The present invention relates to centrifugal spraying devices.

One known type of centrifugal spraying device for use, for example, in applying paint or other surface finishing material, comprises a rotary intercepting and collecting bowl, a rotary atomizer having its axis tilted in relation to the axis of the bowl, so that an angular or sectoral part of the spray material discharged from the periphery of the atomizer is intercepted by the bowl and collected therein, while the remaining part of the spray material discharged from the periphery of the atomizer is free for directional discharge towards the object to be sprayed, means for continuously feeding spray material to the atomizer, and means for conducting the intercepted spray material for redirection towards the atomizer.

One object of the present invention is to provide a new and improved centrifugal spray device of the general type described.

Another object of the invention is to provide a centrifugal spray device of the general type described having new and improved means for conducting the intercepted collected spray material from the collecting bowl for redirection towards the atomizer.

Another object of the invention is to provide a centrifugal spray device of the general type described having the means for feeding the spray material to the atomizer and the means for conducting the intercepted and collected spray material from the collecting bowl for redirection towards the atomizer, so constructed as to correlate their functions in a new and improved manner.

A further object of the invention is to provide a centrifugal spray device of the general type described having the means for feeding the spray material to the atomizer and the means for conducting the intercepted and collected spray material from the collecting bowl for redirection towards the atomizer, so correlated as to regulate automatically the pressures between said means.

Another object of the invention is to provide a centrifugal spray device of the general type described, which has a jet for feeding the spray material to the rotary atomizer and a scoop for picking up the intercepted and collected spray material from the rotary collecting bowl and for redirecting it to the jet, and which is designed to permit the scoop and the jet to be easily removed for ready change, repair or cleaning.

Another object of the invention is to provide a centrifugal spray device of the general type described having a scoop for picking up the intercepted and collected spray material from an annular channel in the collecting bowl and returning it for delivery to the atomizing system of the spray device, and having a nose at the end of the scoop designed to pick up the material from the channel effectively and to prevent the solids from separating out of the material in the channel by centrifugal force, so as prevent excessive wear of the nose and plugging of the scoop as a result of such separated solids.

A further object of the invention is to provide a centrifugal spraying device which is operated under the influence of an electrostatic charge or field emanating from the rotary atomizer and which provides means for minimizing the flow of air across the periphery of the atomizer and for minimizing thereby the ionization of air in the region of said periphery, so that conflicting space charges around the atomizer are minimized.

Another object of the invention is to provide a centrifugal spray device of the general type described having a scoop for the purpose described, and means for deflecting the material which collects on the exterior of the scoop towards a rotary part of the device where it is subjected to centrifugal movement, thereby preventing this material from accumulating in regions where it might interfere with efficient operation.

Still another object is to provide a centrifugal spray device of the general type described, which is designed to provide maximum effective material discharge areas on the rotary atomizer with an atomizer of minimum effective diameter.

A further object of the invention is to provide in conjunction with a centrifugal spray device a control system which permits immediate shut-off and immediate start of spraying operations when such operations are initiated by the actuation of the appropriate control, and which prevents such accumulation of spray material in the device upon shut-down, as would hamper immediate restarting operations.

Various other objects of the invention are apparent from the following description and from the accompanying drawings, in which:

Fig. 1 is a vertical section of a centrifugal spray device constituting one embodiment of the present invention;

Fig. 2 is a detail section of the centrifugal spray device taken on lines 2—2 of Fig. 1;

Fig. 3 is a detail vertical section of the centrifugal spray device taken approximately along the lines 3—3 of Fig. 2 and then turned 180°;

Fig. 4 is a vertical section of the head of a centrifugal spray device constituting another embodiment of the present invention and taken along the lines 4—4 of Fig. 5;

Fig. 5 is a section of the centrifugal spray device taken approximately along the lines 5—5 of Fig. 4;

Fig. 6 is a fragmentary section of the head of a centrifugal spray device constituting another embodiment of the present invention;

Fig. 7 is a detail section of a centrifugal spray device constituting still another embodiment of the present invention;

Fig. 8 is a detail section of the centrifugal spray device taken on lines 8—8 of Fig. 7;

Fig. 9 shows an apparatus partly in side elevation and partly in section for controlling a centrifugal spray device in accordance with certain features of the present invention;

Fig. 10 is an enlargement of part of the control apparatus illustrated in Fig. 9 and shows the main control valve thereof in closed position during shut-down of the centrifugal spray device;

Fig. 11 is a section of the main control valve illustrated in Fig. 10 but shows said valve in open position during operation of the centrifugal spray device;

Fig. 12 is a section of the control apparatus taken on lines 12—12 of Fig. 10; and

Fig. 13 is a section of the control apparatus taken on lines 13—13 of Fig. 10.

