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Device for distributing a medium on a substrate; method for coating a substrate with a medium; substrate coated with use of the device.

The invention relates to a device for uniform distribution of a viscous medium over the width of a web-like moving substrate. According to the invention the device comprises a medium outflow slit (24, 25) which is delimited by walls (34, 35), whereby the slit-wall height dimension is at least 25 times the slit-width dimension and in particular 50-150 times the slit width dimension. The invention also relates to a method for coating a moving substrate with use of such a device and to a substrate which is coated with use of a device according to the invention.

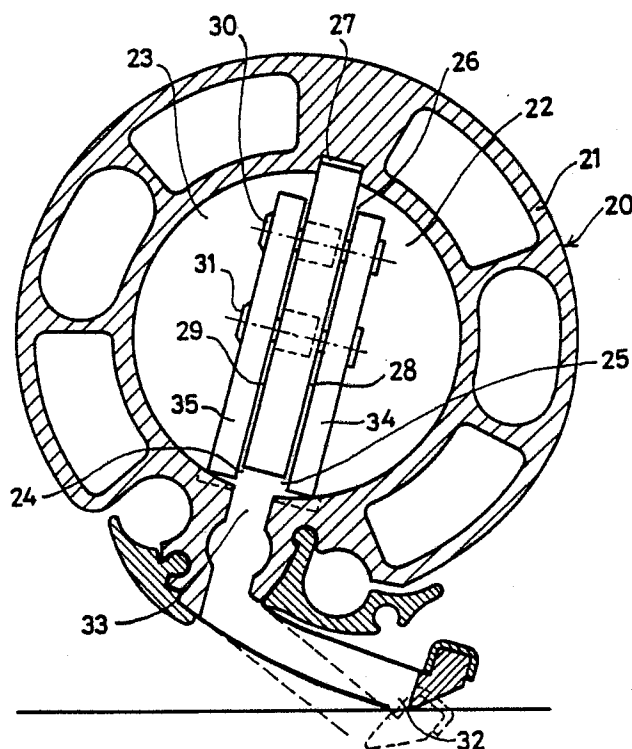


FIG. 2A.

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**Device for distributing a medium on a substrate; method for coating a substrate with a medium;
substrate coated with use of the device.**

The invention relates to a device for uniformly distributing a viscous medium in the width direction of a web-like substrate moving predominantly perpendicularly to the device, at least comprising:

medium supply means; at least one medium-distributing space and an outflow slit adjoining the distributing space.

A device of this type is known from Dutch laid open Patent application 8201505 by the applicant.

In the present application the terms below will be used:

- Slit length; this is the dimension of the outflow slit measured along the length of the medium-distributing device.

- Slit wall height; this is the dimension, viewed in the flow direction of the medium, of the walls delimiting the outflow slit with the smallest dimension in a certain position along the length of the slit.

- Slit width; this is the distance between the walls delimiting the outflow slit in a certain position along the length of the slit.

Using the said known device it is possible to distribute a viscous medium over the width direction of a moving web-like substrate. The device has a rod-shaped exterior and the central axis of said device is generally oriented predominantly perpendicular to the direction of movement of the substrate, to which the medium is to be applied. The device described comprises two outflow slits and is intended for uniformly distributing the medium in the width direction of said moving substrate; yet, such a uniform distribution of medium in the width direction of the substrate is not completely achieved in many cases. This is due to the fact, that, on the one hand, adjustment of each of the slits for obtaining the desired local outflow resistance is very critical while, on the other hand, the slit adjustment may change during operating as a result of deformation due to, inter alia, the pressure of the medium, temperature changes, sagging of the device, etc.

The object of the present invention is to overcome the said disadvantage and for this is characterized in that the dimension of the walls delimiting the slit (the slit wall height), viewed in the flow direction of the medium, is always at least 25 times the slit width.

In particular, a ratio between slit wall height and slit width of 50-150 is employed in the device according to the invention.

