Jan. 11, 1938. W. B. THOMPSON 2,105,275

FLOCK APPLYING APPARATUS

Filed Feb. 21, 1934 3 Sheets-Sheet 1

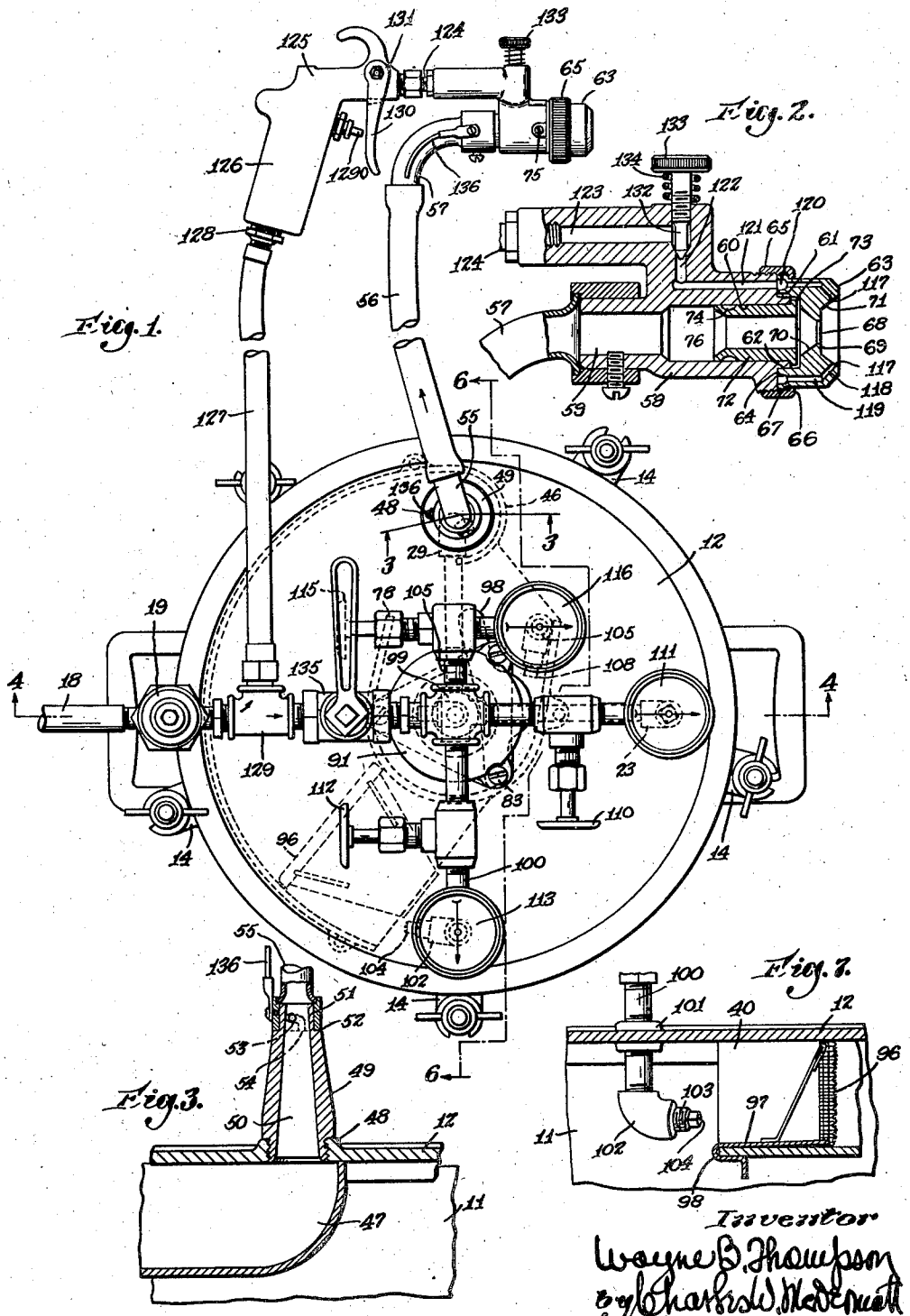


Fig. 1.

Fig. 2.

Fig. 3.

Fig. 7.

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FLOCK APPLYING APPARATUS

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Fig. 4.

