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2,794,418

APPARATUS FOR SPRAY COATING SURFACES

Filed Jan. 20, 1954

2 Sheets-Sheet 1

FIG. 6

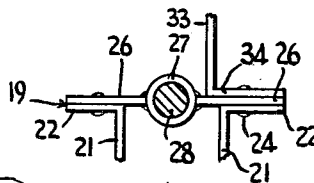


FIG. 1

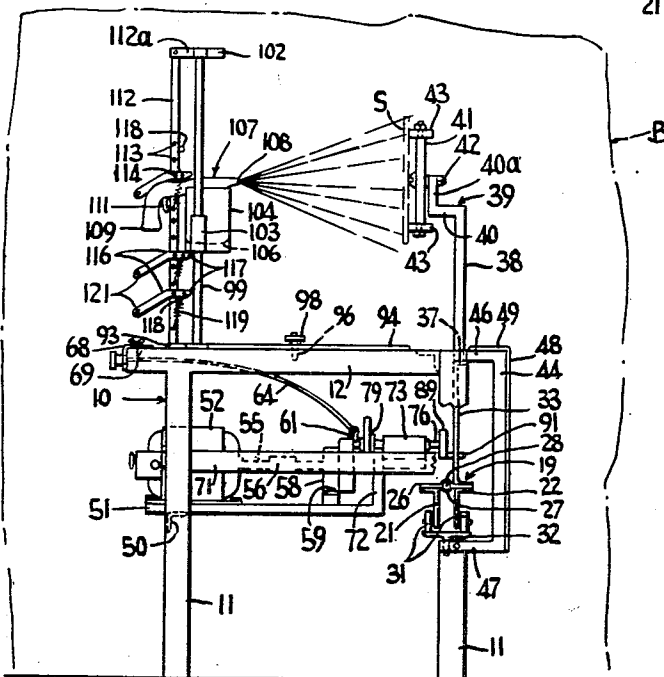
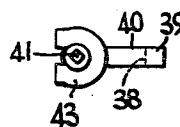


