as the gun travels above it at spaced intervals, and accordingly the travel of the gun with respect to the veneer sheet will be in a line directly across the veneer sheet and perpendicular to the direction of its movement. Consequently, the gun will traverse a series of parallel paths each directly across the sheet and if the gun is arranged to deliver a spray of a given width, for example, 6" in the instance taken, the sheet will receive a complete and substantially uniform coating of the material sprayed. This will be seen more particularly from Figs. 7a to 7d wherein Fig. 7a shows a veneer sheet after the gun has travelled from E to F; Fig. 7b the same veneer sheet after the gun has travelled from F to G; Fig. 7c the sheet after the gun has travelled from G to H; and Fig. 7d the sheet after the gun has travelled from H to E.

Thus, by causing the gun to reciprocate, and by causing a synchronized intermittent oscillation of the tracks such that the tracks remain stationary in a diagonal position, when the gun moves above the conveyor situated beneath the center of the tracks, there is obtained an even back-and-forth movement of the gun whereby a very close approach to uniformity in the coating of an article can be obtained.

It will be seen that by means of the mechanism exemplified the band sprayed by a given movement of the spray means never crosses another band, nor is the space between the center of the bands any greater distance apart at one side of the surface than at the other.

It will be appreciated that the invention in its broader aspects is not limited to the use of spraying mechanism which is mounted on stationary supports above a moving conveyor, and that, in certain instances, the entire spraying mechanism may be moved adjacent a stationary article to be sprayed.

Any desired type of spraying means may be utilized to suit the requirements of a particular case, but in choosing such spraying means it is desirable to select one which will give an even, regular spray in an effective manner. The particular spray means exemplified in Fig. 1 is shown in somewhat larger scale in Fig. 8. As will be seen the gun 12 comprises a spray nozzle port 13 and a suitable inlet port 44, 45 and 46 through which liquid and fluid under pressure may be introduced in a desirable manner.

Since certain changes in carrying out the above method and in the constructions set forth, which embody the invention may be made without departing from its scope, it is intended that all matters contained in the above description or shown in the accompanying drawings shall be interpreted as illustrative and not in a limiting sense. It is also to be understood that the following claims are intended to cover all of the generic and specific features of the invention herein described, and all statements of the scope of the invention which as a matter of language might be said to fall therebetween.

Having described our invention, what we claim as new and desire to secure as Letters Patent is:

1. Apparatus for applying fluid materials to surfaces, comprising spraying means, a track for said spraying means, means to cause said spraying means to move back and forth along said track while electing liquid in a given direction, means to mount said track for oscillation on an axis intermediate its ends, and means to cause said track to move in one direction about said axis when the spraying means is adjacent one end of its course and to move in the other direction about its axis when the spraying means is adjacent the other end of its course, and to remain stationary at intermediate periods.

2. Apparatus for applying fluid materials to surfaces, comprising spraying means, a track for said spraying means, means to cause said spraying means to move back and forth along said track, means to mount said track for oscillation on an axis intermediate its ends, and means to cause said track to move in one direction about said axis when the spraying means is adjacent one end of its course and to move in the other direction about its axis when the spraying means is adjacent the other end of its course, and to remain stationary at intermediate periods.

3. Apparatus for applying fluid materials to surfaces, comprising spraying means, a track for said spraying means, means to cause said spraying means to move back and forth along said track, means to mount said track for oscillation on an axis intermediate its ends, and means to cause said track to move in one direction about said axis when the spraying means is adjacent one end of its course and to move in the other direction about its axis when the spraying means is adjacent the other end of its course, and to remain stationary at intermediate periods.

4. Apparatus for applying fluid materials to surfaces, comprising spraying means, a track for said spraying means, means to cause said spraying means to move back and forth along said track, means to mount said track for oscillation
on an axis intermediate its ends, and means to cause said track to move in one direction about said axis when the spraying means is adjacent one end of its course and to move in the other direction about its axis when the spraying means is adjacent the other end of its course, and to remain stationary at intermediate periods, the track-moving means comprising a cam member having a periphery composed of oppositely-disposed arcuate portions of different radii and intermediate portions joining said arcuate portions, said intermediate portions being formed to provide even and regular curves.

