

Oct. 22, 1957

H. E. MacARTHUR ET AL

2,810,364

SPRAY PAINTING MACHINE

Filed Sept. 15, 1954

4 Sheets-Sheet 1

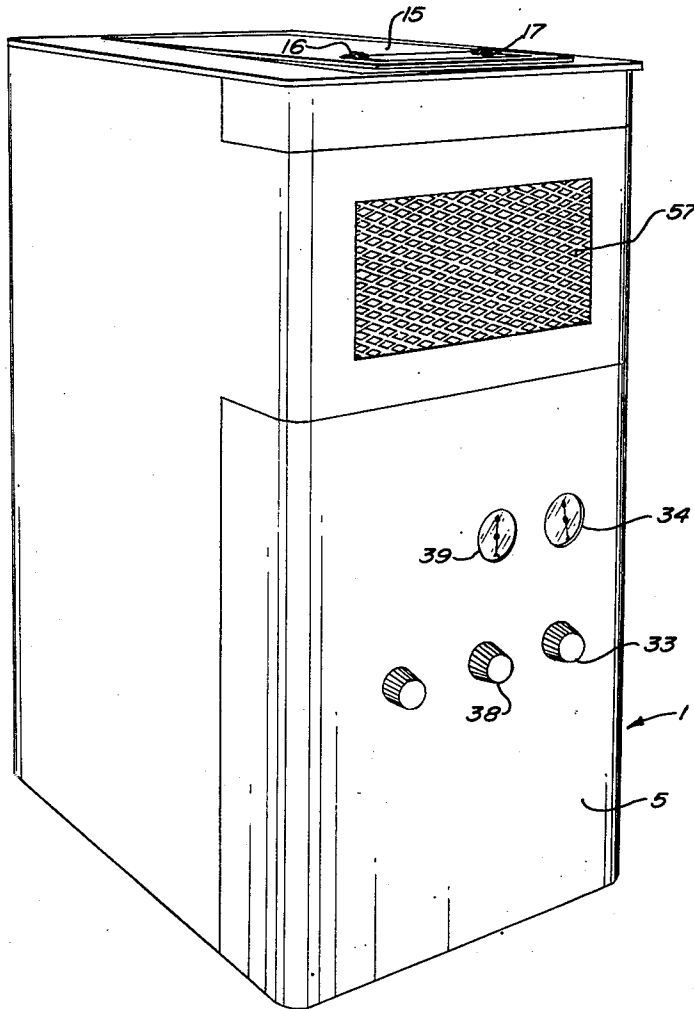


Fig. 1

INVENTORS
HAMILTON E. MacARTHUR
ELMER L. FABER
BY

Marshall, Marshall & Yeasting
ATTORNEYS

Oct. 22, 1957

H. E. MacARTHUR ET AL

2,810,364

SPRAY PAINTING MACHINE

Filed Sept. 15, 1954

4 Sheets-Sheet 2

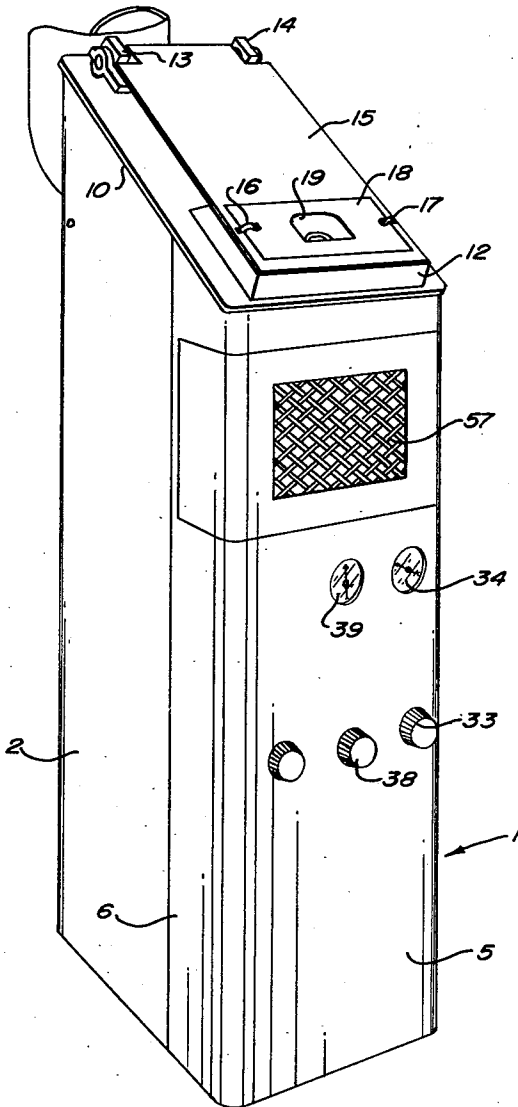


FIG. II

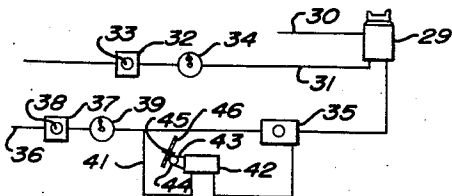


FIG. IV

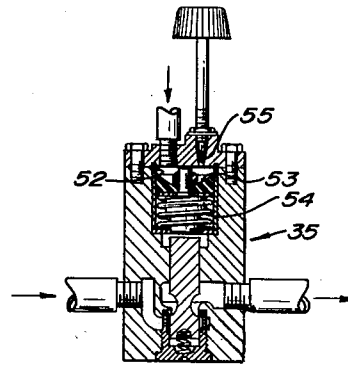


FIG. V

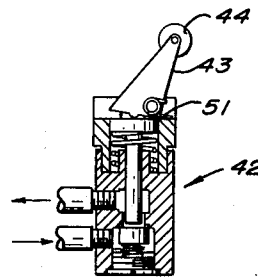


FIG. VI

INVENTORS
HAMILTON E. MACARTHUR
ELMER L. FABER
BY

Marshall, Marshall & Yeasting
ATTORNEYS

Oct. 22, 1957

H. E. MacARTHUR ET AL

2,810,364

SPRAY PAINTING MACHINE

Filed Sept. 15, 1954

4 Sheets-Sheet 3

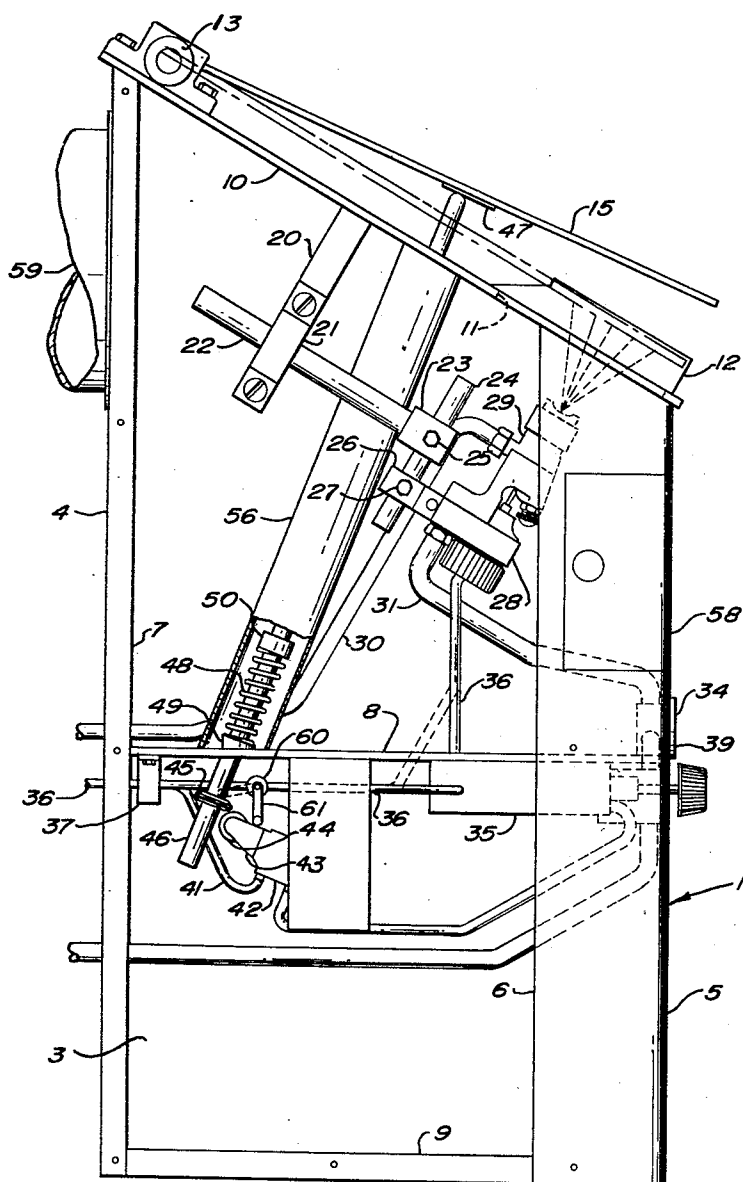


Fig. III

INVENTORS
HAMILTON E. MACARTHUR