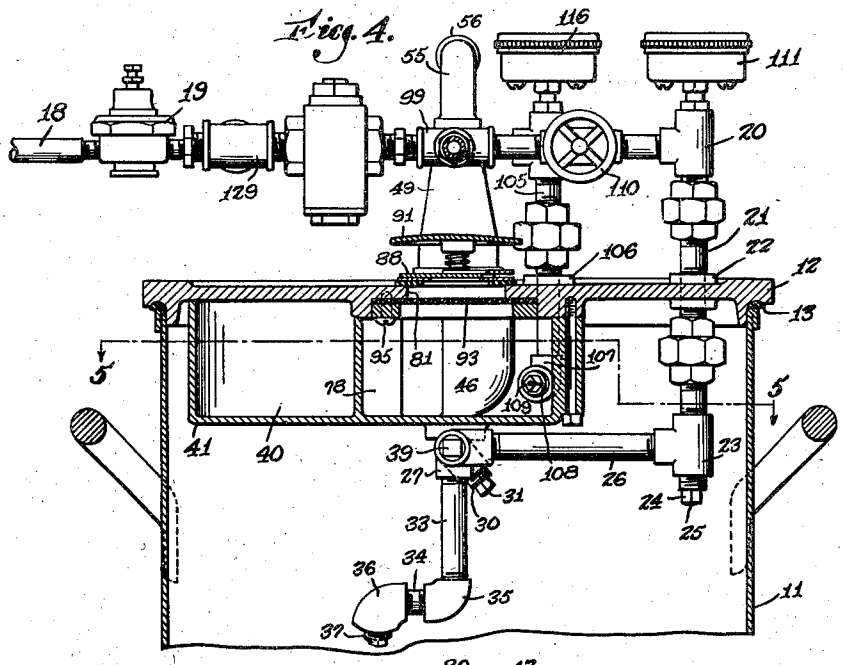
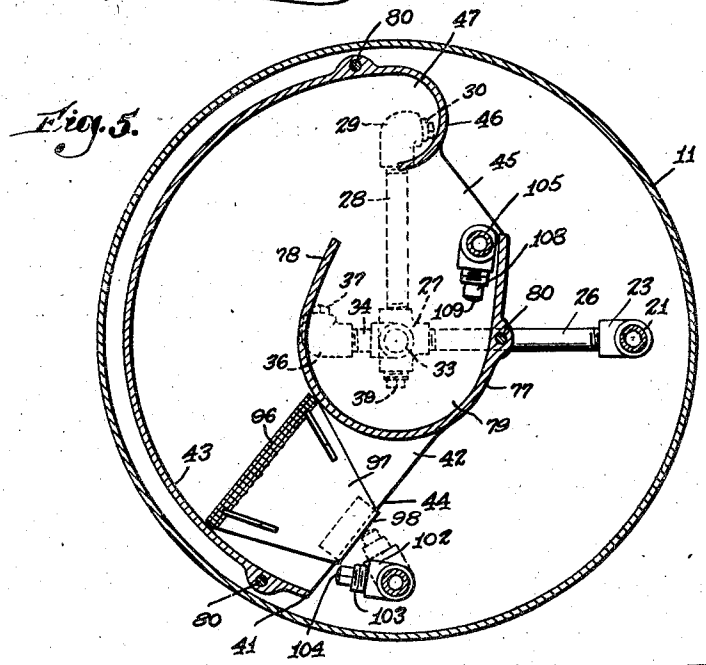


Fig. 5.



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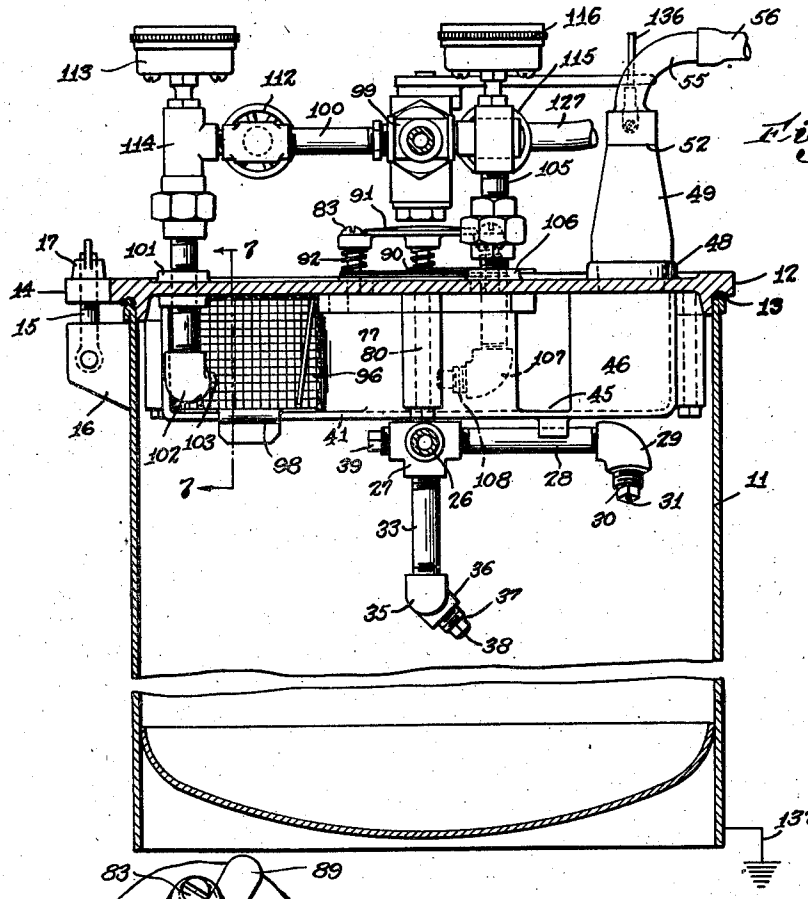


