Dec. 4, 1951 E. GUSTAFSSON ET AL 2,577,519

DRY POWDER SPRAYER

Filed May 14, 1947

5 Sheets-Sheet 1

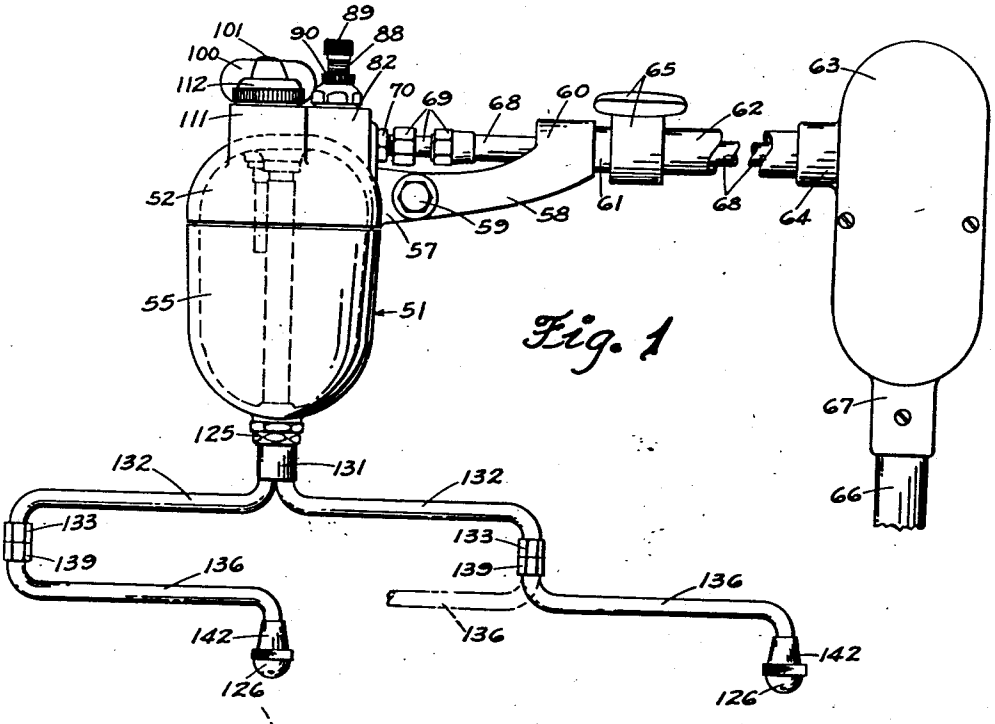


Fig. 1

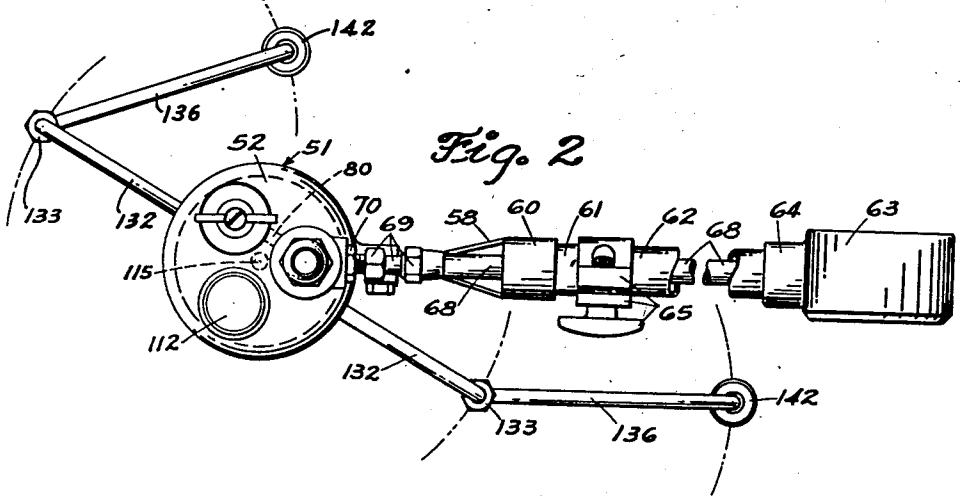


Fig. 2

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Fig. 3