Then, by designing, according to the invention, a device of the above type in a manner such that the ratio mentioned is at least 25 and in particular

50-150, a very important improvement in the distribution uniformity is achieved, as will be explained later in detail.

Slit wall height and slit width will normally be constant over the length of the slit.

However, in order to achieve a desired distribution in certain cases and for certain media, it may be necessary to vary the slit wall height over the length of the slit while keeping the slit width constant. It may also be decided in particular cases to keep the slit wall height constant and to vary the slit width over the length of the slit.

However, the ratio slit wall height to slit width will have to be at least 25 in all cases in order to avoid the problems associated with slit adjustment mentioned earlier.

By means of the measure according to the invention described above, it is achieved that any possible minor local deviations from the adjusted slit width will no longer be traceable in the ultimate distribution result on the substrate. In order to obtain an optimum adjustment of slit width it is advantageous to work with spacers which, in view of the vulnerability of certain pressure media, are preferably free of sharp edges, and with which the best results are obtained, if these are located upstream of the outflow surface of the slit and very preferably in the upstream half of the slit-shaped space.

In many cases it is not necessary for the device to emit medium over its full length, measured in the direction perpendicular to the direction of movement of the substrate. Advantageous embodiments of the device according to the invention in this connection are expressed in the characterizing part of claims 5, 6 and 7. Using the shut-off means described there the result is achieved that the outflow surface is limited in directions perpendicular to the flow direction of the medium.

For particular applications which will be discussed in detail in the text which follows, one or more of the sliding pieces used can very advantageously be provided with lateral bulkheads extending to the upstream side of the substrate and oriented perpendicular to the substrate.

The invention also relates to a method for coating, optionally in a pattern, a moving substrate with a viscous medium using a device for distributing said medium, if desired in combination with coating means, which may optionally work in a pattern, this method being characterized in that one or more of the above described devices for distributing medium according to the invention are used in an embodiment suitable for that particular meth-

od.

The medium-distributing device according to the invention is very advantageously used in cases in which a foam-like medium has to be applied to a moving substrate using a rotary screen printing stencil, known per se, the medium discharge opening of the device resting against the inner wall of said stencil. A rotary screen printing stencil of this type may be an unpatterned stencil for those cases in which the foam is to be applied in an even coating layer to a substrate, for example a textile web. The stencil used may also be provided with a pattern for the case that the foam is to be applied so as to form a pattern.

In another embodiment of the method according to the invention a foam-like medium is distributed on a moving substrate, the foam being supplied at the upstream side of a doctor blade and the medium discharge opening of the medium-distributing device being arranged above the substrate. The two above-described embodiments of the method according to the invention differ not only in respect of the coating means employed in the form of a stencil and a doctor blade. There is also a difference in the type of foam-like medium; when a stencil is used, in which case the medium discharge opening rests against the wall of the stencil, the foam is forced in unexpanded state through the perforations in the stencil. In the last-mentioned application, the foam is given the opportunity, when flowing out in the area in front of the doctor blade, to expand completely and the doctor blade exerts an action, forming a coating layer, on the expanded foam.

The methods described above are, however, by no means limited to use for distribution on, and coating of, a substrate with foam like medium; each viscous medium can successfully be processed using a distributing device according to the invention.

Finally, the invention relates to a substrate obtained by coating, optionally in a pattern, said substrate with a viscous medium, if desired followed by the necessary finishing steps. The uniformity of the distribution of the medium on the substrate over its width is very characteristic if coating is carried out using one or more of the distributing devices, described above, according to the invention.

The invention will now be described by reference to the accompanying drawing, in which:

Figure 1 shows a distributing device according to the state of the art;

Figure 2A and 2B show medium-distributing devices according to the invention;

Figure 3 shows another embodiment of a medium-distributing device according to the invention;

Figure 4 shows yet another medium-distributing device according to the invention;

Figure 5 shows the arrangement of a medium-distributing device according to the invention in combination with the doctor blade for distributing a viscous medium over the width of a substrate;

Figure 6 shows two graphs of the distribution of viscous medium over the width of a substrate; Graph A shows the distribution in a device according to the present state of the art and graph B shows the distribution when using a device according to the invention.