Referring to Figs. 1—3 of the drawings, there is shown a centrifugal spray device 10 comprising a distributor head 11 mounted on a fixed post or stanchion 12 shown in the form of a tube made of suitable material, such as plastic and carrying axially thereof a shaft 13, which
a,967,668 3 is mounted for rotation in an upper ball bearing 14 and a lower ball bearing 15. The lower end of shaft 13 is connected to the shaft 16 of a motor 17, as for example, by an Odong coupling 18. Shaft 13, device 10 including the motor 17 are shown suitably mounted on a bracket 20, which in turn is adjustably secured to a rod 21 by a nut 22. For adjustably mounting the centrifugal spray device 10 on the bracket 20, the bracket has a round recess 23 to receive snugly a round plate 24 slinged to the lower flattened end of the attachment 12 by means of studs 25. A series of clamps 26 secured to the bracket 20 by means of thumb screws 27 bear against the plate 24. With the arrangement shown, the centrifugal spray device 10 can be adjusted about the rod 21 and can be adjusted about axis of the shaft 13.

The distributor head 11 comprises an inverted rotary dished hub 30, which is secured to the upper end of the shaft 13 by a nut 31 threaded on said shaft and bearing against the upper side of said hub and which is adjusted to the desired axial position by means of a spacer washer 32. This hub 30 is provided with a peripheral internal surface 29 flaring radially outwardly so that spray material is caused by centrifugal force to flow outwardly therealong to the rim of the hub.

A rotary atomizer 33 in the form of a disc and more specifically shown in the form of a ring is secured to the lower side of the hub 30 by screws 34. The hub 30 has a depending skirt 35 on the atomizer 33 and provided with a series of circumferentially spaced notches defining openings 36 with the atomizer for the flow of material therethrough. The atomizer 33 has an annular flange 37 with an upper radially outwardly extending flow surface 38 communicating with the openings 36 in a peripheral edge 40 from which the material is ejected as an atomized spray by centrifugal force. The lower side of the atomizer 33 has a V-shaped peripheral rib 41 located below the open end of an encompassing rotary bowl 64 to be described and adapted to propel any material which may have found its way to this lower side centrifugally outwardly for interception by the bowl before said material reaches the ejection edge 40 of the atomizer. If the material found its way along the underside of the atomizer to its single peripheral discharge edge 40, it might interfere with the orderly discharge of the material from said edge coming from the upper flow surface 38 of the atomizer.

A fixed closure 45 for the lower side of the distributor head 11 embraces the fixed stanchion 12 and is secured to the upper end of said stanchion by studs 46. This closure 45 has a cylindrical extension 47 serving as a bracket and carrying at its upper end the outer race 48 of a bearing 50, the axis of which is disposed at an angle to the axis of the shaft 13. The bearing 50 is provided with an inner race 51 which is carried by a rotary ring 52 disposed internally of the bearing and rigidly secured to a flange at the upper end of a ring 53. This ring 53 extends around the bracket 47 and has a labyrinthine running seal 54 with the fixed closure 45. Integral with and extending around the ring 53 is a larger outer ring 55 provided with an upwardly flared internal flow surface 56 and spaced therefrom by an annular passageway 57. The outer ring 55 extends into the cavity of the hub 30 but is spaced radially inwardly from the internal flow surface 29 of the hub 30 and is connected to the inner ring 53 by a web 58 having a series of openings 59 to permit flow of the material through the passageway 57. At its lower end, the outer ring 55 carries integrally a dished radial wall 60 to the outer periphery of which is secured, as for example, by integral formation thereon with an annular wall 61 tapering upwardly toward its upper end and connected at its lower end to the bottom closure 62 by means of studs 63 to form with said closure wall a rotary spray intercepting and material collecting bowl 64. This closure wall 62 is in the general form of a dished annular ring and has a labyrinthic running seal 66 with the fixed closure 45 of the distributor head 11, and the rim of the annular bowl wall 61 has a projecting lip 65 designed to intercept any material that might fall on said rim and to project it radially outwardly instead of permitting it to flow downward along the outside of the bowl.

