This invention relates to the construction of machines for spray-painting objects through masks. It is standard practice to deposit paint in a particular pattern by spraying it at a panel cut out in this pattern. An object placed on the opposite side of the mask panel will receive the paint only in the areas defined by the cut out portions. Painting operations on this principle are often automated by providing a machine with a group of masks mounted for continuous or intermittent movement between loading-unloading and spraying stations.

Most masked patterns are generally linear in nature, such as a line of printed material. This has resulted in emphasizing a linear conveyor-type operation, which is usually expensive and wasteful of floor space. The more structurally efficient rotary table-type of machine has tended to be wasteful of paint as a result of applying a spray path wide enough to encompass an elongated mask as it moves along an arcuate path. In dimensionally small spray operations, the provision of a group of spray guns selectively energized to cover an elongated area as it moves on a curved path is costly and often impractical. The present invention has been developed to obtain the compactness and economy of a rotary operation, while retaining the equivalent of a linear motion of the masks passing through the spray station. This is done by providing for a radial freedom of movement of the mask carriers with respect to the axis of rotation of a rotary support structure for the carriers. The position of the carriers is then altered in the spray station by a positioning device, causing the fixed rotary axis to follow a straight line with respect to the carriers.

The several features of the invention will be analyzed in detail in the discussion of the particular embodiments illustrated in the accompanying drawings. In the drawings:

FIGURE 1 is a side elevation of a complete machine embodying the present invention.

FIGURE 2 is a plan view of the rotary structure for carrying the masks through the cycle of operation.

FIGURE 3 is a sectional elevation on the plane 3-3 of FIGURE 2.

FIGURE 4 is a view on an enlarged scale showing a form of cam device usable in controlling the cycle of operation of the machine.

FIGURE 5 is a sectional elevation of the machine illustrated in FIGURE 3.

FIGURE 6 is a view on an enlarged scale showing the stabilizing arrangement for the mask carriers.

FIGURE 7 is a view on the plane 7-7 of FIGURE 2. FIGURE 8, 9 and 10 are schematic illustrations showing the interaction of the movable mask carriers with the fixed positioning roller for maintaining the alignment of a linear mask opening with respect to the single spray point.

Referring to the drawings, the cabinet 20 includes a hood 21 and a pneum 22. The exhaust duct 23 will apply suction to the room through the center of the mask space defined by the hood 21. A rotary table assembly 24 is mounted on a vertical shaft 25, and carries a group of mask-receiving frames 26-29 from the loading-unloading station at the front (left) as seen in FIGURE 1) through the spraying station at the rear of the machine, as indicated in FIGURE 2. A hub 33 carriers the flange 34 supporting the plate 35, which acts as a platform carrying the entire moving structure of the machine. This moving structure is associated with each of the four mask carriers, and only one of the four assemblies will be described in detail.

This structure may be considered as duplicated at points on the rotor assembly which are 90 degrees apart, as is best shown in FIGURE 2.

The mask carriers are essentially rectangular frames, each of which is secured by screws 36 to the horizontal leg 37 of the beams 38. The vertical legs 39 of these beams are secured by the screws 40 to a rod 41 slidably received in the bearing structure 42 mounted on the plate 35 with the bolts 43. The rods 41 are mounted for sliding movement in a generally radial direction with respect to the axis of the shaft 25, the inner extremity being supported by the bearing structure 44 secured to the plate 35 by the bolts 45. A spring 46 acts between the bearing structure 42 and a stop 47 secured to the rod 41 to apply a biasing action urging the frame 28, and the components associated with it, toward the center of rotation of the shaft 25.

It is preferable to utilize a single guide rod 41 for supporting each of the mask-receiving frames, as this arrangement avoids the close tolerances necessary in using a plurality of guide rods. However, the single rod arrangement requires that provision be made to stabilize the frames about the axis of the rods 41. Each of the carrier frames is therefore provided with spaced brackets as shown at 48 and 49. These are conveniently made of angular configuration, with the vertical leg being secured to the carrier frame by bolts as shown at 50 and 51. The horizontal legs 52 and 53 support the bearing pads 54 and 55, respectively, which engage the top surface 56 of the plate 35 in a sliding relationship. These pads move back and forth across the surface 56 as the mask frames are moved from the position shown on the left side of FIGURE 5 to that on the right.

The primary concern of this mechanism is to so position the carrier frames that the spray axis indicated by the arrow 57 in FIGURE 5 will follow a straight line down the center of the mask space defined by the hood and the spray axes 57 can be produced either by a fixed spray gun, or by a moving gun mounted on an arm rotating about the axis 57. The latter arrangement is conventional, with the gun often mounted to direct the spray in an annular conical pattern about the rotating arm. Referring to the schematic views presented in FIGURES 8, 9 and 10, the line 58 may be considered as the same position with respect to the frame 28 in each of the three views. It is desirable that the axis of the spray 57 (indicated as a dot in the plan view arrangement of FIGURES 8, 9 and 10) traverse this line 58 as the frame 28 moves with the rotor assembly mounted on the shaft 25. The arrangement for assuring the maintenance of this relationship centers in the roller or follower means 59 mounted on the stud 60 secured to the bracket structure 61 connected to a conveyor member 62 of the cabinet by the bolt 63. The follower 59 is therefore on a fixed axis of rotation with respect to the cabinet, and therefore with respect to the supporting structure of the spray gun (not shown) mounted to produce the spray axis 57. The roller 59 engages the curved rail 64, which is maintained in proper curvature by the pins 65. A ventilation grill 66 and the exhaust vent 67 at the rear are secured to the carrier frame 28 by the bolts 68. The curvature of the rail 64 is determined (see FIGURES 8, 9 and 10) in such a manner that the distance along the line 67 from the roller 59 to the reference line 88 will remain the same as the frame 28 moves into, through and out of the spray station. It is made for the fact that the rail 64 contacts the roller 59 at varying points of tangency. The net effect of the interaction between the roller 59 and the rail 64 is therefore
to pull out the frames against the action of the springs 36 a gradual and predetermined amount, and then release them in the same manner to maintain the intersection of the spray axis 57 with a straight line along the masks. It is obvious that the masks (held by the carriers) do not engage in the pipe fittings, but merely as they are still subject to rotation with respect to the axis of the shaft 25. However, the radial movement induced by the roller 95 will cause a straight line on the mask to "track" with respect to the spray axis to generate the equivalent of linear motion.

