

Sept. 20, 1971

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3,606,087

POWDER SPRAY EQUIPMENT FOR OFFSET PREVENTION

Filed Aug. 11, 1967

3 Sheets-Sheet 1

Fig. 1

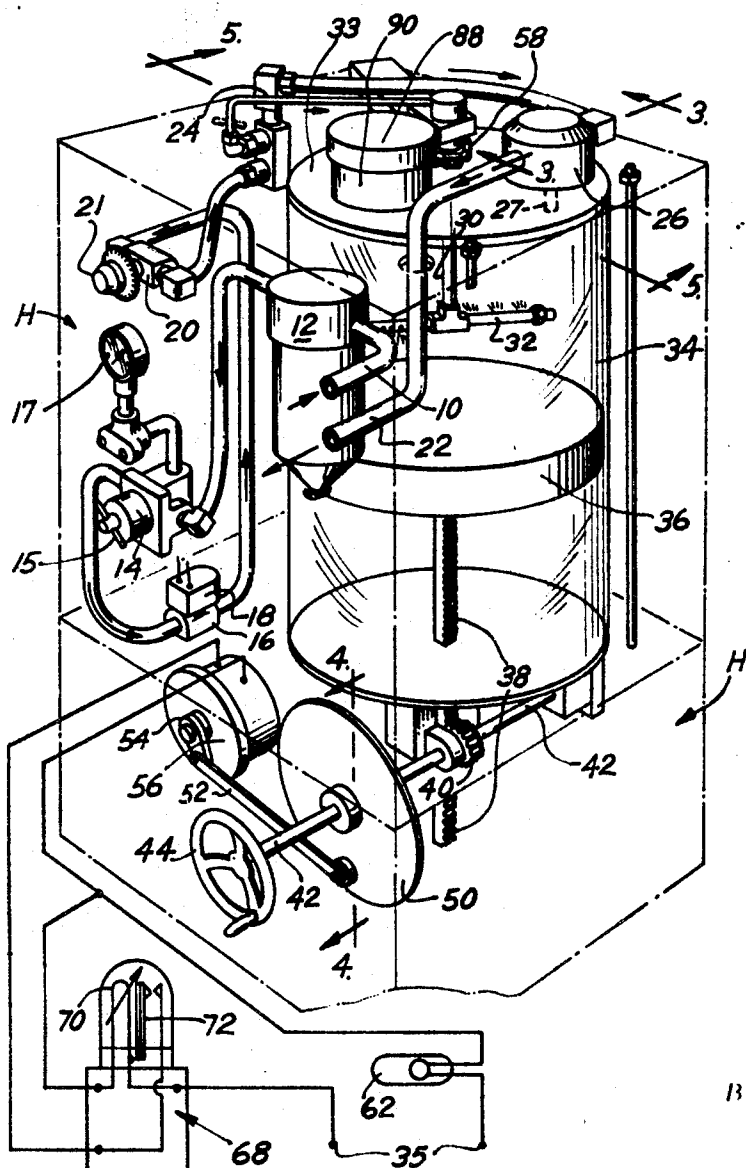
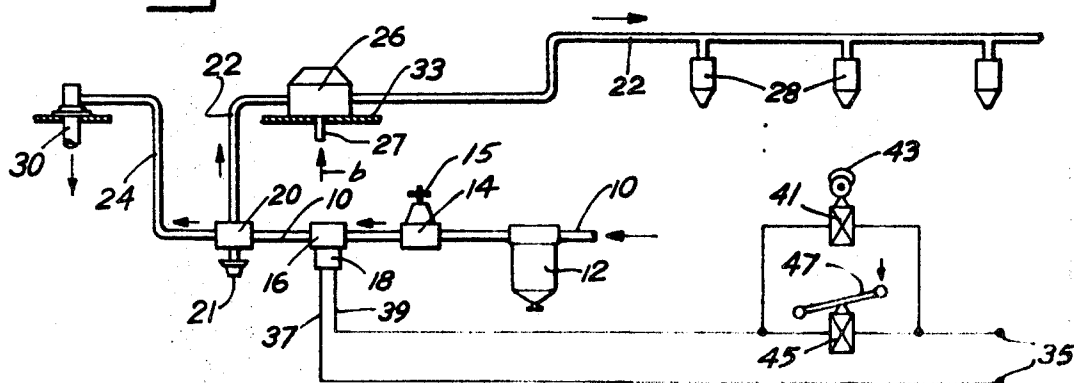
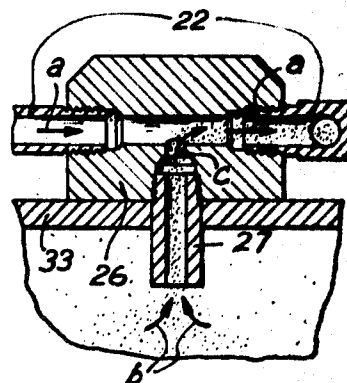