The radial wall 60 defines with the closure wall 62 a scoop chamber 67 in the bowl 64 and said radial wall 60 has a series of passages 68 at its outer periphery adjacent to the annular bowl wall 61 to pass material which is intercepted by the annular wall downward into said scoop chamber.

The annular bowl wall 61 is tapered towards its opposite ends and at the annular junction between the scoop passage sections of said wall at the outer periphery of the scoop chamber 67, said bowl wall has a peripheral groove 72.

The shaft 13 drives the atomizer 33 through the hub 30 and also drives the bowl 64. To effect the drive to the bowl 64, the inner surface of the ring 52 is secured to the inner race of the bearing 50 bears against a cone 75, which is slidably held on the shaft 13 and which has its conical surface pressed against the inner surface of the ring 52 by a coil spring 76 in friction drive contact therewith. The cone 75 is keyed to the shaft 13 for rotation therewith while it is permitted to slide along said shaft, so that the cone 75 is maintained in friction drive contact with the ring 52.

Fixed conduit means for handling the material to be sprayed is substantially in the form of a Y or T and comprises an inlet pipe 80 with two branches 81 and 82. The branch 81 extending substantially radially in the scoop chamber 67 serves to return the material intercepted and collected in the bowl 64 towards the atomizer 33 and the other branch 82 in the form of a jet extends upwardly into the lower end of the passage way 87 substantially parallel to the axis of the ring 53 and below the web 58 and serves to conduct the material to the ring surface 81 for flow under centrifugal action towards the atomizer 33. The conduit means is constructed to permit its component parts to be easily assembled or disassembled to facilitate cleaning, repairing or replacement.

In the specific form shown, the conduit means comprises the inlet pipe 80 shown in the form of a fitting screwed into the fixed closure 45 and connected by a hose 85 to a source of fresh material to be sprayed, such as paint. This pipe 80 has a neck 86 with a series of transverse holes 87 therein and a head 88 above said neck, and the jet 82 is removed for inspection and cleaning without disassembling the unit. The closure 45 has a passage 90 between the chamber surrounding the aper tured neck 86 of the inlet tube 80 and the scoop chamber 67, and screwed into said closure is a fitting 91 communicating with said passage. Fitted into the fitting 91 with a snug sealing slide fit is the scoop 81 shown in the form of a tube, the inner section 92 extending radially of the bowl 64, the outer section 93 being curved in a direction opposite to the direction of rotation of the bowl, as shown in Fig. 2 and terminating in a nose in the vicinity of the bowl wall 61.

The scoop 81 receives support in addition to that afforded by the fitting 91, without interfering with its easy removal, and for that purpose, a cross provided a bracket plate 95 secured to the closure 45, as for example, by welding or soldering, and fastened by screws 96 to a mounting plate 97 affixed to one side of the scoop 81, as for example, by soldering. For removing the scoop 81 for cleaning, repair or replacement, the bottom wall 62 of the bowl 64 is removed by loosening the studs 63, and the fitting 91 is unscrewed from the closure 45 causing it to slide along the scoop to the dot and dash position shown in Fig. 2 where it is clear of the closure.
Upon removal of the screws 96, the scoop 81 with attached mounting plate 97 may be swung in the direction of the arrow A in Fig. 2 and out of the opening at the bottom of the bowl 64 presented by the removal of the bottom wall 62 of said bowl. At the inset end, the scoop 81 is provided on its forward side with a deflector 100 secured to the scoop, as for example, by soldering to direct the intercepted material accumulated in the outer periphery of the scoop chamber 67 into the mouth of the scoop and is provided on its rear side with a plow tip 101 of cemented or sintered tungsten carbide or similar hard material secured to the scoop end, for example, by soldering and extending into the peripheral groove 72 of the bowl. As the bowl 64 rotates in the direction of the arrow in Fig. 2, the plow tip 101 stirs up the material in the groove 72 causing the material to be mixed and preventing thereby solids from separating out of the material in the groove by centrifugal force. Separated solids tend to wear out the scoop nose quickly and to plug up the scoop.

The centrifugal spray device is preferably constructed to operate not only under centrifugal action but also under the influence of an electrostatic charge or field. For that purpose, the fixed stanchion 12, and the rotating parts of the device except the shaft 13, the different bearings and the atomizer 33 may be made of electrical non-conducting material, such as plastic, and a suitable charging electrode may be provided for applying an electrostatic charge to the spray material before it leaves the atomizer. For example, high tension current may be supplied to the shaft 13 through its lower bearings 15, and the hub 30 although made of nonconductive material, such as a phenolic composition, has a conductive coating along its internal surface 29 extending between the conductive shaft and the conductive atomizer 33.

