April 23, 1968 H. SZCZEPANSKI 3,379,173

ROTARY-LINEAR SPRAY PAINTING MACHINE

Filed Oct. 3, 1966 5 Sheets-Sheet 1

FIG. 1

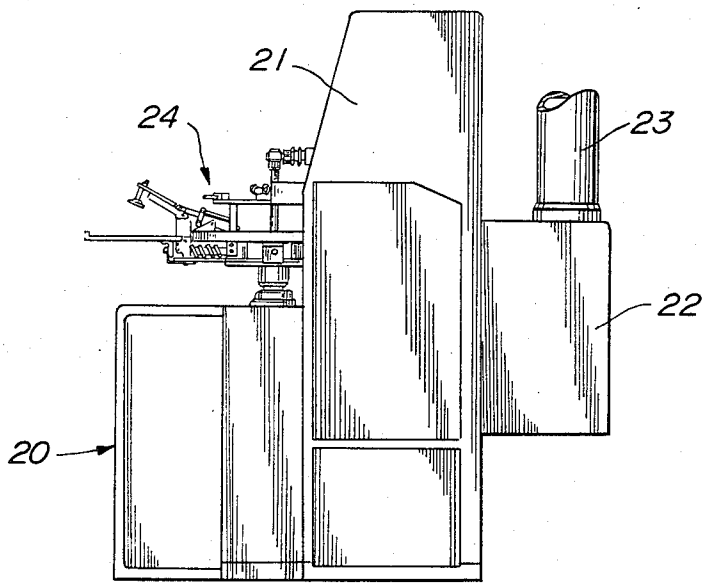
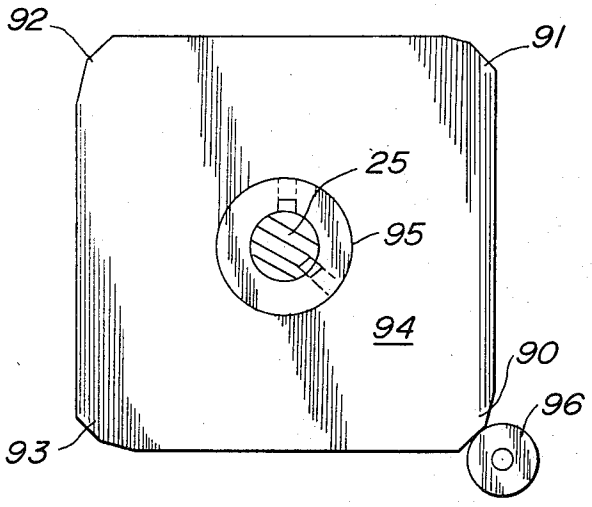


FIG. 4



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ROTARY-LINEAR SPRAY PAINTING MACHINE