Fig. 2

Fig. 3



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3 Sheets-Sheet 2

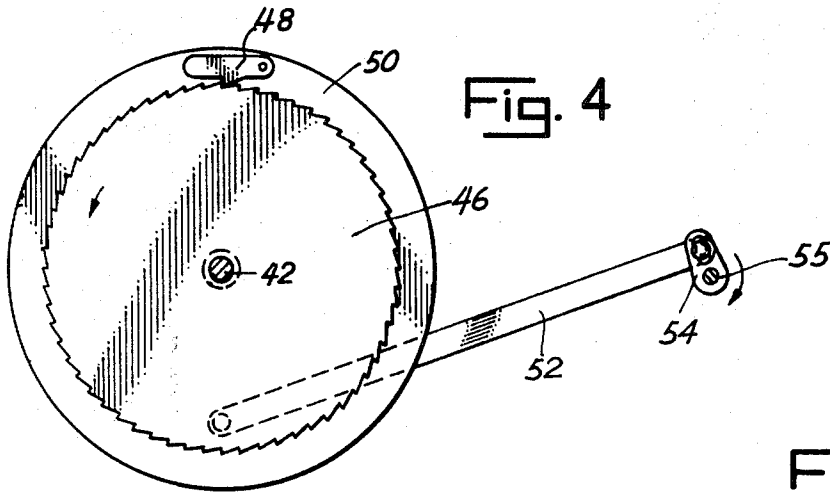


Fig. 6

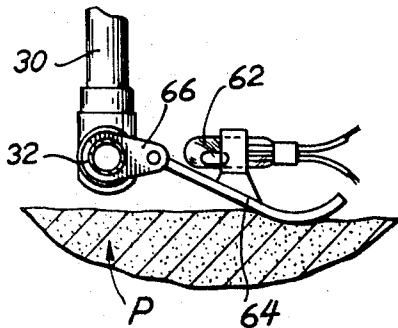


Fig. 5

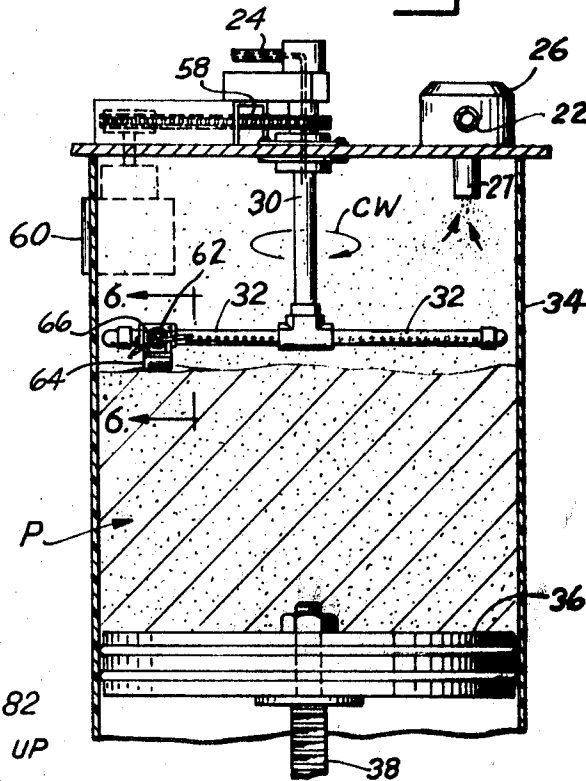
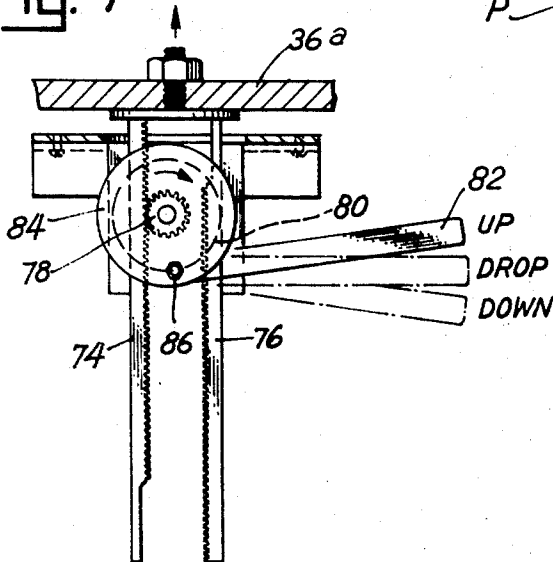