As the atomizer 33 rotates, air in the region of its discharge peripheral edge 40 becomes ionized and may have a distracting and disruptive influence on the orderly arrangement and travel of the atomized material to be sprayed, towards the article to be sprayed. To minimize this effect, the hub 30 has a contoured air deflecting peripheral flange 110 presenting an upwardly and radially outwardly curved surface 111 facing the upper flow surface 38 of the atomizer 33 and adapted to lead the air away from said surface as the hub and atomizer rotate. To prevent material that has passed through the opening 36 from deviating along the deflector flange 110, the hub 30 is provided with a peripheral notch 112 below the flange, and the atomizer 33 is provided with a short circumferential ramp 113 leading from the lower side of said notch and from the openings 36 to the upper flow surface 38 of the atomizer 33.

In operation, the material supplied through the inlet pipe 80 is fed through the jet 82 into the passageway 57, and flows through the holes 59 and by centrifugal action along the internal flowing flow surface 56 outwardly over the rim of the ring 55 and then radially along the flowing surface 29 of the hub 30 towards the openings 36. The material then flows by centrifugal action through the openings 36, along the ramp 113 of the atomizer 33 and then along the upper flow surface 38 of said atomizer until it reaches the peripheral edge 40 of said atomizer from which it is discharged outwardly as a jet of atomized material. The bowl 64 being mounted to rotate about non-parallel axes, the bowl intercepts a sector portion of the spray ejected from the periphery 40 of the atomizer 33, while the remainder of the spray of predetermined angle travels directionally towards the article to be sprayed. The angle of intercept of the bowl 64 with the material discharged from the atomizer 33 depends upon the angular relationship between the axes of the bowl and of the atomizer and also the axial relation of the atomizer on the shaft 13. Hence, the spray width can be determined by changing the spacing washer 32 to one of appropriate thickness.

Any material intercepted by the bowl 64 flows through the passages 68 in the radial wall 60 and into the scoop chamber 67, is picked up by the scoop 81 therein and is pressured through said scoop by the rotation of the bowl into the jet 82 where it joins the fresh material fed into the jet from the inlet pipe 80. This permits the intercepted material, which may have become more viscous, to be mixed with the fresh material prior to spraying, so that a uniform spray is maintained.

One important advantage of interconnecting the scoop 81 and the jet 82 into a branch system is that it creates automatically pressure conditions that control flow through the scoop in either direction according to the amount of intercepted material in the bowl 64. For example, at the start of spray operations, the scoop chamber 67 is empty and the pressure conditions in the scoop chamber 67 are such, that the fresh material from the inlet pipe 80 is fed under pressure to the jet 82 for delivery to the atomizer 33 but also through the scoop 81 in a radially outer direction to the outer periphery of the scoop chamber 67 to fill said parts of the scoop. The back pressure in the scoop is equal to or slightly greater than the material feed pressure, whereupon the material flows in the opposite direction in the scoop towards the jet 82 where it is mixed with fresh material. The back pressure serves to oppose feed pressure in the inlet pipe 80 so that an excessively high feed rate to the atomizer 33 is prevented and floating of the distributor head 11 is obviated.

Another advantage of interconnecting the scoop 81 and the jet 82 into a branch system is that it permits the use of a relatively large diameter jet and assures maximum jetting action therewith.

In the following description of different modifications of the invention, the parts thereof corresponding to the parts in the construction of Figs. 1-3 are designated by the same reference numbers but with subscript letters a and b.

Figs. 4 and 5 show a modified distributor head 11a in which a shaft 13aa has connected to its upper end an inverted rotary dished hub 30a by a nut 31a threaded on said shaft and bearing against the upper side of said hub. This hub 30a is adjusted to the desired axial position by means of a spacer washer 32a. A dished rotary atomizer 33a in the form of a ring is secured to the lower side of the hub 30a by screws 34a, and a dished or conical guide or feed ring 120a is secured to the lower side of the atomizer by the same screws. The hub 30a, the atomizer 33a and the guide ring 120a are in nested relationship and in face to face contact, the hub seating on the atomizer and the atomizer seating on the guide ring. Radially beyond the region of seating contact of the hub 30a and the atomizer 33a and an annular flaring flow passage 121 along the top of the atomizer leading to a radial flange 122 on the atomizer and then to the upper of two separate axially spaced peripheral spray discharge edges 123 and 124 on said flange, and radially beyond the region of seating contact of the atomizer 30a and the guide ring 120a is an annular flaring flow passage 125 along the bottom of the atomizer leading to the flange and to the lower of these discharge edges. The lower outer peripheral edge of the hub 30a has notches forming with the upper of the two guide 126 leading to the flow passage 121, and the lower peripheral edge of the atomizer 33a has notches forming with the ring 120 openings 127 leading to the flow passage 125.