Figure 1 shows a distributing device according to the present state of the art 1 composed of a body 2 with medium-distributing spaces 3 and 4, slit-shaped outflow surfaces 5 and 6, as well as a conventional medium-collecting space 7 and a medium discharge opening 8. Adjustment of the dimension of the slit-shaped outflow surface 5 and 6 is achieved by means of adjustable strips 9 and 10. In the situation shown, the medium-distributing device 1 is located at the inner side of a stencil 11, the medium discharge opening 8 being in contact with the inner wall of said stencil 11. The discharged medium passes through the perforations in the stencil and in this way arrives at the surface of the moving substrate 12. Adjustment of the strips 9 and 10 is particularly time-consuming and critical; minor faults in adjustment, as well as deviations as a result of sagging of the device may result in a high degree of non-uniformity of the distribution.

Figure 2A and 2B show a distributing devices according to the invention, according to a first embodiment in which the device 20 with a body 21 comprises distributing spaces 22 and 23. The medium can flow into slit-shaped spaces 28 and 29 in the downstream direction, these spaces ending in outflow strips 24 and 25. The slits are formed by plates 34 and 35 which are fixed by spacers and fastening means 30 and 31, respectively, on a plate, which in this case is arranged centrally, extending over the length of the distributing device. The plates 34 and 35 are in tight contact with the inner wall of the device 20 on one longitudinal side.

In a typical embodiment of the distributing device shown in Figure 2, the slit wall height is 45 mm, while the slit width is 0.5 mm, the quotient between the two parameters therefore being 90. For the device and for the devices to be described in the text which follows, the rule applies that, depending on the desired distribution, additional adjustment may take place by either varying, while maintaining a ratio of at least 25 between slit wall height and slit width, the slit width according to a particular pattern over the length of the device, with the slit wall height being fixed, or varying the slit

wall height according to a particular pattern, with the slit width being fixed, as mentioned before.

Figure 3 shows another embodiment of the device; the device 40 comprises medium-distributing spaces 44 and 45, a slit-shaped space 46 of large length, the medium flowing from distributing space 42 in the direction shown by arrow 44 to space 43 and from there, as shown by arrow 45, arriving in the slit-shaped space 46. 47 indicates a spacer intended for maintaining the width of the slit-shaped space at the correctly adjusted value.

Figure 4 shows yet another embodiment of the device according to the invention. The device 50 comprises medium-distributing spaces 51, 52, connecting to slit-shaped spaces 53 and 54, which in turn debouch into a collecting space 57 from which the medium can flow out through medium discharge opening 56.

Figure 5 shows the situation in which a substrate 72 is passed over a roll 71, a doctor blade 74 being arranged at short angular distance in front of the perpendicular plane through their axis of the roll. In the upstream direction of the substrate, a medium-distributing device 60 is arranged with distributing spaces 63 and 64 to which medium supply lines 61 and 62 connect and in which the distributing spaces 63 and 64 are arranged, as is shown in Figure 4 described above; the slits formed connect to a collecting space 67 which ends in medium discharge opening 75. A sliding piece 68 to which a lateral partition 70 is attached, is received in the collecting space. The connection between the rod-shaped section 68 and the lateral partition 70 is formed by a strip-shaped part received in the collecting space 67. By displacing the sliding piece 68, the length of the slit-shaped outflow is first of all effectively limited while the lateral partitions 70 on the substrate prevent the medium, for example expanded foam, from spreading more than desired over the width of the moving substrate. The desired thickness of the coating layer is adjusted by means of doctor blade 74.

