

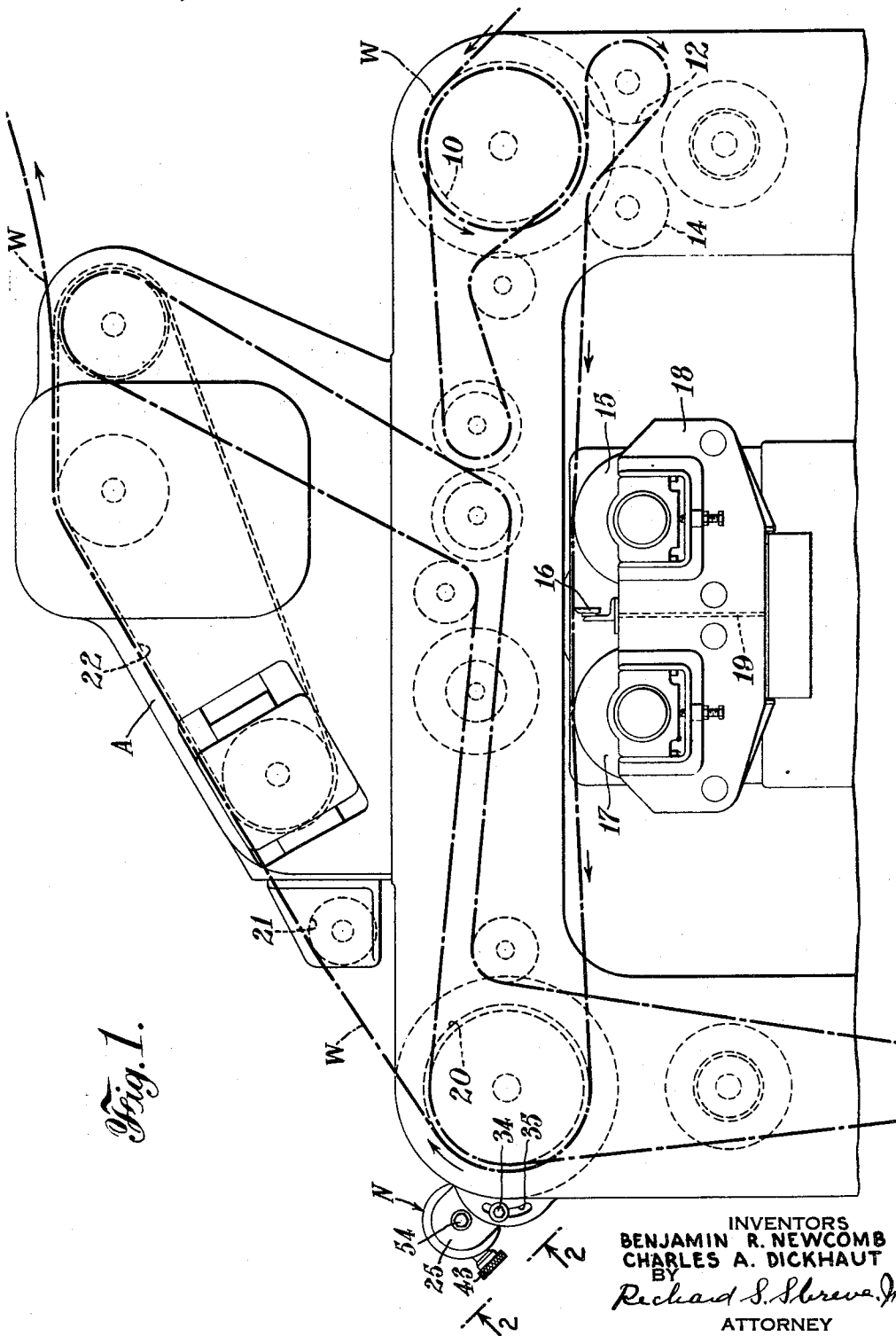
March 13, 1951

C. A. DICKHAUT ET AL
APPARATUS FOR COATING WEBS

2,545,266

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3 Sheets-Sheet 1



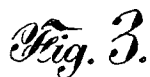
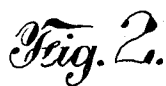
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3 Sheets-Sheet 3