5. Apparatus for applying fluid material to surfaces, comprising spraying means, a track for said spraying means, means to cause said spraying means to move back and forth along said track means to mount said track for oscillation on an axis intermediate its ends, means to cause said track to move in one direction about said axis when the spraying means is adjacent one end of its course and to move in the other direction about its axis when the spraying means is adjacent the other end of its course and to remain stationary at intermediate periods, the track-moving means comprising a cam member and a pair of rollers embracing the same, and a rotatable shaft, said cam member and said pair of rollers being mounted one on said track and one on said shaft, and said cam member having a periphery composed of oppositely-disposed arcuate portions of different radii and intermediate portions joining said arcuate portions.

6. Apparatus for applying fluid material to surfaces, comprising spraying means, a track for said spraying means, means to cause said spraying means to move back and forth along said track means to mount said track for oscillation on an axis intermediate its ends, means to cause said track to move in one direction about said axis when the spraying means is adjacent one end of its course and to move in the other direction about its axis when the spraying means is adjacent the other end of its course and to remain stationary at intermediate periods, the track-moving means comprising a cam member and a pair of rollers embracing the same, and a rotatable shaft, said cam member and said pair of rollers being mounted one on said track and one on said shaft, and said cam member having a periphery composed of oppositely-disposed arcuate portions of different radii and intermediate portions joining said arcuate portions, and said rollers having a diameter equal to one-half the difference between the radius of the arcuate portion of smaller radius and the radius of the arcuate portion of larger radius.

7. Apparatus for applying fluid materials to surfaces, comprising conveyer means, track means above said conveyer means and extending beyond either side thereof, spraying means reciprocable on said track means, means to oscillate said track means about a central axis in one direction when the spraying means is adjacent one end of said track means and in the other direction when the spraying means is adjacent the other end of said track means, and means to impart reciprocation to said conveyer means, said driving means being arranged for adjusting the relative speeds of movement of said conveyer means and said spraying means.

8. Apparatus for applying fluid materials to surfaces, comprising conveyer means, a carriage therefor, track means for said carriage, means for reciprocating said carriage on said track means with controlled accelerating and decelerating movements at the ends of the reciprocatory movements, and means including a cam member for oscillating the track means about a central axis in one direction where the spraying means is adjacent one end of said track means and in the other direction where the spraying means is adjacent the other end of the track means.

9. Apparatus for applying fluid materials to surfaces, comprising spraying means, a carriage therefor, track means for said carriage, track means for reciprocating said carriage on said track means, said means including a pair of wheel members and an endless chain extending over said wheel members, and means for transmitting to said carriage the back-and-forth movement of a point on said chain in directions parallel to a line connecting the axes of said wheel members, means to mount said track means to permit the same to be oscillated about a central axis, a pair of control members carried by said track means at a point between the pivotal point and one end thereof, a rotating cam member embraced by said control members, and means for driving said chain and said cam member in synchronism.

10. Apparatus for applying fluid materials to surfaces, comprising spraying means, a carriage therefor, track means for reciprocating said carriage on said track means, said means including a pair of wheel members and an endless chain extending over said wheel members, and means for transmitting to said carriage the back-and-forth movement of a point on said chain in directions parallel to a line connecting the axes of said wheel members, means to mount said track means to permit the same to be oscillated about a central axis, a pair of control members carried by said track means at a point between the pivotal point and one end thereof, a rotating cam member embraced by said control members, the periphery of said cam member being so formed that said control members will remain stationary with respect to the axis of said cam member at two periods during one rotation of the cam and will be moved in one direction or one of the intervening periods and in a reverse direction at the other of the intervening periods, and means for driving said chain and said cam member in synchronism.

