Spray gun control line 15 includes an air regulator 21 for controlling the pressure of the air operating the spray guns. A lubricator 22 which puts oil into the air to lubricate the spray gun parts, gun control valves 23, 24 which actuate the spray guns, conduit 25 which connects gun control valve 23 with one side of the piston of spray gun 26, and conduit 27 which connects gun control valve 23 with the other side of the piston of spray gun 26. Similarly, conduits 31 and 32 connect gun control valve 23 with each side of the piston of spray gun 33.

In like manner, gun control valve 24 is connected to each side of the piston in spray gun 34 by conduits 35 and 36, and valve 24 is connected to each side of the piston in spray gun 37 by conduits 38 and 39.

Atomizing air lines 16, 17 connect compressed air to the spray guns which atomizes the adhesive as it is being emitted from the guns. Line 16 includes a regulator 42 which controls the pressure of the atomizing air, an atomizing air valve 43, and conduits 44, 45 which connect the atomizing air valve 43 with spray guns 26 and 33, respectively.

Atomizing air line 17 includes a regulator 46 which regulates the pressure of the atomizing air in spray guns 37, 34, atomizing air valve 47 (which, like valve 43, is a pilot operated 2-way valve that turns the atomizing air on and off in the spray guns), and conduits 48, 49 which connect atomizing air valve 47 to spray guns 34 and 37, respectively.

It is to be noted that atomizing air valve 43 connects to the upper two spray guns 26 and 33, while atomizing air valve 47 connects to the lower positioned spray guns 37 and 34. The apparatus is arranged in this manner because it has been found that valve 43 which lowers the gun and atomizes upward (shooting upwardly) requires more atomizing air pressure than the upper guns 26, 33 (which shoot downwardly). Gun control valve 23 controls the operation of the upper spray guns 26 and 33, while gun control valve 24 controls the operation of the lower spray guns 37 and 34. Accordingly, it may be seen that valves 23 and 43 operate as a team to control the upper guns 26 and 33, while valves 24 and 47 operate as a team to control the lower spray guns 37 and 34.

Glue pot line 18 includes an air regulator 52 and connects main line 14 with pressurized glue pot 53. Conduits 54-57 connect glue pot 53 to the spray guns.

FIGS. 4 and 5 show a spray gun which includes a housing 61 adapted to be mounted in close proximity to a flap of a carton and having a cylinder 62 formed therein, a piston 63 having a piston head 64 positioned in cylinder 62 and a piston rod 65 extending upwardly therefrom, a needle bar 66 mounted on the top of piston rod 65 and adapted to be reciprocated thereby, a spray head 67 mounted on housing 61 above needle bar 66 and having a plurality of adhesive spray orifices 68 and a longitudinally movable needle 71 extending from each adhesive orifice 68 and operatively connected to needle bar 66.

Piston head 64 is double acting and is provided with sides 72, 73. Compressed air from gun control valve 24, for example, may be connected to exert pressure on side 73 of piston head 64 in gun 37 by connecting the conduit 38 to a port 74 formed in cylinder body cap 75 which is mounted on the bottom of cylinder housing 61. Compressed air from gun control valve 24 may be connected to side 72 of piston head 64 by connecting the conduit 39 to port 76 which is formed in housing 61.

An O-ring 77 provides a seal between housing 61 and cylinder body cap 75, and O-ring 78 is mounted in a groove 81 in piston head 64 to provide a seal between side 72 and side 73 of piston head 64.

Piston rod 65 is centered in a guide liner 82 mounted in an opening 83 in housing 61, and an O-ring 84 provides...
a seal between piston rod 65 and guide liner 82. A dirt seal 85 is mounted in opening 83 above guide liner 82.

Compressed air impinging against side 72 of piston head 64 moves it away from adhesive discharge orifices 68, and piston rod 65 moves needle bar 66 and the needles 71 in the same direction to move the tip of the needles out of the adhesive discharge orifices 68.

On the other hand, the impinging of compressed air against side 73 of piston head 64 moves the piston head 64 in the direction toward adhesive discharge orifices 68 and thereby moves needle bar 66 and needles 71 toward adhesive discharge orifices 68 to move the tips of needles 71 into orifices 68 to stop the discharge of adhesive therefrom.

The top of piston rod 65 is received in an opening in a lower horizontal member 86 of needle bar 66, and is held tightly therein by a socket pipe plug 87.