With both surfaces of the atomizer 33a active for centrifugal flow, a spray substantially twice the volume of material may be atomized to a suitable particle size.

In the construction of Figs. 4 and 5, the inner ring 53a...
has a flange 58a, which is screwed to the outer ring 55a to form an annular passageway 57a between said rings and which has a series of peripheral notches to form operating tabs 55b. The outer ring 55a, integrally carries at its lower end a disposed radial wall 60a to the outer periphery of which is secured, as for example, by integral formation therewith an annular wall 61a tapering upwardly towards its upper open end and connected at its lower larger end to a lower closed wall 62a by means of studs 63a to form with said closure wall a rotary spray intercepting and material collecting bowl 64a. This closure wall 62a is shown comprising two different annular units 130 and 131 secured together by studs 132 and has a labyrinthine seal 66a with the fixed closure 45a of the distributor head 11a. This fixed closure 45a is screwed on to the fixed stanchion 12a and not only forms the labyrinthine seal 66a with the closure wall 62a but also forms the labyrinthine running seal 54a with the lower part of the inner ring 55a.

The radial wall 60a defines with the closure wall 62a the scoop chamber in the bowl 64a and said radial wall has a series of passages 68a at its outer periphery adjacent to the annular bowl wall 61a to pass material which is intercepted by the annular wall downward into said scoop chamber. The annular bowl 61a has a groove 72a at the outer periphery of the scoop chamber 67a receiving the flow tip 104a at the nose end of the scoop 81a extending in the scoop chamber.

The fixed branched conduit system to form the jet and scoop for the distributor head 11a comprises the inlet pipe 80a connected by the hose 85a to a source of fresh material and passing through the fixed closure 45a and then forming the scoop 81a extending into the scoop chamber 67a and the jet 82a extending into the passageway 57a and having its terminal discharge section 135 extending circumferentially around the inner periphery of the jet ring 55a.

The scoop 81a is rigidly secured to a stiffening plate 90a as for example by soldering. When the fixed scoop 81a is disposed in an upward direction in the operation of the spray device, some of the material tends to run down along the scoop and collect and thicken on the stationary closure 45a of the distributor head 11a. To prevent this adverse condition, a buffer 137 rigidly secured to the scoop 81a near its nose, as for example by soldering, and in the form of an angle having its two webs sloping towards the opposed walls of the scoop chamber 67a, deflects the material from the scoop onto the rotating surfaces of the walls 60a and 62a, whence it is returned towards the outer periphery of the scoop chamber, where it is picked up by the nose of the scoop.

Except as otherwise described, the construction of Figs. 4 and 5 is similar to that of Figs. 1-3, and operates in a similar manner, except that the material after leaving the ring 55a by centrifugal action passes through the two separate peripheral edges 123 and 124.

The modification of Figs. 6, 7 and 8 contains some of the features of construction of Figs. 1-3, and some of the features of construction of Figs. 4 and 5 and in addition contains other features. In the modification of Figs. 6-8, the hub 30a nests into the atomizer 33a to form a annular flaring passageway 121b between the bowl and the atomizer and is notched to form the openings 36b with the atomizer, leading into said passage. The atomizer 33b has a flange 122b which has its top surface located to receive the material discharged from the annular passageway 121b and to serve as the sole flow surface of the atomizer and which terminates in the single peripheral discharge edge 46b.

The bowl 64b in the construction of Figs. 6, 7 and 8 has the bottom wall 62b and radial wall 65b defining therebetween the scoop chamber 67b and the branch conduit system is similar to that of Figs. 4 and 5 in that the jet branch 82b extends into the passageway 57b and has its terminal discharge section 135b extending circumferentially around the inner periphery of the ring 55b. However, this discharge section 135b is provided with a pressure adjustable valve 140 in the form of a spring plate, the discharge jet section being square in cross-section and the spring plate being rigidly secured at one end to one wall of said jet section and connecting due to its inherent closure wall closure of said closure wall to close said jet section against discharge. The valve 140 operates according to the pressure in the jet 82b, the amount of opening depending on the pressure in the jet. The upper rim of the bowl 64b is bevelled and is secured to form a series of separate prismatical ledges 44b arranged in stepped relationship, so that any material which may collect on the edge will be cast off centrifugally from said edge and will be suitably atomized while any surplus material will drop off to the next edge for discharge therefrom in atomized form, thereby preventing the material from flowing along the outside of the bowl towards the bottom thereof.