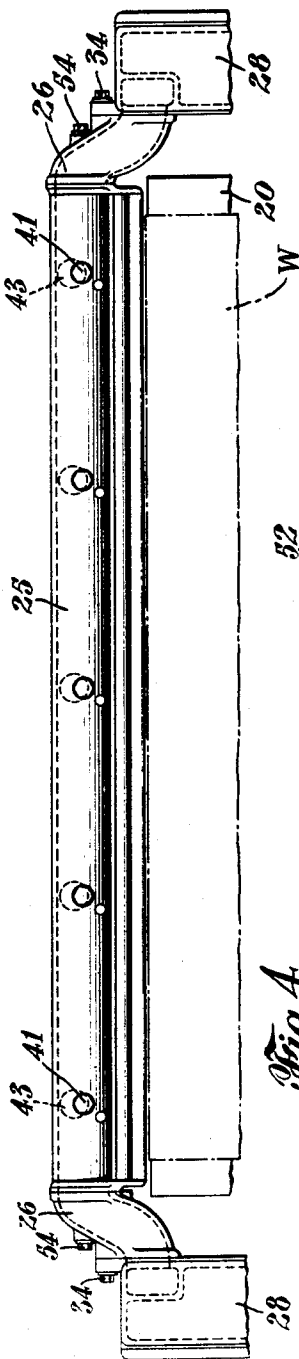


Fig. 4.

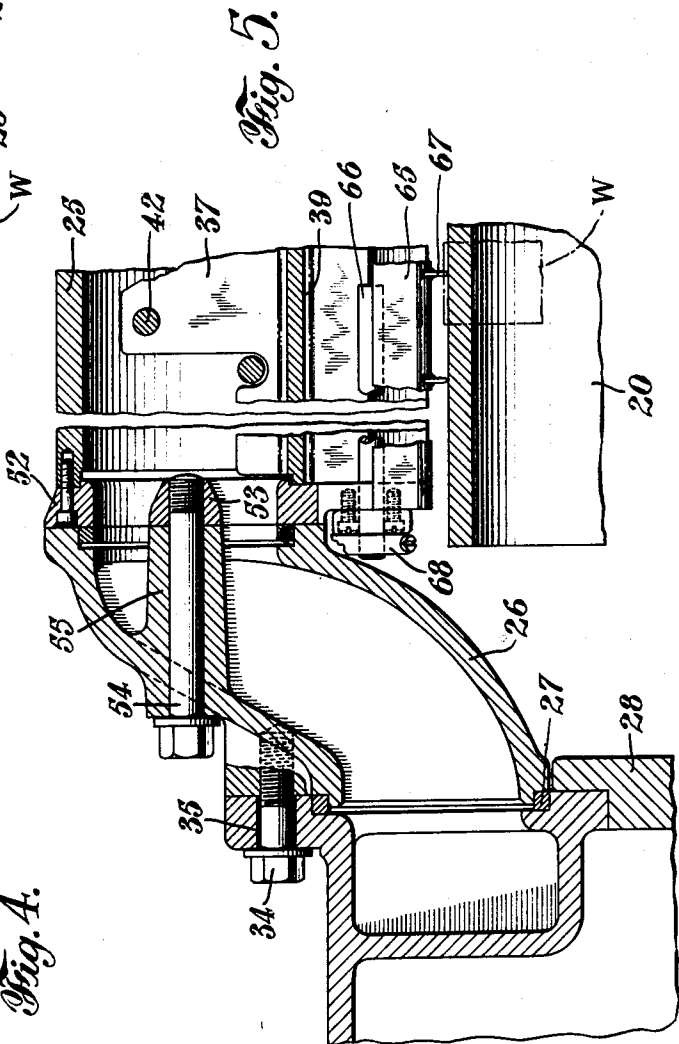


Fig. 5.