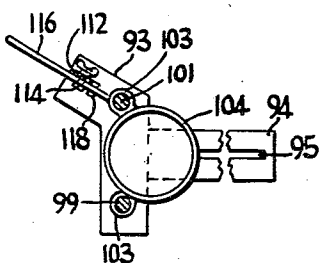
FIG. 5



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FIG. 4



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2 Sheets-Sheet 2

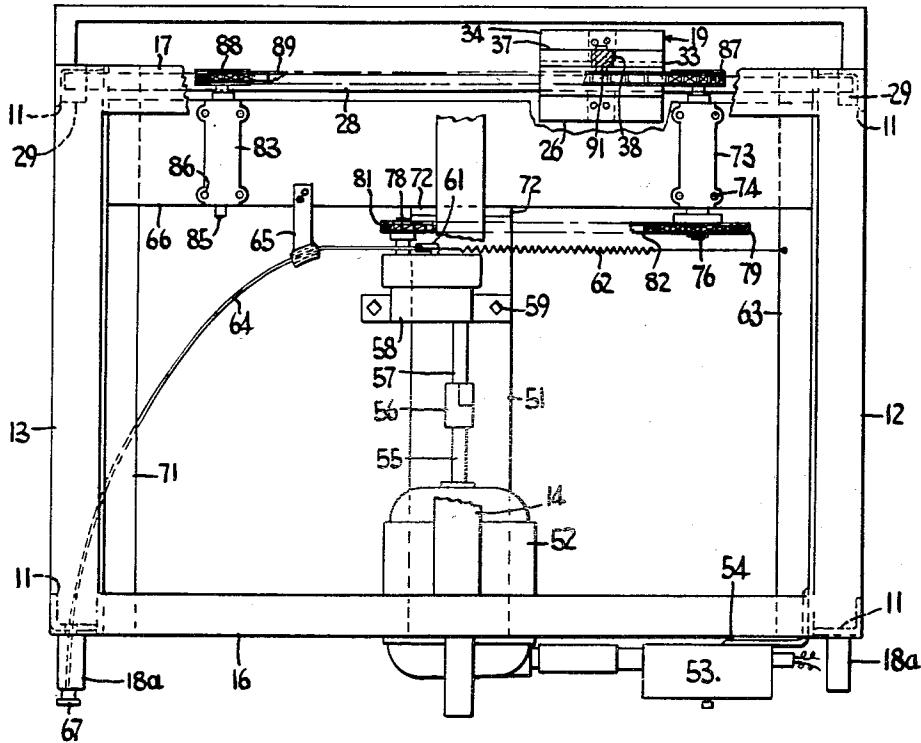


FIG. 3

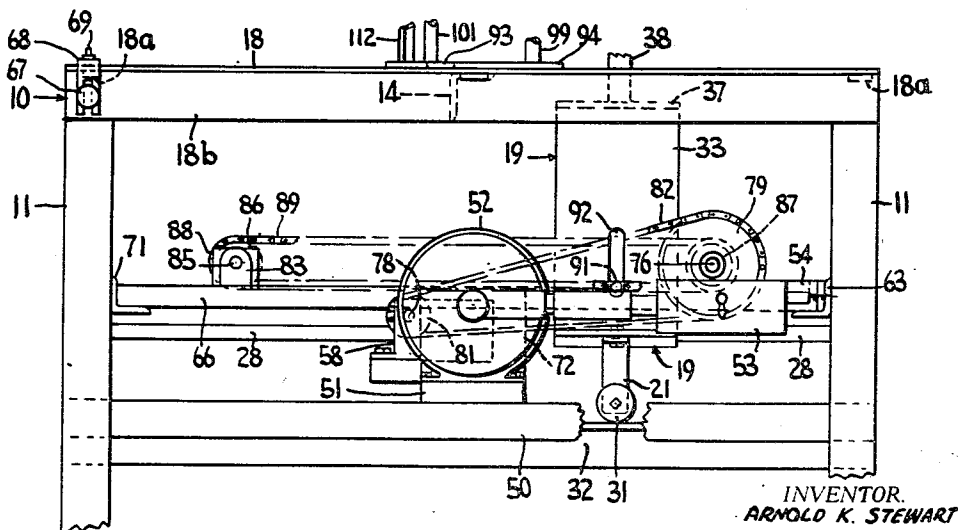


FIG. 2

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## APPARATUS FOR SPRAY COATING SURFACES

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2 Claims. (Cl. 118—300)

This invention relates to apparatus for applying coatings to surfaces and it has particular relation to apparatus for applying a finely divided or atomized spray of a liquid coating material to a panel like surface to provide a relatively uniform film.

In the application of liquid coating compositions to surfaces of such objects as test panels of metal or the like by spraying, it has heretofore been customary to support the panels upon a table or other convenient device and to apply the coating film by spraying from a suitable atomizing device. Usually this device was manually supported and traversed in front of the surface to be coated. The distance between the work and the spray device, as well as the relative angle of the spray to the work surface, was determined by eye and was subject to the judgment of the operator, often a variable factor. Also, the rate of movement of the spray device across the work was gauged by the operator and was subject to many unpredictable variations. The resultant variations involving the human factor manifested themselves by variations in the thickness of the films which in turn produced substantial variations in the shade of the coatings from piece to piece or even in different portions of the same piece.