11. Apparatus for applying materials to surfaces, including spraying means, a track, means to mount said spraying means for reciprocation on said track in position for ejecting material in a direction perpendicular to said track, means for reciprocating the spraying means, and means to cause periodic track movements such that at least a portion of the line of movement of the spraying means in each generally forward direction will be at an unvarying angle with a similar portion of the line of each return movement of the spraying means.

12. Apparatus for applying materials to surfaces, including spraying means, a track, means to mount said spraying means for reciprocation on said track in position for ejecting material in a direction perpendicular to said track, means for reciprocating the spraying means, and means to cause periodic track movements such that the central portion of the line of movement of the spraying means in each generally forward direction will be at an unvarying angle with the central portion of the line of each return movement of the spraying means.

13. Apparatus for applying materials to surfaces, including spraying means, a track, means to mount said spraying means for reciprocation on said track in position for ejecting material in a direction perpendicular to said track, means for reciprocating the spraying means, and means to cause periodic track movements such that the central portion of the line of movement of the spraying means in each generally forward direction will be at an unvarying angle with the central portion of the line of each return movement of the spraying means.
to mount said spraying means for reciprocation on said track in position for ejecting material in a direction perpendicular to said track, means for reciprocating the spraying means, and means to move the track when the spraying means is at each end thereof in a manner such that the spraying means is retracted, so as to permit the same to be advanced as it moves to the other end of the track.

14. Apparatus for applying materials to surfaces, comprising means to move a surface along a path, spraying means, a track extending from side to side of said path, means to mount said spraying means for reciprocation on said track in position to eject spray in a direction perpendicular to said path, means to reciprocate said spraying means, and means to cause track movements such that the spraying means will be advanced at the same speed as a surface being moved along said path during both forward and return movements of the spraying means over said path and will be retracted at intermediate periods.

15. Apparatus for applying materials to surfaces, comprising means to move a surface along a path, spraying means, a track extending from side to side of said path and beyond the side edges thereof, means to mount said spraying means for reciprocation on said track in position to eject spray in a direction perpendicular to said path, means to reciprocate said spraying means from end to end of said track, and means to cause track movements such that the spraying means will be advanced at the same speed as a surface being moved along said path during both forward and return movements of the spraying means over said path and will be retracted at intermediate periods when said spraying means is beyond the side edges of the path.

16. Apparatus for applying materials to surfaces, comprising a pair of wheel members, an endless chain member extending over said wheel members, a guide element carried on said chain member, a reciprocable element formed with a groove extending perpendicularly to a line connecting the axes of said wheel members and embracing said guide element, a track for said reciprocable member, a spraying member carried by said reciprocable member, and means to cause track movements such that a central portion of the line of movement of the spraying means in each generally forward direction will be at an unvarying angle with the central portion of the line of return movement of the spraying member.

17. Apparatus for applying materials to surfaces, comprising a pair of wheel members, an endless chain member extending over said wheel members, a guide element carried on said chain member, a reciprocable element formed with a groove extending perpendicularly to a line connecting the axes of said wheel members and embracing said guide element, a track for said reciprocable member, a spraying member carried by said reciprocable member and arranged to direct spray in a direction perpendicular to said track during the movement of the reciprocable member along the same, and means to cause track movements when the spraying member is adjacent each wheel member to cause a retraction of the spraying members so that the same may be advanced during its movement toward the other wheel member.

18. Apparatus for applying materials to surfaces, comprising a pair of wheel members, an endless chain member extending over said wheel members, a guide element carried on said chain member, a reciprocable element formed with a groove extending perpendicularly to a line connecting the axes of said wheel members and embracing said guide element, a track for said reciprocable member, means for moving a surface along a path traversing a region located centrally with respect to said track, a spraying member carried by said reciprocable member and arranged to eject spray upon said region, means to mount said track for oscillation at an axis intermediate its ends, and means to cause said track to move in one direction about said axis when the spraying means is adjacent one end of its course, and to move in the other direction about its axis when the spraying means is adjacent the other end of its course and to remain stationary at intermediate periods.

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