Fig. 6.

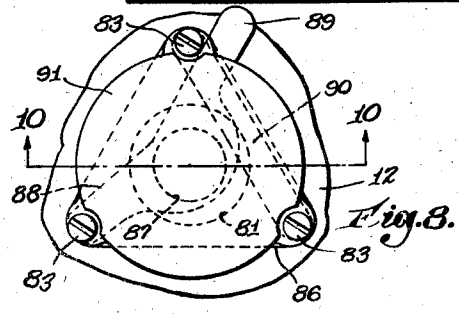


Fig. 8.

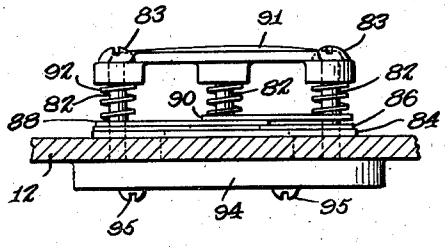


Fig. 9.

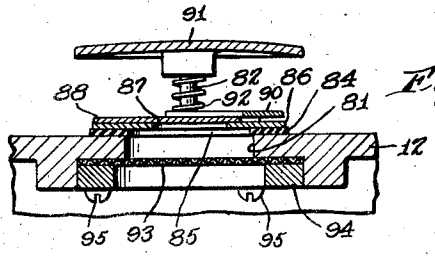


Fig. 10.

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Patented Jan. 11, 1938

2,105,275

UNITED STATES PATENT OFFICE

2,105,275

FLOCK APPLYING APPARATUS

Wayne B. Thompson, Winchester, Mass., assignor to Spray Engineering Company, Somerville, Mass., a corporation of Massachusetts

Application February 21, 1934, Serial No. 712,386

1 Claim. (Cl. 91—8)

The present invention relates to the art of coating and more particularly to apparatus for applying flock, which term is used herein to designate comminuted material, such as cotton, wool, silk, rayon, and the dust of vegetable fibres.

In one commercially successful flock applying apparatus the flock is stored in a container into which air under pressure is introduced. The container is provided with an outlet through which the flock laden air is conducted to the point of application. The container is provided also with a vent through which some of the air introduced into the container escapes to maintain a low pressure within the container, thus to insure the action of the air on the flock under velocity instead of pressure. Experience has demonstrated that the effective rate of air flow velocity should vary with different types of flock. Heavy flock and flock having long fibres require the use of a higher rate of air flow velocity than does light flock and flock having short fibres. The flock applying apparatus referred to was provided with means for varying the pressure of the air introduced into the container and therefore the rate of air flow velocity, but this resulted in the use of an excessive pressure, a waste of air through the vent, and the discharge of too much flock.

The principal object of the present invention is to provide an apparatus for applying flock by which the rate of air flow velocity may be varied in an easy, reliable and economical manner.

To the accomplishment of this object, and such others as may appear hereinafter, the features of the present invention relate to certain devices, combinations and arrangements of parts hereinafter described and then set forth in the appended claims.

The various features of the present invention will be understood readily from an inspection of the accompanying drawings, in which,

Figure 1 is a view in plan;

Fig. 2 is a detail view in sectional elevation of the nozzle head;

Fig. 3 is a detail view in sectional elevation of the flock concentrating chamber and the dome on the line 3—3, Fig. 1;

Fig. 4 is a view in sectional elevation on the line 4—4, Fig. 1;

Fig. 5 is a view in sectional plan on the line 5—5, Fig. 4;

Fig. 6 is a view in sectional elevation on the line 6—6, Fig. 1;

Fig. 7 is a detail view in sectional elevation on the line 7—7, Fig. 6;

Fig. 8 is a detail view in plan of the vent valve;

Fig. 9 is a detail view in elevation of the vent valve, and

Fig. 10 is a detail view in sectional elevation of the vent valve on the line 10—10, Fig. 8.

