June 10, 1969 H. SZCZEPANSKI 3,448,744

INDEXING VERTICAL ROTARY MASK-WASHING MACHINE

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FIG. 2

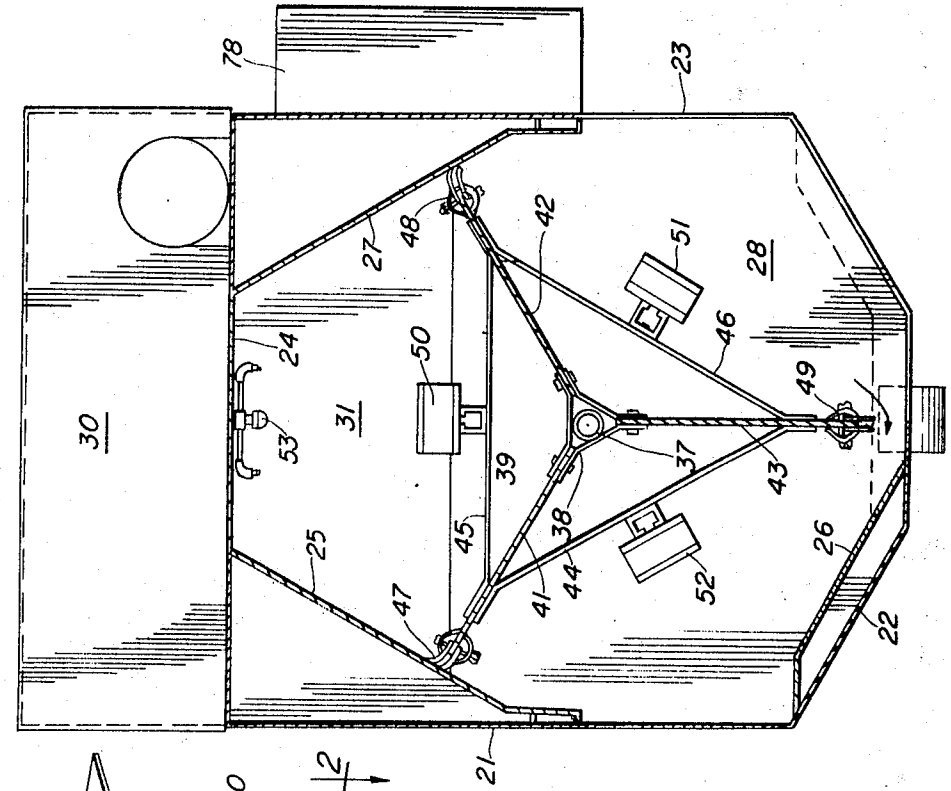
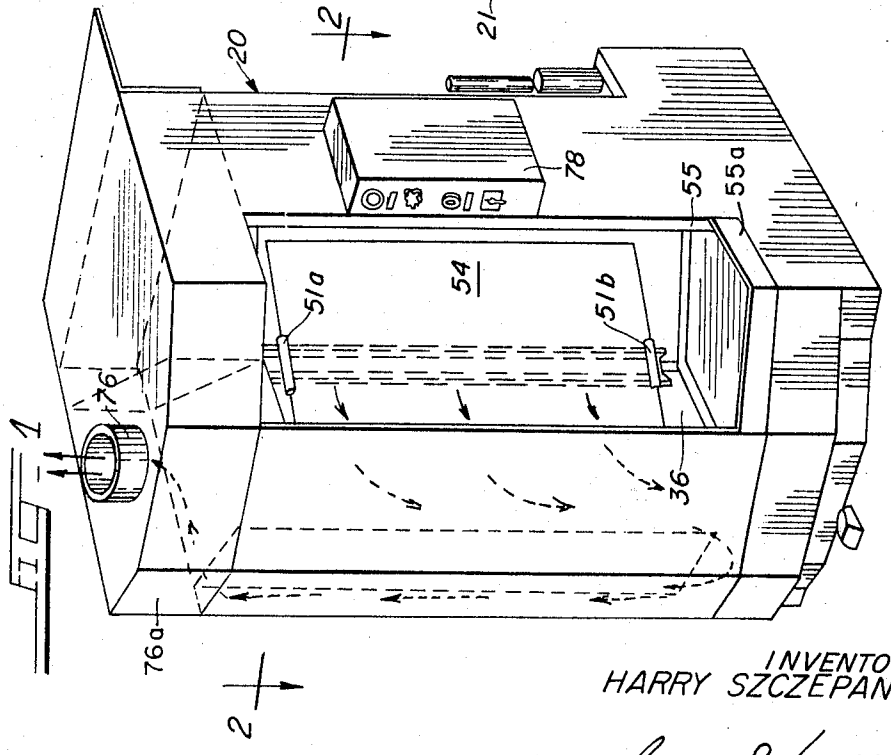