Finally, Figure 6 shows two graphs in which the amount, in grams, of medium, for example foam medium, applied per minute is given in the vertical direction and the location along the longitudinal direction of the distributing device is given in the horizontal direction. Figure 6A shows the result for a device according to the present state of the art, incorporating two slits complementing each other, while Figure 6B shows the results obtaining using a device according to the invention. It is evident in Figure 6A that the application achieved is not uniform; on the other hand, it can be seen in Figure 6B that an extremely uniform application across the longitudinal direction of the device is achieved by means of a distributing device according to the invention. As follows from the above-described ex-

emplary embodiments of the device according to the invention, the medium outflow surface will in many cases be followed by a medium collecting space in which a slit-shaped medium discharge opening is located. Such a collecting space is not necessary, however, in every case, said medium discharge opening can in certain cases be formed by the medium outflow surface, in other words the outflow slit of the slit-shaped space.

Claims

1. Device for uniformly distributing a viscous medium in the width direction of a web-like substrate moving predominantly perpendicularly to the device, at least comprising:

medium supply means; at least one medium distributing space (22, 23) and an outflow slit (24, 25) connecting to the distributing space, **characterized in that** the dimension of the walls (34, 35) (the slit wall height) delimiting the outflow slit (24, 25), viewed in the flow direction of the medium, is always at least 25 times the slit width.

2. Device according to Claim 1, **characterized in that** the slit wall height is 50-150 times the slit width.

3. Device according to Claims 1-2, **characterized in that** one or more spacers (30, 31) extend over the slit width which spacers (30, 31) are free of sharp edges.

4. Device according to Claim 3, **characterized in that** the spacers (30, 31) are located in the upstream direction of the viscous medium at a distance more than half the slit wall height, upstream of the outflow slit.

5. Device according to one or more of the preceding Claims, **characterized in that** the outflow slit (24, 25) is delimited in directions perpendicular to the flow direction of the medium by shut-off means located in a collecting space (67) connecting to the outflow slit.

6. Device according to Claim 5, **characterized in that** the shut-off means are formed by a sliding piece (68) fitting in the collecting space.

7. Device according to Claim 5-6, **characterized in that** the shut-off means are formed by a sliding piece (68), fitting in the collecting space and being of small length while the remaining length required in the direction of the device concerned is formed by flexible hose which can be inflated for shutting-off operation.

8. Device according to Claims 6-7, **characterized in that** a lateral partition (70) which is oriented vertically on the substrate and extending to the upstream side thereof, is fitted on one or more of the sliding pieces (68) applied.

9. Method for coating a moving substrate with a viscous medium using a device for distributing said medium, if desired in combination with coating means which may optionally operate in pattern, **characterized in that** one or more devices for distributing medium according to one or more of Claims 1-8 is used. 5

10. Method according to Claim 9, **characterized in that** a foam-like medium is distributed on a moving substrate (55) using a rotary screen printing stencil (58), and that the medium discharge opening (56) of the medium-distributing device (50) employed, rests against the inner wall of said stencil (58). 10

11. Method according to Claim 9, **characterized in that** a foam-like medium is distributed on a moving substrate (72) using a doctor blade (74), the medium discharge opening (75) of the employed device being located at the upstream side of the doctor blade (74) above the substrate (72). 15 20

12. Substrate obtained by coating, optionally in a pattern, said substrate with a viscous medium, if desired followed by finishing steps, **characterized in that** coating is carried out using one or more of the devices according to Claims 1-8. 25