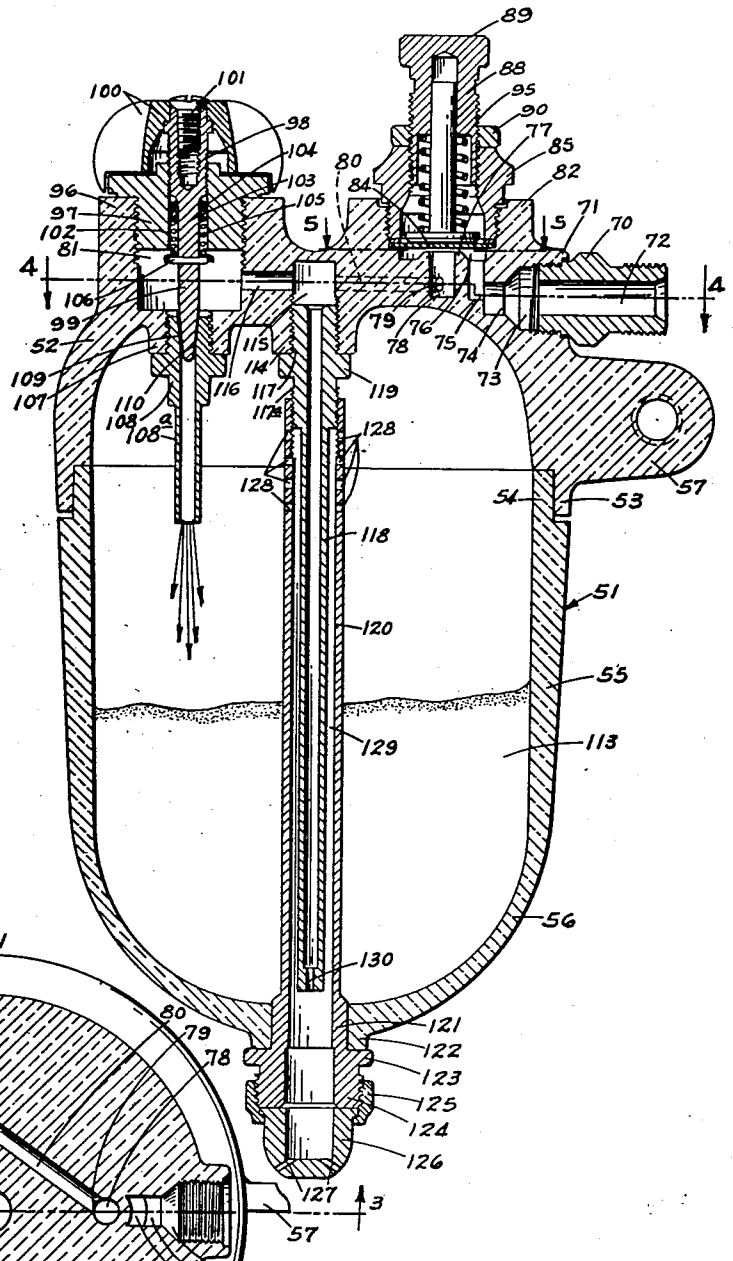


Fig. 5

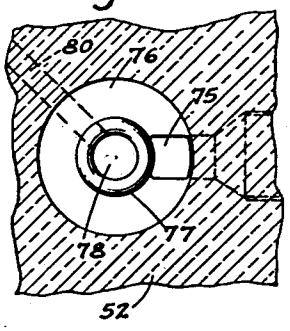
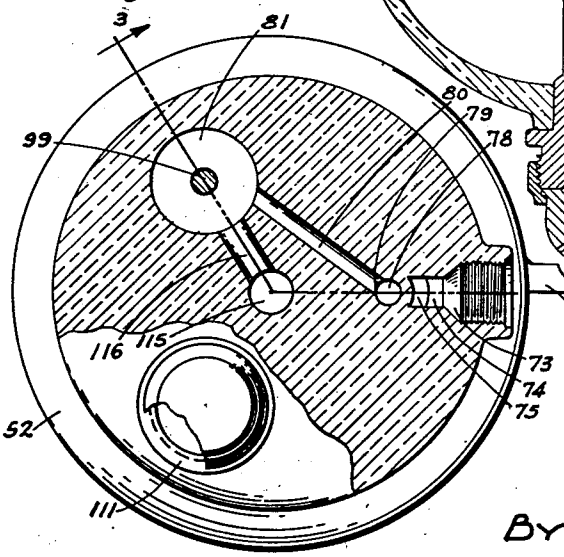


Fig. 4



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Fig. 6

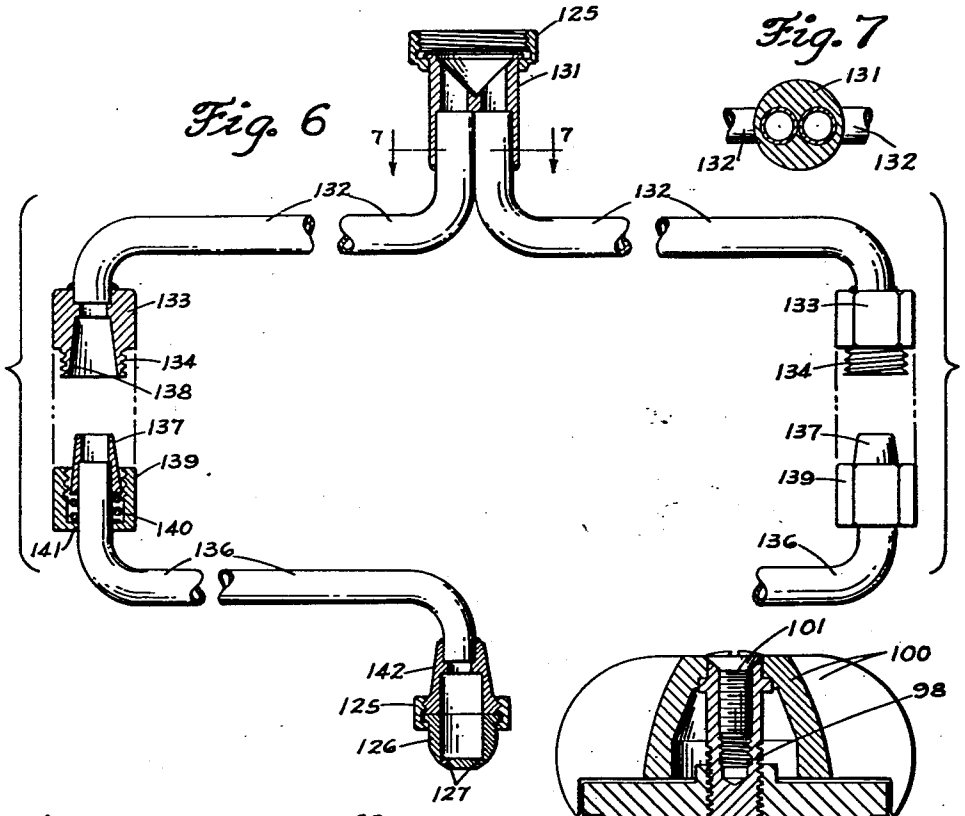
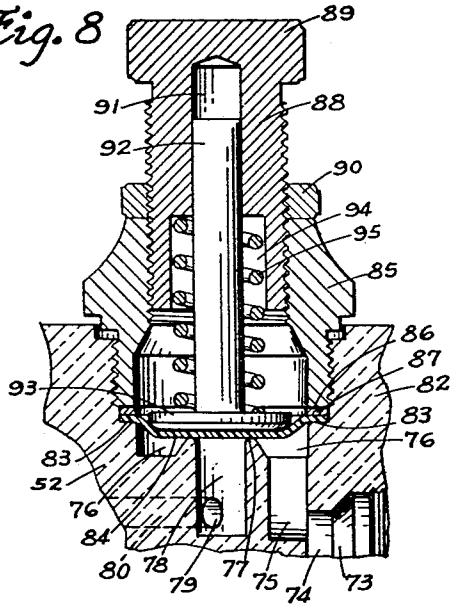