FIG. 1



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FIG. 4

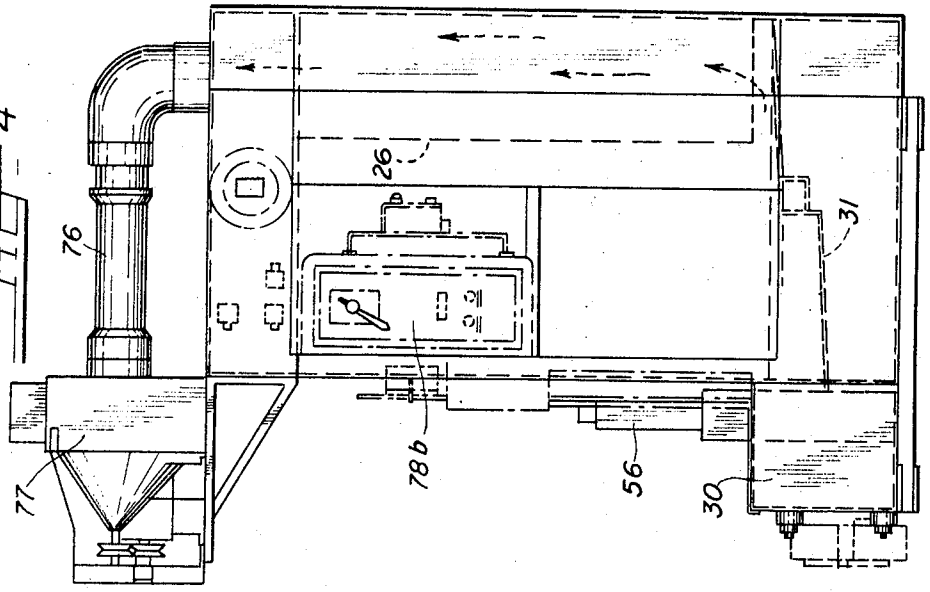
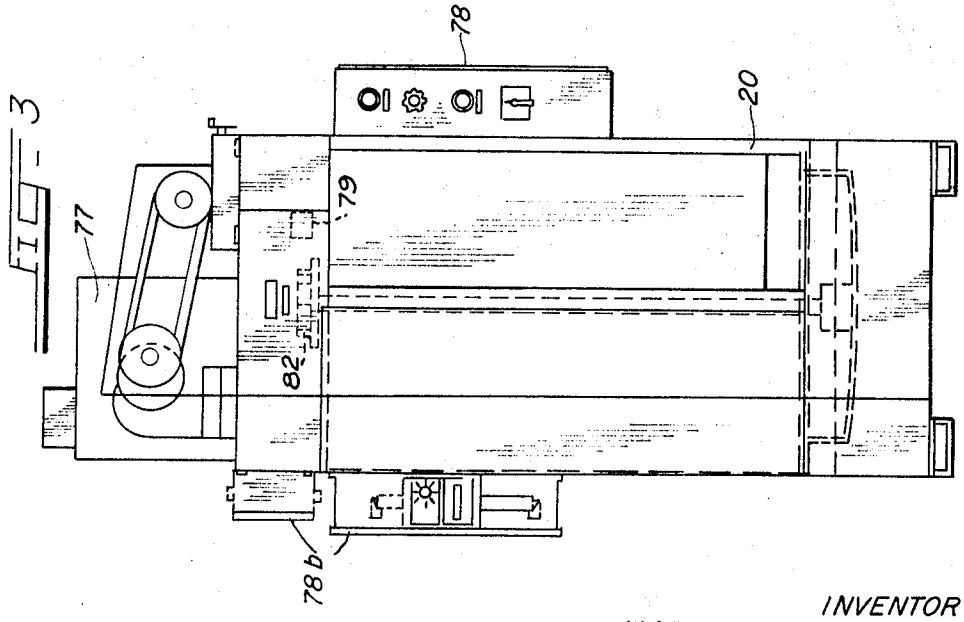