Figs. 9-13 show a control system 143 used in conjunction with a centrifugal spray device of the general character described and operable so that at the instant of material feed shut off, substantially all of the material is withdrawn from the outer periphery of the scoop chamber and from the scoop for virtually instantaneous shut off and is rapidly restored to said outer periphery of the scoop chamber and to the jet for an equally instantaneous start of the spray operation, when the appropriate control member is actuated. In Fig. 9 is shown a centrifugal spray device which may be any one of the modifications described, but which for purpose of illustration is shown of the type illustrated in Figs. 1-3. This spray device 10 comprises the distributor head 11 mounted on the fixed stanchion 12 and is shown in a spray chamber 14 which the articles in which the device may be located. The hose 85 connected to the inlet pipe 80 of the distributor head 11 is connected to a source of material through the control system 143.

The control system 143 (Figs. 9-13) comprises a valve 146 with an inlet 147 connected to the source of fresh material supply and an outlet 148 connected to the hose 85 for delivery to the spray device 10. The valve 146 is shown of the poppet type, and comprises a movable valve member 150 in the form of a poppet extending through a circular port 151 between the inlet 147 and outlet 148 and a valve seat 152 at one end of said port. The poppet 150 has a flange 153 extended to engage the valve seat 152 in closure position of the poppet shown in Fig. 9, a cylindrical body 154 fitting in the port 151 with a slug slide fit and a tapered end section 155 adapted to define an annular clearance 156 therearound for flow passage in open position of the valve 146 shown in Fig. 11.

The poppet 150 is operated between open and closed position from an air cylinder 160 having a piston therein connected to the poppet. Between the air cylinder 160 and the valve 146 is a bellows 162, one end of which is secured to the end of the casing 163 of the valve 146 by a bushing 164 threaded into said casing, the other end of the bellows being connected by a rod 165 to the piston of the air cylinder 160, so that as the air cylinder piston rod is actuated, the bellows is alternately expanded and contracted. The latter end of the bellows 162 is connected to a connecting rod 166 which the poppet 150 so that simultaneously with the alternate expansion and contraction of the bellows, the poppet 150 is correspondingly moved into valve closing and opening positions. The bushing 164 has an internal bore larger than the connecting rod 166 so that for a passage-way 167 between the interior of the bellows 162 and the valve outlet 148.

The air cylinder 160 is of the conventional air motor type well known in the art, and having an air inlet 170 controlled by an electromagnetic device 171 of the solenoid type, which is activated in response to the manipu
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lation of a switch (not shown) to admit air from said inlet to one side or other of the piston in the air cylinder. When the switch is actuated to start the spraying operation, the air from the inlet 170 is admitted to the right side of the piston in the air cylinder 160, causing said piston to move towards the left (Fig. 9) and this causes the valve 146 to open, permitting thereby the fresh material to pass from the valve inlet 147 through the valve to the outlet 148 and then through the hose 85 to the inlet 80 of the spray device 10.

In the operation of the control system, while the spray device 10 is spraying, the valve 146 is in open position shown in Fig. 11, and the bellows 162 is collapsed. When the switch is operated for shut off of the spraying operation, the piston in the air cylinder 160 is moved to the right (Fig. 9), until the poppet 150 moves into closing position against the valve seat 152 shown in Figs. 9 and 10. During this valve closing operation, the bellows 162 is expanding and creating suction, causing the material in the outer periphery of the scoop chamber 67 (Figs. 1–3) and in the scoop 81 to be drawn through the hose 85, through the valve outlet 148 (Figs. 9–13), through the passageway 167 and into the expanding bellows. The drawing of the material from the spray device 10 is shut down in accordance with the actuation of the switch, and causes immediate suspension of spraying operation, even though the spray device is still rotating. During this valve closing operation, the body 154 of the valve poppet 150 is in the port 151 blocking flow threethrough.

