

- [54] **ADHESIVE APPLICATOR FOR
PLYWOOD PATCHING MACHINE**
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- [73] Assignee: **Lockwood Technical, Inc.**, Sand City
(Seaside), Calif.
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118/411, 144/2, 144/310 B, 144/315 R, 156/98,
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156/578, 239/92, 239/417.3, 239/586
- [51] Int. Cl. **B32b 35/00**, B27f 4/00, B05b 1/08
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239/88-92, 63, 110, 417.3, 584, 586; 118/2, 7, 8,
DIG. 9, 410, 411; 156/98, 228, 356, 390, 513, 514,
524, 529, 531, 546, 548, 578

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[57] **ABSTRACT**

A conventional plywood patching machine is modified to permit accurately controlled application of adhesive directly to the interface between patch and ply. Nozzle applicators are built into the hold-down ring of a patching machine in a manner that requires minimum modification of other parts of the machine. A particularly effective nozzle and valve structure is described, responsive to pressure pulses and effectively compensating pressure and viscosity variations. A pulsed air jet spreads the adhesive. A release agent is applied via an airstream to prevent buildup of adhesive on the mechanism.

10 Claims, 4 Drawing Figures

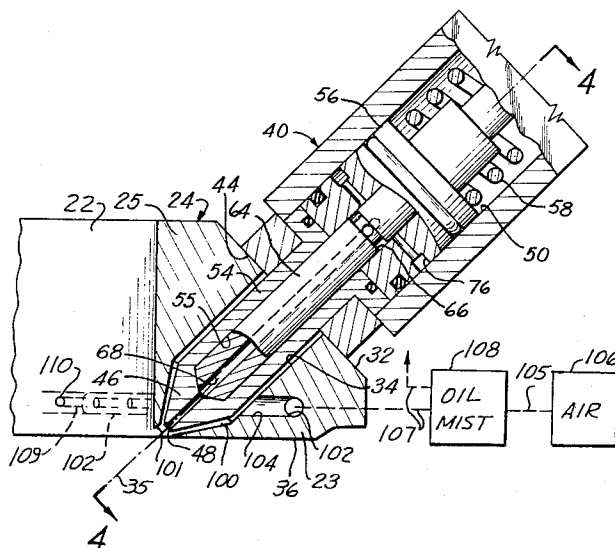


FIG. 1

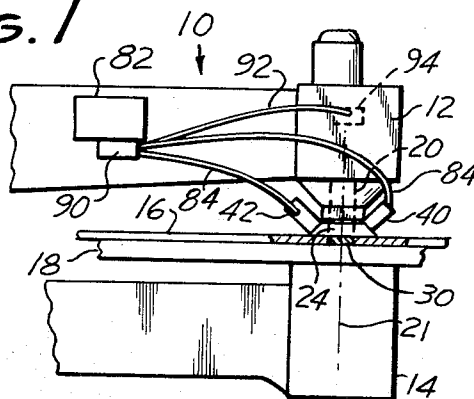


FIG. 2

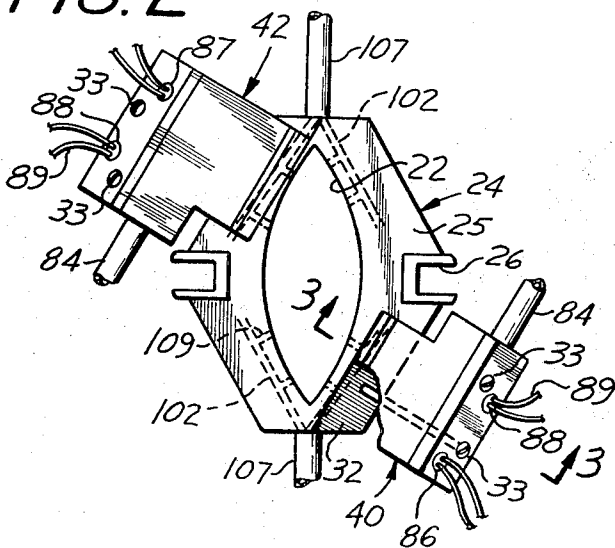
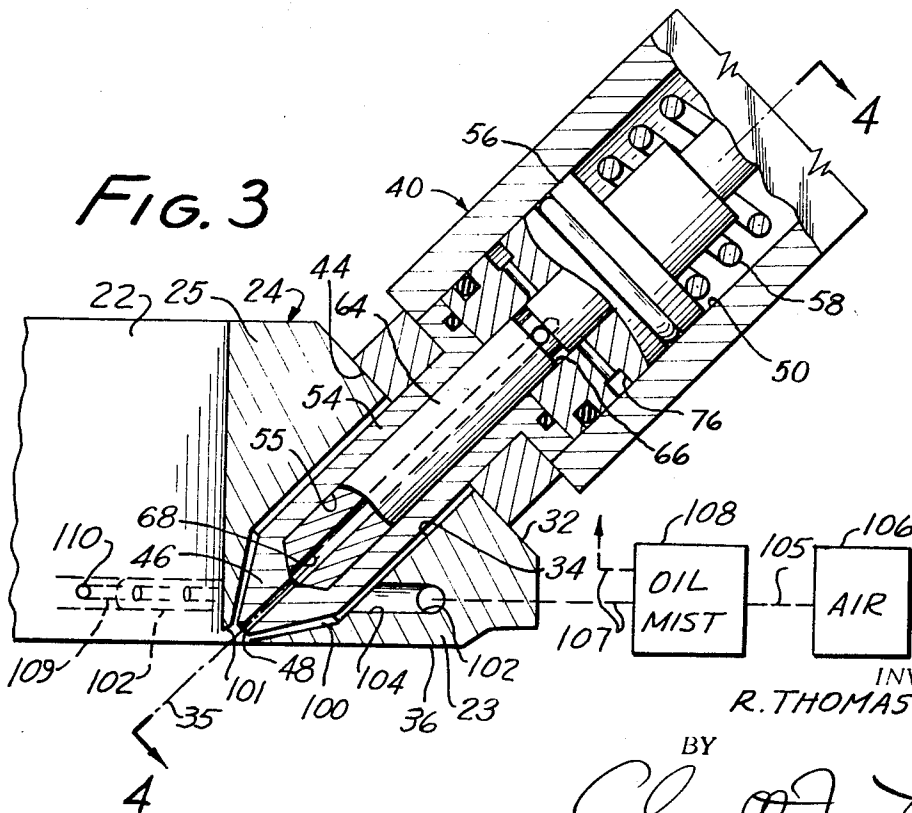