FIG. 3



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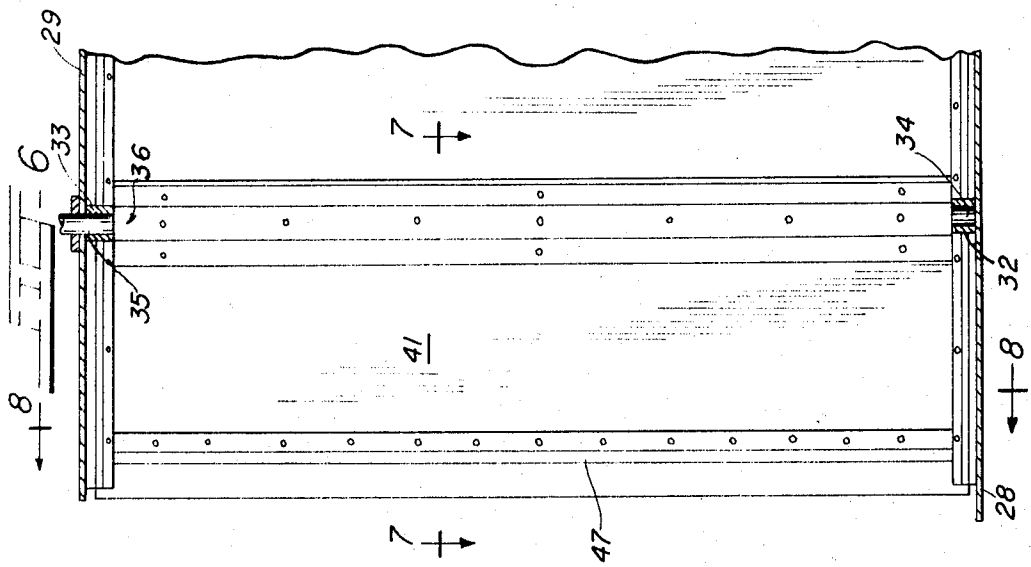
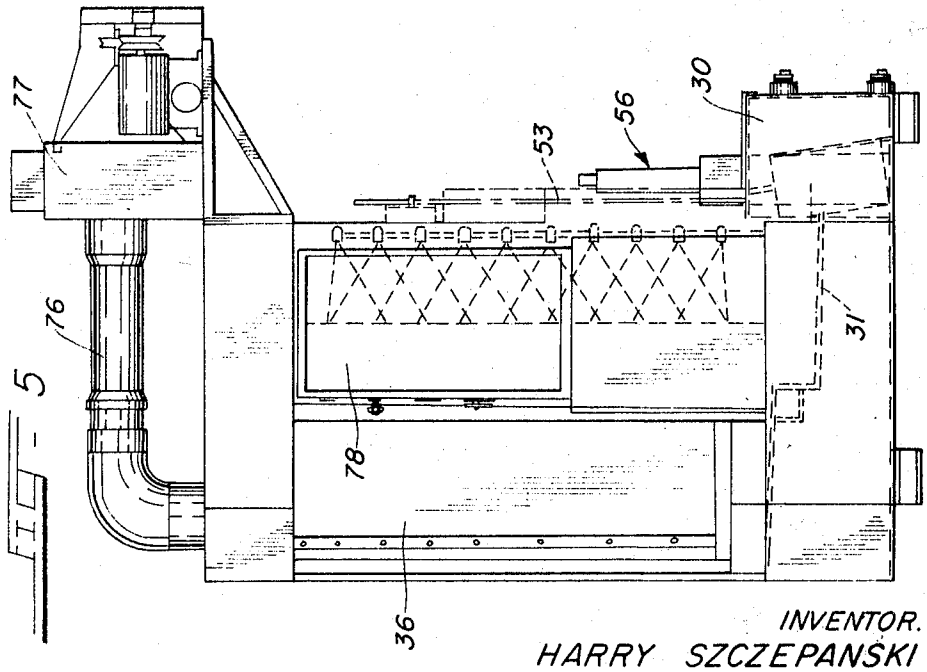


