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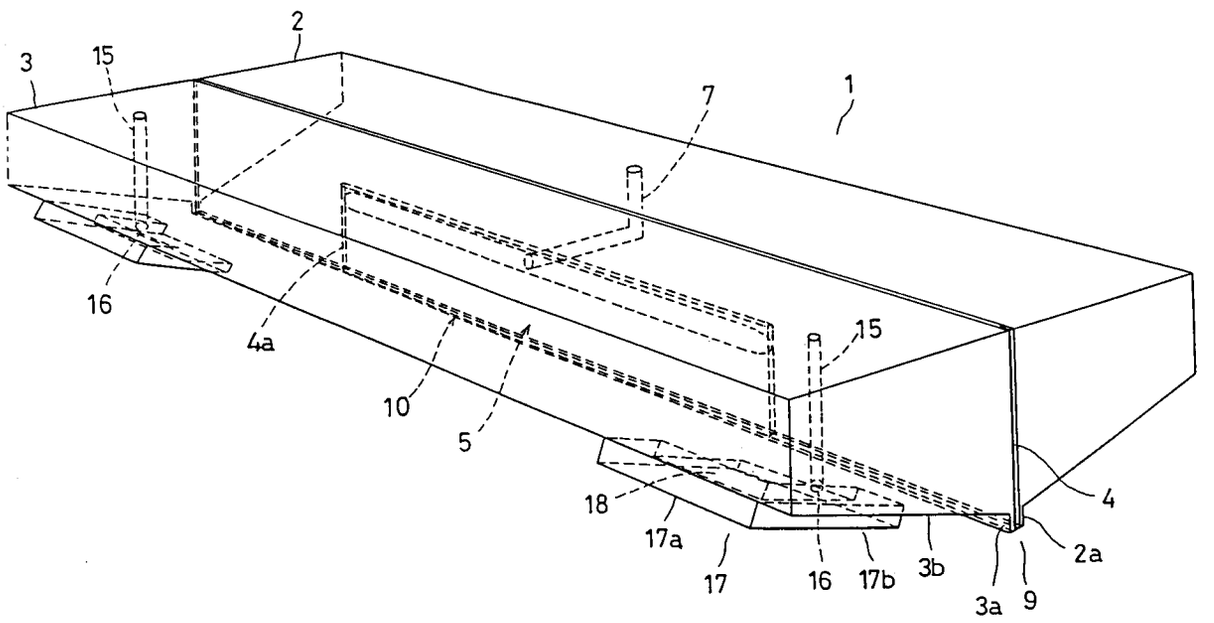
(54) Hot-melt applicator.

(57) A slit-shaped opening is formed at the lower end of the cavity through which hot-melt or other coating material is supplied, and an air nozzle for discharging air toward the outer edge of the opening is disposed or an air nozzle for discharging air upward from the lower side of the adherend is disposed immediately beneath the opening.

FIG. 1



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The present invention relates to an applicator for coating a sheet material, for example, with hot-melt or the like.

As an apparatus for coating the surface of a nonwoven fabric used as the material of paper diaper or the like with a hot-melt adhesive, as shown in Fig. 12, there is known a device called slot coater which has a slender slit opening 210 disposed at the lower end of a cavity 205 communicating with a hot-melt feed port 270a. This device is designed to apply the hot-melt 222 supplied in the cavity 205 on the surface of the nonwoven cloth 220 passing beneath while discharging it from the slit opening 210, and the nonwoven fabric which is the adherend is pressed against the slit opening by two backup rollers 225, 225 disposed at the lower side of the passage.

In the conventional slot coater, in order to apply the hot-melt uniformly on the adherend, the entry angle a of the adherend to the slot coater opening, the send out angle β and tension of adherend were adjusted, but it was difficult to press the adherend to the opening with a proper force, and the adherend was stretched due to excessive tension, a gap was formed against the opening due to insufficient tension, and uniform application was not realized.

Furthermore, the hot-melt was not completely transferred on the adherend depending on the type of the adherend, and the application became non-uniform, or part of the hot-melt was left over in the slot coater opening to laminate on the outer edge. When this deposit exceeds a certain amount, it drops on the adherend and oozes (flows) out to the rear side of the adherend to stick to the roller for feeding the adherend or other parts to tear the adherend or cause stringing phenomenon.

Furthermore, when the hot-melt is intermittently applied to the adherend with said conventional slot coater, the hot-melt does not stop to flow completely at coating intervals, thereby causing so-called stringing to give rise to streaky coats.

For the purpose of solving it, there have been essayed a method of preventing the flow of a hot-melt-by discontinuously pressing a web to the opening of the slot coater or in the alternative, a method of decreasing the leakage of the hot-melt at the suspension of the coating operation by reducing the area of the cavity, but no sufficient effect has been achieved in either methods.

An additional method was carried out with some effect to prevent the leakage of the hot-melt by decreasing the pressure within the cavity to the atmospheric pressure by the aid of a feed valve for hot-melt. However, such a method still fails to achieve effects sufficient enough to ensure the intermittent coating at a high level.

To solve the above problems, the invention is composed as follows.

A hot-melt applicator in accordance with a first embodiment of the invention having a slit-shaped opening formed at the lower end of the cavity through which hot-melt or other coating material is supplied, for applying said coating material on the adherend passing through the lower side of the opening, wherein an air nozzle for discharging air toward the outer edge of the opening is disposed.

A hot-melt applicator in accordance with a second embodiment of the invention having a slit opening formed at the lower end of a cavity in which coating material such as hot-melt is supplied, for applying the coating material on an adherend passing beneath the opening, wherein an air nozzle for discharging air upward from the lower side of the adherend is disposed immediately beneath the opening.

A hot-melt applicator in accordance with a third embodiment of the invention having a slit-shaped opening formed at the lower end of the cavity through which hot-melt or other coating material is supplied to apply said coating material to the adherend passing through the lower side of the opening, wherein a cylinder communicating with said cavity is provided, and a piston adapted to be moved back and forth is provided within the cylinder for decrease and increase of a pressure within the cavity.

In accordance with the applicator of the first embodiment of the invention, the coating material such as hot-melt supplied in the cavity is sent out from the slit opening at the lower end, and is applied on the adherend passing beneath in a width corresponding to the length of the opening. At this time, since air is discharged from the air nozzle toward the outer edge of the opening, and the coating material remaining at the outer edge of the opening is blown away to stick to the adherend. This air also cools the adherend an application on a material less resistant to heat may also be possible.