These variations were especially pronounced when the films were applied by different operators at different times, and in different localities. For example, a manufacturer of coating compositions would make up a material, prepare test panels having coating films of the material, and submit these to a user such as a manufacturer of automobile bodies. Assuming that the coatings on the panels were regarded by the latter as being satisfactory, an order would be placed, and a quantity of the coating material would be shipped to him. He in turn, would prepare test panels from the material upon receipt to see that it was up to standard, and owing to the human factor involved in applying the coatings to the test panels, he often would be unable to duplicate the original panels submitted by the paint manufacturer. It would then be assumed by the second mentioned manufacturer that the material received did not correspond to that represented by the original test panels and a rejection would follow. This was true even though in many cases the material shipped was identical with that employed in coating the original test panels. These difficulties were especially pronounced in the use of liquid coating materials such as enamels and lacquers containing finely divided flake materials such as flake aluminum, bronzing agents or the like. These materials tend to orient themselves as the vehicle sets or dries, but the degree of orientation attained, will depend on the length of time the film remains fluid enough to permit movement of solid particles, and possibly other factors such as the degree of flow of the liquid on the surface. These factors have heretofore been especially subject to the vagaries, or the human element in the handling of the spray guns. Each operator in his attempts to attain a standard adopted by him, would seek to attain a thickness of film or would main-

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tain a spray angle, which was individual to him and might strongly influence the degree of orientation of flake material in the film. The color and sheen of the film in turn, were strongly influenced by this orientation. This was the occasion of much loss and annoyance to the paint manufacturer as well as inconvenience to the ultimate user.

This invention comprises an apparatus for application of liquid coating materials to work such as test panels of metal or the like, embodying means:

1. For positively determining and maintaining the distance and the angle between the spray device and the work.

2. For positively gauging the width of the steps as the spray device is advanced to apply a further strip after the completion of the given step latch or detent action.

3. Positively to determine the relative rate of movement between the spray device and work.

By use of such apparatus, and by maintenance of a fixed schedule of operation, it is possible consistently to duplicate the films upon different pieces of work regardless of the difference in the time between applications or the distance between the points of application. As a result of the use of these several features, it is possible to obtain substantial duplication of surfaces with a given composition, regardless of the operator, differences in date of work and differences in place of application. A user testing a given material, upon an apparatus corresponding to that of the supplier and following the same predetermined schedule of application, will obtain panels duplicating those submitted to him.

For a better understanding of the invention, reference may now be had to the accompanying drawings in which like numerals refer to like parts throughout and in which

Figure 1 is an end view partially in elevation and partially in section of an apparatus embodying the features of the invention.

Figure 2 is a fragmentary end view showing certain features on the apparatus as illustrated in Figure 1 on a larger scale.

Figure 3 is a view looking down upon the mechanism illustrated in Figure 2.

Figure 4 is a detailed view of a base for the mechanism supporting the spray gun.

Figure 5 is a detailed view of a magnetic device for supporting the panels during the spraying operation.

Figure 6 is a fragmentary view showing on a larger scale certain features of the carriage mechanism for supporting the panels.

The apparatus as shown, comprises a booth B in which is disposed a table like structure 10 having legs 11 of angle irons or other suitable materials, end cross bars 12 and 13 and an intermediate cross bar 14. These cross bars are interconnected front and back by transverse bars 16 and 17 to provide a rectangular frame supporting the top 18 constituting a reference surface, which may be of sheet metal or other suitable material. Brackets 18a on legs 11 support an apron portion 18b of the top.

A reciprocating carriage 19 for supporting the work and relatively moving the same with respect to the spray gun (to be described) comprises parallel vertical plates 21 having upper flanges 22 secured by bolts 24 to flanges 25 of a tubular slide 27, which is mounted for sliding movement upon a longitudinal rod 28 having end supports 29 upon the rear pair of the legs 11. At their lower edges, the plate like elements 21 are provided with rollers 31 which travel upon the upper face of a longitudinally extending bar 32 of T section, whereby to steady and support the carriage mechanism.

A standard for supporting plates to be coated upon the carriage, comprises a plate 33 having a rearwardly extending bottom flange 34 secured upon the rearmost of the

pins 26 by means of the bolts 24 already referred to. At its upper edge, the plate 33 is provided with a second flange 37 upon which is mounted a standard 38 extending above the top 18 of the table and being provided at its upper end with an L shaped bracket portion 39 having a horizontal leg 40 with vertical leg 40a, having a bar 41 secured thereupon by a clamping bolt 42. The opposite ends of the bar 41 are provided with horseshoe magnets 43 designed magnetically to support samples such as panels indicated as S, in position to be painted or coated by spray means (to be described). The magnets 43 are indicated as being of the permanent type. However, it will be obvious to those skilled in the art that such permanent magnets may be replaced if desired by means of electromagnets which can be energized and deenergized at will in order to hold or to release the panel which is to be coated.