Fig. 7

Fig. 8



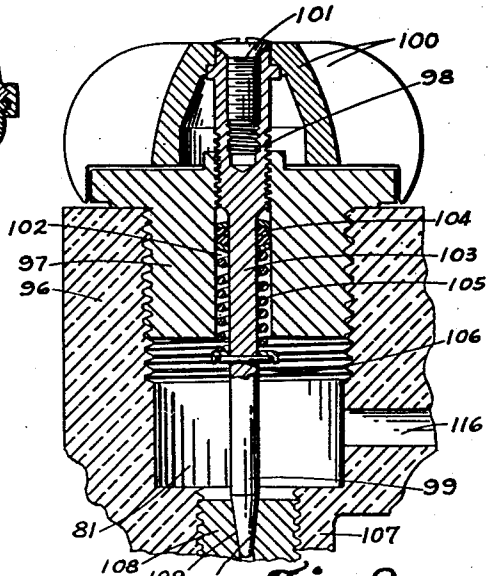


Fig. 9

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Fig. 10

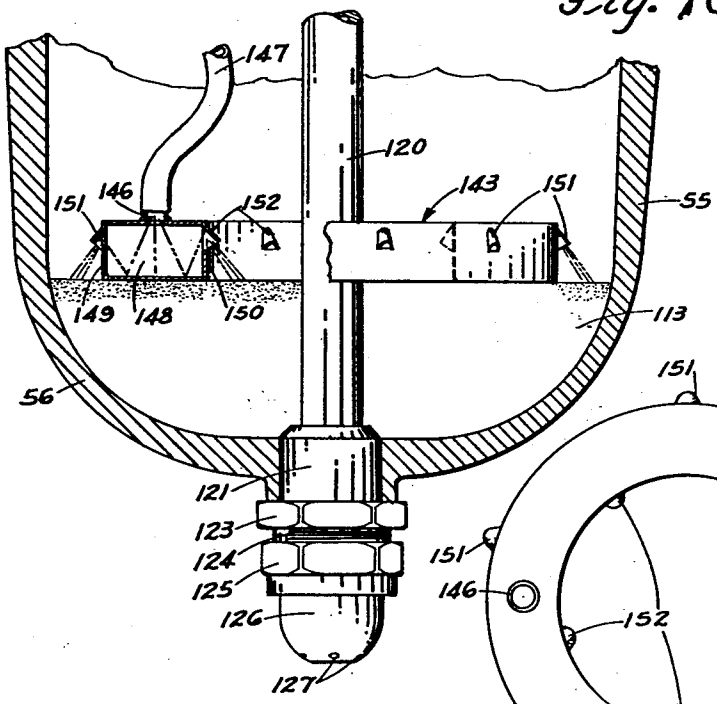


Fig. 11

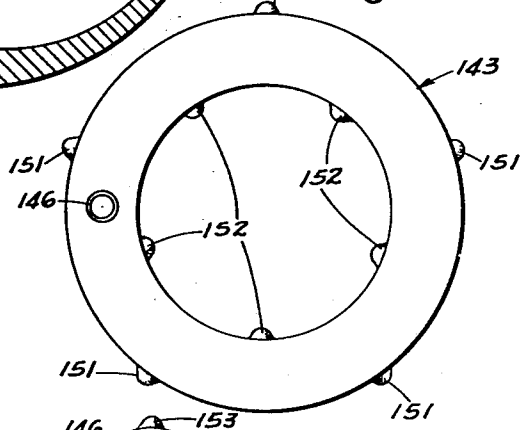


Fig. 12

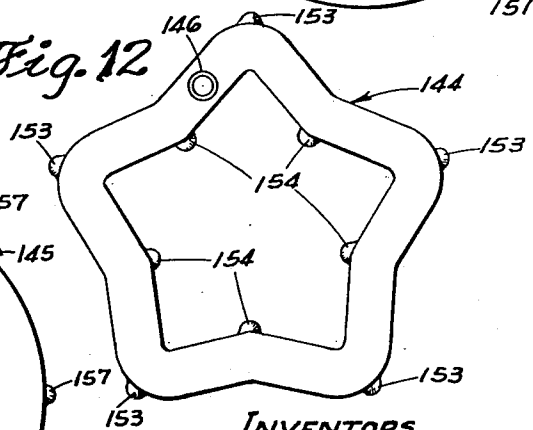
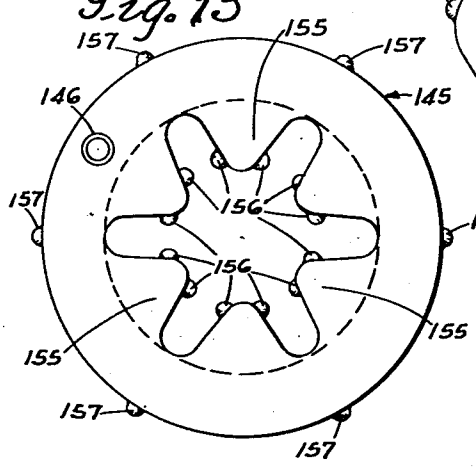


Fig. 13



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DRY POWDER SPRAYER

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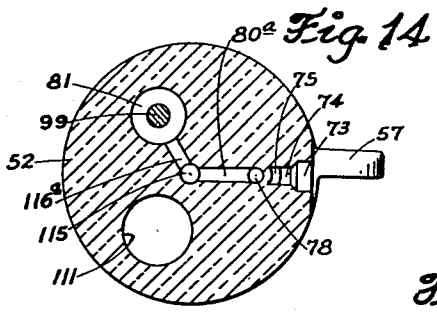


Fig. 14

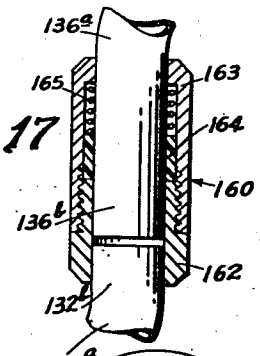


Fig. 17