Referring to the drawings, the apparatus or tool for applying flock, is preferably provided with a metallic tank or chamber 11 (Figs. 4, 5 and 6) comprising a container for a large amount of flock. After the tank 11 is partially filled with flock its open top is covered by a cover 12. The interior of the cover 12 is provided with a gasket 13 to engage the circular top edge of the tank 11 and form an air tight joint. The cover 12 is provided with a series of slotted lugs 14 (Figs. 1 and 6) each of which receives the shank of a bolt 15 which is pivoted between a pair of small plates 16 supported by the exterior surface of the tank 11. The free end of the bolt 15 is screw-threaded and receives a wing-nut 17 adapted to engage the lugs 14.

In order to introduce a motive agent, such as compressed air, into the flock tank 11, the apparatus is provided with a main air line 18 (Figs. 1 and 4) which is connected to some suitable source of supply and is provided with a pressure reducing valve 19. The main air line is provided with a T 20 (Fig. 4) one outlet of which is coupled to one end of a branch air line 21 passing through an internally threaded boss 22 formed in the cover 12.

Within the tank 11 the branch air line 21 is provided with a T 23, the bottom outlet of which receives a nozzle 24 having a discharge orifice 25 directed vertically downward. The other outlet of the T 23 receives one end of a horizontal pipe 26 the other end of which fits into a cross 27 (Figs. 4, 5 and 6). One outlet of the cross 27 receives one end of a horizontal pipe 28 the other end of which is provided with an elbow 29 which receives a nozzle 30 provided with a discharge orifice 31 (Fig. 6) directed downwardly and laterally on an angle of 45 degrees. The bottom outlet of the cross 27 receives one end of a vertical pipe 33 (Figs. 4 and 6) connected to a horizontal pipe 34 through an elbow 35. The free end of the pipe 34 is provided with an elbow 36 which receives a nozzle 37 having a discharge orifice 38 directed downwardly and laterally on an angle of 45 degrees. The remaining outlet of the cross 27 is sealed by a plug 39.

With this construction the air discharged into the flock, through the orifices 25, 31 and 38, causes it to swirl in a clockwise direction, (Fig. 5), in the tank 11. As the flock swirls some

of it is separated from the mass of flock into particles which commingle with the air. This flock, commingled with the air, rises and is caused by the entraining action of the air to enter a lateral passage 40 (Fig. 4) formed between the cover 12 and the bottom of a casting 41.

The casting 41 is provided with a flat floor 42 (Fig. 5) having a vertical, external peripheral wall 43 projecting upward into engagement with the bottom of the cover 12 and extending substantially concentric to the internal wall of the tank 11 from the inlet 44 of the passage 40 to a lateral outlet 45 therefrom. Adjacent the outlet 45 the wall 43 terminates in a reverse curve 46 (Figs. 4, 5 and 6) forming a flock concentrating chamber 47 in which the flock laden air swirls in a clockwise direction. By swirling the flock in the tank 11 in a clockwise direction and by forming the wall 43 concentric to the internal wall of the tank 11, advantage is taken of the centrifugal action to cause the major part of the particles of flock entrained in the air to engage and travel along the wall 43 and thus be directed into the flock concentrating chamber 47. The reversely curved wall 46 causes the flock laden air to swirl in the chamber 47 to maintain the flock delivered thereto in a stirred-up and floating condition.

Directly over the flock concentrating chamber 47 (Fig. 3) the cover 12 is provided with an internally threaded, perforated boss 48 which receives the threaded lower end of an elongated dome 49 provided with an internal frusto-conical passage 50 the larger base of which is at the bottom. Adjacent its upper end the exterior of the dome 49 is reduced to form a vertical cylindrical neck 51 and a horizontal shoulder 52. Projecting laterally from the neck 51 is a short screw 53 which enters an angular slot 54 formed in one end of a goose-neck 55 which fits over the neck 51 and seats on the shoulder 52. The screw 53 and slot 54 constitute a bayonet-joint permitting the ready coupling and uncoupling of the goose-neck 55 to and from the dome 49.

The other end of the goose-neck 55 receives one end of a flexible conduit 56, (Figs. 1 and 6), the other end of which fits over one end of a goose-neck 57. The other end of the goose-neck 57 is coupled detachably to a nozzle head 58 in a manner similar to the coupling between the dome 49 and the goose-neck 55.