FIG. 5



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FIG. 7

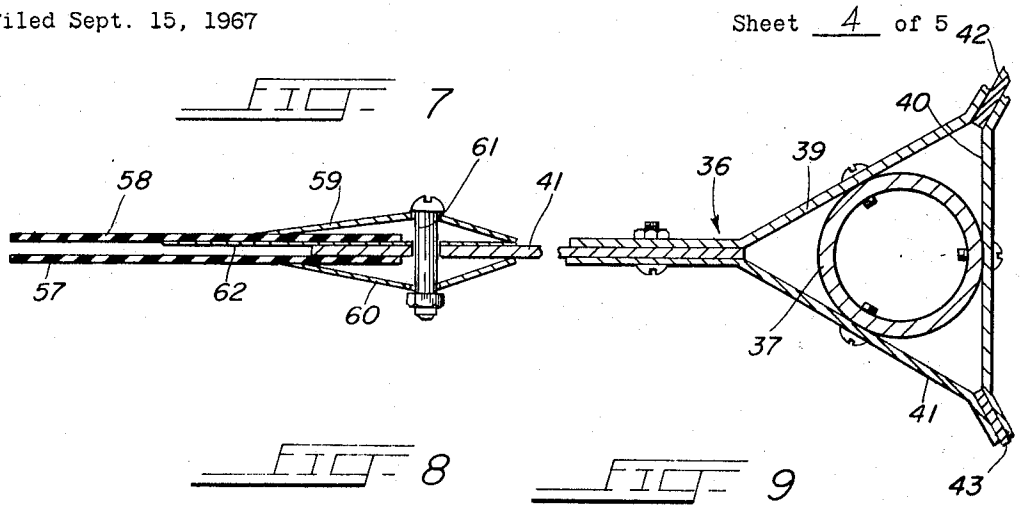


FIG. 8

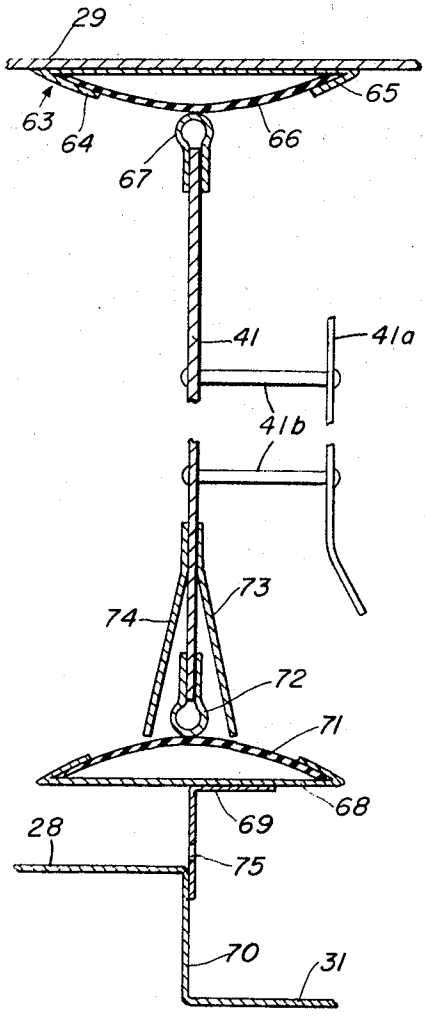
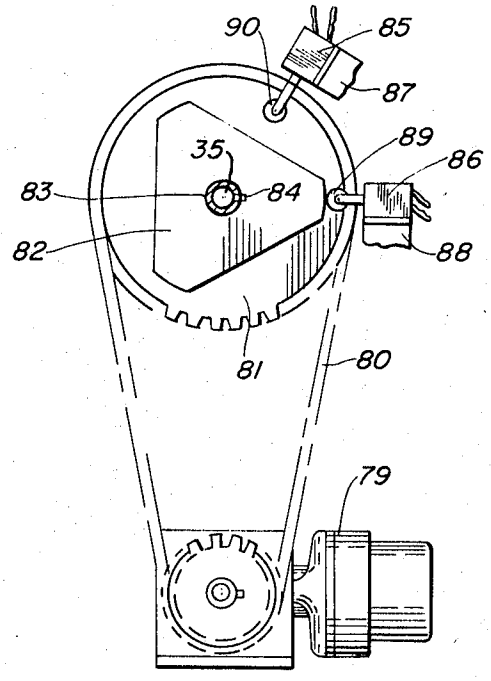