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APPARATUS FOR COATING WEBS

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11 Claims. (Cl. 91—18)

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This invention relates to apparatus for coating webs, and more particularly to the operation of applying to a web of paper or the like a coating of liquid composition containing dissolved or suspended solid material.

In such coating operations it has been customary to apply an excess of coating composition, and to remove the excess by applying an air blast thereto. In the interest of uniformity of distribution, to make sure of spreading the retained material and of complete removal of the excess, the air blast has been applied as a jet extending transversely of the sheet and in the direction opposite to its direction of travel, at an acute angle of less than 45°. This effort toward uniformity of distribution has been at the sacrifice of impregnation or adhesion of the coating material with respect to the paper.

It is therefore the main object of the present invention to produce the desired uniformity of distribution and at the same time accomplish superior adhesion of the coating with respect to the paper. We have discovered that we can accomplish this by directing the jet against the paper at an angle such that the component of force tending to drive the coating material into the web exceeds the component tending to blow the surplus coating material backward.

Furthermore, the sharp or acute angle of the jet with respect to the paper heretofore employed has tended to atomize the coating composition, and create a mist or fog of particles of the coating composition suspended in the ambient air, which floats about and is carried around onto the treated web beyond the jet, being caught by the current or stream of air adjacent the moving web, and thus deposits undesirable small lumps onto the coated web, which mar the finish of the doctored web.

It is therefore a further object of this invention to prevent the deposit of such particles from such mist on the coated web. This we accomplish by providing a baffle beyond the air jet, to deflect such fog or mist away from the jet and air doctored web in such a manner that any suspended particles are prevented from coming in contact with the doctored web. The increased angle of impact above referred to also tends to decrease the quantity of fog or mist produced by the jet.

Other objects are to provide a micrometer adjustment for the slot of the nozzle, to permit accurate predetermination of the width of the air jet, to facilitate the cleaning of the nozzle slot by a swivel mounting of the nozzle to permit it to be swung out into accessible position and

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swing back into its original setting, and otherwise simplify and improve the construction and operation of machines of this character.

Other objects and features of novelty will become apparent as the following description proceeds with reference to the accompanying drawings, in which

Figure 1 is a side elevation of a paper coating machine embodying the apparatus according to the preferred embodiment of the present invention;

Figure 2 is an enlarged detailed cross section through the coating nozzle;

Figure 3 is a detailed section taken along the line 3—3 of Figure 2;

Figure 4 is an inverted plan of the nozzle tube; and

Figure 5 is a detailed section through the inverted ends or elbows of the nozzle tube.

In the drawings, the web to be coated, such as a continuous sheet of paper or the like is indicated generally at W, which enters the machine by passing over a receiving roller 10, and thence over guide rollers 12 and 14 to a substantially horizontal path over a prewetting roll 15, a doctor blade 16, and an applicator roll 17. The doctor blade 16 is mounted on, and the axes of the rolls 15 and 17 are journaled in the ends of, a tank 18 having a partition 19 to provide separate baths of liquid into which the rolls 15 and 17 dip as they revolve, and carry a thin film thereof upwardly and deposit it on the underside of the web W passing over the top of the rolls.

The bath of liquid for the prewetting roll 15 may be the same liquid as that being coated onto the web, or it may be a solvent or other thinner liquid which serves to prepare the web to receive the coating material. The incoming web generally has projecting fibers, which tend to take up the prewetting liquid and form small lumps on the surface. Such fibers and lumps and also air bubbles and loose fibers are removed by the doctor blade 16 and fall into the prewetting tank where they are kept separate from the final coating liquid being applied by the applicator roll 17. Thus the doctor blade 16 has a smoothing action on the web itself as well as upon the coating composition.

The web W with the applied film or layer of liquid coating composition on the underside thereof passes from the applicator roll 17, continuing in the substantially horizontal path, and passes under, onto, and around a platen roller 20. The length of travel and the time element involved between the applicator roll 17 and the platen

roller 20 afford an opportunity for capillary action, saturating or soaking in of the liquid coating composition to fill up the pores, in addition to the action of the prewetting roll 15, the doctor blade 16, and the applicator roll 17, and prepare the way for the air jet hereinafter described.