The flock laden air flows out of the chamber 47 into the conduit 56. The purpose of the dome 49 is to reduce gradually the size of the flock laden air stream as it flows through the dome 49 into the flexible conduit 56. The purpose of the goose-neck 57 is to direct the flow of the flock laden air axially into a cylindrical passage 59 formed in the nozzle head 58. From the passage 59 the flock laden air flows into a larger passage 60 terminating on the front face of the nozzle head 58.

The front face of the nozzle head 58 is provided with a transverse annular seat 61 and a cylindrical seat 62. Rotatably mounted on the cylindrical seat 62 is a nozzle 63 the rear end face 64 of which engages the transverse seat 61. The nozzle 63 is coupled to the nozzle head 58 by an internally threaded ring 65 provided with an inturned flange 66 arranged to engage a peripheral shoulder 67 formed on the nozzle 63.

The nozzle 63 is provided with a central discharge orifice 68 formed in the common base 69 of an internal frusto-conical passage 70 and an external frusto-conical recess 71. The frusto-conical internal passage 70 and the frusto-conical external recess 71 are reversely arranged so that the common base 69 is the smaller base of each of the frusto-conical surfaces.

The front end of the passage 60 is lined with a hollow tube 72 one end of which is provided with a flange 73 engaged with the front end face of the cylindrical seat 62. The tube 72 is provided with a peripheral groove 74 which is engaged by the rounded end of a screw 75 (Fig. 1), thus rendering the tube readily removable. The entrance to the cylindrical interior of the tube 72 is frusto-conical, the larger base being adjacent a mixing chamber 76 occupying the space in the passage 60 not lined with the tube 72.

With this construction the flock laden air is delivered from the passage 59 into the mixing chamber 76 where the flock and the air have an opportunity to expand and then form into an axial line of flow through the frusto-conical entrance of the reduced passage in the tube 72. When this flock laden air leaves the tube 72 it is again directed axially by the frusto-conical surface 70 of the nozzle 63 to the discharged orifice 68. Thus, the flock laden air enters the nozzle head 58 and discharges from the orifice 68 in a common axial line of flow.

It will be apparent to those skilled in the art that if all the air introduced into the tank escaped therefrom through the dome 49 and from the dome to and out of the discharge nozzle 63, the velocity of the escaping air would bear a direct relationship to the air pressure inside the tank. But the flock used in coating the work varies widely in kind, quality, fineness, weight, and length of fibre. In consequence a rate of air flow velocity used in handling one type of flock would be inadequate or detrimental when used in handling another type of flock. For instance, if an attempt were made to withdraw rayon flock from the tank and apply it to a surface using the same air current as that used in handling cotton flock, the rayon flock, due to its weight, would drop out of suspension and clog the conduit extending from the tank to the discharge nozzle.

In order to avoid the necessity of relying solely on the variation of the pressure of the air introduced into the tank to obtain different rates of air flow velocity in the conduit in which the flock is conducted to the point of application to meet the different operation conditions, the illustrated embodiment of the present invention is provided with a vent whereby a portion of the air within the tank may be allowed to escape directly to the atmosphere and thus reduce the rate of air flow velocity in the conduit in which the flock is conducted to the point of use. A valve is provided so that the size of the vent opening may be varied to provide a delicate control of the rate of air flow velocity in the air which entrains the flock and carries it to the point of application and thus adapt the apparatus to the easy, reliable and economical handling of all types of flock.

The floor 42 (Fig. 5) is provided with a vertical, internal peripheral wall 77 having the same height as the wall 43 and spaced therefrom to form the side wall of the passage 40 for a portion of its extent. One end of the wall 77 terminates at the outlet 45. The other end of the wall 77 terminates at a point spaced from the end of the wall 46. For the major portion of its

length the wall 77 is concentric to the wall 43 but is provided with a straight portion 78 which is directed at the juncture between the walls 43 and 46. The wall 77, the portion of the floor 42 enclosed thereby, and the cover 12, form a central filter chamber 79. The casting 41 is bolted to the bottom of the cover 12 by three bolts 80, two of which pass through the wall 43 and the third one of which passes through the wall 77.