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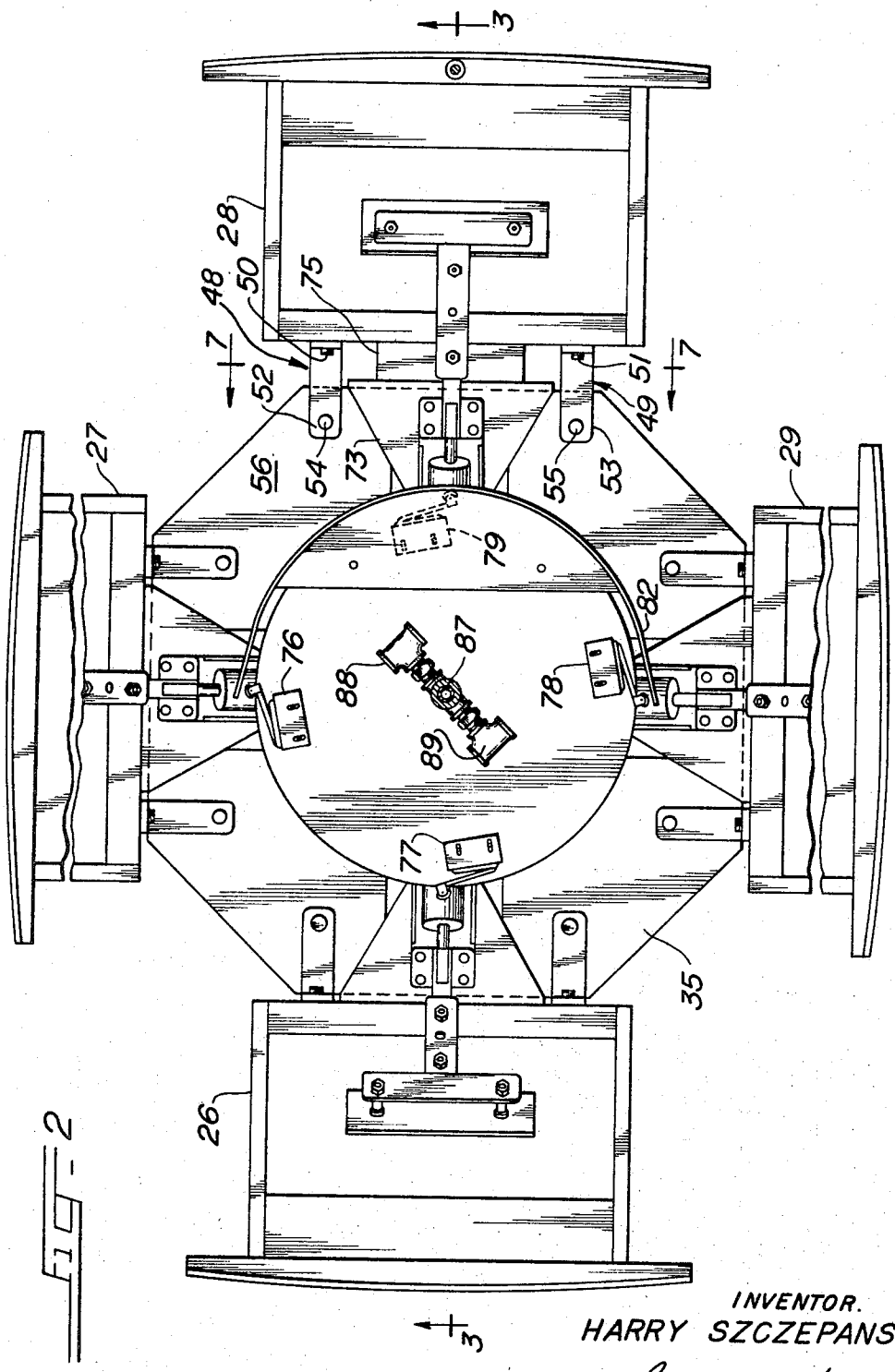


FIG-2

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ROTARY-LINEAR SPRAY PAINTING MACHINE