An advantage of the magnetic panel holding construction as shown, resides in the fact that the panels to be coated are supported entirely without any obstructions with respect to the front face thereof. Also, the lower edge (as well as the other edges) of a panel during the coating operation are not disposed in contiguity to any other surfaces. Therefore there is no danger of the accumulation of a puddle of liquid coating material which may tend to creep by capillary attraction onto the surface to be coated and thus produce unevenness of the coating. Needless to say there are no clips or clamps which may tend to mar the coating film on the panel.

The successful operation of the magnets in the coating operation is surprising inasmuch as it is recognized that many coating compositions contain finely divided iron, or magnetic oxides which tend to concentrate in a magnetic field such as those exerted by magnets 43. These concentrations of magnetic materials could be expected to produce spots in the film. Applicant's discovery that such spots are not produced is nonobvious.

For purposes of enclosing and protecting the slide mechanism described, a frame is provided comprising vertical members 44 and having horizontal end portions 46 and 47 secured at their extremities, as for example by welding, or by other means to the rearmost pair of legs 11. Members 44 support a back plate 48 and the horizontal projections 46 provide a support for a rear top strip 49, the front edge of which is spaced rearwardly from the rear edge of the top plate 18, thus to provide a slot in which the standard 38 can reciprocate.

As will be observed in Figure 2 of the drawings, a bar 50 is connected longitudinally between the front pair of legs 11 and at a substantial distance below the top 18. This bar supports the front end of a plate 51 having a motor 52 of conventional design mounted thereupon. Said motor is provided with switch mechanism 53, bolted to angle 54. The motor is also provided with a drive shaft 55 having a coupling element 56 connecting it to the input shaft 57 of a conventional speed reducing mechanism 58. Since the latter mechanism may well be of conventional design and can be purchased as a commercial product, no attempt is made to illustrate the details of construction thereof. The speed reducing mechanism, like the motor 52, is mounted upon the plate 51 and may be secured in position by bolts 59, or other appropriate fastening devices.

The speed reducing mechanism illustrated is designed to vary from zero output to maximum speed and in a sense, may be regarded as constituting a combination clutch and speed reducing gearing by means of which the output of the motor can be brought to any desired speed from maximum to zero, at will. In order thus to admit of changing the drive to a desired speed, or from operative to inoperative condition as may be desired, without actually stopping the motor 52, a throw lever 61 is provided upon the side of the speed reducing mechanism. This lever is attached to one end of a helical spring 62 having its other end appropriately at-

tached to a cross bar 63 between a front leg and a rear leg of the table structure. The spring functions to maintain the lever normally in the operative position. Means to throw the lever into inoperative condition, comprises a relatively stiff but springy wire 64 which functions for pushing or pulling. At one end it is attached to the lever 61 and extends through a guide clip 65 mounted upon a longitudinally extending plate 66. The wire extends through apron 18b and adjustable bracket 68 and is provided with a pull knob 67, by means of which the wire can be manipulated to operate lever 61. Bracket 68 can be longitudinally adjusted, as by means of thumb screw 69 to limit the wire 64 to a position to attain any desired speed of travel for carriage 19.

Plate 66 is supported at its extremities upon angle iron bars 63 and 71 disposed in horizontal position and interconnecting front legs 11 of the table with the rear legs at a level somewhat above the level of the bar 50. As will be observed in Figure 1 of the drawings, the rear end of plate 51 is connected with the forward edge of the plate 66 by upright members 72. Plate 66, near one extremity thereof, is provided with a journal 73 which is secured in position by means of bolts 74 and constitutes a bearing for a shaft 76 which is driven by output shaft 78 of the speed reducing mechanism 58 through the agency of sprocket gears 79 and 81 respectively upon said shafts 76 and 78, and having a sprocket chain 82 trained thereabout to provide a driving connection. A second bearing or journal 83 similar to the journal 73 is secured, as by bolts 86, to the plate 66 near the extremity thereof opposite that of the bearing 73 and constitutes a journal for the shaft 85.