FIG. 3

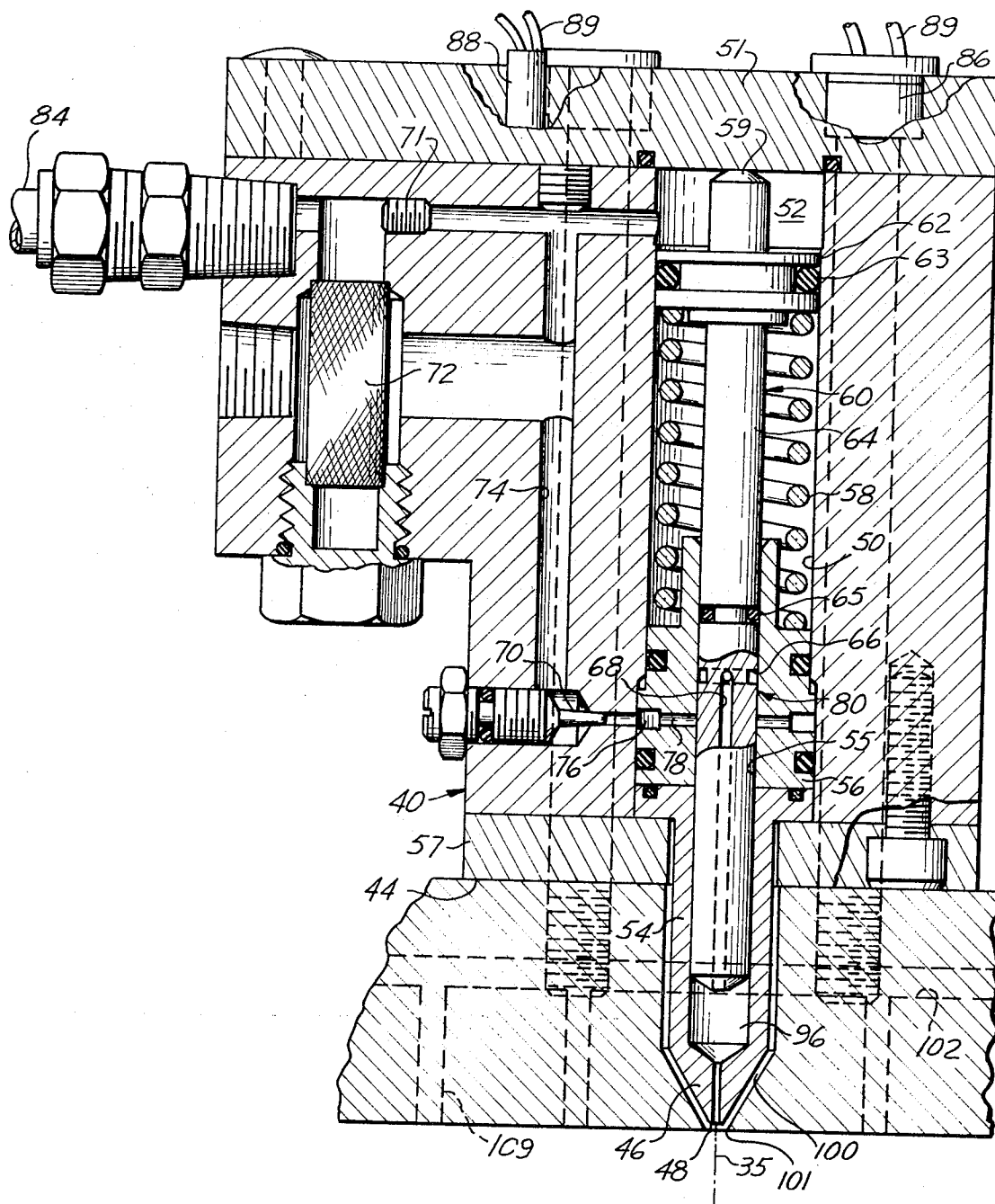


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2 Sheets-Sheet 2

FIG. 4



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ADHESIVE APPLICATOR FOR PLYWOOD PATCHING MACHINE

This invention has to do with the known operation in the manufacture of plywood by which a small defective area of a single ply is removed by a punching operation and is replaced by a sound piece that accurately fits in the punched hole. During such a patching operation, adhesive may be applied to the inserted patch in minimum quantity required to hold it in position until the patched ply has been assembled with other plies to form a completed sheet of plywood.

The present invention provides particularly effective mechanism for applying adhesive in suitable quantity and in accurately defined relation to an inserted patch. The mechanism of the present invention is integrated with the usual punching apparatus in a manner which insures accurate and reliable operation, while requiring remarkably simple and economical modification of already existing machines.

The usual patching machine employed in the plywood industry comprises upper and lower operating heads rigidly related by a heavy U-shaped frame which is built around a table on which the operator lays a single veneer sheet. He positions the defective area of the sheet under a vertically oriented cutter die in the upper head. By tripping a foot switch he causes a hold-down ring to descend and clamp the veneer sheet firmly on the table, followed by a cutter die which shears out a two by four inch section, usually of modified elliptical shape. An ejection plunger within the die ejects the bad section, which is carried away by suction. As the die rises on the return stroke, a similar opposed cutter rises from the lower head, cutting a patch from a clear strip of makeup veneer and pressing the patch into place in the large sheet with a friction fit. Finally, the hold-down ring rises, releasing the sheet to be repositioned for another patch.