Filed Oct. 3, 1966 5 Sheets-Sheet 3

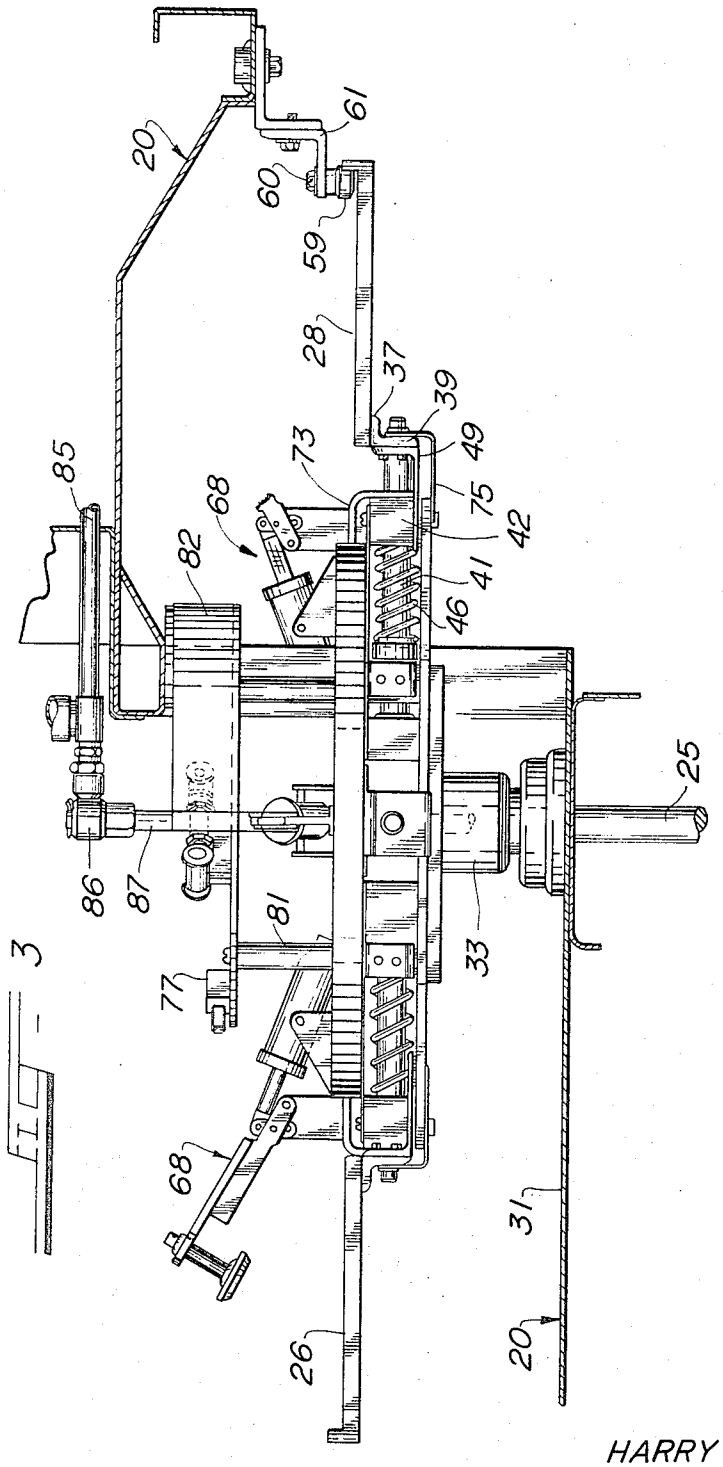


FIG. 3

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ROTARY-LINEAR SPRAY PAINTING MACHINE