ELMER L. FABER
BY

Marshall, Marshall & Spaulding
ATTORNEYS

Oct. 22, 1957

H. E. MACARTHUR ET AL
SPRAY PAINTING MACHINE

2,810,364

Filed Sept. 15, 1954

4 Sheets-Sheet 4

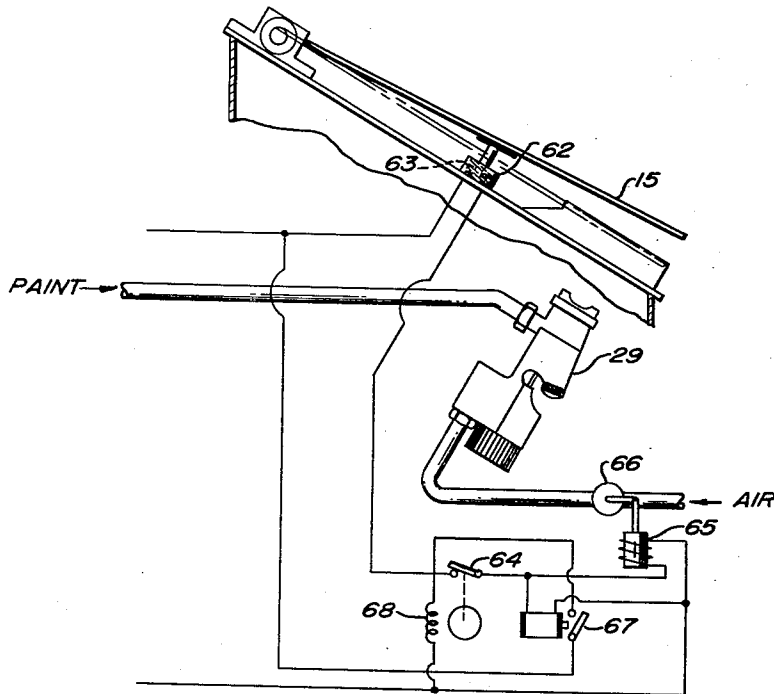


Fig. VII

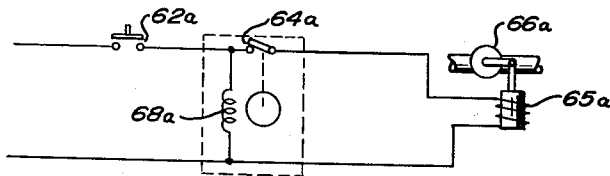


Fig. VIII

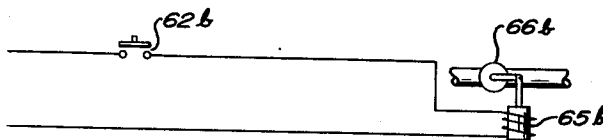


Fig. IX

INVENTORS
HAMILTON, E. MACARTHUR
ELMER L. FABER
BY

Marshall, Marshall & Gustafson
ATTORNEYS

2,810,364

SPRAY PAINTING MACHINE

Hamilton E. MacArthur and Elmer L. Faber, Toledo, Ohio, assignors to Conforming Matrix Corporation, Toledo, Ohio, a corporation of Ohio

Application September 15, 1954, Serial No. 456,287

12 Claims. (Cl. 118—11)

This invention is an improvement in the art of spray painting. It provides a machine which instantly applies a spray coating to each article positioned to receive the spray. The invention is particularly useful when embodied in machines for painting designs upon articles through openings in masks which are shaped to conform accurately to the surfaces of the articles adjacent the openings and which are tightly fitted against such surfaces before spray painting begins.

Heretofore machines have been equipped to direct sprays continuously while articles were being positioned and removed from the paths of the sprays by a conveyor or otherwise. Other machines have been equipped to direct sprays at predetermined intervals and for predetermined times. And still other machines have been equipped with trigger mechanisms having pedals or push buttons or finger pieces to be touched by an attendant to start the sprays. None of these prior devices achieve complete simultaneity between the presentation of the article to be sprayed and the inception of the spraying cycle.