Directly over the filter chamber 79 the cover 12 is provided with a cylindrical opening 81 (Figs. 4 and 10) and three screws 82 (Figs. 8 and 9), the heads 83 of which are elevated above the cover 12. Mounted on the screws 82 and engaged with the exposed face of the cover 12 is a triangular gasket 84 (Figs. 9 and 10) having an opening 85 smaller than the opening 81 but concentric therewith. Mounted on the screws 82 and engaged with the exposed face of the gasket 84 is a triangular plate 86 having an opening 87 smaller than the opening 85 but concentric therewith. The opening 87 may be closed or varied in size by a gate valve 88 one end of which is pivoted on one of the screws 82 and the other end of which is provided with an operating finger piece 89 movable between the other two screws 82. When the finger piece 89 engages one screw 82 as in Fig. 8, the opening 87 is closed by the gate valve 88. When the finger piece 89 engages the other screw 82 the opening 87 is uncovered by the gate valve 88. The finger piece 89 may be moved into a position intermediate the two adjacent screws 82 to vary the effective size of the opening 87. The finger piece 89 travels beneath a strap 90 loosely mounted on the two adjacent screws 82.

The three screws 82 loosely support a cap 91. In order to force the cap 91 against the heads 83, the gasket 84 against the cover 12, and the gate valve 88 against the plate 86, the screws 82 are each provided with a coiled spring 92 one of which is interposed between the pivoted end of the gate valve 88 and the cap 91 and the other two of which are interposed between the strap 90 and the cap 91.

When the gate valve 88 is positioned to close the opening 87 all of the air introduced into the tank 11 in escaping to the atmosphere must pass under its maximum rate of velocity through the discharge nozzle 63. When the gate valve 88 is positioned to uncover the opening 87 a portion of the air introduced into the tank is vented to the atmosphere through the opening. In consequence the flock laden air flows under its minimum velocity to and out of the discharge nozzle 63. By varying the size of the opening 87 from its minimum to its maximum, or any effective size therebetween, the rate of velocity at which the flock laden air is discharged from the tank 11 to and out of the discharge nozzle 63 may be varied to meet the existing operation condition.

When a portion of the air introduced into the tank 11 is allowed to escape into the atmosphere through the vent 87 it is desirable to filter the flock out of the air before it escapes.

The flock is filtered out of the air escaping from the tank 11 through the vent 87 by a screen 93 (Figs. 4 and 10) supported from a frame 94 interposed between the screen and the heads of screws 95 which secure the frame and the screen to the bottom of the cover 12. With this construction that portion of the flock laden air which enters the passage 40 from the tank 11 and which does not enter the flock concentrating chamber 47 and does not pass back into the tank 11 through the outlet 45 of the passage 40, enters the filter chamber 79 wherein the flock is filtered out of the entraining air seeking to escape from the tank 11 through the vent 87 either by falling out of the air stream or by being stopped by the screen 93. In any event the flock laden air vented out of the tank 11 through the vent 87 leaves the flock behind in the filter chamber.

As so far described the air introduced into the flock through the orifices 25, 31 and 38 stirs up and swirls the flock in the tank 11 in a clockwise direction, (Fig. 5), separates floating particles therefrom and then, under velocity, carries the floating particles in a dense cloud into the lateral passage 40. Some of these particles collected in the passage 40 are discharged from the nozzle 63 by the entraining action of the air during its escape from the tank 11 by way of the chamber 47. Some of the particles collected in the passage 40, instead of passing out of the tank 11 to the nozzle 63, are carried by the entraining air into the filter chamber 79. These last named particles are removed from the air by the screen 93 and either accumulate upon the screen or fall upon the floor of the filter chamber. Still others of the particles of flock collected in the passage 40 are carried by the entraining air through the outlet 45 back into the tank 11.

In order to break up any lumps of flock which may be carried out of the tank 11 the passage 40 may be provided with a coarse screen 96 (Figs. 5, 6, and 7). The screen 96 extends vertically from the floor 42 to the bottom of the cover 12 and laterally from the wall 43 to the wall 77. The screen 96 is soldered and braced to one end of a plate 97 the other end of which is bent to form a clip 98 embracing the edge of the floor 42.

In order to stir up the flock collected on the floor of the passage 40 and send the stirred-up flock into the air stream flowing therethrough, thereby to intensify the density of the flock laden air seeking an outlet from the tank 11, to prevent the flock from accumulating and plugging the passage 40, and to drive lumpy flock against the screen 96, the main air line 18 is provided above the cover 12 with a cross 99 (Figs. 1, 4, and 6) to one outlet of which a branch air line 100 is connected. The branch 100 passes through an internally threaded, perforated boss 101 on the cover 12 into the tank 11 where the branch 100 is provided with an elbow 102 (Figs. 6 and 7) which receives a nozzle 103 having an orifice 104 discharging directly into the passage 40. With this construction the floor of the passage 40 and the jet of air discharged by the orifice 104 into the inlet 44 of the passage 40 not only constitute an intensifier for intensifying the flock laden air flowing from the tank 11 through the passage 40, but also act to prevent it from becoming choked by an accumulation of flock. As indicated in Fig. 5 the elbow 102 may be rotated to vary the direction at which the jet of air is discharged from the orifice 104.

