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[56]

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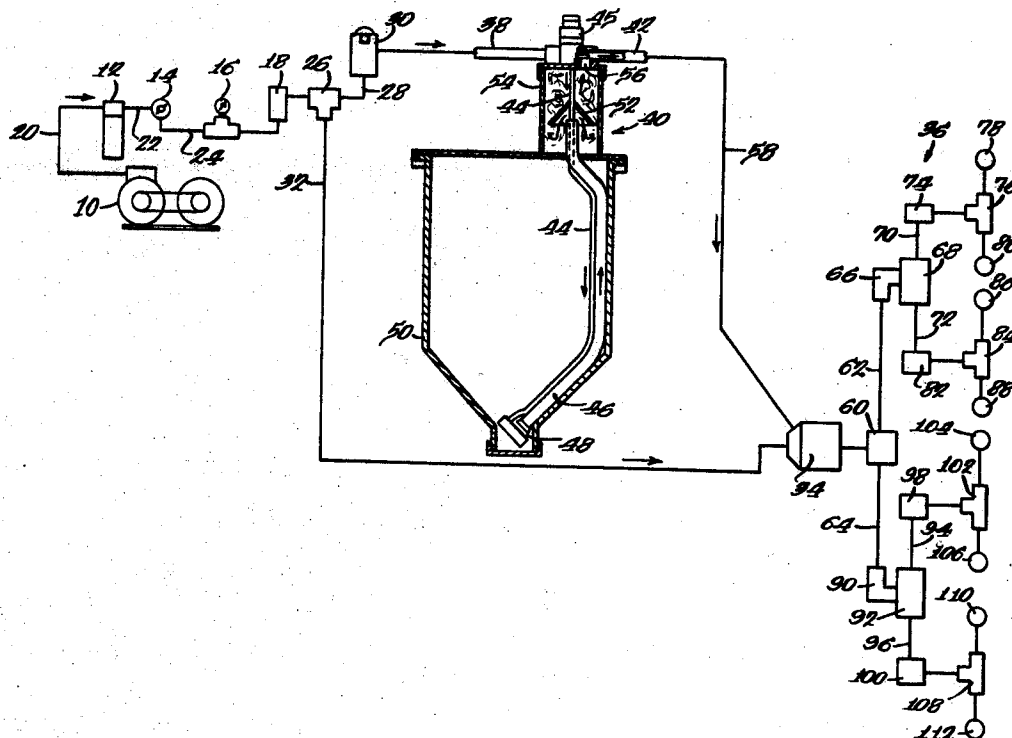
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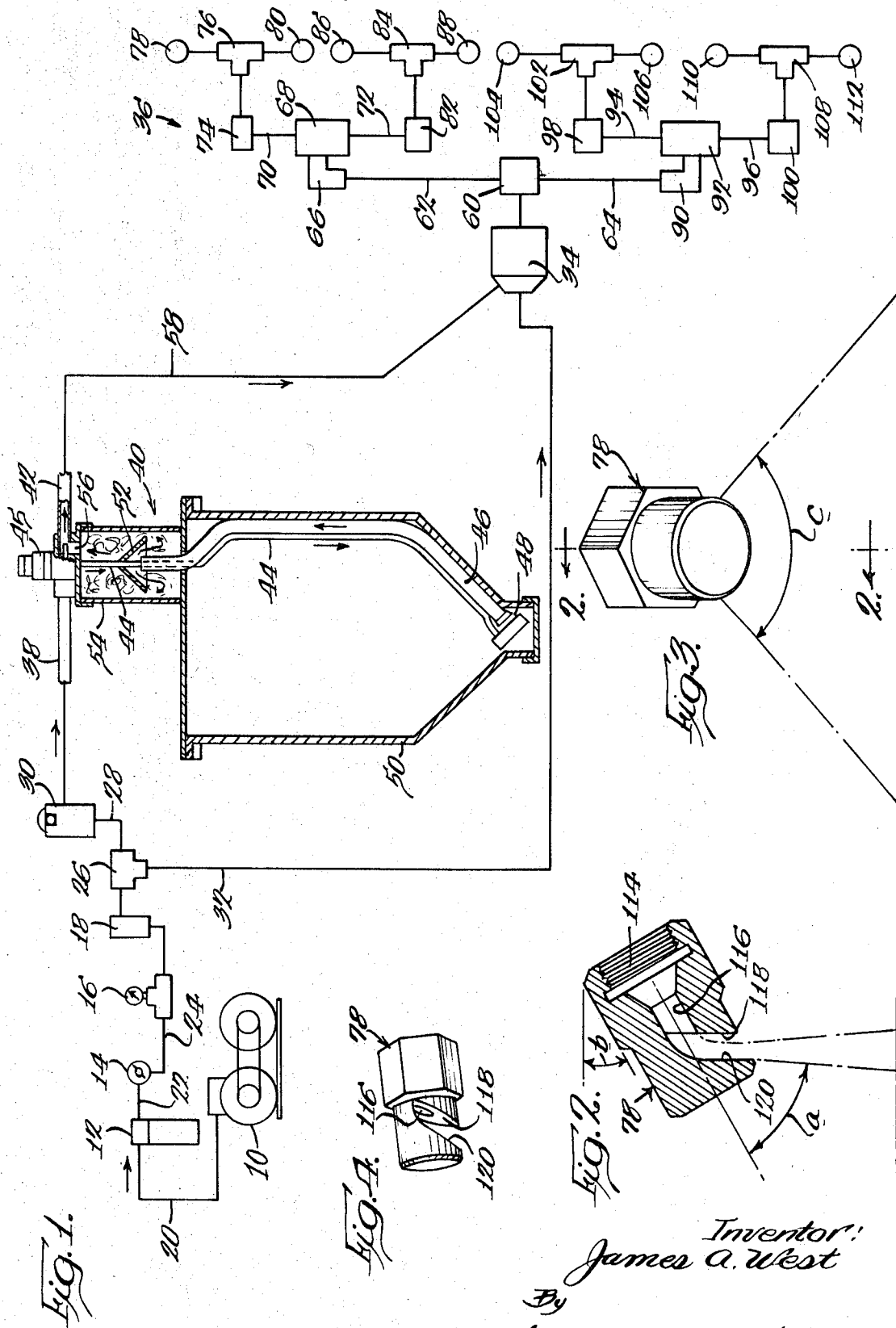
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[54] **POWDER SPRAY SYSTEM**
3 Claims, 4 Drawing Figs.