If the attendant must depress a pedal or push a button or a finger piece to start the spray a lag may occur whose duration depends upon the personal characteristics of the attendant. If she tries to avoid a lag the spray may be started prematurely. If the paint is being applied through openings in a mask and it starts before the article and the masks are tightly fitted together the appearance of the article may be spoiled.

Machines which spray at predetermined intervals for predetermined times are relatively complicated and costly. They must be equipped with pluralities of identical masks for the various articles to be painted. Their cycles may not be fast enough to match the activity of a quick attendant, or they may be so fast that a slow moving attendant will let some of the masks go empty through the spray, thus wasting paint and befouling the masks.

A machine which sprays continuously may have moving masks and moving guns which perform with reasonable efficiency so long as the movements of the masks and the movements of the guns are well coordinated and so long as none of the masks is permitted to be sprayed while empty. Such a machine must run at a speed slow enough to permit the attendant to keep it supplied and to allow for fumbling and fatigue on the part of the attendant. A machine which sprays masked articles continuously must be equipped with many masks.

A general object of this invention is to provide a relatively simple and a relatively inexpensive machine for expeditious spraying of articles through masks.

A further object of the invention is to provide a machine for spraying articles through masks, the machine being so organized that the act of an attendant in pressing an article against the mask starts a spraying cycle.

Another object is to provide a machine in which the pressing of an article against the mask starts a spraying cycle and in which such cycle ends at a predetermined interval after its inception.

Another object is to provide a machine of the type outlined above in which the spray may be stopped by releasing the pressure of the article against the mask.

The following description as illustrated by the accompanying drawings is intended to set forth a preferred embodiment of the invention but not to impose limitations on the scope of the invention.

In the drawings:

Fig. I is a view in perspective of one form of a machine embodying our invention.

Fig. II is a view in perspective of another form of a machine embodying our invention.

Fig. III is a side elevational view of the machine pictured in Fig. II, a side panel being removed to show some of the mechanism, some of the mechanism being shown in broken lines, some paint and air supply tubing being displaced and some valves being omitted for clarity of illustration.

Fig. IV is an air flow diagram indicating the relationship of some of the valves and gauges along air lines leading to a sprayer which is incorporated in a machine of our invention.

Fig. V is a sectional view showing the interior of a transitory valve that is employed in the form of machine illustrated in Fig. II.

Fig. VI is a sectional view showing a pilot valve that is employed in the form of machine illustrated in Fig. II.

Fig. VII is a diagrammatic view showing circuits employed in a modified form of machine in which atomizing air is admitted to the sprayer through a solenoid operated valve and the spraying cycles are initiated and terminated by electric controls.

Figs. VIII and IX are wiring diagrams outlining circuits employed in further modifications.

The mechanism of our invention as illustrated in Figs. II to VI is supported in a cabinet 1 having removable side panels 2 and 3, a back panel 4 and a front instrument panel 5, the instrument panel 5 having wings 6 which are turned back along the sides of the cabinet and lie flush with the side panels 2 and 3. The front, back and side panels are secured to a frame, a vertical corner member 7 and horizontal members 8 and 9 of which frame are visible in Fig. III. The frame member 8 preferably is a shelf which not only functions as a support for parts of the mechanism but also shields the parts which lie below it from deposits of paint.

The cabinet 1 has a sloping roof 10 in which is a window 11 framed by an upstanding flange 12. Pivoted upon the roof 10, by means of hinges 13 and 14 located adjacent the upper edge of the roof, is a mask holder 15 in the shape of a substantially rectangular plate having an opening in its lower end. The mask holder 15 is equipped with clips 16 and 17 adapted to releasably fasten a mask 18 thereto in such position that the mask overlies the opening in the mask holder 15 and the window 11 in the roof 12. The mask 18 has a matrix portion 19 formed, preferably electrolytically, to fit accurately the face of an article to be coated or decorated, and has a pattern cut away to permit the application of sprayed coating to one or more areas on the article corresponding to the cut away pattern.