Fig. 7



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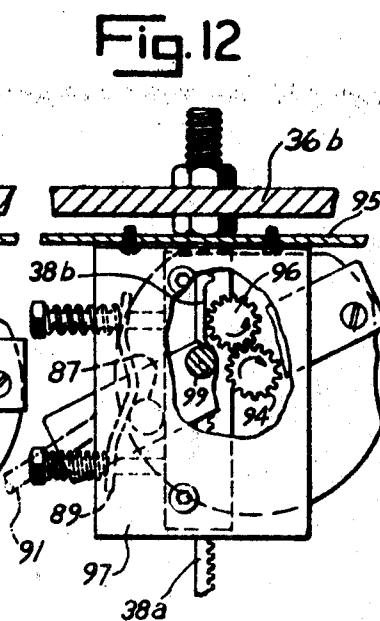
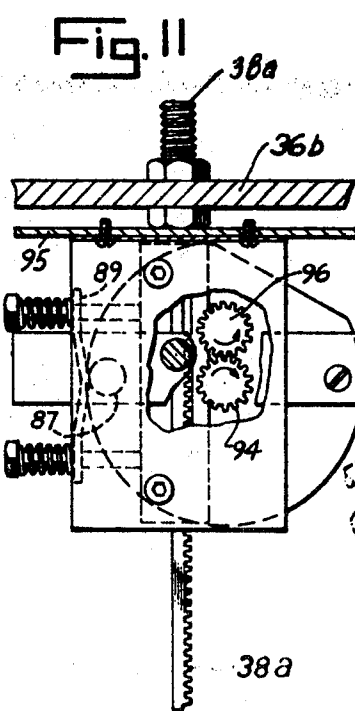
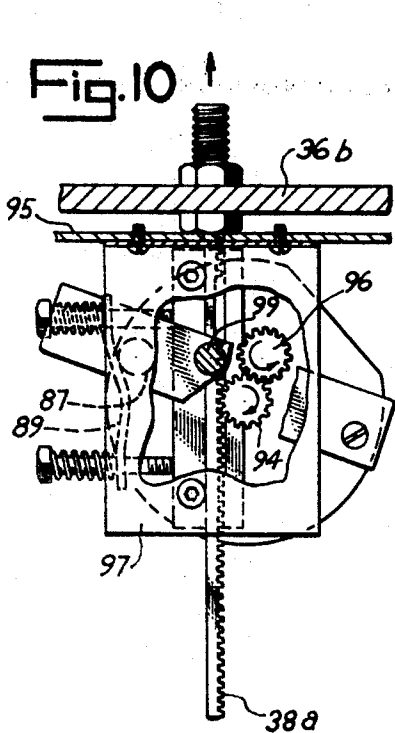
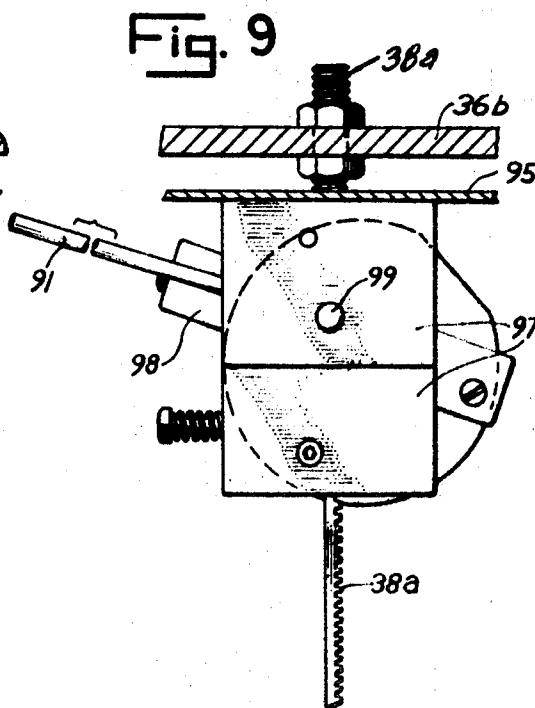
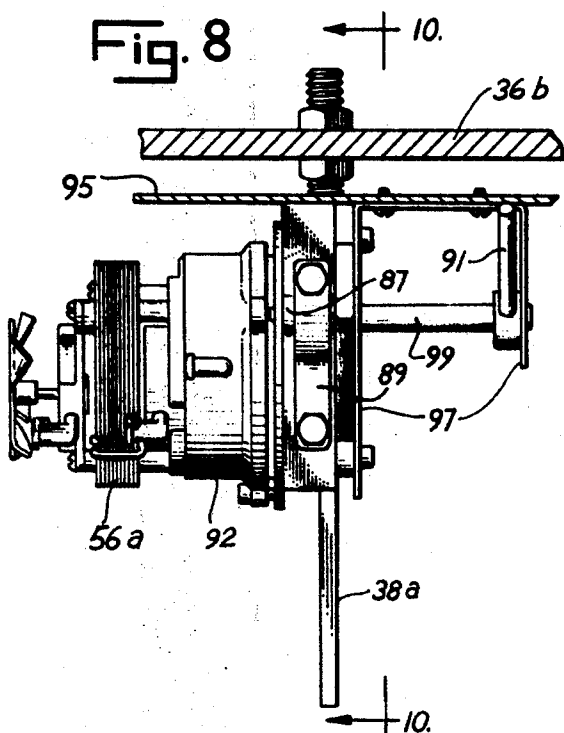
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3 Sheets-Sheet 3