FIG. 9



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FIG. 10

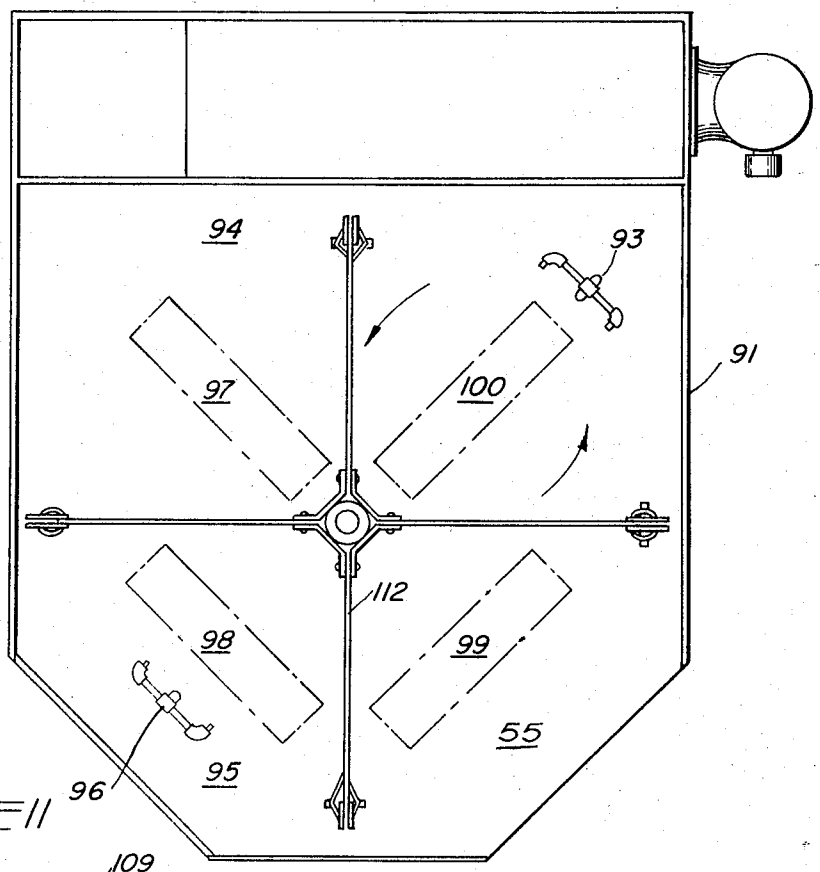


FIG. 11

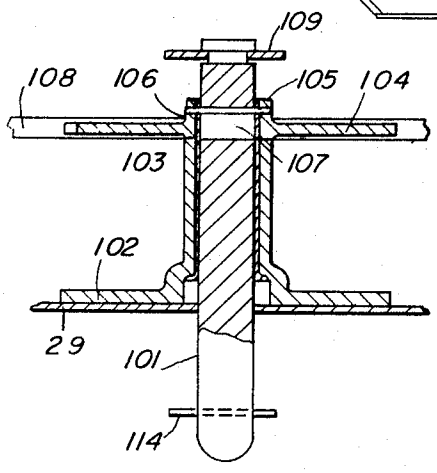
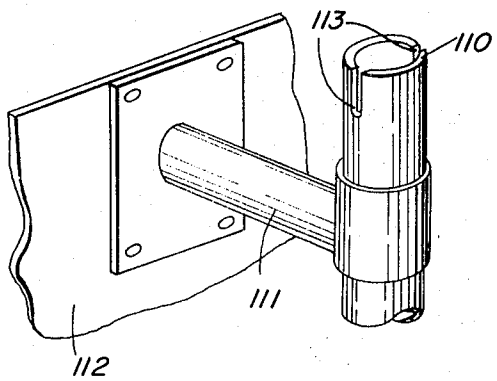


FIG. 12



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United States Patent Office 3,448,744 Patented June 10, 1969

3,448,744

INDEXING VERTICAL ROTARY MASK-WASHING MACHINE

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Int. Cl. B08b 3/04
U.S. Cl. 134—79 6 Claims

ABSTRACT OF THE DISCLOSURE

A mask-washing machine with chambers defined by a group of substantially radial panels forming a rotor moving within a surrounding housing, the rotor being provided with mask-receiving devices for conducting masks between loading-unloading and processing stations determined by indexing mechanism (controlling the angular movement of the rotor about its axis) to place the mask in predetermined positions with respect to processing devices mounted in the housing.

SUMMARY OF THE INVENTION

The placement of intricate patterns of paint on workpieces is normally done by directing a paint spray at the workpiece through a mask. The openings in the mask define the areas on the workpiece receiving the paint. In high-production operations of this nature, accumulations of paint are developed on the mask, and these must be periodically removed. This is commonly done through either manual or automatic washing equipment which projects solvents of various descriptions against the mask surface, or utilizes a relatively recently-developed technique of softening a waxy coating on the mask to release the superimposed paint that has accumulated. Automatic mask-washing machines have usually utilized conveying devices to move the mask from a loading-unloading station through the washing and drying processes. The use of highly-volatile sprays that produce notoriously toxic and explosive fumes creates a very difficult design problem in the automatic washing equipment, as either the washing station or the entire machine must be well sealed to control ventilation and confinement of vapors. To seal the entire machine requires the opening and closing of access doors at the loading-unloading station, and produces a volume of vapor within the machine that increases the ducting and vapor-removal problems. Nevertheless, this latter expedient has been commonly used in the construction of mask-washing equipment.