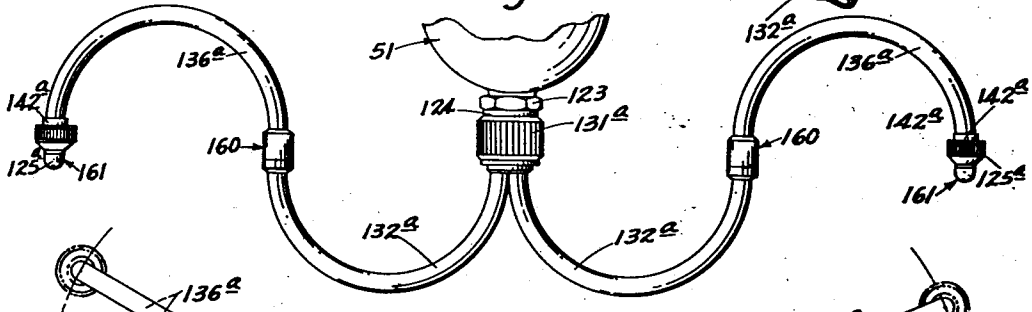


Fig. 15

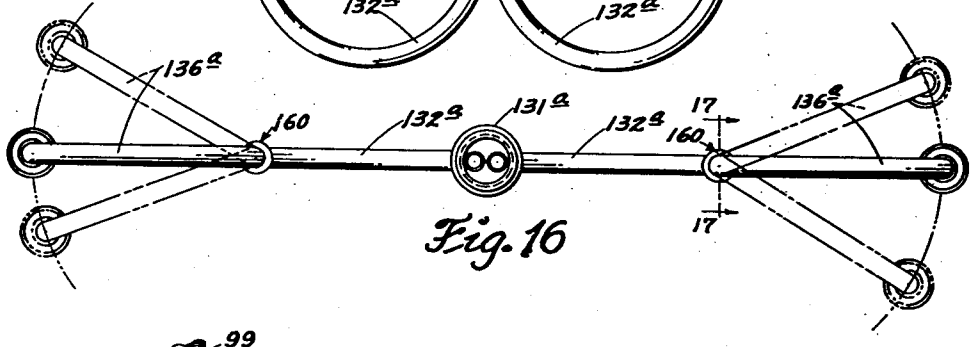


Fig. 16

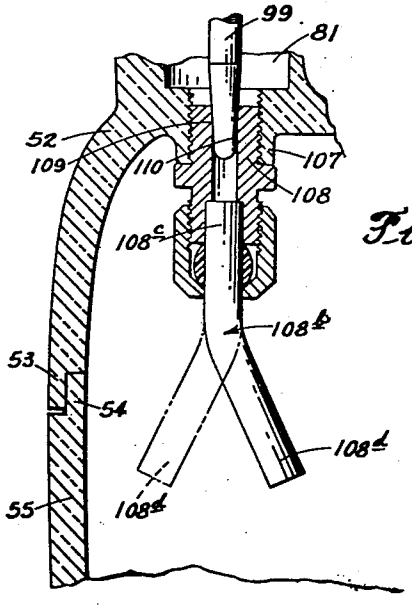


Fig. 18

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UNITED STATES PATENT OFFICE

2,577,519

DRY POWDER SPRAYER

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Application May 14, 1947, Serial No. 748,092

9 Claims. (Cl. 91—45)

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The present invention relates to spraying devices and more particularly to means for spraying powder or powder-like material or substance.