In accordance with the applicator of the second embodiment, the coating material such as hot-melt supplied in the cavity is sent out from the slit opening at the lower end, and is applied on the adherend passing at its lower side in a width corresponding to the length of the opening. At this time, air is discharged from the air nozzle located at the lower side of the passage of the adherend toward the opening, and the adherend is securely pressed against the opening with a proper force. Besides, this air also cools the adherend and it is also possible to apply to materials less resistant to heat.

In accordance with the applicator of the third embodiment, the coating material such as hot-melt supplied in the cavity is sent out of the slit-shaped

opening at the lower end, and is applied to the adherend passing at its lower side in a width corresponding to the length of the opening. At the suspension of the coating operation in the intermittent application, the prevention of leakage of the hot-melt can be effectively performed by moving the piston in a rearward direction to absorb the pressure in the cavity.

Fig. 1 is a perspective view showing one embodiment of the hot-melt applicator in accordance with the first embodiment of the invention. Fig. 2 is a cross sectional view of Fig. 1. Fig. 3 is a view stating a principal part. Fig. 4 is a plan view of a block 3. Figs. 5 and 6 are views showing other embodiments. Fig. 7 is a perspective view showing an embodiment of the hot-melt applicator in accordance with the second embodiment of the invention and Fig. 8 is a cross sectional view of Fig. 7. Fig. 9 is a view stating a principal part. Fig. 10 is a perspective view showing an embodiment of the hot-melt applicator in accordance with the third embodiment of the invention. Fig. 11 is a cross sectional view of Fig. 10, and Fig. 12 is a view stating a conventional slot coater device.

Firstly, referring to the drawings, a hot-melt applicator in accordance with the first embodiment of the present invention will be described.

The main body of an applicator 1 is composed of a pair of blocks 2, 3 disposed butt to butt, with an intervening shim 4, as shown in Fig. 1. The shim 4 is formed in a pi-shape with the opening downward, and the space formed by its concave notch 4a is a cavity 5. That is, the cavity 5 is a space opening downward being formed by two blocks 2, 3 and the shim 4, and has a volume as the product of the thickness of the shim 4 multiplied by the area of this notch. In this cavity 5, a feed hole 7 which projects into one block (cavity side block) 2 and has an opening in the upper surface is penetrating. At the junction of the two blocks 2, 3, thin sheet projections 2a, 3a and the lower end of the shim 4 enclosed by them. The intermediate part of the protrusion 9 has a slender opening 10 in the width of the notch 4a of the shim 4.

In the other block (blind side block) 3, there are two air passage 15, 15 communicating from its top surface to a slop bottom 3b, and the lower end opening is the air nozzles 16, 16. At the position of the air nozzle 16, there is a guide tool 17 for guiding the discharged air to the outer edge of the opening 10. The guide tool 17 is composed of a hook-shaped concealing part 17a affixed to the slope bottom 3b of the block 3 and plate part 17b extending parallel to the block bottom 3b from the concealing part, thereby forming a concave pocket 18, and the nozzle 16 is opened in this pocket 18.

When applying a hot-melt 22 to an adherend 20 made of long sheet nonwoven fabric by using this applicator, while feeding the molten hot-melt 22 from the feed port 7 into the cavity 5, the adherend 20 is continuously moved in the direction of arrow X by guide rollers 25, and an air stream at a proper pressure is discharged from the air nozzle 16. The slurry hot-melt 22 nearly fills up the cavity 5, and flows out downward from opening 10, but, near the exit of the opening 10, since the adherend 20 sent in at angle α is pressed tightly, the flowing hot-melt 22 sticks to the adherend. Part of the sticking hot-melt 22 tends to deposit on the outer surface of the part 3a forming the outer edge of the opening 10 as shown in Fig. 3. But since the air nozzle 16 is provided in this applicator, air is discharged toward the outer edge 3a as shown in Figs. 3, 4 in the direction of arrow Y, and the hot-melt 22(A) which is going to deposit is pressed to the adherend 20 by this air, so that excessive deposit may be prevented. It is effective to discharge air continuously, but it may be also discharged intermittently. Moreover, since the adherend 20 and the hot-melt 22 are cooled by the discharged air, it is possible to apply to the adherend less resistant to heat, and the excessive flow of the sticking hot-melt is suppressed, and a more uniform application is possible.

A different embodiment is shown in Fig. 5. In this example, the air nozzle is formed as the opening end 30a of the air pipe 30, disposed at the send out (exit) side of the adherend. This air pipe 30 is connected to an air source which is not shown in the drawing. By the air discharged from this air discharge port 30a, dropping is removed, and the protrusion 9 of the slot coater is kept clean. The pressure of the air jet should not be higher than required and, for example, in the case of a slot coater with the coating width of 250 to 400 mm, if the inside diameter of the air pipe 30 is 4 mm, dropping could not be prevented completely at the pressure of less than 0.5 kg/cm^2G. It is desired to adjust and set the air pressure depending on the type of the hot melt and material of the adhesive, and it is preferred to install a reducing valve at the air supply side.

Fig. 6 shows another embodiment in which the air nozzle is formed as a wide opening nozzle 40. The air supplied in the air inlet 40a is fine and is discharged as a laminar flow from the wide nozzle opening 40b. In this example, since the air jet flow is nearly uniform and even in the horizontal direction, the air pressure may be set lower than in the foregoing embodiments. It is also easy to mount on an existing slot coater. It is evident that these applicators can be used in the application of other coating materials than the hot-melt paint and other adherends than the nonwoven fabric. As the air, other gases than compressed air may be also

used.

As shown in Figs. 7 and 9, an embodiment in accordance with the second embodiment of invention will now be described.

The main body of an applicator main body 51 is composed of a pair of blocks 52, 53 disposed butt to butt, with an intervening shim 54 at the junction. The shim 54 has an opening shaped downward in a pi-form, and the space formed by its concave notch 54a is a cavity 55. That is, the cavity 55 is a space opened downward formed by the two blocks 52, 53 and the shim 54, and possesses the volume as the product of the thickness of the shim 54 multiplied by the area of the notch. In this cavity 55, a feed hole 57 which pierces into one block (cavity side block) 52 and has an opening on its upper surface is communicating. At the end junction of the two blocks 52, 53 thin sheet projections 53a, 53a projecting downward are formed integrally, and a slender square protrusion 9 is formed by these projections 52a, 53a and the lower end of the shim 54 held by them. The intermediate part of the protrusion is a slender opening 60 in the width of the notch part 54a of the shim 54.