Fixed to the underside of the roof 10 is a bracket 20 having a clamp 21 within which is secured for slidable and rotatable adjustment a round bar 22. The bar 22 is equipped at one end with a fitting 23 within which a rod 24 is fixed by means of a set screw 25. By slightly loosening the set screw 25 the rod 24 may be rotated about its axis and may be slid transversely of the axis of the bar 22. Mounted upon the rod 24 by means of a second fitting 26 and another set screw 27 is a band 28 which embraces a spray gun 29 so oriented as to direct its

3

blast through the window 11 and the cutouts in the matrix portion 19 of the mask 18.

The spray gun 29 is served by a tubular paint supply line 30 and atomizing air supply line 31. Interposed in the atomizing air supply line is a pressure regulating valve 32 which may be manipulated by means of a knob 33 located on the front instrument panel 5 of the cabinet 1. The pressure with which the atomizing air is supplied to the gun is indicated on an atomizing air pressure gauge 34 also located on the instrument panel 5.

Atomizing air is admitted to the spray gun 29 through a valve inside the gun, which valve is not shown since the mechanism of the gun itself is not of our invention. The valve in the gun 29 is opened by the pressure of machine air, supplied from a pilot valve 35 through a machine air supply line 36.

Interposed in the machine air supply line 36 is a pressure regulating valve 37 which may be manipulated by a knob 38 located on the instrument panel 5, and the pressure in the machine air supply line after it passes through the pressure regulating valve 37 is indicated on a gauge 39 also located on the instrument panel 5. The pressure regulating valves and their manipulating knobs are shown in the diagram of Fig. IV but are omitted from Fig. III in which the layout of the paint conducting line, the atomizing air supply line and the machine air supply line is simplified to avoid the confusion that would result because in a photographically accurate representation of the actual position of the lines some of the lines would appear to cross each other and some portions of the lines would be hidden. The manipulating knobs 33 and 38 and the pressure gauges 34 and 39 are shown in their actual positions in Fig. I.

After the machine air supply line 36 leaves the pressure regulating valve 37 a branch 41 leads to a cam operated transitory valve 42. Extending from the transitory valve 42 is an arm 43 having a cam roller 44 in the path of a cam 45 which is adjustably fixed upon a push rod 46 that extends upwardly through the frame member 8 and the roof 10, the upper end of the push rod 46 being in engagement with a wear plate 47 fixed on the lower side of the mask holder 15. An expansive spring 48 surrounds the push rod 46 and extends between an abutment 49 fixed on top of the frame member 8 and a collar 50 adjustably fixed on the push rod 46.

When an attendant presses an article to be painted against the mask 18 the mask holder 15 swings downwardly upon its hinges 13 and 14 and pushes the push rod 46 downwardly against the expansive force of the spring 48 thus causing the cam 45 to engage the cam roller 44 and swing the arm 43 downwardly to open the transitory valve 42. As the arm 43 swings downwardly the cam 45 passes the roller 44 and the arm 43 is snapped back into the position in which it is shown in Fig. III by means of a spring 51, thus permitting the transitory valve 42 to reclose.

The momentary opening of the transitory valve charges an air cylinder 52 in a pilot valve 35 and moves a plunger 53 against the elastic force of a spring 54. This movement of the plunger 53 opens the pilot valve 35 to permit passage of machine air through the line 36 to open the valve in the spray gun 29. The spring 54 immediately begins to move the plunger 53 in a direction to close the pilot valve, the time required for movement of the plunger to close the valve being governed by the rate at which air escapes through an orifice which can be more or less constricted by manipulation of the knob of a needle valve 55.

Thus when the attendant presses an article against the mask 18 the mask holder 15 is swung downwardly and the push rod 46 descends to engage the cam 45 with the cam roller 44 and open the transitory valve 51 which as the cam 45 passes the roller 44 immediately recloses having charged the air cylinder 52 of the pilot valve 35.

4

and thus opened the valve to send machine air to the valve in the gun 29 which then sprays until closing of the pilot valve cuts off the supply of machine air that has held the valve in the gun open.

To shield the push rod 46 and the spring 48 from vagrant paint spray it is surrounded by a housing 56. The concentration of spray within the cabinet 1 is kept at a minimum by the passage of air therethrough in a large volume, the air being admitted through a grill 57 in a door 58 hinged in the front panel 5 and exhausted through a duct 59 which leads from an opening in the rear panel 4. The grill 57 and the duct 59 are so located that the air stream passes immediately beneath the spray from the gun to exhaust the excess spray. The door 58 gives access to the gun 29 and its universally adjustable support structure.