Among the objects of the invention is to provide a novel device or means for distributing a dry powder or powdery substance in the form of a cloud or clouds, particularly for use upon printed sheets in printing as they are moved toward stacking or like position to prevent offset of ink, colors, and the like; comprising a chamber, container or holder, made of any suitable material, but preferably of transparent or like material, for holding the substance, with means for projecting a fluid, such as air, against or into such substance to nebulate or form a homogeneous fluidal and aerated mass of fine particles and air or the like, and with means for conducting such mass with or without more air or the like to a locus of use or application or the like.

Another object of the invention is to provide such means with a novel means of distribution of the nebulated and aerated mass or particles to effect a wide range of application over the printed sheets of different sizes and shapes, which means is preferably adjustable for such purposes.

A still further object of the invention is to provide a novel cover means which carries as a unit the air passages, the air nozzles, the filler means, and the control valves for the passage of air to the powder chamber.

A further object of the invention is to provide novel means for effecting the fluid impulses for the nebulating and aerating of the substance, directly and proximately to the mass of material to be nebulated and aerated, as also to likewise effect the delivery of the nebulated and aerated cloud or clouds of the particles to the locus of application.

Another object of the invention is to provide novel means for more evenly applying the fluid impulses to the mass to be nebulated and aerated.

A still further object is to provide a novel device with means for facilitating the adding or replenishing of more material to the device without dismantling the device.

Another object of the invention is to provide a novel assembly of the parts.

Other objects, advantages, capabilities, features, and the like are comprehended by the invention as will later appear, or as are inherently possessed by the invention.

Referring briefly to the drawings:

Fig. 1 is a view in elevation of an assembly embodying the invention;

Fig. 2 is a top plan view of the same;

Fig. 3 is a vertical sectional view, on an enlarged scale, of the device;

Fig. 4 is a horizontal sectional view taken in a plane represented by line 4—4 in Fig. 3 of the drawings;

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Fig. 5 is a fragmentary sectional view taken in a plane represented by line 5—5 in Fig. 3 of the drawings;

Fig. 6 is a part elevational and part sectional view of an adjustable distributing portion of the device;

Fig. 7 is a sectional view taken in a plane represented by line 7—7 in Fig. 6 of the drawings;

Fig. 8 is a fragmentary vertical sectional view, on an enlarged scale, of a control feature shown in Fig. 3;

Fig. 9 is a similar view of another control feature shown in Fig. 3;

Fig. 10 is a part sectional view of the holder and air delivery means floating on the material in the holder;

Figs. 11, 12 and 13 are plan views of alternate forms of the float means.

Fig. 14 is a sectional view similar to that shown in Fig. 4, on a smaller scale, of an alternate form of device;

Fig. 15 is an elevational view of an alternate form of adjustable distributing portion of the device, comparative to that shown in Figs. 1 and 6;

Fig. 16 is a top plan view of the distributive part of the device shown in Fig. 15;

Fig. 17 is a part sectional view taken in a plane represented by line 17—17 in Fig. 16 of the drawings; and,

Fig. 18 is a fragmentary sectional view of an air supply nozzle part alternative to that shown in Fig. 3.

Referring more in detail to the drawings, the embodiments chosen to illustrate the invention comprises a container, holder or chamber 51, which can be made of any suitable material, preferably of transparent material, such as a synthetic or plastic material, through which the material and the parts inside the holder or chamber 51 may be easily seen. The chamber or container 51 comprises an upper chamber portion comprised in a top, cap or cover 52 having a lip, flange or rim 53 (see Fig. 3) for fitting with a sealing fit to a neck, flange or rim portion 54 of the lower or bowl like chamber portion 55 of the chamber holder 51. As shown the bowl portion 55 is tapered generally downwardly as well as having its wall also tapered to offer a reduced thickness portion 56 to afford a certain amount of flexing at such portion if and when desired.

The cap, closure or cover 52 has a supporting lug or ear 57 (see Figs. 1 and 3) which may be clamped to an arm 58 (see Figs. 1 and 2) as by way of any suitable connecting means, such as a bolt 59, or the like. The arm 58 has a hub 60 in which is connected a tube 61 telescopically adjustable in a tube 62 connected to a box or housing 63, as by way of a hub 64. The relative linear adjustment of the telescopic tubes 61 and 62 is fixed by a suitable clamping means 65 (see Figs.

1 and 2). The box or housing 63 is supported on and connected to the upper end of the hollow post 66, as by way of a hub 67, the post being suitably associated with a printing press or the like (not shown).