Immediately beneath the opening 60, there is an air blower 65 across the passage of the adherend 70. This air blower 65 is a tube having a slit air nozzle 67 in the length nearly equal to the length of the opening 60 in the upper part, and the both ends are closed by plates. An air feed pipe 69 is connected to one of the ends. The other end of the air feed pipe 69 is connected to the air source which is not shown in the drawing. The air blower 65 may be either mounted on the main body 51a of the applicator by a support member 68 passing through the outer side in the width of the adherend, or may be supported separately from the applicator main body 61a. It is practically very convenient to make adjustable the height of the air nozzle 67 with respect to the opening 60. The pressure and amount of the air to be discharged may be enough as far as it is possible to press the adherend securely to the opening with a proper force, and optimum conditions may be set depending on the type of the adherend and the coating material and actual application condition. Accordingly, it is desirable to install a valve capable of adjusting the pressure and amount of air to be supplied in the air blower 65.

When applying hot-melt 72 on the adherend 70 made of long sheet nonwoven fabric by using this applicator, the molten hot-melt 72 is supplied from the feed port 57 into the cavity 55, while the adherend 70 is continuously moved in the direction of arrow X, being guided by guide rollers 75, and an air stream at a proper pressure is discharged from the air nozzle 17. The slurry hot-melt 72 nearly fills up the cavity 55, and flows out downward from the opening 60, but since the adherend 70 is pressed against the opening 60 by the air discharged from the air nozzle 67, the flowing hot-melt 72 deposits on this adherend. Besides, by the discharged air, the adherend 70 and the hot-melt 72 are cooled from the back side, so that it is possible to apply to the adherend which may be less resistant to heat. Moreover the excessive flow of the depositing hot-melt is suppressed, and more uniform application is possible. As the air, meanwhile, other gas than compressed air may be used as well. It is evident, moreover, that this applicator may be used in application of other coating materials than the hot-melt paint, or other adherends than nonwoven fabrics.

Next, as shown in Figs. 10 and 11, the embodiment in accordance with the third embodiment of the invention will be described.

The body of the applicator 101 is composed of a pair of blocks 102, 103 butted against each other with a shim 104 interposed between said blocks. Said shim 104 is in the form of a box with an open bottom having a cutout 104a, the space of which provides a cavity 105 for holding a hot-melt to be applied. The cavity 105 is formed by the pair of blocks 102, 103 and the shim 104 into a space formed with an opening in the lower portion. The space has a volume which is equal to the number obtained by the multiplication of the thickness of the shim 104 by the area of the cutout. The abutment between the two blocks 102 and 103 is formed integral with narrow plate-like downward projections 102a, 103a, which are combined with the lower end of the shim 104 to form an elongated square ridge 109. The intermediate portion of said ridge 109 provides an elongated opening 110 as wide as the cutout 104 of the shim 104.

The cavity side block 102 is internally formed with an auxiliary cylindrical cavity 115 which communicates with said cavity 105 through a passageway 116 and also with a feeding opening 118 for hot-melt via a through-hole 117. Additionally, there is provided a cylinder portion 119 which communicates with the auxiliary cavity 115 into which a piston 121 is disposed slidably (moveable). Said piston 121 is moved back and forth relative to the auxiliary cavity 125 by a piston rod 123 which extends outwardly. A drive 125 for the piston 121 and a feeding valve 127 for hot-melt are connected with a control 130, so that the piston 121 may be moved backwardly and outwardly the instant the valve 127 is closed.

In order to apply a hot-melt to an adherend 120 constituted by a nonwoven fabric in the form of a lengthy sheet by the use of the applicator, with the piston 121 resting in a determined forward position (a position somewhat before the top end of the

stroke) and the valve 127 remaining open, the hot-melt 122 in a melting state is transferred through the feed opening 118 into the cavities 115, 105, while the adherend 120 is continuously moved by a guide roller 125 in the direction of arrow X. The slurry-like hot-melt 122 is sent out of the opening 110 in a downward direction. The hot-melt 122 so transported is bonded to the adherend 120 due to the fact that the adherend 120 which has been introduced at an angle is being pressed to the area close to the outlet of the opening 110. Since the hot-melt 122 is liable to run off in an irregular manner at the outset of the coating operation, the piston 121 may be advanced so as to increase pressures within the cavities 115, 105. Such an increase of pressure causes a forcible extrusion of the hot-melt, thereby preventing the tendency toward the sticking of a small amount of the hot-melt to the adherend at the start of the coating operation.

When the coating operation is stopped, the valve 127 is closed to cease supplying the hot-melt, and the piston 121 is swiftly moved backward. Then, a decrease of pressure will result in the cavities 115, 105, so that the hot-melt will be absorbed in a rearward direction, which avoids leakage from the opening 110. Consequently, if an intermittent coating takes place, the run-off and stop of the hot-melt can be accurately achieved, with the result that the intermittent coating operation at a high level in which no stringing occurs may be performed. It is apparent that this applicator may be used in the application of other coating materials than the hot-melt paint, and adherend other than the nonwoven fabric as well.

As described above, in accordance with the applicator of this embodiment of the present invention, when coating materials such as a hot-melt are applied to an adherend, air is emitted toward the outer edge of an opening through which the coating materials are discharged, whereby there is no deposition of coating materials in the quantity left around the opening, which enables the effective prevention of any outbreak of faulty goods due to drops of the coating materials. The arrangement such that air emitted from the lower side of the adherend toward the opening through which the coating materials are discharged allows the adherend to be securely pressed on the opening with a proper force so as to obtain a uniform painting of hot-melt.

Furthermore, since the pressure within the cavity holding the hot-melt can be increased and decreased quickly, possible leakage of a hot-melt paint at the stop or suspension of the coating operation can be prevented effectively, thereby enabling a precise performance of intermittent coating.

Claims

1. A hot-melt applicator having a slit-shaped opening formed at the lower end of the cavity through which hot-melt or other coating material is supplied, for applying said coating material on the adherend passing through the lower side of the opening, wherein an air nozzle for discharging air toward the outer edge of the opening is disposed.