Needles 71 are provided with a tip 88, a shaft 91, and a head 92. Head 92 is received in a space in needle bar 66 between lower horizontal member 86 and upper horizontal member 93 which is provided with slots 94 that receive shafts 91 but do not pass needle heads 92.

Each needle head 92 is supported by a spring assembly 95 which presses upwardly to insure that tip 88 of needle 71 is seated properly in orifice 68 of adhesive discharge nozzle 96, despite any manufacturing variations of the dimensions of tips 88 or the adhesive discharge orifices 68.

Spray head 67 includes a base 97 which is bolted to a cap 98. Nozzle 101 is seated in an opening in cap 98 and forms an annular air discharge orifice 102 around the tip of adhesive discharge orifice 68. Atomizing air may be connected into annular air discharge orifice 102 from atomizing air valve 47 through conduit 49 into an air passage 103 formed in base 97. Air passages 104 in cap 98 connect air passage 103 to the annular air discharge orifice 102.

An adhesive chamber 105 is formed in base 97 and is connected to the interior of adhesive discharge nozzle 96 and to adhesive discharge orifice 68. Adhesive may be connected into an adhesive chamber 105 from glue pot 53 by means of conduit 57 (see FIG. 1).

To prevent adhesive from seeping out along the shaft 91 of needle 71, packing 106 is positioned around shaft 91 and is held in place by a packing nut 107.

It is to be noted that spray head 67 and needles 71 may be removed from housing 61 and replaced as a unit by unscrewing bolts 108 and sliding the needles 71 out of the slots 94 in the upper horizontal member 93 of needle bar 66. This easy removal as a unit for inspection, cleaning, and repair is one of the outstanding advantages of the invention.

FIG. 3 shows a schematic wiring diagram of the invention which includes line conductors 111, 112, fused disconnect switch 113, an operating circuit which includes a conductor 114 having connected therein an auxiliary contact 115 on the drive motor starter which opens the circuit to the spray guns if the motor stops, a contact 116 of a selector switch 117 which is operated by a lever 118 (FIG. 1) and is provided with three stops (automatic 121, off 122, and manual-test 123), and a carton operated limit switch 124.

Conductor 114 also connects to contacts 125, 126 of knob operated selector switch 127. Switch 127 allows for operation of the pair of upper guns, or the pair of lower guns by engaging the selector switch. Contact 125 is connected to a solenoid 128 which controls the actuation of atomizing air valve 43 of the upper guns 26, 33, and contact 126 is connected to a solenoid 129 which controls the actuation of atomizing air valve 47 of the lower guns 37, 34.

A conductor 132 connects to an auxiliary contact 114 and such contacts 132, 133, 134. Contact 133 is connected to a solenoid 135 which controls the operation of gun control valve 23 of the upper guns, and contact 134 is connected to a solenoid 136 which controls the operation of gun control valve 24 of the lower guns. A cam operated limit switch 137 is connected in conductor 132 and is actuated to pulse the guns to spray the glue.

A test circuit is provided which permits testing the operation of the apparatus. The test circuit includes a conductor 138 and a contact 141 which by-passes auxiliary contact 115 and contact 116, and connects to contacts 125, 126 of solenoids 128, 129. The test circuit also includes a conductor 142, and a contact 143 which by-passes limit switch 137 and connects to contacts 133 and 134 and solenoids 135, 136.

In automatic operation, contact 116 is closed and contacts 141 and 143 are open. If no carton is positioned beneath the guns to close the limit switch 124, the circuit is open to solenoids 128, 129 of the atomizing air control valves 43, 47, and the circuit is also open to the solenoids 135, 136 of the gun control valves 23, 24. Accordingly, the spray guns are not actuated.

In manual-test operation, contact 115 is open and contacts 141 and 143 are closed to thereby by-pass the limit switch 124, and by-pass the limit switch 137.

In automatic operation, the flap of a carton is passed in close proximity to the tip of a spray gun, such as spray gun 27, allowing air valve 47 is actuated by carton operated limit switch 124.

Then, piston head 64 is moved away from adhesive discharge orifices 68 by the operation of gun control valve 24 (actuated by cam operated limit switch 137) sending compressed air through conduit 29 to impinge against side 73 of piston head 64. Conductor 125, needle bar 66 and needles 71 away from orifices 68 to withdraw needle tips 88 therefrom, and the previously actuated atomizing air from annular orifices 102 impinges against the adhesive being discharged from orifices 68 and carries the adhesive to the surface of the carton flap. Then gun control valve 24 is actuated by cam operated limit switch 137 to send compressed air through conduit 39 to impinge against the side 73 of piston head 64 to move piston 63, needle bar 66, and needles 71 toward orifices 68 to close orifices 68 by inserting the tips 88 of needles 71 therein. Then atomizing air valve 47 shuts off the atomizing air going through gun 57. A time delay mechanism in valve 47 delays the shutting off of the atomizing air until after adhesive discharge orifices 68 have been closed by needles 71.