Extending through the telescopic tube means 61—62 is a flexible air delivery tube 68 which is coupled at an end thereof by way of a suitable coupling means 69 which is in turn coupled to a coupling member 70 (see Fig. 3) secured, as threaded, to a threaded socket portion 71 of the cap 52 (see Fig. 3), and with the other portion of the tube 68 extending through the tube 61—62 to the box 63 in which the tube 68 is reeled on a suitable let-off and take-up means (not shown) in the box 63, and thence connected, as by way of the post 66, to a suitable air compressing means associated with the press, (not shown).

The coupling 70 has a passage 72 for delivery of compressed air to a chamber 73 of the socket portion 71, and this chamber 73 has a passage 74 leading to a passage 75 which in turn leads to a valve chamber 76, all formed with and provided in the cap 52 (see Figs. 3 and 8). In the valve chamber 76 is a valve seat 77 surrounding a valve chamber outlet passage or chamber 78 and in the wall of the chamber 78 is an outlet port 79 in communication with an air passage 80 (see Fig. 4) leading to a valve chamber 81.

Referring to Fig. 14, in lieu of running an air passage 80 from the chamber 78 to the valve chamber 81, a more direct and shorter passage 80^a is run from the chamber 78 to a central recess or chamber 115 (later described) and from this recess or chamber 115 is run an air passage 116^a, which serves the same purpose of supplying air or air impulses to the chamber 81, in lieu of by way of the passage 80 as shown in Fig. 4.

At the chamber 76 the cap 52 has a hub portion 82 having an annular valve seat 83 on which is supported the border of a diaphragm type of valve 84. The hub 82 is threaded to receive a hollow nut 85 having an annular seating portion 86 (see Fig. 8) for pressing against a pressure ring 87 which seats on the border portion of the diaphragm 84, thus sealingly holding the parts in place.

The nut 85 is threaded to adjustably receive an adjusting nut 88 having a head 89 for digital engagement when adjusting the nut 88. The nut 88 may be held in adjusted relation by way of the locknut 90 threaded to the nut 88 and engageable with the top of the nut 85 (see Fig. 8). In the nut 88 is a chamber 91 in which is slideable the stem 92 of a valve follower or valve pressure head 93, and the nut 88 also has a spring chamber 94 in which is an end portion of the spring 95, the other end portion of this spring being pressed against the valve follower or head 93, as shown in Fig. 8.

The cap 52 also has a hub portion 96 in which the chamber 81 is provided, and this hub 96 is threaded to receive a valve control means comprising a plug 97 threaded in the hub 96 (see Fig. 9). In this plug 97 is threadedly engaged a threaded stem portion 98 of a valve 99. At the upper end of the stem 98 is connected a finger piece 100 held in operative relation to the stem 98 by a set screw 101 or the like, whereby the opening of the valve 99 may be adjusted by a digital turning of the piece 100 and the consequent adjusting of the threaded part of the stem 98 in the plug 97. The plug 97 has a recess or chamber 102 through which extends a reduced portion 103 of the stem 98, and in this recess 102 is located suitable packing means 104 held pressed by a spring 105 which reacts against a crosspin 106 provided in the stem portion 103.

The cap or cover 52 is provided with a threaded hub portion 107 in which is connected an air nozzle connector 108 carrying an air nozzle 108^a and 108^b (see Figs. 3, 9 and 18), and having a valve seat portion 109 cooperative with the seating portion 110 of the valve 99. As shown in Fig. 3 the nozzle 108^a is fixed to the connector 108 and is straight to direct air impulses downwardly against the powder 113 in the chamber 51 so as to stir up a cloud of dust or powder and to cause it to be nebulated and aerated. With some kinds of dust the direct downward projection of the air impulses from the nozzle 108^a may cause the forming of a deep recess or well in the powder mass. Hence, it is desirable, in such cases, to provide a nozzle such as 108^b shown in Fig. 18. In this case the upper end portion 108^c of the nozzle 108^b turnably fits in a socketed part of the nozzle connector 108 so that the lower portion 108^d of the nozzle 108^b is bent to take different angular positions as shown by way of illustration, in full and dotted line positions in Fig. 18, so that the air impulses may be directed toward different portions of the surface of the powder 113 in the chamber 51 as also with a more or less horizontal component of direction of thrust of the air impulses, whereby there is a better stirring up and a more widely distribution of the disturbed powder or powder particles, and also an avoidance of the formation of a hole or pit or pocket in the powder mass.

The cap or cover 52 also has a filler hub or the like 111 closed by a filler cap 112 (see Figs. 1 and 2). When it is desired to replenish the chamber or holder 51 with more powder 113 a simple removing of the cap 112 is all that is necessary for the pouring in or adding of some more powder, after which the cap 112 may be closed.

At the central portion of the cap 52 is provided a threaded hub 114 having a recess or chamber 115 communicating by way of a passage 116 leading to the valve chamber 81, and in the case of the form shown in Fig. 14, also communication with the passage 80^a leading to the valve chamber 78. In the hub 114 is connected the shank portion 117 of an air nozzle 118, the shank 117 having a nut portion 119 for screwing the shank 117 home (see Fig. 3). The shank portion 117 also has a portion 117^a to which is threadedly engaged the upper or inner end of a mixing chamber 120, the latter extending down or away and having a hub portion 121 fitting closely in a hub portion 122 at the lower end or remote portion of the holder 51. See Fig. 3. The part 121 has a nut or like part 123 adapted to turn the parts 120 and 121 and also abut the hub 122. The lower or outer portion 124 of the hub 121 is threaded to receive a coupling member 125 for the holding on of a spray nozzle head, tip or the like 126 which may have any suitable spray orifices or the like 127.