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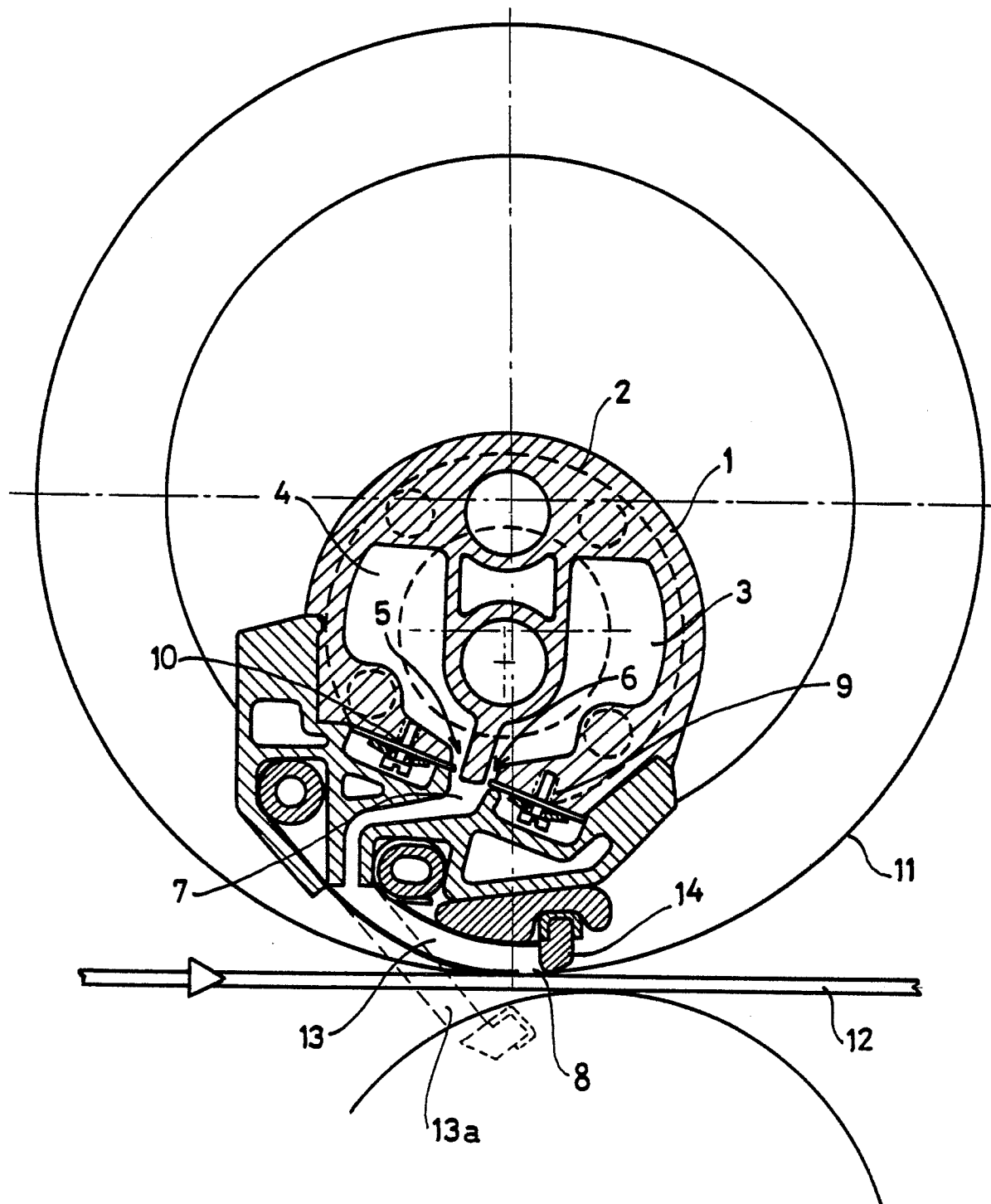


FIG. 1.