The present invention provides a practical arrangement for moving sealed chambers around through a housing between loading-unloading and processing stations. These chambers are defined by the substantially radial panels of a rotor arranged preferably on a vertical axis, and moving within a surrounding housing. The vertical orientation accommodates long masks commonly used in industrial processes, or considerable groups of smaller masks. This arrangement also facilitates the access to the machine by an operator in comfortable standing position, and considerably decreases the amount of necessary floor space for a given washing capacity. The rotor and chamber structure has the superficial appearance of a revolving door, and the advantages of incorporating this type of structure in a machine of this nature are very significant, both with respect to the cost of construction, and also with respect to the performance and decreased maintenance. The housing has an opening exposing the rotor sector between angularly adjacent panels, and ventilation means are incorporated to assure inflow at the opening.

DETAILED DESCRIPTION

The several features of the invention will be analyzed in detail through reference to the accompanying drawings, in which:

FIGURE 1 is a perspective view of a complete mask-washing machine embodying the present invention, as viewed from the operator's loading-unloading station.

FIGURE 2 is a section on the plane 2—2 of FIGURE 1.

FIGURE 3 is a front elevation of the machine shown in FIGURE 1.

FIGURE 4 is a side elevation of the machine shown in FIGURES 1, 2, and 3.

FIGURE 5 is an opposite side elevation with respect to FIGURE 4.

FIGURE 6 is a sectional view on a plane through the axis of the rotor.

FIGURE 7 is a view on the plane 7—7 of FIGURE 6, on an enlarged scale.

FIGURE 8 is a view on the plane 8—8 of FIGURE 6, on an enlarged scale.

FIGURE 9 is a view of the rotating and control mechanism associated with indexing the rotor.

FIGURE 10 is a schematic illustration on a horizontal plane through a modified form of the invention.

FIGURE 11 is a section of a disengageable drive system for moving mask racks and is associated with the FIGURE 10 modification.

FIGURE 12 is a perspective view showing a rotatable mask rack arrangement for use in conjunction with a FIGURES 10–11 mechanism.

Referring first to FIGURES 1 through 9 of the drawings, the illustrated machine includes a housing indicated generally at **20** defined by the sheet steel side sections **21–24**, the inner vertical sheets **25–27**, the floor **28**, the upper plate **29**, the tank structure **30**, and the sump **31**. Bearings **32** and **33** in the floor **28** and top plate **29**, respectively, are mounted on a vertical axis in the housing **20** for receiving the journals **34** and **35** of the rotor assembly **36**. The construction of the rotor is best shown in FIGURE 2, and includes the tube **37** to which the bracket plates **38–40** are secured in any convenient manner, such as by screws or plug welding. At their adjacent points, the bracket plates **38–40** define spaced flanges receiving the axial and radially-extending panels **41–43** at evenly-spaced intervals around the axis of the rotor assembly. This spaced relationship is preferably reinforced by braces as shown at **44–46**. At any given position of the rotor assembly about its axis of rotation (exclusive of the loading station), the panels **41–43** define, in conjunction with the appropriate portions of the interior of the housing, a chamber sealed off with respect to adjacent chambers and the exterior of the machine by the seal assemblies **47–49** extending along the axial outer edges of the panels, and by seals at the top and bottom of the panels in the position of the panels **41** and **42** in FIGURE 2. These latter seals isolate the spray chamber in which the solution or paint-removing spray is projected against masks carried by the supports **50–52**, in sequence, as the rotor proceeds in increments of rotation in a counterclockwise direction, as viewed in FIGURE 2. The panels **41** and **42** define the spray chamber in conjunction with the inner walls **24**, **25** and **27** of the housing, together with the top plate **29** and the sump **31**. The spray device **53** may be of any convenient type, either fixed or movable, and will normally either project solvent or hot water against masks held in the holding devices. A mask is indicated generally in FIGURE 1 at **54**, which is held is position by the upper device **51***a* and the lower device **51***b*. The height of the machine will normally be such that the access opening **55** in the housing will be disposed so that a workman can place the

mask **54** in engagement with the machine from a convenient standing position. After the mask **54** has proceeded around the several processing positions, which will normally include at least spraying and drying, the cleaned mask is removed from the machine. Normally, a mask is placed in the machine, and the indexing controls then actuated to present a clean mask to the operator. This same movement rotates the dirty mask into the cleaning chamber for automatic processing.