In accordance with the present invention, adhesive is applied via one or more applicator nozzles which are mounted directly on the hold-down ring and project obliquely through the body of the ring to the working edge immediately adjacent the clamped ply. Upon withdrawal of the cutting die and automatic insertion of the sound patch, a drop of adhesive is applied directly by each nozzle to the interface between the patch and the surrounding ply. That adhesive is then preferably distributed over the desired area by an air blast delivered through nozzle structure incorporated directly in the adhesive applicator or built into the hold-down ring in positively defined spatial relation to the nozzle orifice. Two such applicator nozzle assemblies are preferably mounted on opposite sides of the hold-down ring, although as many as four can be provided if desired.

Each operation of the adhesive applicators is coordinated with the machine operation by control mechanism which may be largely of conventional form.

Another aspect of the invention provides coordinated nozzle and valve structure by which a readily adjustable and accurately definable quantity of adhesive is applied during each cycle of operation. Although that structure is superficially similar to previously known structures, such as that shown in U.S. Pat. No. 3,315,899, for example, the present valve is particularly well adapted for metering small amounts of adhesive. Moreover, the adjusting mechanism inherently provides substantial compensation for normal variations in input pressure and in viscosity of the adhesive.

Primary advantages provided by the invention are the accurate metering of adhesive applied during each cycle and the reliable positioning of the applied adhesive with direct relation to the hold-down ring of the machine and hence in closely defined relation to the patch itself.

A further advantage of the invention is that the nozzle assemblies can readily be adapted for application of hot melt adhesive, by providing heaters and thermostats in the assemblies to maintain them and the hold-down ring at suitable elevated temperature.

A further aspect of the invention effectively prevents build-up of adhesive on the patching mechanism, particularly on the cutting die, the ejection plunger and the hold-down ring it-

self. That is accomplished by applying a suitable release agent, such as silicone or lecithin, for example, to those elements by means of an air stream which is preferably projected from orifices in the hold-down ring in timed relation to the action of the patching mechanism. The same air and the same pulsing mechanism can usually be used for that purpose as for spreading the drop of adhesive, but separate airstreams and timing controls may be provided if desired.

A full understanding of the invention, and of its further objects and advantages, will be had from the following description of illustrative mechanism for carrying it out. The particulars of that description, and of the drawings which form a part of it, are intended only as illustration and not as a limitation upon the scope of the invention.

In the drawings:

FIG. 1 is a schematic fragmentary side elevation representing a patching machine in which the invention is embodied;

FIG. 2 is a plan representing two injection nozzles assembled with a typical hold-down ring in accordance with the invention;

FIG. 3 is a section at enlarged scale on line 3—3 of FIG. 2; and

FIG. 4 is a section on line 4—4 of FIG. 3.

In FIG. 1 the machine frame is indicated schematically at 10 with upper head 12 and lower head 14. A wood ply is indicated at 16 in operating position between the two heads on the supporting table 18, the thickness of the ply being greatly exaggerated for clarity of illustration. The punching die 20 is reciprocated along the vertical axis 21. It works in the fitting aperture 22 (FIG. 2) of hold-down ring 24, and enters a corresponding clearance opening in lower head 14. After a punching operation, the discarded section of ply 16 is removed and is replaced by a sound patch, all by automatic mechanism of known construction, which need not be described in detail. As shown in FIG. 1 a sound patch 30 has been inserted in the plane of ply 16.

In accordance with the present invention, injection nozzle assemblies 40 and 42 are mounted in fixed relation directly on hold-down ring 24 in the general orientation shown schematically in FIG. 1, in position to place adhesive directly upon the interface between patch 30 and ply 16.