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POWDER SPRAY EQUIPMENT FOR OFFSET PREVENTION

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3 Claims

ABSTRACT OF THE DISCLOSURE

Equipment for spraying powder on freshly printed sheets of paper to prevent offset. A compressed air line discharges from a nozzle directed toward the sheet of paper and has a side inlet that picks up the powder from a container. To effect such pick-up, compressed air pressurizes the powder container. The powder is agitated in the container so as to form a cloud. To insure uniform consistency of the cloud a constant level of powder is maintained in the container.

My present invention relates to powder spray equipment particularly adapted for offset prevention in the art of printing.

Heretofore the prevention of ink offset (transfer of ink from printed sheets to the backs of other printed sheets when they are piled following the printing thereof) has been practiced by four different methods all of which involve the application of anti-offset material such as particles of starch, wax or the like to the surface of the freshly printed page to absorb any ink that is still wet, and to slightly space the sheets apart as they are piled so that air can circulate between them to finish the drying process. The prevention of ink offset is particularly necessary in connection with modern day high-speed printing presses, and particularly with certain types of inks that may not dry quickly and certain types of papers which do not readily absorb the ink.

The four methods referred to are:

- (1) Liquid spray equipment in which particles of dextrin or the like are dissolved in water.
- (2) Liquid spray equipment in which particles of starch or the like are held in suspension by a chemical gelling agent.
- (3) Dry powder spray equipment.
- (4) Hot melt wax spray equipment.

Each of the four methods has the objection that "over-spraying" is required in order to insure complete coverage of the printed page. Any over-spray beyond the limits of the printed page contaminates the surrounding air and deposits on parts of the printing press and any other adjacent objects.