While the web W is on the platen roller 20, the wet web is subjected to the air blast from the nozzle N, which impinges thereagainst at a line on the periphery of the roller 20, preferably in the horizontal plane of the axis of the roller. The jet from the nozzle N impinges against the web W on the roller 20 at an angle of less than 90° but more than 45° to the tangent to the roller at the point of impact, so that the component of force tending to drive the coating composition into the web exceeds the component of force tending to blow the excess coating material backward. The increased angle also reduces the quantity of mist or fog of coating liquid produced by the jet, and that which is produced is deflected further backward by a baffle B, which prevents the mist or fog from coming in contact with the air doctored web beyond the jet from the nozzle N.

From the platen roller 20 the air doctored web passes over a guide roller 21 to a suction box A containing a traveling perforated rubber apron 22, and thence to a drier or other processing as desired.

As shown in Figure 2, the nozzle N comprises a tube 25 extending parallel to the axis of the platen roller 20 and having inturned ends or elbows 26 journaled in bearings 27 mounted in or integral with the machine frame 28 beyond the ends of the platen roller 20. The bearings 27 preferably are centered substantially in the horizontal plane of the axis of the platen roller. The inturned ends or elbows 26 of the nozzle tube carry bolts 32 which move in arcuate slots 33 formed in a bracket on the machine frame. Similar bolts 34 move in arcuate slots 35 cast in the machine frame 28. The slots 33 are machined for accurate adjustment, which is secured in position by tightening the bolts 32, and locked by the bolts 34. Thus the nozzle tube 25 may be adjusted to swing about the centerline of the bearings 27. The slots 33 form a stop to limit the adjustment to an angle greater than 45° and less than 90° to the tangent to the platen roller 20.

The nozzle tube 25 has an outwardly directed substantially radial flange or lip 36 preferably integral with the wall of the tube, which cooperates with a movable plate 37 spaced therefrom to form the sides of the nozzle slot. The remaining edge of the wall of the tube is formed with a groove 38 which receives a ridge 39 on the movable plate 37. The ridge 39 is urged into the groove 38 by a compression spring 40 coiled about a stud 41 extending radially inwardly from the wall of the tube 25. The internal margin of the plate 37 is engaged by a micrometer adjusting screw 42 extending inward through the opposite wall of the tube 25 and provided with an external adjusting knob 43 preferably calibrated to read in terms of width of nozzle slot. The groove 38 forms a longitudinal abutment about which the plate 37 pivots when the micrometer adjusting screw 42 is turned to adjust the width of the nozzle slot.

It should be noted that the ridge or knife edge 39 in the groove 38 provides a seal against leakage in all positions of adjustment. Also, the air pressure on the inner side of the plate 37 is greater than on the side having the ridge, so that the air pressure acts to effect its own seal. Further-

more, there is no strain or springing effect on the plate 37 in any position of adjustment.

The baffle B which deflects further backward the mist or fog of atomized coating composition from the nozzle N comprises an elongated bar 45 of substantially triangular cross-section, hollowed to reduce its weight, and slidably mounted on a shelf 46 formed in the machine frame below the bearings 27. The bottom wall of the baffle 45 is slotted to receive bolts 47 which lock it in position after adjustment of the position of the baffle by screws 48.

The apex or ridge 49 of the baffle B is below the line of impact of the jet from the nozzle N, and the baffle B has two walls diverging downwardly from the apex or ridge 49. The outer wall 51 is inclined away from the point of impact at an angle substantially equal to the air jet angle for intercepting coating composition atomized by said impact, and the inner wall 50 is smoothly curved and spaced from the periphery of the platen roller 20 for conducting the air discharged from the nozzle slot further backward away from the nozzle slot, and prevent the rotating action of the mist or fog which would otherwise carry the same around the nozzle onto the treated and air doctored web, and thus deposit undesirable small lumps of coating material thereon.