A valve 60 which is interposed in the machine air supply line remains open and has no function so long as a heavy arm 61 is in the position which it is shown in full lines in Fig. III. If however the heavy arm 61 is adjusted to a position in which it rests by its own weight on the top of the cam 45 as shown by dash lines in Fig. III, the valve will be closed whenever the mask holder 15 is released and the cam 45 moves upwardly. So long as the arm 61 is in the position in which it is shown in full lines the gun 29 will continue to emit its spray until the pilot valve 35 is closed by its timer mechanism, whether or not the attendant lifts the article being sprayed. If however the arm 61 is adjusted to the position in which it is shown in dash lines the spray will be cut off if downward pressure on the mask holder is released before the expiration of the predetermined time for which the timer is set.

With the arm 61 in the position in which it is shown in dash lines in Fig. III the transitory valve 42 and the pilot valve 35 may be by-passed by the machine air supply line as indicated in dash lines in Fig. III. With the transitory valve and the pilot valve thus by-passed the atomizing air valve in the gun 29 will be opened whenever the mask holder 15 is pressed downwardly and will be closed whenever the mask holder is released. In machines that are intended to be operated only in this manner the transitory valve 42 and the pilot valve 35 and the tubes connecting them together and to the machine air supply line may be omitted.

In the form of device illustrated in Figs. I to VI inclusive the operation is controlled by the machine air passing through tubes and valves. These forms of device have the advantage that they may operate indefinitely without danger of explosion. If however non-explosive paint is used or if explosion proof electrical apparatus is substituted for the machine air lines and valves, the modifications diagramed in Figs. VII, VIII and IX are quite practicable.

In the device diagramed in Fig. VII the arrangements of cabinet, mask holder, gun, paint line and ventilating system may be similar to or identical with those hereinbefore described. In this electrically controlled modification a switch 62 is arranged to be closed whenever the mask holder 15 is pushed down and opened whenever the mask holder 15 is released. A spring 63 of sufficient strength to raise the mask holder 15 may be either incorporated in the switch 62 or may be separate therefrom. Closing the switch 62 completes a circuit through a normally closed switch 64 and a solenoid 65 and actuates the solenoid to open a valve 66 in the atomizing air line thus starting the emission of spray from the gun 29. Closing the switch 62 also completes a circuit through the normally closed switch 64 and the coil of a relay 67 which while it is closed keeps the solenoid 65 energized to hold the valve 66 open. Closing the switch 62 also energizes the motor of a timer 68, the running of which for a predetermined time opens the normally closed switch 64 thus breaking the circuit through the solenoid 65 and causing the valve 66 to close. The operation of the device equipped with the

5

electrical apparatus diagramed in Fig. VII substantially duplicates the operation of the device equipped with the pneumatic apparatus diagramed in Fig. IV, viz, when an attendant, in pressing an article to be decorated against a mask, pushes the mask holder downwardly the solenoid 65 is energized and the gun continues to spray for a predetermined time regardless of whether or not the mask holder 15 is allowed to rise.

In the modification controlled by electrical apparatus such as that diagramed in Fig. VIII, closing of a switch 62a completes a circuit through a normally closed switch 64a and a solenoid 65a and opens a valve 66a in the atomizing air line. Whenever the switch 62a opens, the solenoid 65a is deenergized no matter how brief the time for which the switch 62a has been closed. Therefore atomizing air will be sprayed only if the switch 62a is closed. The electrical apparatus diagramed in Fig. VIII also contains a timer 68a which is set in motion when the switch 62a is closed and which causes the normally closed switch 64a to open after a predetermined interval. The spray in a machine equipped with the electrical apparatus diagramed in Fig. VIII therefore will start when the switch 62a is closed and will stop when either the switch 62a or the normally closed switch 64a is opened.

The spray in a machine having an electrical apparatus such as that diagramed in Fig. IX will start when a switch 62b is closed to energize a solenoid 65b and open a valve 66b and will continue as long as the switch 62b remains closed. The length of each spraying cycle therefore depends on how long the switch 62b is kept closed by downward pressure on the mask holder.

Many forms of switches, relays, solenoids, timers, valves, gauges and guns adapted for use in the machine of the instant invention are standard purchasable items. Such items therefore have not been illustrated or described in detail herein. Where inflammable painting materials are used explosion proof apparatus is preferable. Photosensitive switches and other appropriate electronic apparatus may be substituted where it is equivalent in function to the apparatus shown and described herein.