In the case of the method (1), the dextrin is dissolved in the water, and the water is dissipated substantially as intended in order to leave the dry particles of dextrin deposited on the printed page. Since each particle of dextrin is saturated with water it is relatively heavy when compared with dry particles such as starch or the like used in method (3) and is therefore more readily directed by the spray gun to its desired position of deposit on the printed page. The dextrin particles of method (1) are more apt to stay in position than the starch particles when discharged dry as in method (3). However, the dextrin (which is of blue-white character) is quite objectionable in the over-spray and somewhat objectionable on the printed page itself due to stickiness of the deposit. Also the mixture of water and dextrin tends to crystallize, resulting in loss of control of physical makeup of the offset prevention coating because such crystals vary

2

greatly in size as compared to the original starch particles which may be precisely controlled in the dry powder method within the optimum uniformity range of the order of 20 to 50 microns in size.

- 5 Similarly in method (2), although the chemical gelling agents tend to keep the particles in suspension, certain dryers such as alcohol or the like are additionally required, and the resulting over-spray as well as the spray on the printed page are somewhat sticky and may even
10 cause the piled sheets to adhere together with some paper and/or ink combinations which, of course, cannot be tolerated.

- Method (3) using dry powder such as starch is accomplished by either spraying the dry particles utilizing compressed air or electronically charging the particles so that they are expelled from the dry powder hopper and attracted to the printed page. The dry powder method has the advantage of absence of either the water or dextrin of method (1) or the water and the gelling agent of method (2) which required dissipation after spraying but the contamination of the surrounding air and work space is greater because excessive over-spraying is required by reason of the consistency of the spray varying. Accordingly, the spray must be adjusted to thin consistency, and then when heavy consistency is encountered over-spraying occurs. This contaminates the surrounding air and work space because the over-spray powder has a tendency to be floated away by stray air currents around the printing press. Faint "clouds" of the powder may drift to considerable distances and be deposited on remote as well as adjacent objects so that in addition to the over-spray itself the drifting powder extends the area of undesirable deposit. Also in offset printing the floating dry powder has a tendency to eventually clog the offset blanket whereas in type printing it tends to fill in the type.

- The foregoing paragraph refers to spraying whereas the electronic charging method considerably reduces the necessity for the over-spray but is a considerably more expensive system to install and maintain.

- 40 Method (4) requires more elaborate equipment than the first three methods, including heating means, and is more difficult to control and keep in properly functioning condition.

- Thus, all four methods of the prior art have both advantages and disadvantages requiring a compromise choice by printers of the method which can best be tolerated for the particular operating conditions of use.

- My present invention contemplates powder spray equipment for offset prevention wherein the offset prevention powder is constantly supplied of uniform consistency so that the equipment can be adjusted for minimum over-spray with assurance that all sheets of paper coming through the press will be uniformly sprayed. Accordingly, one object of the invention is to design spray equipment which at all times presents a uniform volume in which a cloud of spray powder is maintained regardless of the quantity of powder magazine of the equipment.

- Another object is to provide a powder magazine in the form of a container in which there is a vertically movable piston, and means to elevate the piston as the supply of the powder is depleted, such means being automatically controlled by the level of the powder in the container.

- Another object is to provide an effective agitating means for the surface of the powder in the container in the form of a rotating shaft having a laterally extending air discharge pipe that rotates within the container, thus subjecting the entire surface of the powder therein to the agitating action of discharged air.

- Still another object is to provide for powder pick up from the cloud of powder within the container and introduction thereof into a compressed air line extending to the powder spray nozzle.

A further object is to provide a powder level responsive switch operable to control the elevating movement of the piston within the magazine or powder container, and to provide a time delay means that insures against "fluttering" of the control switch causing intermittent on and off operation of a motor that drives the piston upwardly, the time delay means delaying the start of the motor until the switch has been moved sufficiently to stay in circuit closed position.

An additional object is to provide for powder-spraying the paper being printed, only at the time a printed sheet is in position below the spray nozzle.