Upon their rear ends, the shafts 76 and 85 are provided with sprocket gears 87 and 88 which preferably are of the same diameter and constitute supports for a sprocket chain 89 which is trained thereabout and constitutes means for reciprocating the slide mechanism on the rod 28. To this end, the chain is provided with a rearwardly projecting stud 91 which extends into a slot 92 in the plate 33 in such manner that as the chain travels, the carriage is reciprocated back and forth at a substantially uniform rate except at the extreme ends of the travel (which in any event are beyond the limits of the spray).

Spray mechanism for coating panels supported by the magnets 43 comprises a baseplate 93 having a rearwardly extending tongue 94 which is longitudinally slotted as indicated at 95 (see Figure 4). This baseplate rests on the table top 18 and may be adjusted backward and forth with respect to the panel to be coated and locked in any desired position of adjustment by means of a stud 96 (or a plurality of studs) extending through the bar 14 and appropriate openings in the top 18 into slot 95. A nut 98 upon each stud provides means by the aid of which the baseplate may be clamped in any desired position of adjustment.

A pair of rod like standards 99 and 101 extend upwardly from the baseplate and are interconnected at their upper extremities for purposes of imparting strength to the structure, by means of a bowed cross member 102. Slides 103 upon the standards are rigidly joined to a support for a spray gun. This support in the embodiment shown, is indicated as comprising a cylinder 104 adapted to receive a container 106 of a conventional spray gun mechanism 107 having nozzle 108 designed to project a spray of coating material onto the panel S. This spray gun comprises a handle 109, preferably of pistol grip type, having a valve (not shown) operated by a trigger 111, by means of which the spray may be shut off or opened up at will as required in the operations. Such hose connections as are required for pressure are included but are not illustrated, since they are obvious.

Latch mechanism by means of which the support 104 and the attending spray gun can be positively indexed up or down upon the rods 99 and 101 positively to obtain predetermined width between the bands of spray in coat-

ing a panel, includes a third vertical standard 112 which is shown in the drawing as a flattened bar joined by branch 112a to bow 102. The bar is formed with numerous uniformly spaced perforations 113 designed to receive pivot bolts 114 of a series of triggers 116 having detent or point portions 117 designed to project into the path of the slides on the vertical rod 101. Small lugs 118 on the standard 112 project into the path of the tip or detent portions 117 of said triggers in position to prevent said portions from being tipped downwardly by the weight of the spray gun and its support. Such lugs do not interfere with the upward movement of the triggers 116. The triggers are held against the lugs 118 by means of coil springs 119, having the lower extremities thereof secured in appropriate ones of the opening 113 in order to maintain tension on the portions 117. The backward extending extremities 121 of the triggers 116 constitute handles by means of which the portions 117 may be manually swung upwardly to release them from engagement with the slide 103 on the rod 101. An advantage of this latch mechanism is that the spray gun can be indexed from one level to the next substantially instantaneously, merely by pulling on the supporting triggers. The next trigger in the series automatically arrests, the movement of the gun at precisely the desired level. The movement of the gun up or down is in a plane perpendicular to the plane of movement of the panel S and the gun does not move transversely out of this plane. Therefore, the path of the spray is fixed during the movement of the panel.