A typical hold-down ring 24 is shown in plan in FIG. 2, comprising essentially a flat plate 25 with central aperture 22 of modified elliptical or biconvex lunar shape. The side slots 26 receive bolts by which the ring is mounted on the mechanism of the head assembly. Aperture 22 is surrounded by a boss 23 on the lower face of plate 25, and that boss carries the working face 36 (FIG. 3) by which the ply is clamped to table 18 during the patching operation. In accordance with the present invention the edge of plate 25 is cut away on each side to form an oblique mounting surface 32. A bore 34 is formed in that mounting surface on an axis 35 which passes substantially through the intersection of the side wall of die aperture 22 and the lower working face 36 of the hold-down ring. Axis 35 lies in a plane that is generally radial with respect to the axis 21 of the hold-down ring, and is oblique with respect to that axis and perpendicular to mounting surface 32.

The typical nozzle assembly 40 shown in FIGS. 3 and 4 has a transverse mounting face 44 from which projects the nozzle tip 46. Assembly 40 is mounted by the screws 33 with face 44 flatly engaging the oblique mounting surface 32 of the hold-down ring and with nozzle tip 46 projecting axially into bore 34. The nozzle tip is designed with a conical end which fits just back of the dihedral angle formed by the wall of die aperture 22 and the lower surface 36 of the ring, so that the nozzle avoids any interference either with the die or with the clamped ply. At the same time, the nozzle delivery orifice 48 is directed accurately toward the junction between patch 30 and the surrounding ply 16.

The main body of nozzle assembly 40 has a through bore 50, which is closed at its rearward end and partially closed at its forward end by the end plates 51 and 57, respectively. The forward portion of bore 50 is reduced in diameter by the fix-

edly mounted tip member 54 and valve member 56, in which the coaxial bore 55 terminates forwardly in nozzle orifice 48. The piston member 60 comprises the piston 62, which works in the piston chamber 52 formed by the rearward portion of bore 50, and the forwardly projecting plunger 64, which works in bore 55 and acts as valve element. Plunger 64 has a peripheral valve channel 66 and a communicating axial bore 68 which opens forwardly into bore 55. Adhesive is excluded from the portion of main bore 50 forward of piston 62 by the seals 63 and 65. Piston member 60 is yieldingly urged rearwardly by the strong spring 58 to the normal retracted position shown in FIG. 4 and defined by the stop post 59. Pressure application to piston chamber 52 drives the piston member forward against the force of spring 58 to the projected position shown in FIG. 3, defined in the present illustrative structure by contact of the forward end of plunger 64 with the nozzle tip.

Adhesive from conduit 84 is directed by the plug 71 through the replaceable filter element 72 to the vertical bore 74. The upper end of bore 74 communicates directly with piston chamber 52. Its lower end communicates via the needle valve 70 with the peripheral channel 76 in valve member 56. A plurality of radial holes 78 connect that channel with axial bore 55, forming with plunger channel 66 a valve designated by the numeral 80. The axial position of the holes 78 is forward of valve channel 66 when piston member 60 is in its normal retracted position as in FIG. 4, and is back of channel 66 when the piston member is fully projected as in FIG. 3. Hence in both extreme positions of piston member 60 nozzle orifice 48 is isolated by valve 80 from supply conduit 84. However, during movement of piston member 60 in either direction valve 80 opens momentarily, for a time determined by the passage dimensions and the rate of the piston movement. During the brief open periods of valve 80, flow through it is limited by needle valve 70, which is adjustable manually to control the adhesive feed.

Liquid adhesive is maintained in a supply tank, indicated schematically at 82 (FIG. 1), from which it is supplied via the flexible conduits 84 to the two nozzle assemblies in parallel. When hot melt adhesive is to be used, as is preferred, the tank and conduits are heated electrically in conventional manner. Each nozzle assembly is independently heated, as by a resistive heater 86 set into the body of the assembly and controlled by a thermostatic probe 88 which maintains the nozzle assembly and the adjacent portions of ring 24 at suitably elevated temperature. Electrical connections are indicated at 89.

Supply tank 82 typically incorporates a pump mechanism, indicated schematically at 90, for producing in conduit 84 a sharp pressure pulse in response to an electrical control signal supplied via the line 92. Such mechanism may, for example, be of the general form described in U.S. Pat. No. 3,348,520, issued on Oct. 24, 1967 to Glynn H. Lockwood and assigned to the same assignee as the present application. An electrical signal for control of mechanism 90 can be generated in known manner, as by a microswitch 94 mounted in position to be actuated by mechanical movement of a suitable member of patching machine 10 after patch 30 has been inserted in the defective ply 16. The derivation of such a signal is well known in and of itself, and is not a part of the present invention.