With these and other objects in view, my invention consists in the construction, arrangement and combination of the various parts of my powder spray equipment, whereby the objects above contemplated are attained, as hereinafter more fully set forth, pointed out in my claims and illustrated in detail on the accompanying drawings, wherein:

FIG. 1 is a diagrammatic view of a pneumatic and electrical system of a powder spray system including portions of the equipment for offset prevention embodying my present invention;

FIG. 2 is a perspective view of the major portion of the mechanism of such equipment, a housing for the mechanism being shown in dot-and-dash lines and a further electrical diagram being included;

FIG. 3 is an enlarged sectional view on the line 3—3 of FIG. 2 showing a powder pick up fitting;

FIG. 4 is an enlarged sectional view on the line 4—4 of FIG. 2 showing a drive means for a powder elevating piston;

FIG. 5 is a vertical section view on the line 5—5 of FIG. 2 showing an agitator for the upper portion of the powder in the magazine or powder container;

FIG. 6 is an enlarged sectional view on the line 6—6 of FIG. 5 showing a control switch;

FIG. 7 is a vertical sectional view showing a modified form of piston elevating mechanism;

FIG. 8 is a side elevation of another modified form of piston elevating mechanism;

FIG. 9 is an end elevation thereof;

FIG. 10 is a sectional view on the line 10—10 of FIG. 8 showing the mechanism of FIGS. 8 and 9 in the position assumed before the piston starts up, the mechanism being adjusted for raising the piston;

FIG. 11 is a similar sectional view showing the mechanism adjusted to a neutral position and the piston resting in lowered position and

FIG. 12 is a similar sectional view showing the mechanism adjusted for lowering the piston and the piston all the way down after having been lowered.

On the accompanying drawings I have used the reference numeral 10 to indicate a compressed air supply line. A foreign matter filter 12, a pressure regulator 14, and a solenoid valve 16 are provided in the line 10 which extends to a spray regulating valve 20. Two lines (22 and 24) extend from the valve 20. The first line 22 is an air line to spray nozzles 28 after passing through a powder pick-up fitting 26. A powder pick-up pipe 27 depends from the fitting 26 into a container 34 for offset prevention spray powder shown in FIG. 2. The top of the container is shown at 33. The second line 24 extends into a vertical hollow shaft 30 which as shown in FIG. 5 has a pair of air discharge pipes 32 extending laterally therefrom. These are located in the container 34 which is in the form of a vertical cylinder having a vertically movable piston 36 therein. The piston is adapted to support a body of offset spray prevention powder P as shown in FIG. 5 and its periphery may be suitably provided with sealing means such as O-rings for retaining the powder.

A rack 38 depends from the piston 36 and is adapted to be driven vertically by the rotation of a pinion 40. The pinion is mounted on a shaft 42 terminating in a hand wheel 44 outside the housing H as shown in FIG. 2.

A handle 15 for the pressure regulator 14 and a control knob 21 for the spray regulator valve 20 may also be located outside the housing whereas a pressure gauge 17 to indicate the out-put pressure of the pressure regulator valve 14 may be exposed to view through a wall of the housing.

The shaft 42 is driven by a ratchet mechanism comprising a ratchet disc 46 and pawl 48, the pawl being pivoted to a pawl-carrying disc 50 oscillatable on the shaft 42. For oscillating the disc, a link 52 and a crank 54 are provided, the crank being driven by an electric motor 56 through suitable step-down gearing such as that which results in rotation of the crank shaft 55 about 1 r.p.m.

The vertical shaft 30 and the air discharge pipes 32 constitute agitating means for the upper surface and adjacent portions of the powder P in the container 34. For this purpose air is discharged from a series of spaced perforations in the pipes 32 which are shown in FIG. 5, those for the left hand pipe discharging toward the viewer and those in the right hand pipe discharging away from the viewer. The rotation of the shaft 30 is clockwise as indicated by the arrow CW so the air is discharged opposite to the direction of movement. I have found this to be the most effective arrangement for disturbing the surface of the powder and causing a cloud thereof to pervade the space in the container 34 above the level of the powder as shown by stippling. FIG. 3 illustrates the resulting pick-up of the powder due to the passage of compressed air through the fitting 26 as indicated by the arrows *a*. Other arrows *b* indicate powder pick-up which is then mixed with the air passing through as indicated by the arrow *c* and I have found this arrangement efficient to pick up the desired amount of powder without furnishing more than needed as would be the case if Venturi action were utilized.