The spray-generating equipment supplying the spraying device **53** is provided by the equipment indicated at **56** in FIGURE 5. This structure forms no part of the present invention, and a variety of pumping or other pressure-generating devices can be used. The solvent or other sprayed material is recirculated from the tank **30**, and eventually moves down into the sump **31**, from which it is returned to the tank **30** by drainage.

The details of the seal structures are best shown in FIGURES 7 and 8. The axial outer seals along the edges of the panels of the rotor are shown in FIGURE 7, and include the spaced rubber-like flaps **57** and **58** on opposite sides of the panel **41**, together with the clamping strips **59** and **60** secured by the bolt **61**. It is preferable that a spring leaf **62** of bronze be included in the assembly to reinforce the wiping action of the flaps **57** and **58**. The bolt **61** can be tightened to whatever extent is necessary to produce the desired clamping action against the flaps **57** and **58**. This same structure is duplicated at the outer axial edges of the other panels as well.

The top and bottom edges of the rotor panels are sealed at the position where they define the spray chamber by the structure shown in FIGURE 8. Opposite the position of the top edge of the panels, a steel strip **63** is secured to the top plate **29** of the housing in any convenient fashion. This strip provides the spaced inwardly-slanted flanges **64** and **65** which receive the flexible piece **66** of neoprene, or some similar material, to provide a resilient surface against which the rounded fitting **67**, which defines the upper edge of the panel **41**, may engage as the rotor turns and assumes its various positions in sequence.

At the lower extremity of the panels, a strip **68** is mounted on the bracket **69** secured to the offset **70** extending from the floor **28** down to the sump **31**. The strip **68** is similar in configuration to the strip **63**, and positions the yieldable piece **71** for engagement with the fitting **72**. To encourage drainage of spray into the sump, the deflector plates **73** and **74** are mounted on opposite sides of the panels as shown. Since each panel will alternately define one side and then another of a spraying chamber, the deflectors **73** and **74** are duplicated along the bottom of each panel. To facilitate drainage from the floor **28** into the sump, the bracket **69** is provided with holes as shown at **75** so that any liquid draining down from the masks or panels onto the floor **28** will find its way back into the sump **31**. The rotor panels may be provided with drain shields as shown at **41***a* in FIGURE 8. These are set out from the panels by spacers **41***b* a sufficient distance to drain directly into the sump **31**. This arrangement takes the direct spray away from the seals, and improves the operation of the machine.

It is preferable, and usually a safety requirement, that the housing be provided with ventilating equipment, as indicated by the duct **76** and blower **77** shown in FIGURE 5. The details of this equipment form no part of the present invention. The control box **78** shown in FIGURE 1 will normally include the usual push-button switches and other controls for predetermining the cycling and indexing of the machine. The components of these controls are standard, and form no part of the present invention. A variety of explosion-proof switches and other related electrical mechanism usable with fire-hazard devices is mounted in boxes such as **78***b* shown in FIGURE 3, and may be selected to suit the requirements of the particular machine. The components of the housing structure are arranged to provide a particular flow pattern for the ventilation draft induced by the blower **77**. The solvent vapors normally encountered in the operation of these machines are heavier than air, and the dam **55***a* at the entrance opening tends to trap these vapors in the machine. The panel **26** of the double wall structure is terminated above the floor **28**, and forms a suction duct leading up into the chamber **76***a* served by the blower duct **76**. The vapors are therefore sucked off the floor area where they tend to accumulate. FIGURE 2 shows another arrangement for venting the opening **55**. The seals in the position of the seal **49** stop at a point where clearance exists, allowing a ventilation draft to flow inward at this point, as indicated by the arrow.

The driving mechanism for the rotor assembly **36** is best shown in FIGURE 9. The source of power for rotating the assembly is derived from the gear motor **79** mounted above the panel **29**, and secured in any convenient manner to the housing structure **20**. Power is delevered through the chain **80** to the sprocket **81** secured to the journal **35** of the rotor. A cam plate **82** has its hub **83** also in engagement with the journal **35**, and is held in selected angular position with respect thereto by the set screw **84**. A group of switches as shown at **85** and **86** are mounted on brackets as shown at **87** and **88** secured in any convenient manner to the structure of the housing **20** in position such that these switches can control the gear motor **79** and the spraying device **53**. The switch **86**, being actuated by the engagement of its roller **89** with the cam plate **82**, can serve to stop the rotation of the rotor. The engagement of the roller **90** associated with the switch **85** can be used to reset the circuits in conjunction with the switch **86** to control the indexing of the rotor to the next operating position.