2. A hot-melt applicator having a slit opening formed at the lower end of a cavity in which hot-melt or other coating material is supplied, for applying the coating material on an adherend passing beneath the opening, wherein an air nozzle for discharging air upward from the lower side of the adherend is disposed immediately beneath the opening.

3. A hot-melt applicator having a slit-shaped opening formed at the lower end of the cavity through which hot-melt or other coating material is supplied, for applying said coating material on the adherend passing through the lower side of the opening, wherein a cylinder portion communicating with said cavity is provided, and a piston is provided within said cylinder which may be moved back and forth for providing increase and decrease of pressures within the cavity.

4. The hot-melt applicator of Claim 3, wherein an air nozzle for discharging air toward the outer edge of the opening is disposed.

5. The hot-melt applicator of Claim 3, wherein an air nozzle for discharging air upward from the lower side of the adherend is disposed immediately beneath the opening.

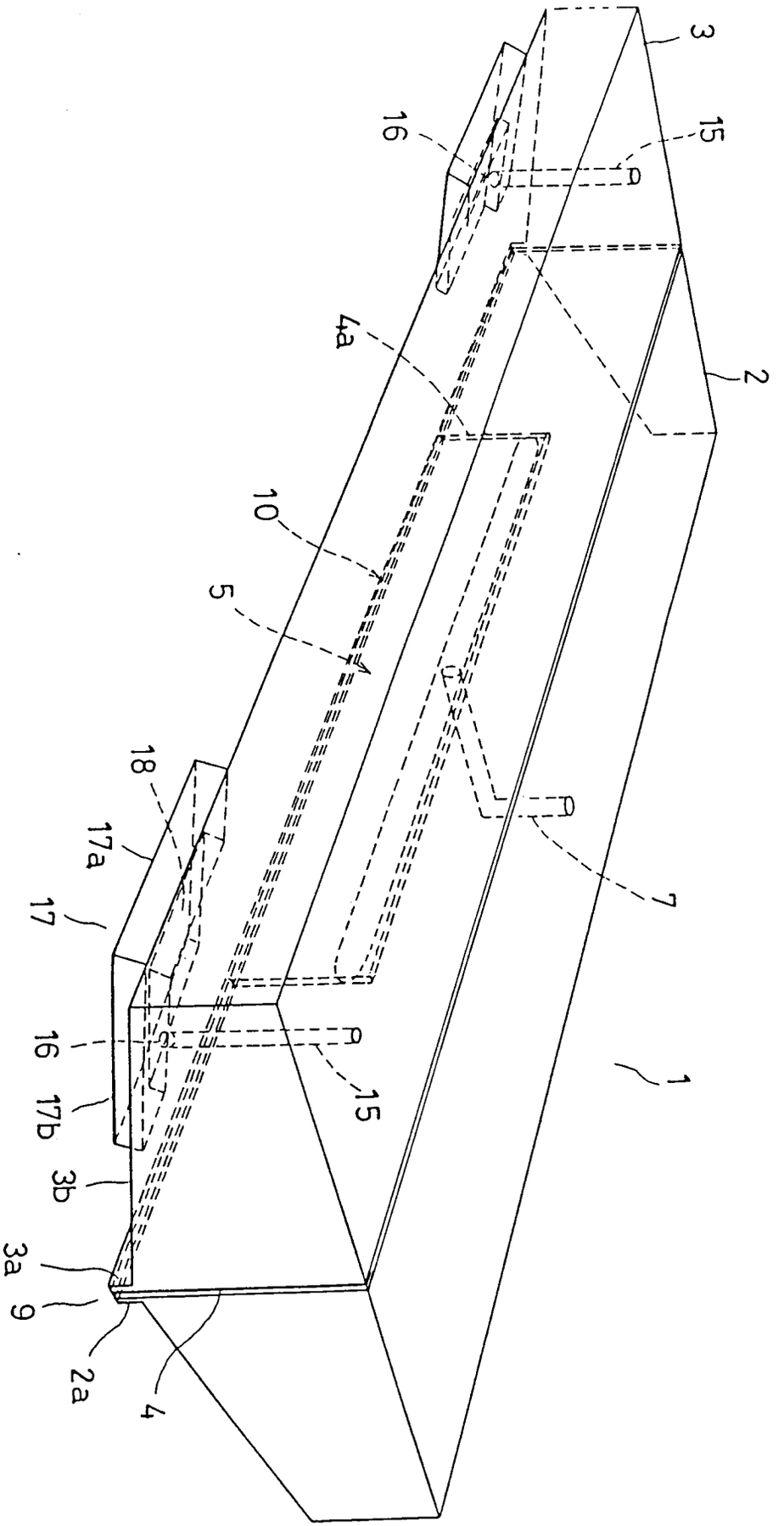


FIG.1

FIG. 2

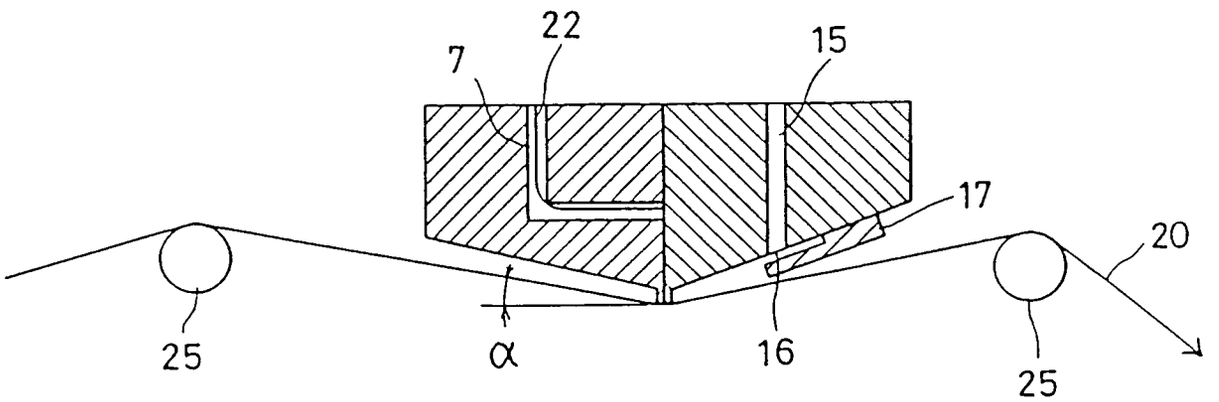


FIG. 3

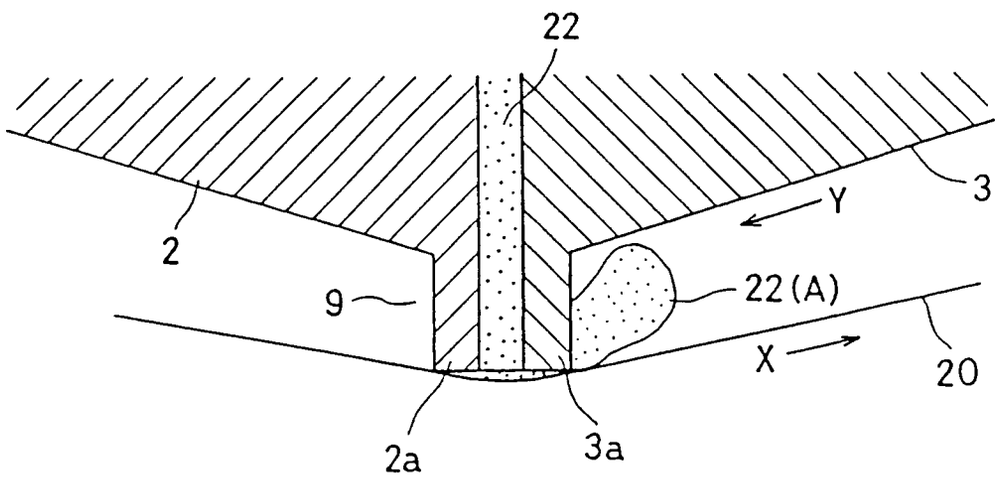


FIG.4

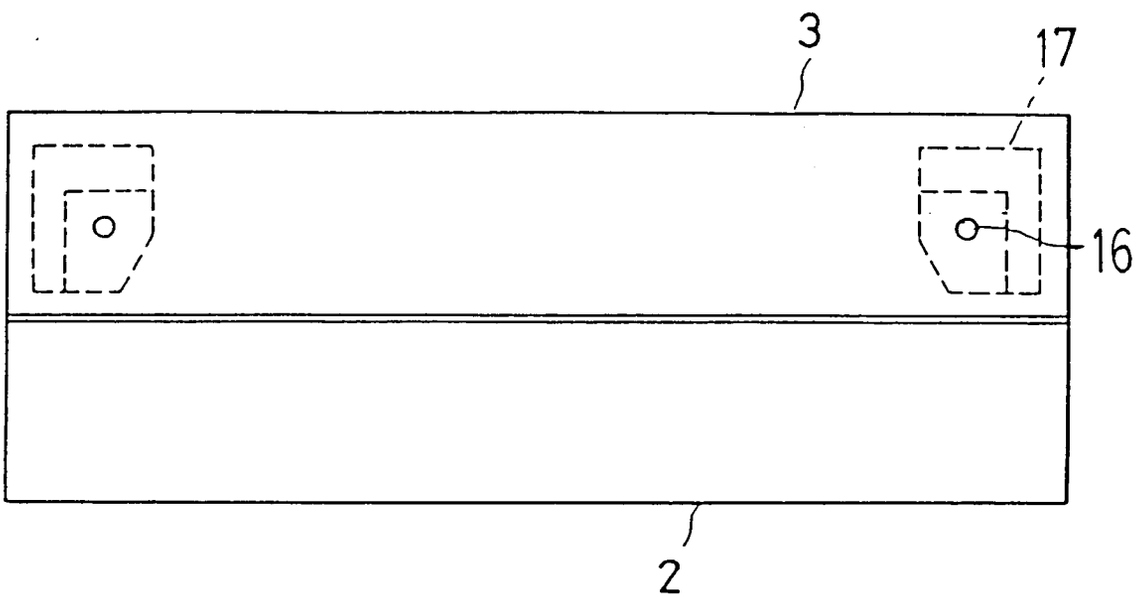


FIG.5

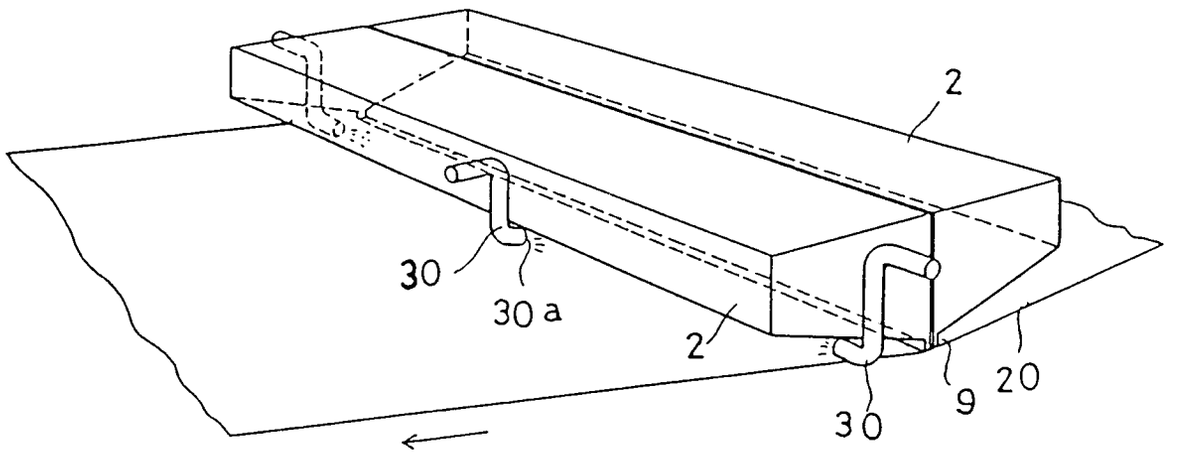


FIG.6

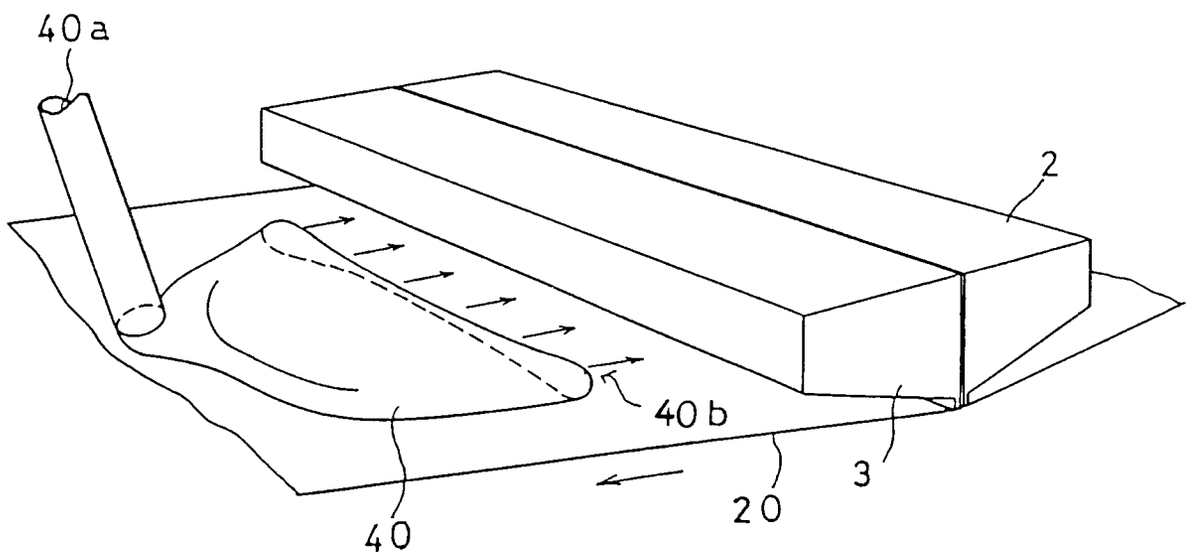


FIG. 7

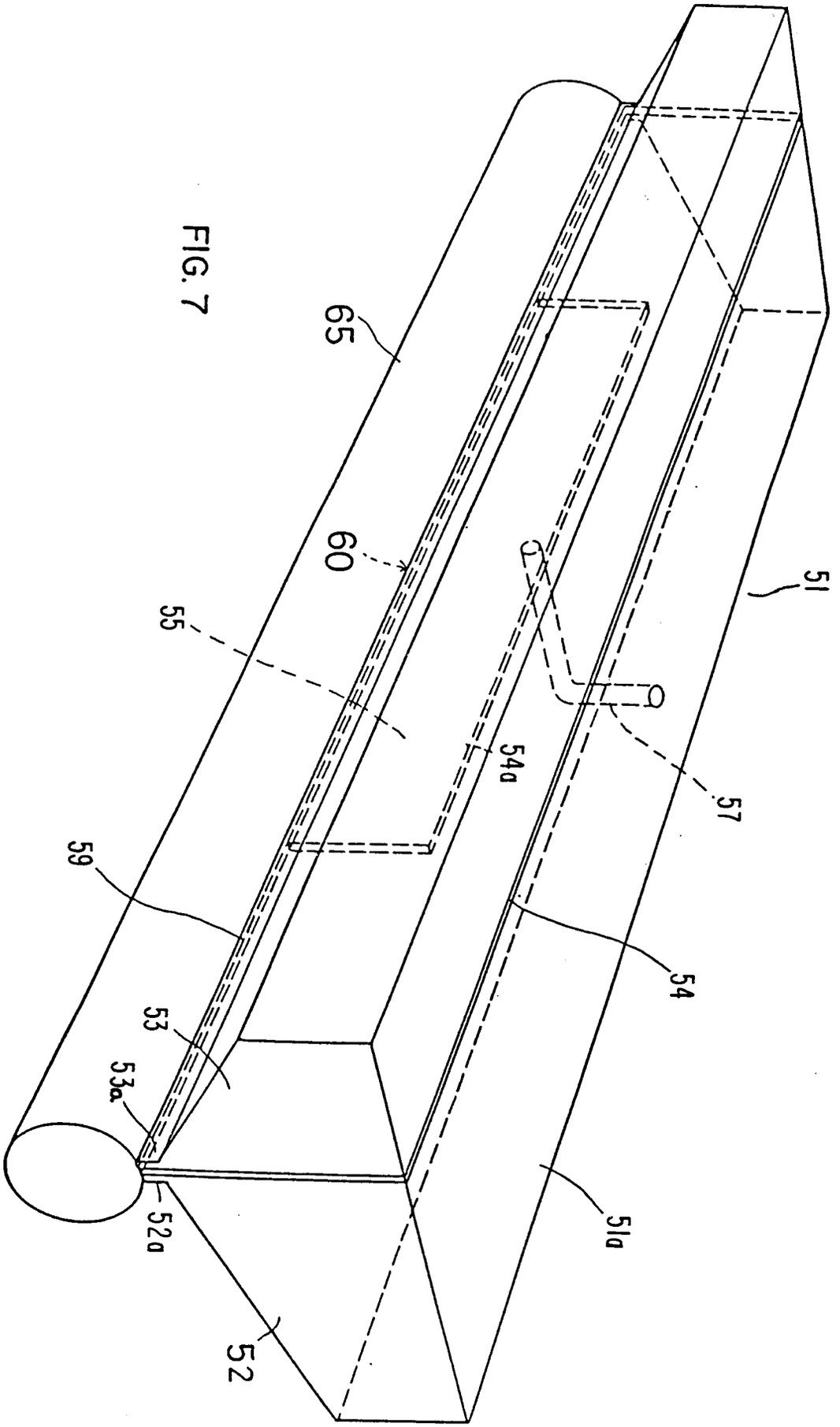
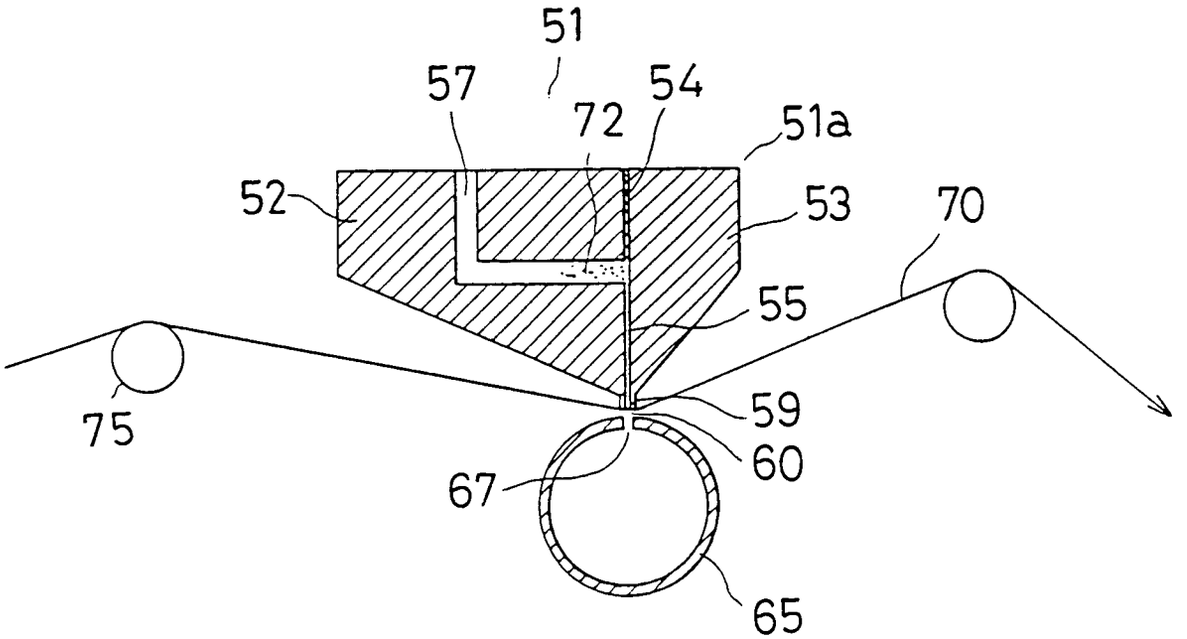