Upon delivery of a pressure pulse via conduits 84 to the two nozzle assemblies 40 and 42, the two pistons 62 are driven forward simultaneously. As each valve 80 opens momentarily, a pulse of adhesive is supplied to the small nozzle chamber 96 formed in bore 55 forward of the plunger. After a definite travel increment by the plunger valve 80 closes, isolating chamber 96 from the adhesive source. As piston 62 continues to be driven forward, the adhesive in chamber 96 is positively ejected from nozzle orifice 48. Hence the mechanism deposits a small but accurately reproducible volume of adhesive directly at the interface between ply and patch. As the pressure pulse in conduit 84 subsides, piston 62 is returned by spring 58 to its normal position. During most of that piston retraction valve 80 is closed, so that plunger 64 positively

withdraws adhesive from the nozzle orifice and chamber, preventing leakage from the nozzle during the quiescent period before the next cycle. The momentary opening of valve 80 during piston retraction does not significantly affect that plunger action, since the differential pressure across the valve is small. That differential pressure may be in either direction, depending upon the action of control pump 90 (FIG. 1) and upon the detailed design of the valve and nozzle assembly.

A particular advantage of the described valve structure is the ease and accuracy with which the amount of adhesive deposited during each cycle of operation may be determined by adjustment of control needle valve 70. Variations in the amplitude of the pressure pulses, and also variations in viscosity of the adhesive due to such factors as temperature, tend to be compensated by inherent action of the mechanism. For example, an increase in the average pressure during a pulse causes the flow rate past control valve 70 to increase correspondingly; but piston 62 is also driven forward more quickly, so that valve 80 remains open for a shorter period. Similarly, increased viscosity of the adhesive reduces the flow rate past valve 70, but also reduces the rate of adhesive flow to piston chamber 52 and thereby slows the piston movement. With appropriate dimensioning of the various passages, highly effective compensation can be obtained, so that the delivery per cycle is remarkably accurate and stable.

It is sometimes advantageous to spread the applied adhesive over a wider area than that on which it is initially deposited by the nozzle. The present invention accomplishes that by means of an air jet that is produced by air nozzle structure directly related to the adhesive nozzle. The spatial relation of the air jet to the deposited adhesive is then reliably maintained. A particularly simple and effective air nozzle is formed by providing clearance between the conical outer surface of the adhesive nozzle tip portion and the surrounding body of the hold-down ring. As shown in FIGS. 3 and 4, such clearance produces a conically tapered annular chamber 100 with nozzle orifice 101. That orifice concentrates the air jet at the apex of the cone, which is on axis 35 of the adhesive nozzle, and is spaced axially approximately at the work surface. Air may be supplied to chamber 100 via passages formed in the body of the hold-down ring, as by drilling intersecting holes and plugging portions not used. Such passages are indicated somewhat schematically at 102, with side passages 104 leading to each of the chambers 100. A source of pressure pulses of air is indicated schematically in FIG. 3 at 106, with output 105 communicating with flexible conduits 107 leading to suitable fittings on the hold-down rings. That structure is omitted from FIG. 1 for clarity of illustration.

Pulse source 106 may be of any suitable type that produces air pulses in uniform timed relation to the adhesive pressure pulses, preferably immediately after the latter. For example, compressed air may be supplied via a solenoid valve that is opened momentarily in response to an electrical control pulse. The control pulse may be derived from switch 94 (FIG. 1), the desired time delay being provided by suitable design of the valve solenoid, for example. Or a separate switch similar to switch 94 may be mounted with independent adjustment relative to the mechanism of the patching machine.