To produce a uniform spray at all times from the nozzles 28 regardless of the quantity of powder P in the container 34, the level of powder must be maintained within close limits and this I have accomplished by means of a powder level sensing plate 64 pivoted to a fitting 66 carried by one of the pipes 32. The plate 64 is dragged around on top of the powder and carries a mercury switch 62 in circuit with the motor 56, and is also controlled by a time delay switch or relay 68 which may be an Amperite vacuum tube type of relay (No. 26N015). The circuit for the motor 56, the mercury switch 62 and the relay 68 may be supplied from current supply terminals 35. An adjustable heater 70 acts on a bimetal element 72 to close normally-open contacts in the relay after a few seconds time period following energization of the relay. Accordingly, whenever the level of the powder P is so depleted as to close the contacts in the mercury switch 62 the motor 56 will be energized but not until the time period of the relay has expired. This insures that during such time period and consequent further lowering of the level of the powder the switch 62 will be more positively closed instead of fluttering between open and closed positions, thus insuring that when the motor 56 is energized it will remain energized until such time as the piston 36 elevates the powder sufficiently to cause the level thereof to again raise the powder level sensing plate 64 to the position of FIG. 6 for again de-energizing the motor 56. Accordingly the level of the powder is maintained within relatively close limits.

The shaft 30 is rotated by a chain drive 58 from a motor 60 which may be continuously energized during operation of the equipment. The speed of rotation may be on the order of 1 r.p.s. which I find produces a uniform and constant cloud of powder in the container 34 above the level of the powder therein. The resulting spray from the nozzles 28 can be held at a minimum by proper adjustment of the spray regulating valve 20 with assurance that all sheets of printed paper will be evenly sprayed without the necessity of any over-spraying which, as hereinbefore been mentioned, is undesirable.

It is also desirable that the nozzles 28 are operable only following the deposit of a sheet and inoperable while the next sheet is being deposited. This may be accomplished by energizing the solenoid 18 of the solenoid valve 16 only at the proper time in the cycle of operation of the printing press. For this purpose a switch 41 (FIG. 1) is provided between one of the current supply terminals 35 and a wire 39 running to the solenoid 18, the other wire 37 therefrom running back to the other supply line 35. A cam 43 closes the switch 41 only after the printed sheet is deposited and only long enough to properly spray the sheet, the spraying operation being terminated before another sheet is delivered from the printing press. The cam 43 is of course driven in timed relation to the operating cycles of the printing press.

A switch 45 may be provided to shunt the switch 41 and is provided with a hand-operable lever 47 so that the spray nozzles 28 may be manually operated at any time desired for the purpose of adjusting the nozzles and/or spray regulating valve 20 which may be in the form of a needle valve. This manual operation is also an aid in adjusting the pressure regulator 14.

A modification of the mechanism for elevating the piston 36 is shown in FIG. 7 wherein the piston is indicated 36a. It is provided with an up rack 74 and a down rack 76 which which a pinion 78 is selectively engageable. The pinion and a motor 80 to drive the pinion at very low speed through suitable step-down gearing are carried by a mounting disc 84 pivoted at 86 and provided with a control lever 82 which in the solid-line position shown in FIG. 7 causes the piston to be elevated. When it is time to refill the container 34 with another charge of powder, the lever 82 may be adjusted to the "DOWN" position shown in FIG. 7 for lowering the piston, after which a cover cap 88 may be removed from a filler tube 90 (see FIG. 2) for introducing additional powder. With the equipment shown in FIG. 2 the hand wheel 44 is used for lowering the piston.

The up rack 74 has some of the teeth cut away from the lower end while the down rack 76 has some teeth cut away from the upper end to limit travel of the racks and thereby the piston 36a, as otherwise the piston might be driven too far and jammed.