FIG. 8



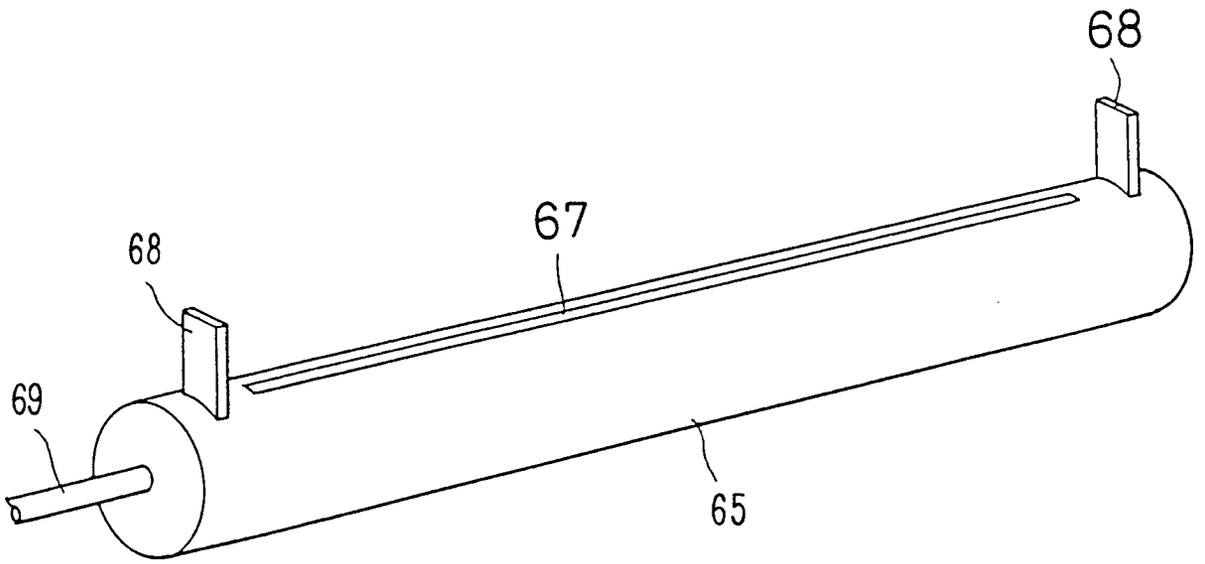


FIG. 9

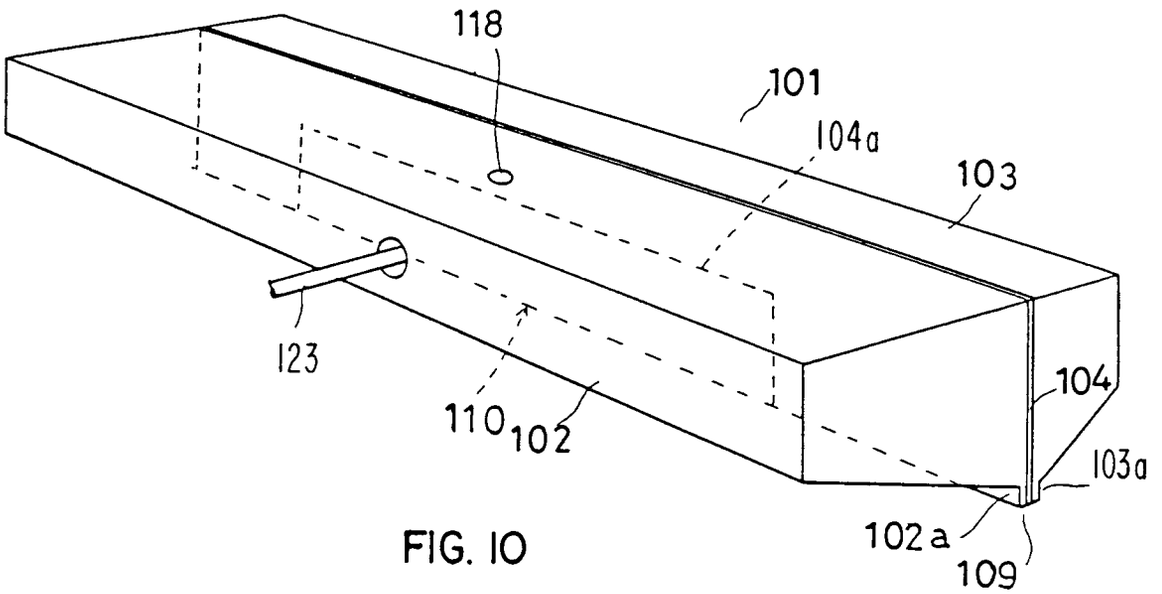


FIG. 10

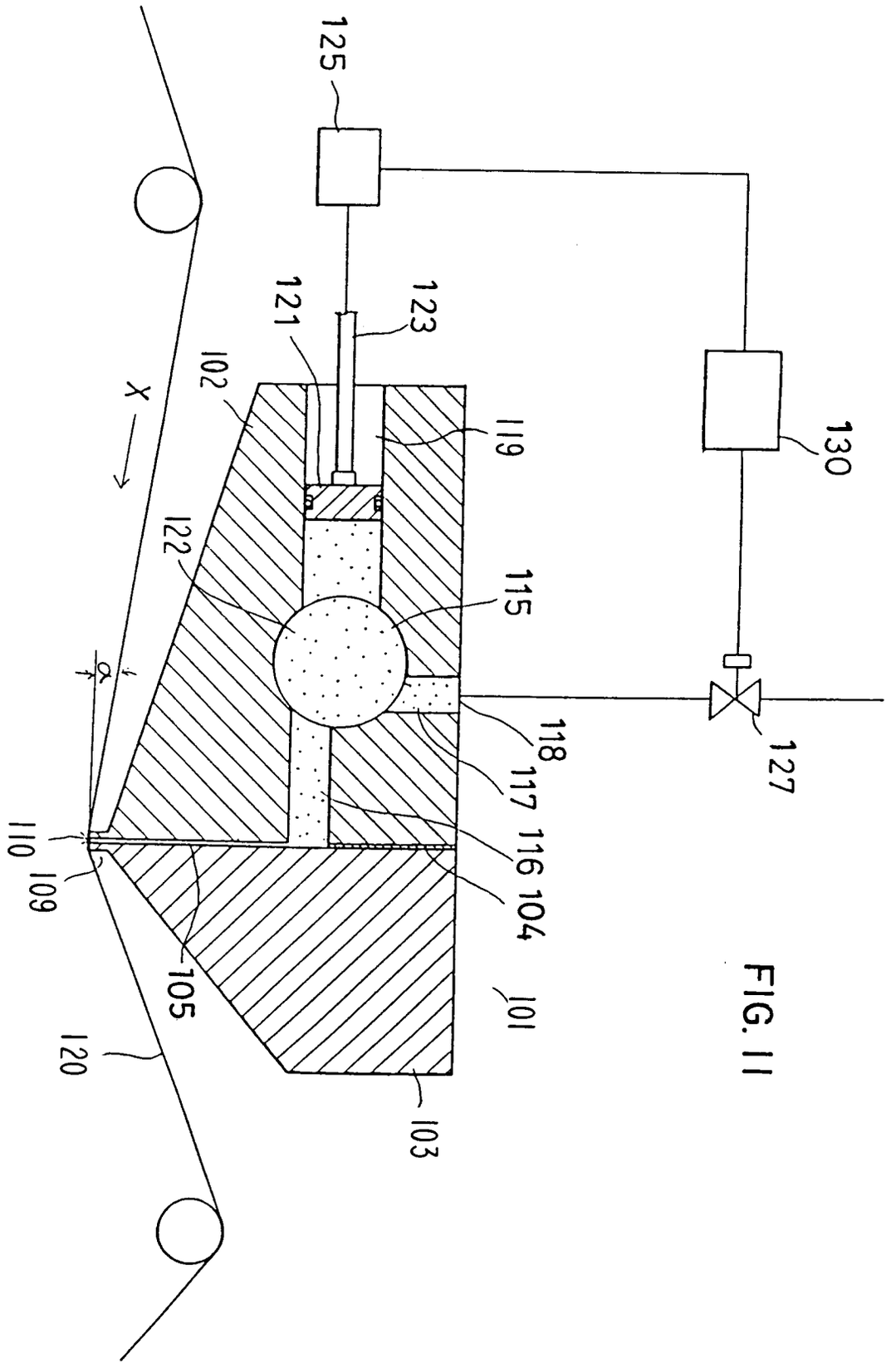