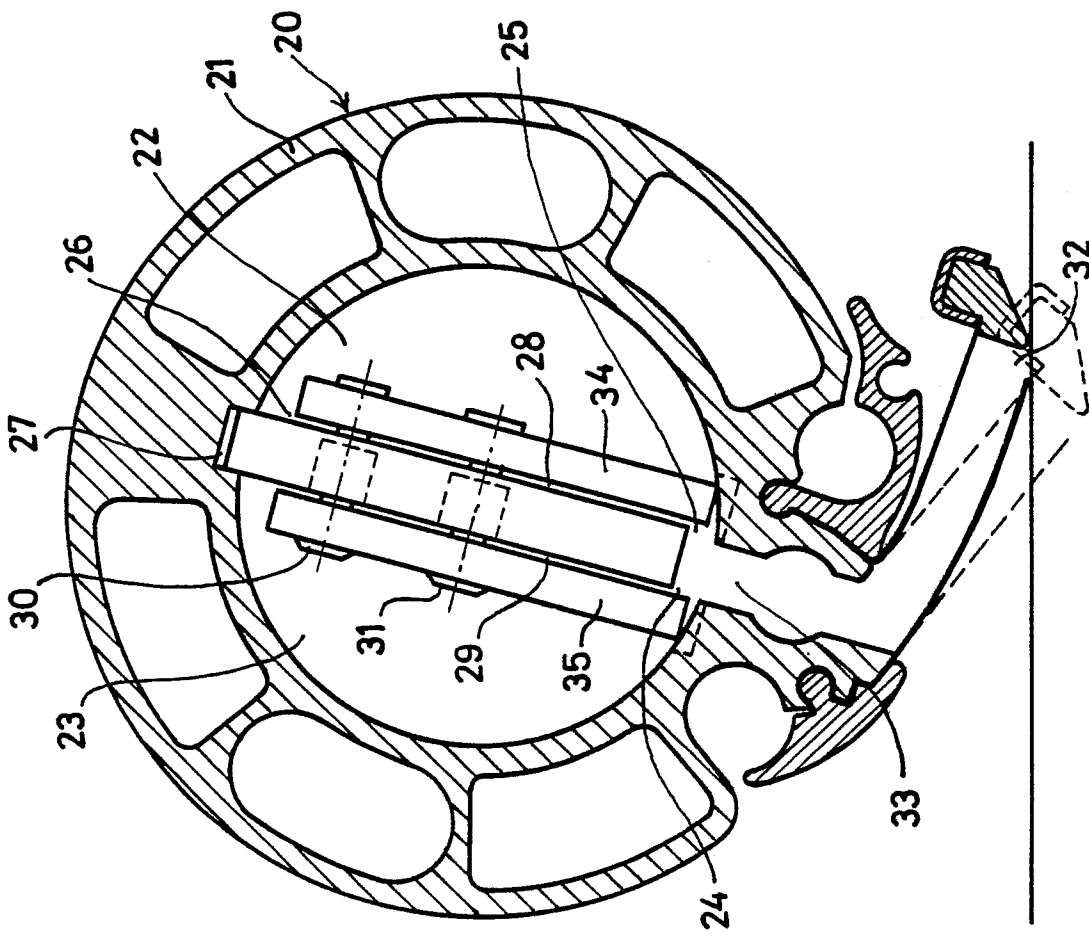


Fig. 2A.