In order to prevent the flock collected on the screen 93 or the floor of the filter chamber 79 from accumulating sufficiently to choke the vent 87, to stir the flock up in the filter chamber 79, whirl the stirred-up flock into the flock concentrating chamber 47, and thereby intensify the density of the flock laden air escaping from the chamber 47 to the nozzle 63, another outlet of the cross 99 (Fig. 1) is connected to a branch air line 105 which passes into the tank 11 through an internally threaded, perforated boss 106 (Figs. 4 and 6). Within the tank 11 the branch 105 is provided with an elbow 107 which receives a noz-

zle 108 located in the filter chamber 79 adjacent the junction between the outlet 45 and the vertical wall 77, and provided with an orifice 109 (Fig. 5). With this construction the jet of air discharged into the filter chamber 79 through the orifice 109 stirs up the flock in the chamber, whirls the flock therein in a clockwise direction, (Fig. 5), separates floating particles from the whirling flock, and carries the floating flock by the entraining and centrifugal actions of the air discharged from the orifice 109 along the wall 77, from the straight portion 78 of which the flock laden air flows towards the flock concentrating chamber 47. Some of the flock discharged from the filter chamber 79 passes back into the tank 11 through the outlet 45, but most of it is carried into the flock concentrating chamber 47 in which it is whirled and from which it is discharged to the nozzle 63. The filter chamber 79 and the jet of air discharged from the orifice 109 not only constitute an intensifier for intensifying the flock laden air passing out of the chamber 47 to the nozzle 63, but also act to prevent the vent outlet 87 from becoming choked by an accumulation of flock in the filter chamber 79.

From an inspection of Fig. 5 it is apparent that at least some of the flock in its travel from the tank 11 to the nozzle 63 by way of the chamber 47 is subjected to three distinct whirls, the whirl in the tank 11 being the greatest in extent, the whirl in the chamber 47 being the least in extent, and the whirl in the filter chamber 79 being intermediate in extent, and that the apparatus is designed to take advantage of the centrifugal action developed during each whirl. The air which flows to the nozzle 63 by way of the chamber 47 is delivered from the orifices 25, 31, 38, 104 and 109. The air from the orifices 25, 31 and 38 becomes laden with flock in the tank 11. The air from the orifice 104 becomes laden with flock in the passage 40. The air from the orifice 109 becomes laden with flock in the filter chamber 79. All the flock laden air from the three different sources which pass into the chamber 47 unite therein to produce a discharge of concentrated flock from the nozzle 63.

In order to vary the pressure of the air introduced into the tank, the passage 40 and the filter chamber 79, as may be desired to meet the different operating conditions and to obtain the desired volume of flock with the particular type thereof being handled, the three branch air lines 21, 100 and 105 are provided with control valves. The air flowing through the branch 21 is controlled by a valve 110, (Figs. 1 and 4). The pressure in the air delivered to the branch 21 through the valve 110 is registered on a gage 111 connected to the top outlet in the T 20. The air flowing through the branch 100 is controlled by a valve 112 (Figs. 1 and 6). The pressure in the branch 100 is registered on a gage 113 fitted into a T 114. The air flowing through the branch 105 is controlled and its pressure is registered by a valve 115 and a gage 116, respectively, (Fig. 1).

In order that the flock discharged axially of the nozzle discharge orifice 68 may be flattened, the walls of the frusto-conical recess 71 are provided with a pair of diametrically opposite orifices 117 (Fig. 2) through which air is discharged supplementally upon the main discharge. Each orifice 117 is formed in the front end of a passage 118 which communicates through a passage 119 with an annular groove 120 formed in the rear end face of the nozzle 63. Communicating with the groove 120 is a horizontal passage 121 formed in the nozzle head 58.

The passage 121 communicates with a vertical passage 122 which communicates in turn with a horizontal passage 123. Air is delivered to the passage 123 through a short pipe 124 (Fig. 1) coupled to the front end of a metallic body 125 which has integral therewith a handle or grip 126. The air under pressure is preferably introduced into the body portion 125 through the grip 126 which is connected to one end of an air hose 127 through a coupling 128. The other end of the air hose 127 is connected to one outlet of a T 129 carried by the main air line 18.