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309, 310, 311, 312, 302; 51/11; 239/(Inquired);
231/598, 521; 118/(Anti offset Digest), 315

ABSTRACT: Powder spraying apparatus which includes a plurality of nozzles fed by a manifold. Each nozzle is placed at an angle to the web being sprayed and has a deflector surface substantially perpendicular to the web. A curved transition zone is located between the nozzle and deflector to provide a fan-shaped powder spray.





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POWDER SPRAY SYSTEM

The powder spray system and method of the present invention are particularly adapted for spraying powder on flat sheet material or on a continuous web of material where it is desired to prevent adhesion of the same or other materials thereto. For example, one important application of the present invention is its use in conjunction with a printing process where it is desired to spray powder on the surfaces of printed sheets after the printing thereof and before other sheets are stacked thereon, whereby the powder acts as a spacer until the ink has dried and thereby prevents any offset effect as when ink on one sheet is transferred to the back of an adjacent sheet. The present invention may also be used to spray powder on a continuous web of material, and one example of an application of the latter type is its use to spray powder on a web of plastic material prior to or during the winding of the latter in a roll. The powder prevents the layers of plastic from adhering to one another and thus assures that the plastic roll can subsequently be unrolled without difficulty. It will thus be seen that the powder spray system of the present invention is adapted for the spraying of powder on a variety of different materials which by way of example may be in sheet form or in the form of a continuous web.