The method for spraying adhesive on the flaps of a carton is replaced as a unit with the present invention includes the steps of passing the flaps of a carton in close proximity to the tips of a spray gun, passing atomizing air from a plurality of atomizing orifices of the spray gun until the atomizing air stabilizes into a steady stream, passing an adhesive from a multiplicity of adhesive orifices of the spray gun, implanting said adhesive with the atomizing air to atomize it and carry it to the surface of the carton flaps, stopping the passage of adhesive from the adhesive orifices, and maintaining the passage of atomizing air from the atomizing orifices for a predetermined time period, to clean the tip of the spray head and prevent adhesive from smearing thereon. Then the passage of atomizing air from the atomizing orifices is stopped. The carton flap is moved relative to the tip of the spray gun during the spraying operation so that the flap receives stripes of adhesives. Such stripes may overlap to form a band.

The present invention provides a number of advantages over the prior art. It uses a lesser quantity of adhesives, it reduces the time required to compress and seal the glued flap, and it requires less maintenance than roll type adhesive applicators. Instead of applying a gummy layer, which is thicker than needed for effective sealing, the present invention sprays on a controlled mist of tiny droplets which coagulates and dries faster, and reduces compression time. Mesmy maintenance problems that go with rollers and glue pots are eliminated.

The specially designed spray heads with their multiple orifices deposit the adhesive on the carton flap and prevent overspray.
The present invention provides precise control of the adhesive coverage. The multiple orifice spray head may be positioned as close to the carton flaps as required to achieve precise control, not only of adhesive thickness, but also of adhesive pattern. For example, the spray head may be positioned to spray a broad band of adhesive for maximum flap coverage, or it may be positioned so as to spray thin stripes of controlled width on the flap when less coverage is desired.

Another important advantage is provided by the selector switch 127 which enables the operator to select to spray top flaps, or to spray bottom flaps, or to spray all flaps simultaneously by the flick of a switch.

The present invention is easily adapted to new or existing machines. It is not necessary to remove the roller type applicators when installing the spray kit of the present invention on conventional case sealers. The spray kit of the present invention functions with either resin or dextrin adhesives.

Although spray gun apparatus including four spray guns have herein been illustrated and described, it will be realized that spray gun apparatus including only two guns for spraying either the top flaps or the bottom flaps of a case may be provided. The two gun spray apparatus may be especially desirable for the emergency replacement of defective gussets or gaskets or other similar applicators who receive cartons having one set of flaps already sealed, since such manufacturers glue only either the bottom flaps or the top flaps.

It is to be understood that the form of the invention hereinafter shown and described is to be taken as a presently preferred embodiment. Various changes may be made in the shape, size and arrangement of parts. For example, equivalent elements may be substituted for those illustrated and described herein, parts may be reversed, and certain features of the invention may be utilized independently of the use of other features, all without departing from the spirit or scope of the invention as defined in the appended claims.

The claimed invention:

1. Spray gun apparatus for spraying adhesive on the flaps of a carton comprising a spray gun having a spray head provided with a plurality of adhesive spray orifices and atomizing-air orifices, an air filter adapted to be connected to a source of compressed air, a spray gun control line connected to said air filter and connecting together an air pressure regulator, an atomizing air valve, and the atomizing orifices of said spray gun, an atomizing air valve being separate from said spray gun and adapted to be located at a point remote from the spray gun, a glue line operatively connected to said air filter and connecting together an air pressure regulator, an air lubricator, an air passage formed in said base and connected to said atomizing-air orifices by air passages formed in said cap, a needle bar connected to said piston rod and reciprocable thereby, a spray head detachably mounted on said housing and having a plurality of adhesive spray orifices contained therein, and a longitudinally movable needle extending from each of said orifices and operatively connected to said needle bar, said needle bar being detachably connected to a lower horizontal member connected to said piston rod and having an upper horizontal member with slots formed therein, each of said needles having a tip which seats in its orifice, a shaft which is received in one of said slots, and a head which is received in a space between the upper and lower horizontal members of said needle bar and is too large to pass through said slots.