The modification shown in FIGURES 10, 11 and 12 differs from that of the previous description by provision of four panels on the rotor, rather than three, and in the provision for a rotatable support of the masks as they move through a spraying station. The housing **91** may be similar in construction to that previously described in conjunction with the housing **20**, and a spray head is shown in fixed position with respect to the housing at **93**. The spray **93** may be considered as a washing station, and the chamber identified at **94** will normally be used for drying the residual spray material from the masks. The chamber **95** may be provided with a spray unit as shown at **96** for applying a waxy coating to the masks that have been properly cleaned and dried. After emerging from the coating and drying operation, the masks are presented at the open position **55** where they are accessible to the workman.

The masks supported by the rotatable racks **97–100** identified by position in FIGURE 10 are selectively driven opposite the spray head **93** by the device illustrated in FIGURE 11. The top plate **29** of the housing **91** has a suitable opening for slidably and rotatably receiving the retractable pin **101**. This pin is rotatably received within a bearing structure **102** secured to the plate **29**, and the sleeve **103** is interposed between the pin **101** and the inside of the bearing structure **102**. The sleeve supports the hub of the sprocket **104**, and the hub **105** of the sprocket is traversed by a diametral pin **106** which also traverses the slot **107** in the pin **101**. Rotation of the sprocket **104** by the chain **108** can be continuous, with the axial movement of the pin **101** controlled by the actuator **109** positioned by any convenient means such as a solenoid (not shown). The axial movement of the driving pin **101** will bring it to and from engagement with the upper end of the tubular shaft **110** of a rotatable mask-supporting rack mounted in the bearing bracket **111**. These brackets are all secured to the rotor structure **112**, and the opposite slots **113** in the upper extremity of the shaft **110** engage the driving member **114** of the pin **101**. Thus, after the rotor has assumed one of its indexed positions, actuation of the member **109** will drop the pin **101** axially downward so that the drive **114** will engage the slots **113**

to induce rotation of the shaft **110**, thus exposing the masks on both sides to the action of the sprays **93** and **96**. If the duration of the washing cycle is sufficiently long, it is possible that an extra drying station will not be necessary after the application of the coating material in the chamber **95**. If this is not true, the number of sectors of the rotor, and the corresponding number of chambers (or stations) in the housing can be selected to provide the necessary drying time.

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. An automatic mask-washing machine having a housing and mask-processing means mounted in said housing, and also having a rotor provided with mask-receiving means, wherein the improvement comprises:

bearing means mounted in said housing receiving journal means on said rotor;

a plurality of substantially radial panels on said rotor, said panels each having seals extending into movable sealing relationship with the walls of said housing to define movable chambers therein for receiving masks;

indexing means for positioning said rotor in predetermined angular positions about the axis thereof, at least one of said positions corresponding to placement of masks carried by said rotor opposite a spraying device mounted in said housing; and

resilient seal means in the floor of said housing opposite the lower ends of panels disposed on opposite sides of said spraying device with said rotor in said one position.

2. A machine as defined in claim **1**, wherein said housing has sump means at said one position.

3. A machine as defined in claim **2**, wherein said housing has drainage from the floor thereof into said sump means underneath said resilient seal means.

4. An automatic mask-washing machine having a housing and mask-processing means mounted in said housing, and also having a rotor provided with mask-receiving means, wherein the improvement comprises:

bearing means mounted in said housing receiving journal means on said rotor;

a plurality of substantially radial panels on said rotor, said panels each having seals extending into movable sealing relationship with the walls of said housing to define movable chambers therein for receiving masks; and

indexing means for positioning said rotor in predetermined angular positions about the axis thereof, at least one of said positions corresponding to placement of masks carried by said rotor opposite a spraying device mounted in said housing, and another of said rotor positions corresponding to an opening in said housing exposing the sector between angularly adjacent panels of said rotor, and said seals are disposed with clearance with respect to said housing at the position of said seals adjacent a vertical edge of said opening, said housing including suction ventilating means inducing flow into said opening and through said clearance.

5. A machine as defined in claim **4**, wherein said housing has a dam along the lower edge of said opening.

6. A machine as defined in claim **4**, wherein said chamber has a double wall portion providing a vertical ventilating duct extending to an intake point adjacent the bottom of said chambers.

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U.S. Cl. X.R.

134—153, 154; 118—319, 326