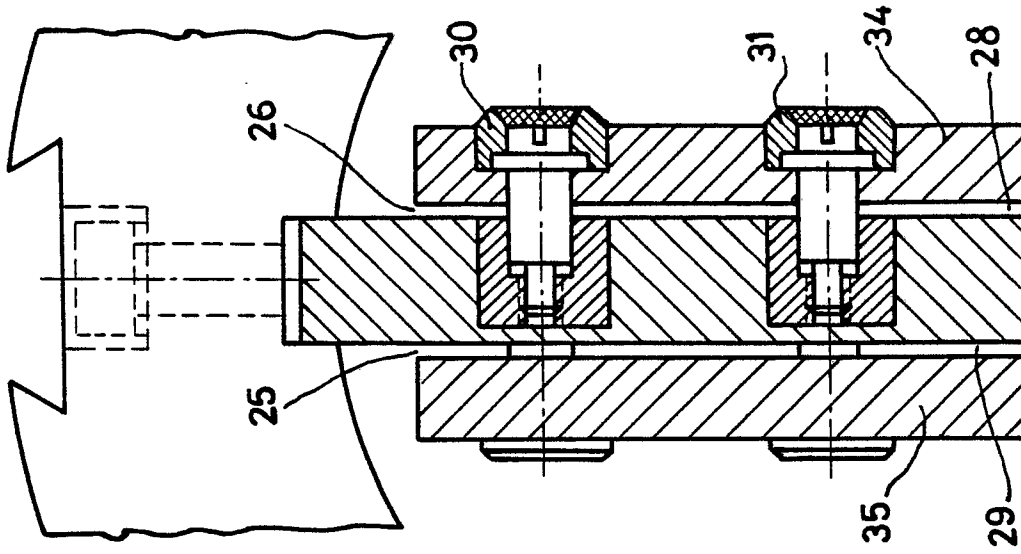
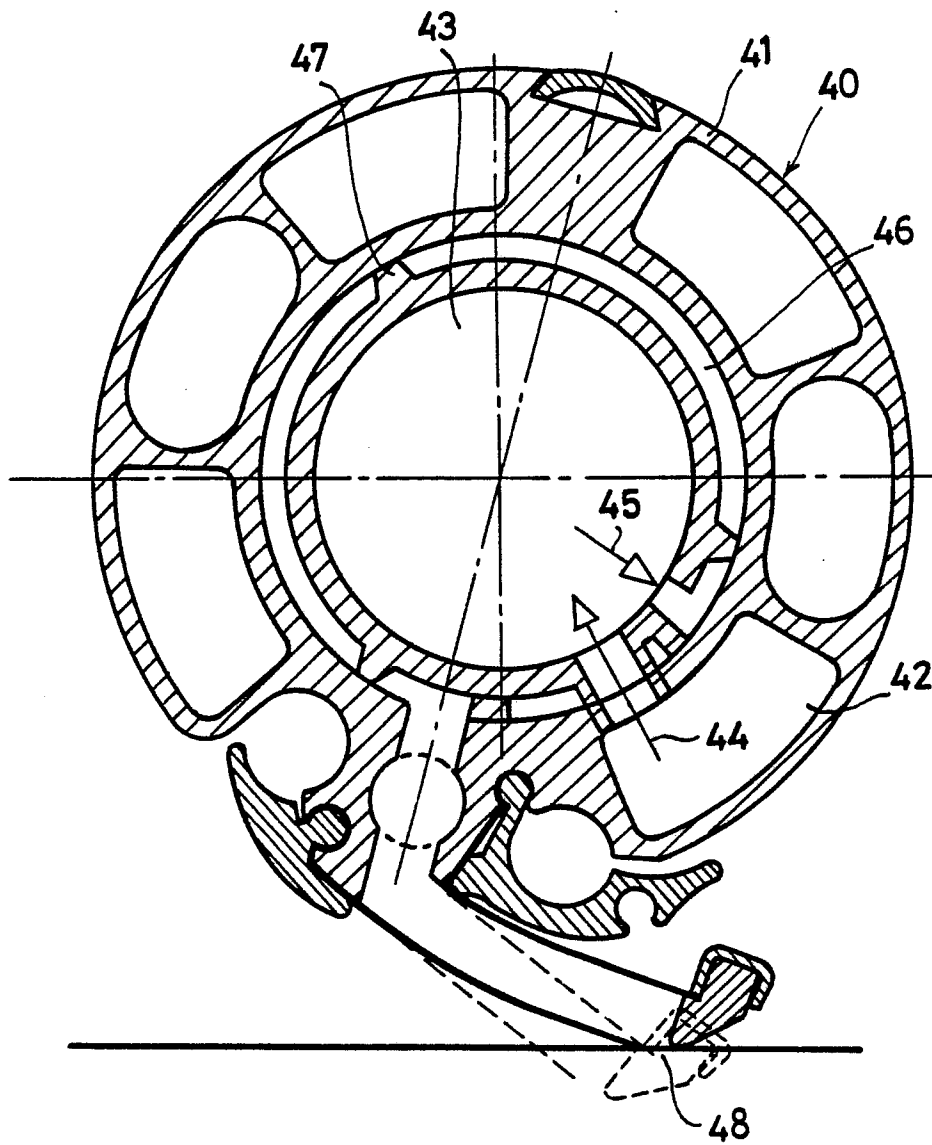