At the upper or inner end portion of the mixing chamber 120 is provided one or more orifices 128 through which air and powder particles may be entrained and pass into the annular chamber 129. The lower or outer end of the air nozzle 118 is quite remote from the orifices 128, and is provided with an outlet or orifice 130 so as to project therethrough a jet of air so as to act with an aspirating effect on the mixture of air and powder passing down or along the chamber 129 to the nozzle 126.

When assembling, the bowl part or chamber 55 and the cover 52 are located with the flanges 53 and 54 together and the assembly 120—121—123 is inserted through the hub 122 for the threaded upper or inner end of the chamber 120 to engage with the threaded part 117a of the shank 117, and by turning the same by way of the nut 123 the parts are screwed home and the flanged parts 53 and 54 are held in sealed condition.

In operation, air under pressure is supplied by way of the air delivery tube 68 to the valve chamber 76. When the pressure rises to the point sufficient to overcome the force of the spring 95, the valve diaphragm 84 will raise suddenly from its seat 77 and permit a charge of air under pressure to pass, as an impulse, through the passages 78 and 80 to the chamber 81, or through the passages 78 and 80a to the chamber 115, and also by way of the passage 116a to the chamber 81, and, in the case of Figs. 3 and 4, thence by way of the passages 116, 115 and 118, and in the case of Fig. 14, thence by way of the passages 115 and 118 to be ejected by way of the orifice 130 to aspirate air and powder in the chamber 129 and to project the resultant mass by way of the nozzle 126—127; and at the same time some of the air charge will pass through the valve 109—110 and nozzle 108a or 108b to project puffs or charges of compressed air against the powder 113 to cause the same to be stirred up and form a cloud or clouds of the dust or particles and the air, which will pass through the orifice or orifices 128 into the chamber 129 and be drawn by and with the air jet projected from the orifice 130. The pressure of the air charges is regulated by adjusting the pressure on the spring 95, and the density or intensity of the powder content in the mixture of air and powder in the chamber 55 of the holder 51 and in the chamber 129 is regulated by adjusting the valve 109—110. Any desired result may be obtained by simply those two adjustments.

In use, a single spray nozzle 126, as shown in Fig. 3, may be sufficient when spraying a small printed sheet, but when larger sheets are being printed the nozzle arrangement as shown by way of illustration in Figs. 1, 2, 6, 15 and 16 may be used. Such arrangement is shown as comprising a header 131 or 131a adapted to be coupled to the nozzle hub 124 by way of the coupling member 125 or the header 131a. Connected to this header 131 or 131a are two or more ducts 132 or 132a, as desired. The ducts 132 have nozzle heads 133 of suitable form and provided with threaded portions 134 which correspond to the part 124 of the showing made in Fig. 3. Hence, if the spread of the arms 132 is sufficient for spraying on the sheets of a size being printed, it is then only necessary to attach the nozzle tips 126 and the couplings 125, by abutting the nozzle tips 126 to the ends of the parts 134, and screwing home the couplings 125 on the threaded parts 134.

In the case of Figs. 15 and 16, the ducts 132a, which are curved for affording a minimum resistance of passage of the impulsed mixture of air and material, are connected to ducts 136a, also likewise curved for like reasons, by way of swivel type of coupling means 160, and the outer ends of the ducts 136a have connected thereto spray nozzles or nozzle heads 161.

Referring to Figs. 1, 2 and 6, for use with large or larger printed sheets, adjustable tube arms 136 may be connected to the parts 133—134, such as arms 136 comprising tapered or telescopic connector parts 137 adapted to fit into corresponding parts 138 of the parts 133, so that the part 137 may rotate in the part 138 and still be in sealing contact. The parts 137 are connected to an end of the tubes 136 and carry union or coupling members 139 threaded to engage the parts 134 and also to compress springs 140 carried in them and between the part 137 and a flange part 141 of the part 139. See Fig. 6. The free ends of the tubes 136 carry nozzle parts 142 threaded to receive the couplings 125 for holding the nozzle parts 126 in abutment thereto, as in the case shown in Fig. 3. Hence, the arms 136 may be angularly adjusted to cover any area of printed sheets desired. The arm parts 132 may also be angularly adjusted in the header 131.

Referring to Figs. 15, 16 and 17, the arms 132a and 136a are swivelly jointed or joined by way of the coupling means 160. This means comprises a threaded part 162 in which fits an end portion 132b of the duct arm 132a, and thread to the part 162 is a connector 163 in which extends an end portion 136b of the duct arm 136a, and which portion 136b turns or swivels when adjusting the position of the arms 132a and 136a. In the member 163 is provided suitable packing or sealing means 164 and a spring 165 for holding the packing or sealing means 164 in sealing condition. The arms 132a may also, if desired, turn in the connection 131a.

The spray nozzles 161 at the outer ends of the arms 136a may be of similar structure to that shown in Fig. 6, and wherein the nozzle 161 may be connected to an end part 142a fixed to the end of the arm 136a, and suitably threaded to receive a coupling ring 125a.