Filed Oct. 3, 1966 5 Sheets-Sheet 4

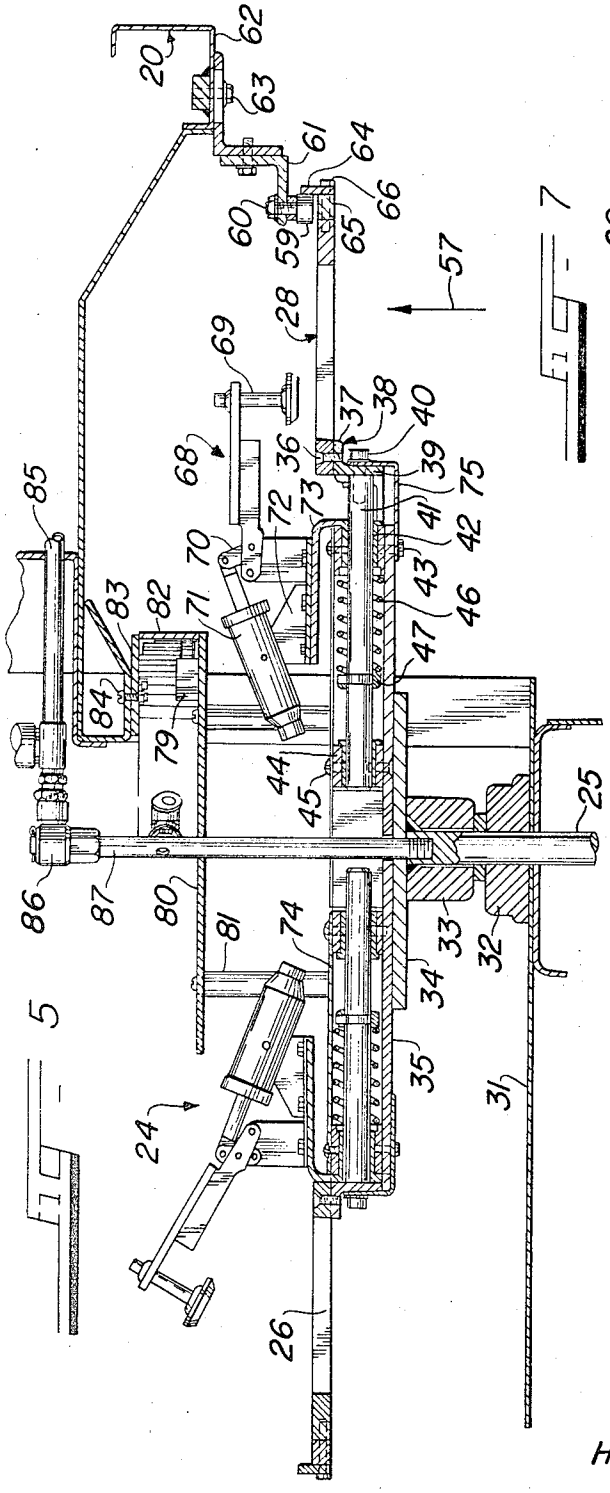


FIG 5

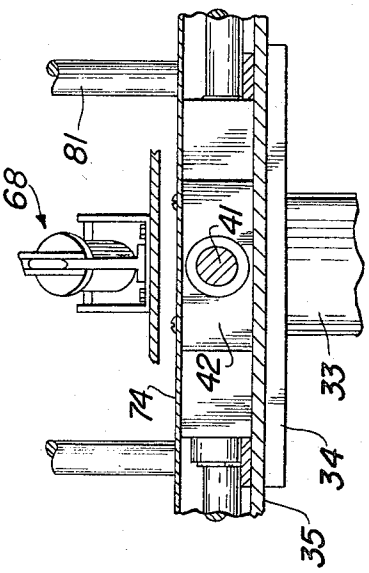


FIG 7

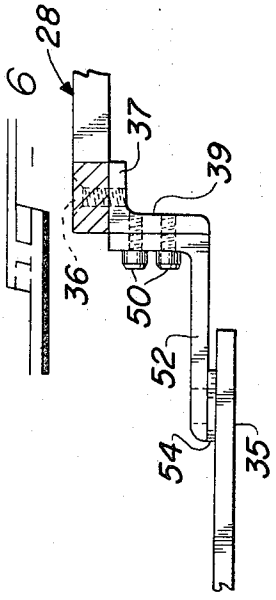


FIG 6

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ROTARY-LINEAR SPRAY PAINTING MACHINE