Powder spray systems have long been known in the printing arts, but considerable difficulty has been encountered in defining and controlling the powder spray. Moreover, clogging of the nozzles and powder waste have been major problems with the powder spray systems heretofore known. One important feature of the present invention relates to the use of fan deflection-type nozzles for spraying a powder and air mixture. While fan deflection-type nozzles have long been used in the nonanalogous art of spraying water, they have not heretofore been used in a powder spray system. The present invention is predicated on the new discovery that a combination of fan deflection-type nozzles with a powder supply and suitable manifolding produces an excellent, readily controllable spray pattern, and at the same time eliminates clogging of the nozzles and waste of powder. Another feature of the invention relates to the provision of an injecting air stream which is supplied continuously to the inlet of a manifold assembly whenever the associated printing press is operating so as to maintain the manifold assembly in a clean condition.

It is therefore one object of the present invention to provide improved powder spraying apparatus which is virtually non-clogging, produces an improved highly efficient powder spray pattern, and includes means for maintaining the system clear during portions of an operating cycle when spraying of powder is temporarily discontinued.

Another object of the invention is to provide an improved method of spraying a powder and air mixture which method contemplates the use of a fan deflection-type nozzle not heretofore used in a powder spray system.

The foregoing and other objects and advantages of the invention will be apparent from the following description of a preferred embodiment thereof.

Now, in order to acquaint those skilled in the art with the manner of making and using the powder spray method and apparatus of the present invention, I shall describe, in conjunction with the accompanying drawings, the best mode contemplated by me for carrying out the invention.

In the drawings:

FIG. 1 is a schematic view of a power spray system constructed in accordance with the present invention, a powder gun head unit which comprises one component of the system being shown substantially enlarged and in vertical section;

FIG. 2 is a vertical sectional view of a fan deflection-type nozzle which is used in the powder spray system of the present invention, there being eight such nozzles utilized in the particular embodiment illustrated in FIG. 1;

FIG. 3 is a front elevational view of the deflection-type nozzle of FIG. 2; and

FIG. 4 is a perspective view of the nozzle of FIGS. 2 and 3.

The preferred embodiment shown in the drawings will be described herein for use in conjunction with a printing press in order to spray powder on printed sheets after the printing thereof and before such sheets are stacked upon one another. However, it should be understood that the invention has various other applications as mentioned hereinabove, and its use with a printing press is merely to illustrate one application for which it is particularly well adapted. Referring now to the drawings, FIG. 1 shows a power spray system including an air compressor 10, an air dryer 12, an air regulator 14, a pressure gage 16 and an air valve 18, the latter being controlled from the printing press so as to be open when the press is operating. Air under pressure is conducted from the compressor 10 through an air conduit 20 to the dryer 12, through a conduit 22 to the regulator 14, and then through a conduit 24 to the air valve 18 the pressure gage 16 being located in the conduit or line 24. When the associated printing press (not shown) is in operation, the air valve 18 will be open and air will flow through the valve 18 and through a tee fitting 26 where the air is divided so that a portion thereof passes through a conduit 28 and on to a timing air valve 30, while the remainder of the air passes through a line 32 whereby it is supplied as an injecting airstream directly to a booster 34 which constitutes an inlet for a manifold assembly indicated generally at 36.

The air which passes through the timing valve 30 is conducted through a conduit 38 which leads to a powder gun unit indicated generally at 40. As the clean, dry, oil-free air enters the powder gun 40 it separates and a portion of the air flows directly through an injector tube 42 while the remainder of the air flows downwardly through a tube 44 and then upwardly in a tube 46 which is closely adjacent the tube 44.

The portion of the air which flows downwardly through the tube 44 is regulated by an air regulator 45 provided at the top of the powder gun head. As the regulated air flows upwardly into the lower end of the tube 46 it blows across an open gap 48 before it enters the tube 46 and thereby draws powder from the bottom of a container 50 into the gap and into the tube 46 causing the powder to be mixed with the air flowing upwardly in the tube 46. Thus, a powder and air mixture flows upwardly in the tube 46, and when such mixture leaves the upper end of the tube it engages against a cone-shaped deflector 52 which effects further mixing of the powder and air in a mixing chamber 54. The powder and air mixture is then drawn upwardly in the chamber 54 and through an opening 56 which communicates with the injector tube 42, the mixture being drawn up through the opening 56 due to the vacuum created by that portion of the air which flows through the powder gun inlet tube 38 and directly through the injector tube 42. Accordingly, a controlled mixture of powder and air flows out through the injector tube 42 and through a conduit 58 to the booster or manifold inlet 34.