The machine may be installed in any convenient fashion in the frames 26-29 by conventional securing means which permit the ready removal of the masks from the frames for cleaning. The work pieces will be placed on top of the frames at the loading-unloading station of the machine, and will be held down in place against the masks by the clamping device 68. These devices form no part of the present invention, and are available as standard equipment. The foot 69 will bear upon the work pieces under pressure generated by a combination of a toggle mechanism generally indicated at 70 and the air cylinder 71 pivotally mounted on the fulcrum 72 secured to the bracket 73, which is mounted on the plate 35 to provide a platform for the clamping structure.

Preferably, a cover sheet 74 is incorporated in the rotating assembly to keep the components clear of accumulations of foreign material, and a shield 75 bridges the gap between the beam 38 and the edge of the plate 35 to inhibit the passage of paint in this area, and thus avoid accumulations of paint on the moving components. The shield 75 is of relatively light material, and is conveniently formed into the angular configuration shown in the drawing. The horizontal leg of this shield is slideably received against the bottom of the plate 35, either between the bolts 43, or with suitable slots provided in the shield for clearance. The vertical leg of the shield 75 is secured by the same bolts 40 that fasten the beam 38 to the rod 41.

The actuation of the clamping devices 68 may be rendered automatic through the use of a plurality of switches 76-79 mounted on the platform 80 supported by a group of columns as shown at 81, which are fixed with respect to the plate 35 either by direct attachment, or by being mounted on the cover 74. These switches control conventional solenoid valves (not shown) associated with each of the air cylinders 71, and the movement of the switches causes the actuating arms to engage the rail 82 maintained in a generally arcuate configuration by the stiffener 83 secured to the cabinet 20 by screws as shown at 84. As the actuating arm of the switches enter into the arcuate portion of the rail 82, the closure of the switches induces a clamping action moving the clamps from the condition shown to the left in FIGURE 5 to that on the right. The work pieces are thus held tightly against the masks through the passage past the spray guns under the hood 21. They are also automatically released as they emerge from the spray hood so that the operator can remove them without the necessity of manually actuating the clamps. The compressed air for actuating the clamping devices 68 is supplied through the conduit 85 and the rotatable joint 86 to the vertical pipe 87 secured to the end of the shaft 25. The pipe 87 rotates with the shaft, and is able to pass exclusively linear motion, as they are still subject to rotation with respect to the axis of the shaft 25. However, the radial movement induced by the roller 95 will cause a straight line on the mask to "track" with respect to the spray axis to generate the equivalent of linear motion.

The machine may be constructed to follow a continuous rotation. Where the intermittent form of cycle is used, the operator will remove a completed work piece, and replace it with another at whatever speed she desires. The cycle of operation will then involve a rotation of the machine of 90 degrees, where the completion of the cycle will be determined by the engagement of one of the high spots 90-93 of the cam plate 94 secured to the hub 95 engaging the shaft 25. The cam follower 96 is associated with the indexing mechanism responsible for rotating the assembly 24, which is of conventional construction. Preferably, the cam arrangement shown in FIGURE 4 will be disposed within the cabinet 20 at a convenient location with respect to the actuating equipment.

The particular embodiments of the present invention which have been illustrated and discussed herein are for illustrative purposes only and are not to be considered as a limitation upon the scope of the appended claims. In these claims, it is my intent to claim the entire invention disclosed herein, except as I am limited by the prior art.

I claim:

1. A spray painting machine, comprising:
   a frame;
   a rotor rotatably mounted in said frame;
   at least one mask carrier mounted on said rotor for movement having a component toward and away from the axis of rotation of said rotor; a spray station producing a spray axis disposed at a selected position along the path of movement of said mask carrier determined by the rotation of said rotor; and a cam and follower means mounted on said frame and mask carrier, and adapted to induce substantially radial motion of said mask carrier to cause said spray axis to follow a straight line with respect to said mask carrier; and drive means for said rotor.

2. A machine as defined in claim 1, wherein said rotor is mounted for rotation on a vertical axis.

3. A machine as defined in claim 2, wherein said spray station directs spray on a substantially vertical axis.

4. A machine as defined in claim 1, wherein a plurality of mask carriers are mounted on said rotor, and said frame defines a loading station providing access to said mask carriers for insertion and removal of workpieces in and from said mask carriers.

5. A machine as defined in claim 1, wherein said rotor includes a table plate, and said mask carrier is slidably mounted on said table plate for substantially radial movement with respect to the axis of rotation of said rotor, and said mask carrier has a cam disposed to engage a follower means mounted on said frame adjacent to said spray station.

6. A machine as defined in claim 5, wherein said table plate includes guide means determining the path of radial movement of said carrier.

7. A machine as defined in claim 6, wherein a plurality of mask carriers are mounted on said table plate, and said guide means includes interengaged rod and bearing means, and also includes stabilizing members mounted on said carriers and slidably bearing on portions of said table plate at positions spaced from the axes of said rod and bearing means.

No references cited.

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