125
123
121
102
X
119
130
122
115
α
118
117
116
104
110
109
105
101
120
103
127

FIG. 11

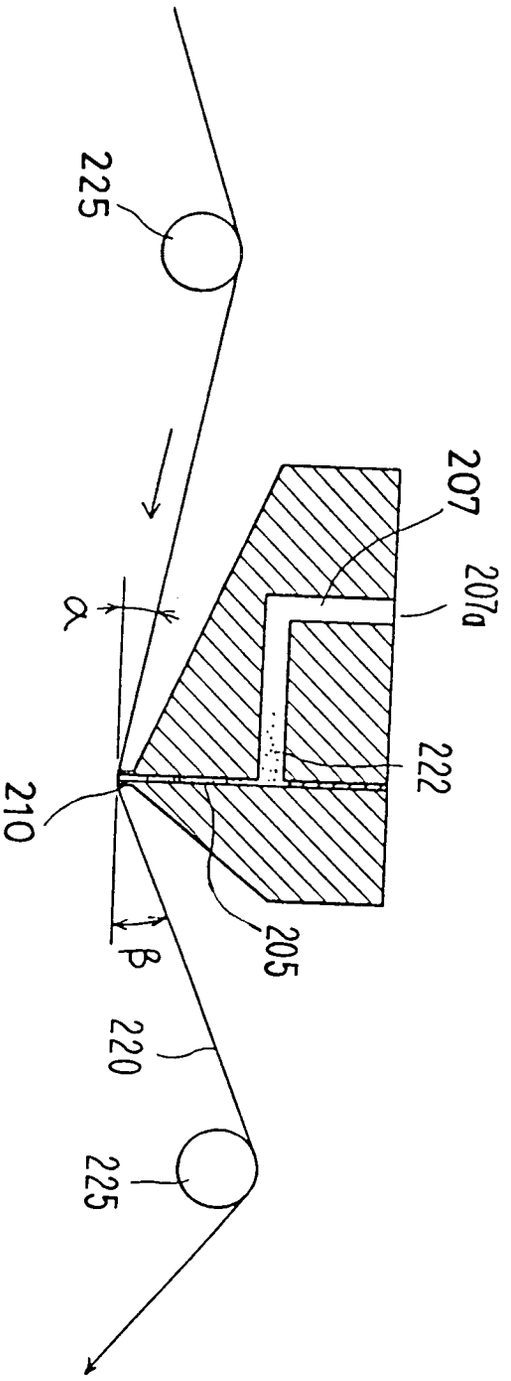


FIG. 12