When the switch is actuated to restart spraying operation, the piston in the air cylinder 160 is moved towards the left from the position shown in Fig. 9, causing the bellows 162 to contract and forcing the material in the bellows and in the passageway 167 through the empty scoop 81 (Figs. 1–3) into the outer periphery of the scoop chamber 67 (Fig. 6) and to the jet 70. During this bellows contracting operation, the valve poppet 150 is moving towards the left (Fig. 9) but the body 154 sliding in the port 151 is still blocking flow through said port, so that the column of material being pressured by the bellows 162 is not dissipated through said port.

The filling of the scoop 81 and the outer periphery of the scoop chamber 67 causes the material when the poppet 150 (Figs. 9–13) reaches the open position shown in Fig. 11 to flow from the valve inlet 147 to the valve outlet 148, and through the inlet 80 of the spray device 10 directly to the jet 70 (Figs. 1–3) towards the atomizer 33, and also to the scoop, thereby causing immediate start of spraying operation.

While the invention has been described with particular reference to specific embodiments, it is to be understood that it is not to be limited thereto but is to be construed broadly and restricted solely by the scope of the appended claims.

What is claimed is:

1. A spraying system comprising a centrifugal spray device including a rotatable atomizer defining an annular flow surface along which the material to be sprayed flows under centrifugal action and having a peripheral discharge edge, a rotary bowl having its axis tilted in relation to the axis of said atomizer for intercepting part of the spray projected from said edge and collecting the intercepted material, means forming in said bowl an annular scoop chamber extending radially outwardly and rotatable with said bowl, said scoop chamber having means to cause the material intercepted in the bowl to flow thereinto, a stationary scoop disposed in said scoop chamber and arranged to dip into and receive material from the outer periphery of said scoop chamber as said scoop chamber rotates, an inlet feed pipe arranged to deliver fresh material to the device, said scoop near its outer end having a connection with said feed pipe, and a jet connected to said feed pipe and arranged to deliver material towards said atomizer flow surface, said scoop and said jet constituting branches of said feed pipe, a valve having an outlet connected to the feed pipe and having an inlet adapted to be connected to a source of material supply, means defining a chamber in communication with said source of material supply and means automatically operable in response to the actuation of said valve for expanding said chamber while said valve is being operated towards closed position for creating a suction which draws the material from the scoop, the scoop chamber and the jet, whereby spray operations are substantially instantaneous and shut off and controlling said chamber while said valve is operating towards open position for forcing material back into said scoop, scoop chamber and jet, whereby spray operations are substantially instantaneous and restarted.

2. A spraying system as in claim 1, wherein said valve has a movable valve member, said chamber defining means comprises a bellows having an end wall movable along the axis of the bellows, and said automatic chamber expanding and contracting means comprises a rigid connection between the movable valve member and said movable end wall, and wherein means are provided for moving the end wall of said bellows in either direction along the axis of the bellows for valve opening and closing operations.

3. A spraying system as described in claim 1, wherein said valve comprises said chamber extending radially outwardly and rotatable with said bowl, said scoop chamber having means to cause the material intercepted in the bowl to flow thereinto, a stationary scoop disposed in said scoop chamber and arranged to dip into and receive material from the outer periphery of said scoop chamber as said scoop chamber rotates, an inlet feed pipe arranged to deliver fresh material to the device, said scoop near its outer end having a connection with said feed pipe, and a jet connected to said feed pipe and arranged to deliver material towards said atomizer flow surface, said jet having a pressure responsive valve operable to open when the pressure in said jet exceeds a predetermined amount, said scoop and said jet constituting branches of said feed pipe.

4. In a centrifugal spray device, a rotatable atomizer defining an annular flow surface along which the material to be sprayed flows under centrifugal action and having a peripheral discharge edge, a rotary bowl having its axis tilted in relation to the axis of said atomizer for intercepting part of the spray projected from said edge and collecting the intercepted material, means forming in said bowl an annular scoop chamber extending radially outwardly and rotatable with said bowl, said scoop chamber having means to cause the material intercepted in the bowl to flow thereinto, a stationary scoop disposed in said scoop chamber and arranged to dip into and receive material from the outer periphery of said scoop chamber as said scoop chamber rotates, an inlet feed pipe arranged to deliver fresh material to the device, said scoop near its outer end having a connection with said feed pipe, and a jet connected to said feed pipe and arranged to deliver material towards said atomizer flow surface, said jet having a pressure responsive valve operable to open when the pressure in said jet exceeds a predetermined amount, said scoop and said jet constituting branches of said feed pipe.