In accordance with a further aspect of the invention, a fine mist of a suitable liquid releasing agent, such as a silicone oil, for example, is dispersed in the air delivered to passages 102. That is typically accomplished by inserting in the line 105 a conventional mechanism, indicated schematically at 108, such as is employed in a standard pneumatic oiler for dispersing a mist of oil into an airstream. When a releasing agent is thus introduced into the airstream expelled from air nozzle orifice 101, the releasing agent forms a film on the hold-down ring, the cutting die and other metal working parts of the patching machine, and prevents buildup of adhesive on those parts. A wide variety of substances are known to have suitable releasing properties for preventing such buildup. The present invention provides mechanism for effectively and conveniently depositing such known materials directly at the desired site.

It is sometimes desirable to distribute the air carrying the dispersed releasing agent somewhat more widely than through the nozzle orifice 101 associated directly with the adhesive applicator. For that purpose the passages 102 may be extended any desired distance in the body of the hold-down ring, with side passages 109 at spaced intervals opening into the main aperture 22 through special air nozzles 110 (FIG. 3). If preferred, air carrying the releasing agent may be distributed exclusively through such special nozzles, the air supplied to nozzle chamber 100 being taken directly from pulse source 106 without addition of releasing agent. For that purpose a separate set of air passages similar to passages 102 may be provided in the hold-down ring to serve air nozzles 110.

I claim:

1. In combination with a plywood patching machine having a hold-down ring with an aperture and a working face surrounding the aperture for clamping a ply, the machine having a cutting die working in the aperture in the hold-down ring for punching out defective ply sections and means for inserting sound sections in the ply while clamped by the ring;

a nozzle assembly rigidly mounted on the hold-down ring and including a nozzle tip with a nozzle orifice substantially at the line of intersection of the working face and the aperture of the ring,

conduit means for supplying adhesive to the nozzle assembly,

and means for ejecting liquid adhesive from the nozzle orifice in timed relation to the operation of the machine to adhere the sound section in the ply.

2. The combination defined in claim 1, and in which

said hold-down ring has a bore on an axis that is in a generally radial plane and is oblique with respect to the axis of the ring,

and said nozzle assembly is mounted on an outer peripheral portion of the ring adjacent the bore and includes a nozzle tip portion extending into the bore with said nozzle orifice at the end of the tip portion.

3. The combination defined in claim 1, and in which said nozzle assembly includes

structure forming a nozzle chamber communicating with the nozzle orifice, and a coaxial piston chamber rearward of the nozzle chamber and communicating with said conduit means,

a piston member including a piston in the piston chamber

and a coaxial plunger projecting forward into the nozzle chamber, the piston member being axially slidable between a normal rearward position and a forward position,

and adhesive metering mechanism for supplying adhesive from said conduit means to the nozzle chamber forward of the plunger,

said adhesive ejecting means including

means for applying to said conduit means pressure pulses in timed relation to the operation of the machine to drive the piston member forward and thereby expel adhesive from the nozzle chamber through the nozzle orifice.

4. The combination defined in claim 3, and in which said metering mechanism includes

passage structure communicating between said conduit means and said nozzle chamber,

and a normally closed valve connected in series with said passage structure and including means acting to open the valve after the start and to close the valve before the end of said forward movement of said piston member.

5. The combination defined in claim 4, and in which said metering mechanism includes also a manually adjustable flow limiting valve connected in series with said passage structure and with said normally closed valve.

6. The combination defined in claim 1, and including structure forming a second nozzle orifice closely adjacent the first said nozzle orifice and directed obliquely toward the axis thereof, and means for ejecting air from the second nozzle orifice in timed relation to said adhesive ejection from the first said nozzle orifice.

7. The combination defined in claim 6, and including means for dispersing into said air prior to its said ejection a finely divided liquid releasing agent.

8. The combination defined in claim 7, and in which said releasing agent is silicone oil.

9. The combination defined in claim 1, and including structure forming at least one orifice opening through the aperture wall of said hold-down ring in a generally radial direction,

and means for ejecting through the last said orifice air containing a finely divided releasing agent.

10. The combination defined in claim 9, and in which said releasing agent is silicone oil.

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