It is to be understood that the foregoing description and the accompanying drawings are exemplary only and that the invention is susceptible to variation and modification within the spirit and scope of the subjoined claims.

Having described the invention, we claim:

1. In a machine for spray painting designs upon articles through accurately fitting masks, in combination, a cabinet having a window therein, a mask holder overlying said window, said mask holder having an opening therein which registers with said window, means for mounting a selected mask upon said mask holder over said opening, said mask holder being yieldable when an article upon which a design is to be painted is pressed against such mask so mounted over said opening, an air blast sprayer so located within said cabinet as to direct a spray through such mask, and means that are actuated by the yielding of said mask holder for starting the air blast of said sprayer immediately after such yielding and that are actuated by the recovery of said mask holder for stopping the air blast of said sprayer immediately after such recovery.

2. In a machine for spray painting designs upon articles through accurately fitting masks, in combination, a cabinet having a window therein, a mask holder overlying said window, said mask holder having an opening therein which registers with said window, means for mounting a selected mask upon said mask holder over said opening, said mask holder being yieldable when an article upon which a design is to be painted is pressed against such mask so mounted over said opening, an air blast sprayer so located within said cabinet as to direct a spray through such mask, means actuated by the yielding of said mask holder for starting the air blast of said

6

sprayer, and means for automatically stopping such air blast after a predetermined interval.

3. In a machine for spray painting designs upon articles through accurately fitting masks, in combination, a cabinet having a window therein, a mask holder overlying said window, said mask holder having an opening therein which registers with said window, means for mounting a selected mask upon said mask holder over said opening, said mask holder being yieldable when an article upon which a design is to be painted is pressed against such mask so mounted over said opening, an air blast sprayer so located within said cabinet as to direct a spray through such mask, means actuated by the yielding of said mask holder for starting the air blast of said sprayer, means for automatically stopping such air blast after a predetermined interval, and means for adjusting the duration of such predetermined interval.

4. In a machine for spraying designs upon articles through accurately fitting masks, in combination, a cabinet having a window therein, a mask holder overlying said window, said mask holder having an opening therein which registers with said window, means for mounting a selected mask upon said mask holder over said opening, said mask holder being yieldable when an article upon which a design is to be painted is pressed against such mask so mounted over said opening, an air blast sprayer so located within said cabinet as to direct a spray through such mask, an atomizing air supply line for said sprayer, a machine air supply line, and a valve that is connected to said machine air supply line and that is opened by the yielding of said mask holder for starting the air blast of said sprayer immediately after such yielding and that is closed by the recovery of said mask holder for stopping the air blast of said sprayer immediately after such recovery.

5. In a machine for spraying designs upon articles through accurately fitting masks, in combination, a cabinet having a window therein, a mask holder overlying said window, said mask holder having an opening therein which registers with said window, means for mounting a selected mask upon said mask holder over said opening, said mask holder being yieldable when an article upon which a design is to be painted is pressed against such mask so mounted over said opening, an air blast sprayer so located within said cabinet as to direct a spray through such mask, an atomizing air supply line for said sprayer, a machine air supply line, an actuating valve connected to said machine air supply line and opened by the yielding of said mask holder for thereby starting such sprayer, and a pilot valve with a timer connected to said actuating valve for automatically stopping such sprayer after an interval predetermined by adjustment of said timer.

6. In a machine for spraying designs upon articles through accurately fitting masks, in combination, a cabinet having a window therein, a mask holder overlying said window, said mask holder having an opening therein which registers with said window, means for mounting a selected mask upon said mask holder over said opening, said mask holder being yieldable when an article upon which a design is to be painted is pressed against such mask so mounted over said opening, an air blast sprayer so located within said cabinet as to direct a spray through such mask, an atomizing air supply line for said sprayer, a machine air supply line, an actuating valve connected to said machine air supply line and opened by the yielding of said mask holder for thereby starting such sprayer, a pilot valve with a timer connected to said actuating valve for automatically stopping such sprayer after an interval predetermined by adjustment of said timer, and means for adjusting the pressure of machine air applied to said valves.