5. In a centrifugal spray device, a rotatable atomizer defining an annular flow surface along which the material to be sprayed flows under centrifugal action and having a peripheral discharge edge, a rotary bowl having its axis tilted in relation to the axis of said atomizer for intercepting part of the spray projected from said edge and collecting the intercepted material, means forming in said bowl an annular scoop chamber extending radially outwardly and rotatable with said bowl, said scoop chamber having means to cause the material intercepted in the bowl to flow thereinto, a stationary scoop disposed in said scoop chamber and arranged to dip into and receive material from the outer periphery of said scoop chamber as said scoop chamber rotates, an inlet feed pipe arranged to deliver fresh material to the device, said scoop near its outer end having a connection with said feed pipe, and a jet connected to said feed pipe and arranged to deliver material towards said atomizer flow surface, said jet having a pressure responsive valve operable to open when the pressure in said jet exceeds a predetermined amount, said scoop and said jet constituting branches of said feed pipe.
pressure in said jet, said scoop and said jet constituting branches of said feed pipe.

6. In a centrifugal spray device, a rotatable atomizer defining an annular radially extending flow surface along which the material to be sprayed flows under centrifugal action and having a peripheral discharge edge, said atomizer being electrically conductive and being adapted to be connected to a source of current to produce an electrostatically atomized spray, and means for deflecting the air away from the atomizer flow surface to prevent the creation of ionized air in the vicinity of said discharge edge, said air deflecting means comprising an electrically non-conductive hub secured to said atomizer for rotation therewith and having an annular radially extending surface confronting said atomizer flow surface and contoured axially away from said atomizer flow surface in a radially outward direction to deflect the air away from said atomizer flow surface.

7. A spraying system comprising a centrifugal spray device including a rotatable atomizer defining an annular flow surface along which the material to be sprayed flows under centrifugal action and having a peripheral discharge edge, a rotary bowl having its axis tilted in relation to the axis of said atomizer for intercepting part of the spray projected from said edge and collecting the intercepted material, means forming in said bowl an annular scoop chamber extending radially outwardly and rotatable with said bowl, said scoop chamber having means to cause the material intercepted in the bowl to flow thereinto, a stationary scoop disposed in said scoop chamber and arranged with its nose end at the outer periphery of said scoop chamber, means including a feed pipe forming a supply duct arranged to deliver fresh material to said centrifugal spray device, a cut-off valve in said feed pipe for interrupting the flow of material therethrough, means forming an expansible chamber connected in said feed pipe between said cut-off valve and said centrifugal spray device and forming a part of said supply duct, means connecting said scoop to feed material from said scoop chamber into said supply duct at a point between said cut-off valve and said centrifugal spray device, and means automatically operable in response to the actuation of said cut-off valve for expanding said chamber while said supply valve is being operated to ward closed position for creating a suction which draws the material from the scoop whereby spray operations are substantially instantaneously cut off, and for contracting said chamber while said valve is operating toward open position for forcing material back into said scoop and to said centrifugal spray device, whereby spray operations are substantially instantaneously restarted.

8. A spraying system comprising a centrifugal spray device including a rotatable atomizer defining an annular flow surface along which the material to be sprayed flows under centrifugal action and having a peripheral discharge edge, a rotary bowl having its axis tilted in relation to the axis of said atomizer for intercepting part of the spray projected from said edge and collecting the intercepted material, means forming in said bowl an annular scoop chamber extending radially outwardly and rotatable with said bowl, said scoop chamber having means to cause the material intercepted in the bowl to flow thereinto, a stationary scoop disposed in said scoop chamber and arranged with its nose end at the outer periphery of said scoop chamber, means including a feed pipe forming a supply duct arranged to deliver fresh material to said centrifugal spray device, a cut-out valve in said feed pipe for interrupting the flow of material therethrough, means forming an expansible chamber connected in said feed pipe between said cut-off valve and said centrifugal spray device and forming a part of said supply duct, a check valve in said duct between said chamber and said centrifugal spray device to prevent reverse flow of material from said spray device, means connecting said scoop to feed material from said scoop chamber into said supply duct at a point between said cut-off valve and said check valve, and means automatically operable in response to the actuation of said cut-off valve for expanding said chamber while said valve is being operated toward closed position for creating a suction which draws the material from the scoop whereby spray operations are substantially instantaneously shut off, and for contracting said chamber while said valve is operating toward open position for forcing material back into said scoop and to said centrifugal spray device, whereby spray operations are substantially instantaneously restarted.

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