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FIG. 8

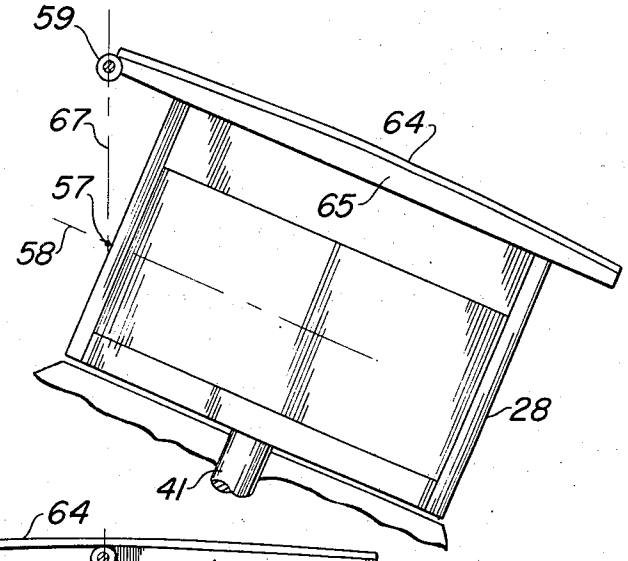


FIG. 9

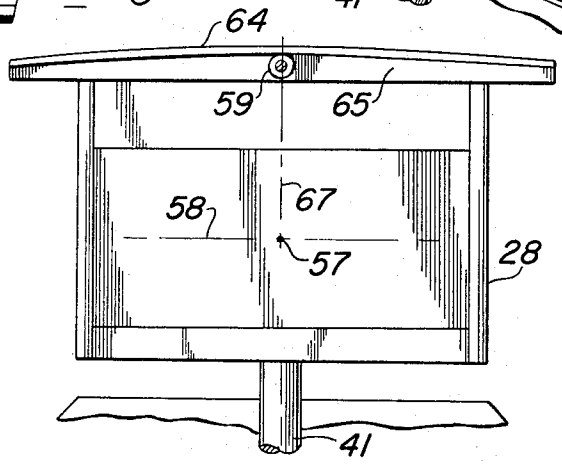
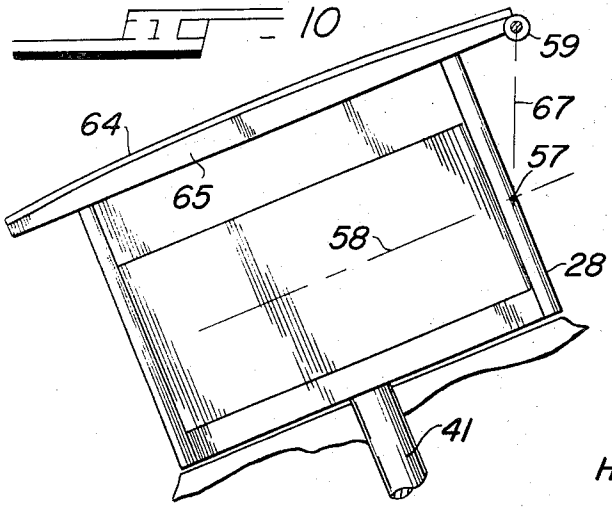


FIG. 10



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United States Patent Office 3,379,173 Patented Apr. 23, 1968

3,379,173

ROTARY-LINEAR SPRAY PAINTING MACHINE

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Filed Oct. 3, 1966, Ser. No. 583,846
7 Claims. (Cl. 118—301)

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 principal 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 obtained 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 through a 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 the 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 plenum **22**. The exhaust duct **23** will apply suction to the plenum **22**, and thus maintain a ventilation draft inwardly through the 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 underneath the hood **21**.

The shaft **25** intersects the top panel **31** of the cabinet structure, and is received within a suitable bearing block **32**. 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** slideably 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 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 mask frames. The spray axis **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 as it rotates. Referring to the schematic views presented in FIGURES 8, 9 and 10, the line **58** may be considered as in 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 convenient member **62** of the cabinet by the bolt **63**. The roller **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 guns (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 arched piece **65**. Both the rail and the arch are secured to the carrier frame **28** by the bolts **66**. 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 **58** will remain the same as the frame **28** moves into, through and out of the spray station. Slight correction may be 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 **46** 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 an 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 **59** will cause a straight line on the mask to "track" with respect to the spray axis to generate the equivalent of linear motion.

The masks will normally 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 by 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 FIGURE 5. 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 carries the pipe fittings **88** and **89** for connection to conduits (not shown) leading to the air cylinders **71**.

The shaft **25** may also carry a cam arrangement for controlling the termination of the cycle of operation of the machine, if this appears to be desirable. As an alternative, the machine may be constructed to follow a continuous rotary movement. Where the intermittent form of cycle is used, the operator will remove a completed work piece, and replace it will another at whatever speed she is able to maintain. On final placement of the new work piece, a cycle of operation of the machine is initiated by energizing a suitable control button (not shown). 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;

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 masks mounted in said 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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