As previously described, a portion of the air supplied to the tee fitting 26 passes through the conduit 32 and is conducted directly to the booster or manifold inlet 34, and it will now be understood that such injector air as it enters the booster 34 serves to draw the powder and air mixture from the conduit 58 into the booster 34. Moreover, the injector airstream flowing through the conduit 32 is controlled by the air valve 18 which will be open whenever the associated printing press is operating, and thus the injector airstream will be supplied continuously to the manifold inlet 34 whenever the press is operating. On the other hand, the timing valve 30 correlated to press operation, by appropriate timing and/or connecting means known in the art, in such a manner as to open and close the valve 30 in timed relation to movement of sheets of paper through the press, whereby the powder gun 40 is pulsed on and off to cause powder to be sprayed intermittently and only on printed areas of sheets of paper. Thus, whenever the timing valve 30 is closed, the main valve 18 supplies clear air to the manifold assembly 36 in order to maintain the manifold assembly in a clean condition.

As the injector air from the conduit 32 and the powder and air mixture from the conduit 58 enters the manifold inlet

member 34, they are mixed in a tee block 60 and one-half of the resulting powder and air mixture passes through a conduit 62 while the other half passes through a conduit 64. The powder and air mixture flowing through the conduit 62 passes through a fitting 66 and into a center block 68 where fitting mixture again divides and one-half thereof passes through a line 70 while the other half passes through a line 72. The line 70 leads to an end block 74 and then to a tee fitting 76 where the stream is divided so that one-half is conducted to a nozzle 78 and the other half to a nozzle 80. The line 72 leads to an end block 82 and then to a tee fitting 84 where the stream therein is divided so that one-half is conducted to a nozzle 86 and the other half to a nozzle 88. In a similar manner, the air and powder mixture distributed from the tee block 60 to the conduit 64 passes through a fitting 90 to a center block 92 and is divided so as to flow through conduits 94 and 96 respectively to end block members 98 and 100. The powder and air mixture flowing to the end block 98 is conducted to a tee fitting 102 and then to a pair of nozzles 104 and 106, while the mixture flowing to the end block 100 is conducted to a tee fitting 108 and then to a pair of nozzles 110 and 112. The three blocks or fittings 60, 68 and 92 are all preferably of a type which impart substantial turbulence to the powder and air mixture by causing the powder to spin around thereby assuring that the powder is evenly distributed to the several nozzles provided in the manifold assembly. It will be noted that in the particular embodiment illustrated in FIG. 1 there are eight nozzles provided, and the manifold assembly 36 serves to distribute one-eighth of the total powder and air mixture to each nozzle.

Each of the several nozzles shown schematically in FIG. 1 is identical to one another and thus only the nozzle 78 shown in FIGS. 2, 3 and 4 will be described herein. The nozzle 78 has a threaded female inlet 114 leading to an axial passage 116 which terminates at a surface 118. As the powder and air mixture is ejected from the end of the passage 116 it impinges against a deflection surface 120 which is inclined at a precisely predetermined angle a from the axis of the nozzle in accordance with the spray pattern desired, the angle a being approximately 60° in the embodiment illustrated and being called herein the "second angle." As the powder and air mixture impinges against the deflection surface 120 it forms a downwardly directed fan-shaped spray as shown in FIG. 3, and the spray is quite flat or narrow when viewed from the side as shown in FIG. 2.

The nozzle 78 is oriented so that its axis is inclined from the horizontal by an angle b , herein called the "first angle," which is approximately 30° , whereby the flat fan-shaped spray is aimed downwardly when it leaves the nozzle at the lower end of the deflection surface 120, the latter surface being disposed approximately vertically due to the orientation of the nozzle as shown in FIG. 2. The width of the spray pattern as viewed in FIG. 3, i.e. the included angle c defined by the fan-shaped spray, is dependent upon the angle a between the nozzle axis and the deflection surface 120. That is, by increasing the angle a , a wider spray pattern or increased included angle c will be produced, while a decrease in the angle a will produce a narrower spray pattern or smaller included angle c . In the embodiment illustrated the included spray angle c is approximately 100° .