Referring to Figs. 10, 11, 12 and 13, on the powder 113 in the chamber 55 are shown a sort of float means 143, 144, 145, in the general form of hollow rings or the like, each having an inlet tube or neck 146 to which is connected a flexible tube 147 (see Fig. 10), the other end of the tube 147 being connected to the delivery end of the air nozzle 108a or 108d (see Figs. 3 and 18).

Referring to Figs. 10 and 11, the float 143 is shown of annular form so that it can spacedly surround the member 120 and rest upon the powder 113, and it has a chamber 148 in which the air charges from the nozzle 108a or 108d and tube 147 are supplied. At the upper portions of the outer and inner walls 149 and 150 of the member 143 are provided a plurality of downwardly directed and outwardly inclined air jet nozzles or noses 151 and 152 through which air may be impelled to be projected against the powder 113, at distributive points, to evenly stir up the powder so as to nebulate it and aerate it with the air, and also to effect reaction forces so as to maintain the member 143 at the surface of the powder mass, as in a floating condition, so as to counteract the tendency of submerging the member 143, especially when fresh powder is added to the chamber 55 by way of the filler hub 111 from time to time. The members 143, 144 and 145 are preferably made or composed of lightweight material, such as a synthetic, plastic or like material, and also may be transparent if desired.

The form shown in Fig. 12 is of a more or less tortuous form and having outer and inner air jet nozzles or noses 153 and 154 corresponding to the noses 151 and 152 shown in Fig. 10.

The form shown in Fig. 13 is of generally annular form and also has inwardly extending chamber portions or lobes 155, as shown in Fig. 13, and these lobes have at the sides thereof and near the top thereof air jet nozzles or noses 156

corresponding to the noses 152 and 154 shown in Figs. 10, 11 and 12. The chamber 145 also has outer noses 157 corresponding to outer noses 151 and 153 shown in Figs. 10, 11 and 12.

While we have herein described and upon the drawings shown illustrative embodiments of our invention, it is to be understood that the invention is not limited thereto but comprehends other constructions, details, arrangements of parts, features, and the like without departing from the spirit of the invention.

Having thus disclosed the invention, we claim:

1. In a device for spraying a dry powder material, comprising a holder having a hollow body portion providing a chamber portion for normally holding the dry powder material and a cover portion also having a hollow portion providing a chamber portion above the said chamber portion in said hollow body portion, both said body portion and said cover portion having mutually engageable closing parts for uniting said chamber portions, a connecting means connected at its lower end to the lower portion of said first mentioned chamber portion of said body portion and extending upwardly in both said chamber portions and connected at its upper end to said cover portion for holding said body portion and said cover portion in mutually closed condition, said cover portion having an air passage provided with an air inlet and an air outlet means extending in said chamber portions provided between said body portion and said cover portion, said connecting means having a passage provided with an inlet means at its upper end portion for communicating with said air passage provided in said cover portion, and said connecting means having an outlet means at its lower end portion, said connecting means having a passage at an upper portion thereof for powdered material and air to pass from the upper portion of said chamber portions into said passage in said connecting means, and a spray means connected to said lower end portion of said connecting means and communicating with said passage in said connecting means and extending outside of the chamber portion of said body portion.

2. A device as set forth in claim 1, and wherein said air passage in said cover portion has a nozzle extending into said chamber portions and above said powder therein for projecting air against said powder in said first chamber portion and to stir up and mix with some of said powder for said mixture to pass into the passage provided at the upper portion of said connecting means.

3. A device as set forth in claim 2, and wherein said air passage in said cover has a valve means for controlling and regulating the passage of air from said air passage in said cover portion and to said nozzle extending into said chamber portions.

4. A device as set forth in claim 3, and wherein is provided an air-pressure control valve in said air inlet of said air passage provided in said cover portion.

5. In a device for spraying a dry powder material, comprising a holder having a chamber for the dry powder material and having a lower body portion providing a chamber portion for normally holding the dry powder material and an upper cover portion also having a chamber portion normally in communication with said first mentioned chamber portion, said body portion and said cover portion having mutually engageable closing portions, connecting means connected to said body portion and to said cover portion for connecting said body portion and said cover portion together at said mutually engageable closing portions, said connecting means having a passage therein and provided with an opening at an upper portion thereof and having a lower portion thereof extending through and outwardly of said lower body portion and exteriorly of said chamber, a spray nozzle means connected to said lower end portion of said connecting means and communicating with said passage in said connecting means, said cover portion having an air passage therein with said air passage provided with an air discharge means located in the upper portion of said chamber for supplying air to the powdery material located in said first mentioned chamber portion for producing a cloud of powdery material in said chamber portions to flow to said openings in the upper portion of said connecting means and to said passage in said connecting means.

6. A device as set forth in claim 5, and wherein said passage in said cover portion has a passage portion extending to and connected to the passage in said connecting means at said upper portion thereof.

7. A device as set forth in claim 6, and wherein said cover portion has an air discharge means located in the upper portion of said chamber for supplying air to said powdery material, and comprises an air distributing means floating on the powdery material in said holder, and an air duct connected to said floating means and to said air discharge means.

8. A device as set forth in claim 7, and wherein said floating air distributing means has downwardly directed air distributing nozzles for projecting jets of air against said powdery material in said holder.

9. A device as set forth in claim 7, and wherein said floating air distributing means is of extended form for extending over said powdery material in said holder and around said connecting means.

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