The nozzle tube 25 is rotatably mounted with respect to the elbows 26, so that the nozzle slot may be swung away from the platen roller 20 into position easily accessible for cleaning, and swung back after cleaning into the desired angle position without further adjustment or resetting. The ends of the tube 25 are secured to spiders 52 having central hubs 53 which receive axles 54 mounted in internal bosses 55 formed in the elbows 26. A stop lug 57 is formed on the tube 25, and is engaged by an adjusting screw 58 mounted in a bracket 59 on the machine frame. A locking screw 60 on the tube 25 engages a lug 61 on the machine frame for holding the nozzle in operative position, but when released permits the nozzle slot to be swung away from the platen roller. After cleaning, the nozzle tube is swung back on the axles 54 to bring the lugs 57 against the screw 58, after which the screw 60 locks the nozzle in operative position.

It will be understood that while the micrometer adjustment is desired to be set at predetermined calibrations, after wear of the parts and other causes, it may be desirable to set the adjustment to suit individual conditions regardless of the calibrations. Such conditions may require different local adjustment of the several micrometer screws along the length of the nozzle tube. Also, not only the width of the nozzle slot, but also the degree of the nozzle angle above 45° to the tangent to the web, will be adjusted to suit different coating compositions, different coating weights, different webs, and different pressures of air blast.

To facilitate starting up the operation of the machine, for loading the machine or threading the web therethrough, a feeder comb 65 is provided, which comprises a shaft 66 journaled in the spiders 52 and having curved tines 67 spaced along the surface of the platen roller. A hand lever 68 serves to turn the shaft 66 and swing the tines 67 to advance the web through the machine in starting up the operation.

While one embodiment of the invention has been illustrated and described in detail, the invention is not limited to these details, but in-

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stead embraces such modifications as fall within the scope of the following claims.

What is claimed is:

1. Apparatus for coating a web of sheet material with a liquid composition, comprising a frame, a platen roller journaled in said frame, a nozzle tube parallel to the axis of said platen roller and having inturned ends journaled in said frame on an axis substantially at the periphery of said roller, said nozzle tube having means forming a longitudinal slot for directing a jet of air substantially toward the journal axis of said inturned ends.

2. Apparatus for coating a web of sheet material with a liquid composition, comprising a frame, a platen roller journaled in said frame, a nozzle tube parallel to the axis of said platen roller, said nozzle tube having a longitudinal flange extending toward the periphery of said roller and a longitudinal abutment spaced from said flange, and a plate pivoted on said longitudinal abutment and cooperating with said flange to form a longitudinally extending nozzle slot, said plate having a portion extending into said tube, and means passing through the wall of said tube and engaging the portion of said plate inside the tube for swinging said plate about its pivot for adjusting the width of said nozzle slot.

3. Apparatus for coating a web of sheet material with liquid coating composition, comprising a nozzle tube having a longitudinal slot, an external flange extending substantially radially outwardly from one edge of said slot, a plate separate from said nozzle tube and pivoted on the opposite edge of said slot and having an inner portion extending into the interior of said nozzle tube and an outer portion extending outwardly coextensive with said flange to form therewith a nozzle slot, and micrometer adjusting screws passing through the wall of said nozzle tube and engaging said inner portion for moving said plate about its pivot to adjust the width of said slot.

4. Apparatus for coating a web of sheet material with liquid coating composition, comprising a nozzle tube having a longitudinal slot, an external flange extending outwardly from one edge of said slot, a plate pivoted on the opposite edge of said slot and extending outwardly coextensive with said flange to form therewith a nozzle slot, said plate extending rearwardly through said slot into the interior of said tube, spring means inside said tube engaging the internal portion of said plate for urging it about its pivot toward said slot, and micrometer adjusting screws extending inward through the wall of said tube in opposition to said spring means and longitudinally spaced to engage the internal portion of said plate at intervals therealong to respectively locally adjust the width of said nozzle slot.