It is important that the nozzle 78 has no internal vanes and thus is not susceptible to internal clogging of the powder being sprayed. Moreover, substantially the entire spray pattern constitutes useful spray and there is virtually no powder waste. It should be understood that the term "fan deflection-type nozzle" as used herein and in the appended claims refers to a nozzle of the general type shown in FIGS. 2-4 having a passage such as the passage 116, and a deflection surface such as the surface 120 spaced from the end of the passage 116 and arranged so that the powder and air mixture impinges against the deflection surface and is thereby formed into a flat or narrow generally fan-shaped spray pattern.

The operation of the foregoing powder spray system in conjunction with a printing press will now be reviewed briefly. The plurality of nozzles, there being eight nozzles shown in the embodiment of FIG. 1 at 78, 80, 86, 88, 104, 106, 110 and 112, are arranged above an area past which printed sheets are moved so that the powder will be sprayed on the printed surfaces of such sheets before they are stacked upon one another and will act in effect as a spacing medium between the sheets until the ink has had an opportunity to dry. For intermittent operation, the timing valve 30 is operable to open and close at predetermined time intervals so as to pulse the powder and air mixture through the powder gun assembly 40 and the line 58 to the manifold assembly 36. However, during such intermittent operation, the air valve 18 remains open as long as the printing press is operating. Thus, even during portions of the cycle when no powder is being supplied to the manifold assembly 36, an injector airstream flows continuously through the line 32 to the manifold inlet or booster 34 so as to maintain the manifold assembly 36 in a clean, clear condition. For continuous operation, the timing valve 30 is eliminated or conditioned to remain open and thus the powder will continuously be sprayed from the nozzles so as to sweep the printed sheets as long as the printing press is on impression. The fan deflection-type nozzles have no vanes or cup-shaped recessed areas where residual powder can build up and cause clogging and sporadic puffs of excess powder as in the case of conventional powder nozzles heretofore used, and they produce a highly desirable flat, fan-shaped powder spray pattern which is substantially entirely useful and thus minimizes powder waste. Moreover, as previously described, the three blocks or fittings 60, 68 and 92 are preferably turbulence producing fittings which spin the powder and distribute the same evenly to each of the plurality of nozzles so as to provide for uniformity in the powder spray emitted from each of the nozzles.

While I have described my invention in a preferred form, I do not intend to be limited to such form, except insofar as the appended claims are so limited, since modifications coming within the scope of my invention will readily occur to those skilled in the art, particularly with my disclosure before them.

I claim:

1. In a powder spray system for spraying a mixture of powder and air on the surface of web or sheet material, including means for supporting and locating the web or sheet material during the spraying thereof, the improvement comprising, in combination, a plurality of fan deflection-type nozzles disposed above said material to be sprayed and having deflection surfaces which when impinged by a powder and air mixture will form the same into a plurality of relatively flat fan-shaped sprays contiguous to one another at the surface of the material to be sprayed, each of said nozzles having an axial passage inclined downwardly at a first angle to the surface of the material to be sprayed, a deflection surface inclined downwardly at a second angle from said axial passage and a curved transition surface leading from said axial passage to said deflection surface for producing a spray of powder and air parallel with said deflection surface, the sum of said first and second angles being approximately 90° whereby the deflection surface of each of said nozzles will be disposed approximately perpendicular to the surface of the material to be sprayed so as to produce a flat fan-shaped spray directed approximately perpendicular to said surface, a manifold assembly for distributing a powder and air mixture to each of said nozzles, and powder gun means for supplying a mixture of powder and air to said manifold assembly.

2. A powder spray system of the type defined in claim 1 including injection means for supplying an injection airstream to said manifold assembly, first automatically operable timing valve means for controlling the supply of powder and air so as to pulse the mixture of powder and air to said manifold assembly at predetermined timed intervals, and second valve means for controlling said supply of injection air to said manifold assembly, said second valve means being continuously open whenever an associated printing press is operating

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whereby said injection airstream will be continuously supplied to said manifold assembly even when said timing valve means is closed to maintain said manifold assembly free of residue powder.

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3. A powder spray system of the type defined in claim 1 where said first angle is approximately 30° and said second angle is approximately 60°.

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