The passage of the air through the body portion 125 is controlled by a normally closed main air valve (not shown) the stem 1290 of which is arranged to be engaged by a trigger 130, at the will of the operative, to depress the stem 1290 and thus open the main air valve. The upper end of the trigger 130 is provided with a yoke 131 which embraces the body portion 125 to which the yoke is secured in a pivotal manner.

The volume of air discharged through the orifices 117 is controlled by a spindle 132 (Fig. 2) the point of which has a valve seat engagement with the wall of the vertical passage 122 just below its point of confluence with the passage 123. The spindle 132 is threaded into the nozzle head 58 and is provided with a milled head 133 to facilitate its adjustment. Coiled about the spindle 132 and interposed between the nozzle head and the head 133 is a spring 134 acting to hold the spindle 132 in any desired position of adjustment.

The shape of the discharged material is controlled by the spindle 132. When the spindle 132 is engaged with its valve seat the target formed by the discharged material is circular. By manipulating the spindle 132 the shape of the target formed by the discharged material may be varied from a circle to an ellipse. In the showing of Fig. 2 the orifices are arranged vertically, thus providing for the flattening of the discharged material into a horizontally arranged fan. By loosening the ring 65 the nozzle 63 may be angularly adjusted to obtain the fan in any desired plane.

To operate the apparatus the tank 11 is filled to within not less than six inches from its top with clean, dry flock, and the cover 12 secured in place. With the valve 110 closed and the valves 112 and 115 opened, a main air valve 135 (Fig. 1) is opened to admit air under the pressure determined by the pressure reducing valve 19 into the apparatus from the main air line 18. The valves 112 and 115 are adjusted to obtain differential pressures in the branches 100 and 105, respectively, in accordance with the kind of flock with which the tank 11 is filled. Assuming that the main air line pressure is over sixty pounds per square inch, for instance, the pressure of the air introduced into the tank through the branch 100 should be varied from fifteen to forty-five pounds per square inch and the pressure of air introduced into the tank through the branch 105 should be varied from five to forty-five pounds per square inch depending upon the type of flock in the tank. The gate valve 88 is adjusted to obtain the proper sized opening for the vent 87 and thus determine the rate of air flow velocity through the conduit connecting the dome 49 and the nozzle head 58. For cotton flock the vent 87 should be substantially uncovered. For rayon flock the vent 87 should be substantially closed. The effective size of the vent 87 should be varied to accommodate

the apparatus to the particular type of flock employed. Then the valve 110 which controls the volume of the flock laden air discharged is opened gradually until a pressure substantially less than five pounds per square inch is indicated on the gage 111, whereupon the flock is discharged from the nozzle 63 in a turbid condition. As the tank empties, the valves 88, 110, 112 and 115 may be re-adjusted to maintain the desired character of flock discharge.

To apply the flock, the work is coated with a suitable adhesive. The handle 126 of the apparatus is engaged in the palm of the operative's hand with the index and adjacent fingers thereof engaged with the trigger 130. By manipulating the gun body 125 the flock flowing out of the nozzle 63 is applied to the surface of the coated work, care being taken to drive the flock into the adhesive of the previously coated work. In order to prevent the formation of flock mounds on the work the operative, after each flock applying operation, directs the flock slantwise at the work with the result that the excess flock is blown therefrom and subsequently recovered for re-use. Usually it is necessary to apply successive coats of flock to the adhesively coated work in order to obtain an even surface having a velvety or cloth-like appearance. When the flock applying operation has been completed the main valve 135 may be closed and the trigger 130 may be operated to utilize the supplemental air jets issuing from the orifices 117 for dusting off the excess flock.

In order to dissipate the statical electricity generated by the passage of flock through the conduit 56 the opposite ends of a wire 136 are connected to the goose-necks 55 and 57, the tank 11 being grounded by a wire 137 (Fig. 6).

Nothing herein explained is to be interpreted as limiting the various features of the present invention in the scope of its application to use in connection with the particular apparatus or the particular mode of operation or both selected for purposes of illustration and explanation. While the particulars of construction herein set forth are well suited to one mechanical form of the invention and to the use to which it is put, it is not limited to this use, nor to these details of construction, nor to the conjoint use of all its features, nor is it to be understood that these particulars are essential since they may be modified within the skill of the artisan without departing from the true scope of the actual invention, characterizing features of which are set forth in the following claim by the intentional use of generic terms and expressions inclusive of various modifications.

What is claimed as new, is:

An apparatus for applying flock having, in combination, a nozzle, a container for the flock, an outlet from the container in communication with the nozzle, means for introducing air under pressure into the container and discharging the air against the flock to impart movement thereto, means for varying the air pressure, and separate means for varying the velocity of the air flow through the outlet.

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