5. Apparatus for coating a web of sheet material with a liquid composition, comprising a frame, a platen roller journaled in said frame, a nozzle tube mounted on said frame parallel to the axis of said platen roller, means on said nozzle tube forming a nozzle slot for directing a jet of air onto the periphery of said platen at an oblique angle to the tangent thereto at the point of impact, and a baffle mounted on said frame adjacent said nozzle tube and having a ridge parallel to said nozzle slot and an outer surface inclined away from the point of impact at an angle substantially equal to the air jet angle for intercepting coating composition atomized by said impact, said baffle also having an inner surface spaced from the periphery of said roller

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for conducting further backwardly the air discharged from said nozzle slot.

6. Apparatus for coating a web of sheet material with a liquid composition, comprising a frame, a roller journaled in said frame, a nozzle tube mounted on said frame parallel to the axis of said roller, means on said nozzle tube forming a nozzle slot for directing a jet of air onto the periphery of said platen at an angle to the tangent thereto at the point of impact, and a baffle mounted on said frame adjacent said tube and having angularly disposed flanges forming at their apex a ridge parallel to said nozzle slot and adjacent the point of impact, the outer of said flanges being inclined away from the point of impact at an obtuse angle for intercepting coating composition atomized by said impact, the flange of said baffle toward the roller having a surface spaced from the periphery of said roller for preventing any rotary action of the mist formed by said nozzle which would otherwise deposit particles of coating material on the air-doctored web.

7. Apparatus for coating a web of sheet material with a liquid composition, comprising a frame, a platen roller journaled in said frame, a nozzle tube parallel to the axis of said platen roller and having a longitudinal slot for directing a jet of air toward a line on the periphery of said platen roller, and arms journaled on said frame for mounting said nozzle tube for movement about said line as a pivotal axis, to adjust the angle between said jet and a tangent to said platen roller at said line, without changing the distance of said nozzle from said line.

8. Apparatus for coating a web of sheet material with liquid coating composition, comprising a thick-walled circular nozzle tube having a longitudinal slot, an external flange extending outwardly from one edge of said slot, the opposite edge of said slot having a longitudinal groove, a plate having a longitudinal ridge seated in said groove, said plate extending outwardly from said ridge coextensive with said flange to form therewith a nozzle slot, said plate extending inwardly from said ridge inside said tube, and screws extending inwardly from opposite sides of said tube and respectively having means abutting opposite sides of the inward extension of said plate for adjusting the width of said nozzle slot.

9. Apparatus for coating a web of sheet material with coating composition, comprising a nozzle tube having a longitudinal slot, an external flange extending outwardly from one edge of said slot, a plate pivoted on the opposite edge of said slot and extending outwardly therefrom coextensive with said flange to form therewith a nozzle slot, said plate extending inwardly from said pivot inside said tube, spring means inside said tube bearing on the inward extension of said plate to urge it about its pivot away from said flange, and screws extending inward through said tube and engaging the opposite side of said inward extension of said plate for swinging it about its pivot in opposition to said spring means for adjusting the width of said nozzle slot.

10. Apparatus for coating a web of sheet material with coating composition, comprising a frame, a platen roller journaled in said frame, a nozzle tube parallel to the axis of said platen roller, means for supporting said nozzle tube on said frame for swinging about an axis substantially at the periphery of said roller, said nozzle tube having means forming a longitudinal slot for directing a jet of air substantially toward said axis.

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11. Apparatus for coating a web of sheet material with coating composition, comprising a frame, a platen roller journaled in said frame, a nozzle tube supported by said frame on an axis parallel to the axis of said platen roller and having a longitudinal slot for directing a jet of air against said platen roller, a baffle mounted on said frame having a ridge adjacent the periphery of said platen roller and parallel to its axis, and means for mounting said nozzle tube on said frame to position said slot to project said jet against said platen roller in close proximity to said ridge and at an angle of less than 90° but more than 45° to the tangent to said platen roller at the point of impact.

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