2. The spray gun defined in claim 1, wherein each of said needle heads is supported by a spring assembly mounted on said lower horizontal member of the needle bar, and said needle head is pressed upwardly by said assembly to insulate that the needle tip is seated properly in its orifice despite any manufacturing variations in the dimensions of needle tips and orifices.

3. A spray gun for spraying adhesive on the flaps of a carton comprising a housing adapted to be mounted in close proximity to a carton and having a cylinder formed therein, a piston having a piston head positioned in said cylinder and a cylinder rod extending therefrom, an atomizing orifices of said spray gun, said atomizing air valve being separate from said spray gun and adapted to be located at a point remote from the spray gun, a glue line operatively connected to said air filter and connecting together an air pressure regulator, an air lubricator, an atomizing air valve, and the atomizing orifices of said spray gun, said spray gun having a longitudinally movable needle extending from each of said adhesive-spray orifices, and means for operating said needles in unison to open and close said adhesive-spray orifices.

4. The spray gun apparatus defined in claim 1, wherein is provided cam operated limit switch means connected to said gun control valve for actuating said control valve to operate the spray guns.

5. The spray gun apparatus defined in claim 1, wherein is provided cam operated limit switch means connected to said gun control valve for actuating said control valve to operate the spray guns.

6. Spray gun apparatus for spraying adhesive on the flaps of a carton comprising upper and lower pairs of spray heads each provided with a plurality of adhesive-spray orifices and atomizing air orifices, said air filter adapted to be connected to a source of compressed air, a spray gun control line connected to said air filter and connecting together an air pressure regulator, an air lubricator, an air passage formed in said base and connected to said atomizing-air orifices by air passages formed in said cap, a needle bar connected to said piston rod and reciprocable thereby, a spray head detachably mounted on said housing and having a plurality of adhesive spray orifices contained therein, and a longitudinally movable needle extending from each of said orifices and operatively connected to said needle bar, said spray head and needles being easily removable as a unit from said housing for maintenance or repair.

7. In a spray head for spraying adhesive on the flap of a carton, a plurality of adhesive discharge nozzles positioned in said cap, an air discharge nozzle positioned around each of said adhesive nozzles, a spray head base bolted to said spray head cap, said air discharge nozzle being connected to said base by air passages formed in said cap and base, a single adhesive chamber formed in said base and connected to said adhesive nozzles by passages formed in said spray head, said air passages being connected to said air by air passages formed in said cap and base, a single adhesive chamber formed in said base and connected to said adhesive nozzles by passages formed in said spray head and base, a recirculating needle bar, and a needle extending from each of said adhesive nozzles and detachably connected to said needle bar and reciprocable in unison there-
with, whereby to spray the flap of carton with uniform parallel stripes of adhesive as the flap is moved along in proximity to the spray head.

9. A spray gun for spraying adhesive on the flaps of a carton comprising a housing adapted to be mounted in close proximity to a flap of a carton and having a cylinder formed therein, a piston having a piston head positioned in said cylinder and a piston rod extending therefrom, a spray head bolted on said housing and including a cap bolted to a base, a plurality of adhesive-spray orifices contained in said cap, a single adhesive chamber formed in said base and connected to each adhesive-spray orifice by passages formed in said spray head, an atomizing-air orifice positioned around each adhesive-spray orifice, an air passage formed in said base and connected to said atomizing-air orifices by air passages formed in said cap, an atomizing-air valve separate from said spray gun, an air conduit connecting said atomizing-air valve to said spray gun so that the gun may be located at a point remote from the atomizing-air valve, a needle bar connected to said piston rod and reciprocable thereby, and a longitudinally movable needle extending from each of said adhesive spray orifices and operatively connected to said needle bar, said needle bar having a lower horizontal member connected to said piston rod and having an upper horizontal member with slots formed therein, each of said needles having a tip which seats in its orifice, a shaft which is received in one of said slots, and a head which is received in a space between the upper and lower horizontal members of said needle bar and is too large to pass through said slots, and a spring assembly supporting each needle head and mounted on said lower horizontal member of the needle bar, said spring assembly pressing upwardly against the needle head to insure that the needle tip is seated properly in its orifice despite any manufacturing variations in the dimensions of needle tips and orifices, said spray head and needles being easily removable as a unit from said housing for maintenance and repair by unbolting said head from said housing and sliding the needles out of the slots in said needle bar, said spray head being easily disassembled for cleaning by unbolting the cap from the base.

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