7. In a machine for spray painting designs upon articles through accurately fitting masks, in combination, a cabinet having a window therein, a mask holder having an opening therein which registers with said window, means for

7

mounting a selected mask upon said mask holder over said opening; said mask holder being yieldable when an article upon which a design is to be painted is pressed against such mask so mounted over said opening, an air blast sprayer so located within said cabinet as to direct a spray through such mask; and means actuated by the yielding of said mask holder for starting the air blast of said sprayer, said cabinet having an intake opening for the ingress of ambient air and an exhaust opening for the egress of contaminated air, said intake opening and said exhaust opening being so located that air drawn into said intake opening and out of said exhaust opening passes below such spray.

8. In a machine for spraying designs upon articles through accurately fitting masks, in combination, a cabinet having a top with a window therein, a mask holder overlying said window, said mask holder having an opening therein which registers with said window, means for mounting a selected mask upon said mask holder over said opening, said mask holder being yieldable when an article upon which a design is to be painted is pressed against such mask so mounted over said opening, an air blast sprayer so located within said cabinet as to direct a spray partly through such mask, an atomizing air supply line for said sprayer, a machine air supply line, an actuating valve connected to said machine air supply line and opened by the yielding of said mask holder for thereby starting such sprayer, and a pilot valve with a timer connected to said actuating valve for automatically stopping such spray after an interval predetermined by adjustment of said timer.

9. In a machine for spraying designs upon articles through accurately fitting masks, in combination, a cabinet having a top with a window therein, a mask holder overlying said window, said mask holder having an opening therein which registers with said window, means for mounting a selected mask upon said mask holder over said opening, said mask holder being yieldable when an article upon which a design is to be painted is pressed against such mask so mounted over said opening, an air blast sprayer so located within said cabinet as to direct a spray partly through such mask, an atomizing air supply line for said sprayer, a machine air supply line, an actuating valve connected to said machine air supply line and opened by the yielding of said mask holder for thereby starting such sprayer, and means for adjusting the pressure of atomizing air supplied to said sprayer.

10. In a machine for spraying designs upon articles through accurately fitting masks, in combination, a cabinet having a top with a window therein, a mask holder overlying said window, said mask holder having an opening therein which registers with said window, means for mounting a selected mask upon said mask holder over said opening, said mask holder being yieldable when an article upon which a design is to be painted is pressed against such mask so mounted over said opening, an air

8

blast sprayer so located within said cabinet as to direct a spray partly through such mask, an atomizing air supply line for said sprayer, a machine air supply line, an actuating valve connected to said machine air supply line and opened by the yielding of said mask holder for thereby starting such sprayer, a pilot valve with a timer connected to said actuating valve for automatically stopping such spray after an interval predetermined by adjustment of said timer, and means for adjusting the pressure of actuating air applied to said valves.

11. In a machine for spraying designs upon articles through accurately fitting masks, in combination, a cabinet having a top with a window therein, a mask holder hinged to said cabinet and overlying said window, said mask holder having an opening therein which registers with said window, means for mounting a selected mask upon said mask holder over said opening, said mask holder being yieldable when an article upon which a design is to be painted is pressed against such mask so mounted over said opening, an air blast sprayer so located within said cabinet as to direct a spray partly through such mask, and means actuated by the yielding of said mask holder for starting the air blast of said sprayer, said cabinet having an intake opening for the ingress of ambient air and an exhaust opening for the egress of contaminated air, said intake opening and said exhaust opening being so located that air drawn into said intake opening and out of said exhaust opening passes below such sprayer.

12. In a machine for spray painting designs upon articles through accurately fitting masks, in combination, a cabinet having a window therein, a mask holder overlying said window, said mask holder having an opening therein which registers with said window, means for mounting a selected mask upon said mask holder over said opening, said mask holder being yieldable when an article upon which a design is to be painted is pressed against such mask so mounted over said opening, an air blast sprayer so located within said cabinet as to direct a spray through such mask, means actuated by the yielding of said mask holder for starting the air blast of said sprayer, means for automatically stopping such air blast after a predetermined interval, and means actuated by recovery of said yieldable mask holder during such predetermined interval for immediately stopping the air blast of such sprayer.

References Cited in the file of this patent

UNITED STATES PATENTS

1,608,810	Rasmussen et al.	Nov. 30, 1926
1,756,744	Hatch	Apr. 29, 1930
1,792,699	Morton	Feb. 17, 1931
1,829,779	Benjamin	Nov. 3, 1931
2,350,708	Roselund	June 6, 1944
2,616,390	Klinck	Nov. 4, 1952