In the operation of the mechanism as shown, a panel to be coated, e. g., a steel test panel, is brought into engagement with the pole pieces of the magnets 43 on the standard 38 where it is held by magnetic attraction. The gun 107 suitably loaded with the desired coating material is disposed with the paint container in the holder 104. The holder is then raised or lowered as may be required to bring the gun into register with the desired upper or lower edge of the panel and is held in that position by the appropriate trigger 116. The motor 52 is then started and the clutch lever 61 is operated to provide a positive continuous drive at the desired speed between the speed reducing mechanism 58 and the chain 89. The stud 91 upon the chain 89, engaging in slot 92, causes the carriage mechanism together with the standard 38, to be reciprocated back and forth in the path of the spray at a uniform rate of linear motion to lay down a band of coating of high uniformity upon the panel S. After any desired number of passes of the panel have been made in front of the gun 107, the trigger 111 is operated to shut off the spray. Usually, 2 to 4 passes are made for each band or step. Trigger 116 is then operated to release the slide 103 on rod 101 thus permitting the gun support to be moved to the next trigger in order to lay down a second strip of coating material upon the panel to be coated. This operation is repeated as many times as may be required dependent upon the width of the panel to be coated. The width of the steps is regulated to attain maximum uniformity of the film.

In the operation of this mechanism, it will be observed that the spray gun is held stationary during the spraying operations thus making it convenient for the operator to maintain his hand upon the gun handle in position to control the trigger of the gun with highest facility. The area of spattering is reduced to a minimum since the gun is directed constantly at one zone. The gun is supported by the mechanism without effort on the part of the operator and therefore operations are performed with a minimum of fatigue. It will also be apparent that the spray mechanism, which is often relatively delicate and subject to dearrangement by vibration, is held perfectly still with least possible chance of dearrangement

which might affect the rate of delivery of the coating material to the spray gun.

The films may be dried by air or by baking as may be desired, dependent upon the material used in the coating operation.

It will be appreciated that if fully duplicatory test panels are to be obtained in the laboratory of a supplier of a given coating material and the laboratory of the user of the same, each must be equipped with a substantially duplicatory apparatus. The two apparatuses must be set to the same spacing and angles of essential parts. The spray guns must be duplicatory or equivalent in size constructions and pressures of operation, speeds of operation and the number of passes should be made to correspond. If best results are to be attained dilutions of materials and temperatures of ambient atmospheres should be approximately equalized. Also drying schedules should be similar. Small departures from complete duplication in apparatus and schedules of operation may sometimes be made without undue departure from duplication of the resultant films.

It will be apparent to those skilled in the art that various modifications may be made in the apparatus of this invention. For example, the panel holder comprising the magnets 43 may be replaced by suitable clips though it is apparent that such device frequently is undesirable since for purposes of securing the panels by clips, it is usually necessary to have some projection overlapping the front of the panel. Other spray gun supporting mechanism than that disclosed could be employed, but the embodiment shown is regarded as being extremely simple and highly satisfactory in operation. It is possible, though usually less desirable, to reciprocate the gun while holding the work stationary.

The forms of the invention shown and described are merely illustrative. Numerous modifications may be made therein without departure from the spirit of the invention or the scope of the appended claims.

I claim:

1. Apparatus for applying a film of a coating composition to a ferrous metal panel, said apparatus comprising a carriage, means transversely to reciprocate the carriage, means upon the carriage to hold a panel to be coated and comprising a magnet adapted to support the panel solely from the rear thereof and with the face thereof completely exposed, means to reciprocate the carriage back and forth in front of the panel, means to support a spray gun in a fixed vertical plane in front of the panel in position to apply a coating film to the panel as the latter is reciprocated backward and forward and means positively to index the spray gun up or down in order to lay down a succession of strips of coating material of predetermined width upon the panel to be coated.

2. Apparatus for applying a film of a coating composition to a ferrous metal panel comprising a table, a reciprocating carriage mounted upon the table, a standard fixed upon the carriage in vertical position and means mounted upon the standard, magnetically to support said panel with the face thereof completely exposed, a second standard mounted in fixed position upon the table, a spray gun mounted upon the second standard and indexing means associated with the standard and comprising latches secured upon the standard and having detents projecting to arrest vertical movement of the spray gun, means to move the detents to disengaging position to permit the gun to be moved to engage the next detent.

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