Another modification is shown in FIGS. 8, 9, 10, 11 and 12 wherein the piston is indicated 36b and the rack 38a. A motor 56a is operatively connected through step-down gearing in a housing 92 to an up pinion 94 which rotates about 1 r.p.h. A down pinion 96 meshes therewith, and the motor 56a, housing 92 and pinions 94 and 96 are carried by a frame 98 secured to a rock shaft 99. The rock shaft 99 rocks in a channel shaped bracket 97 (see FIG. 8) secured to the bottom 95 of the cylinder 34 and a reversing lever 91 is also secured to the rock shaft for up operation of the mechanism when in the raised position of FIGS. 8, 9 and 10 and for down operation when in the lowered position of FIG. 12. There is also an intermediate position shown in FIG. 11 which will be referred to hereinafter.

When in the position of FIG. 10, the up pinion 94 meshes with the rack 38a and upon rotation according to the arrows on the pinions the piston 36b will be elevated. When the pinion 94 runs out of rack teeth there will be no further elevation of piston and thus the elevation thereof is limited.

The elevating mechanism of FIGS. 2 and 4 requires lifting of the pawl 48 to permit the piston 36 to be lowered. If there is pressure within the cylinder 34 the piston may be lowered rather violently. With the mechanism shown in FIG. 7 or that shown in FIGS. 8 to 12, the motor 80 or the motor 56a may be utilized for lowering the piston 36a or 36b. By quickly moving the lever 82 from the "UP" position to the "DOWN" position in FIG. 7 or the lever 91 from the raised position of FIG. 10 to the lowered position of FIG. 12, motorized up operation is changed to motorized down operation so that the piston descends

slowly instead of being forced violently downward. During the time of the lowering operation, the container 34 may be refilled with offset prevention powder.

If it is desirable, however, to let the piston be lowered independent of the motor, the lever 82 may be adjusted to the "DROP" position of FIG. 7 or the lever 91 to the neutral position of FIG. 11 with both pinions out of mesh with the rack.

FIGS. 8 to 12 also show an over-center mechanism to retain the reversing lever 91 in either the raised position of FIG. 10 or the lowered position of FIG. 12, and comprises a spring-pressed V-blade 89 coacting with a pin 87 of the frame 98 in an obvious manner. To avoid the "DROP" position of FIG. 7 or the neutral position of FIG. 11 the lever 82 or the lever 91 is quickly moved from one position to the other. When the lever 91 is in the lowered position of FIG. 12 and the piston 36b is all the way down the rack runs out of teeth for the pinion 96 where they are cut away as indicated at 38b so as to prevent jamming of the parts after the piston is all the way down and the motor 56a continues to be energized.

From the foregoing specification it will be obvious that I have provided a relatively simple mechanism for producing a uniform cloud of offset spray prevention powder and a pick-up means cooperating therewith to supply the powder to one or more nozzles suitably arranged over the sheet delivery portion of a printing press. The mechanism produces a uniform powder spray at all times because of a substantially constant volume in the "cloud" containing portion of the container 34. The agitator 30, 32 produces the cloud, and due to its rotation the cloud is uniform throughout the volume of the container provided for it so that powder pick-up through the pipe 27 is also uniform.

I claim as my invention:

1. In powder spray equipment for offset prevention, a container for offset spray powder, a compressed air line extending to a powder spray head and means for introducing offset powder into said compressed air line comprising a side inlet into said air line and communicating with the interior of said container above a body of offset spray powder therein to receive powder therefrom, means for agitating the upper portion of said body of powder, and means automatically responsive to the level of such powder to maintain such level substantially constant, said last-named means comprising a piston vertically moveable within said container and supporting the body of powder therein, power means for elevating said piston, and means controlled by the level of said powder to stop operation of said power means at a predetermined level of said powder and start the operation of said power means at a predetermined lower level of said powder, time delay means being provided between said level control means and said power means to delay operation of said power means when said control means responds to said predetermined lower level of said powder.

2. Powder spray equipment according to claim 1 wherein said means for agitating comprises an air discharge element connected with said compressed air line and discharging horizontally into said container spaced above the level of such powder and comprises an air discharge pipe having a series of air discharge openings, and means for moving said air discharge pipe within said container, said air discharge openings being directed rearwardly with respect to the direction of travel of said air discharge pipe.

3. Powder spray equipment according to claim 2 wherein said last means comprises a vertical shaft depending into said container, and means for rotating said shaft, said air discharge pipe being mounted on said shaft and extending laterally therefrom.

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