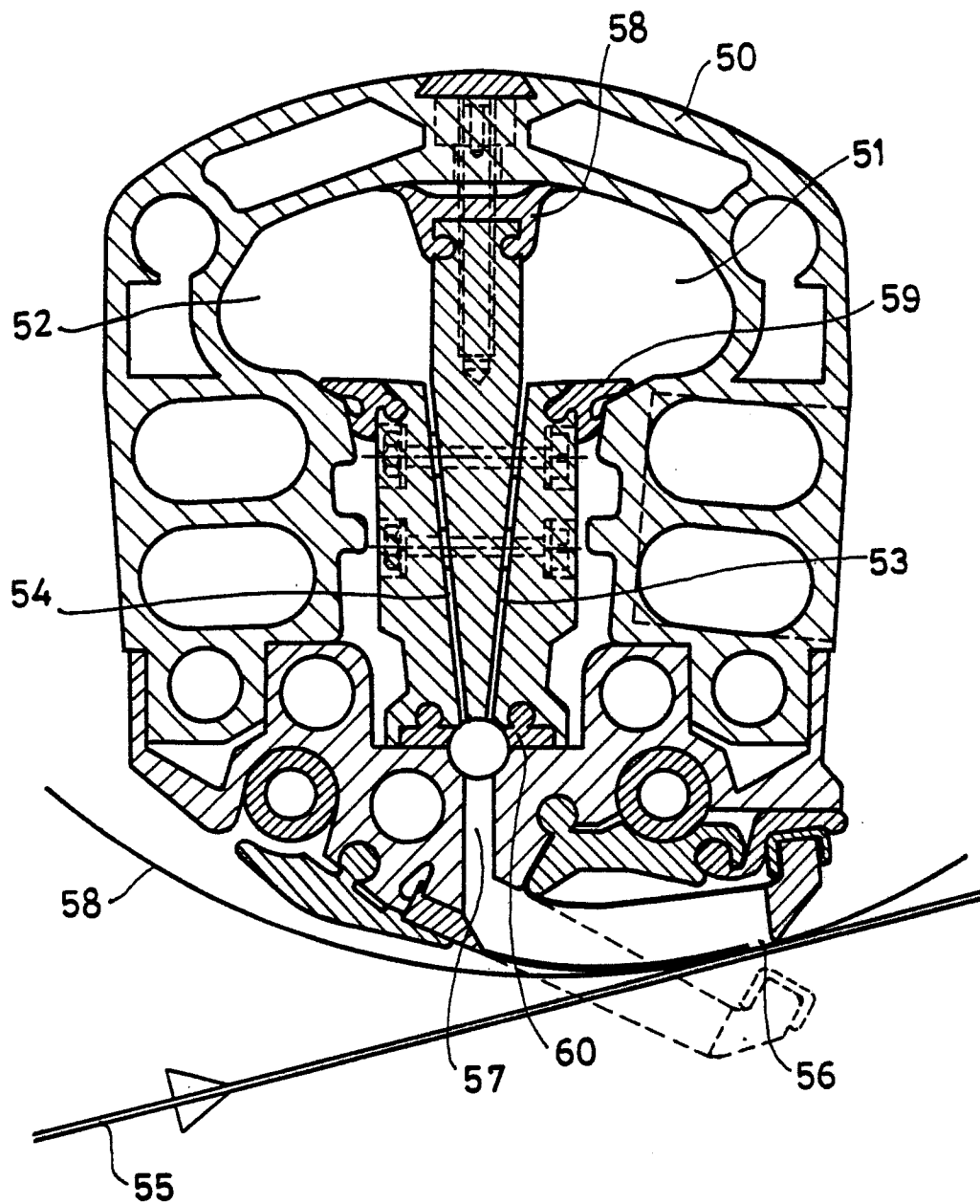
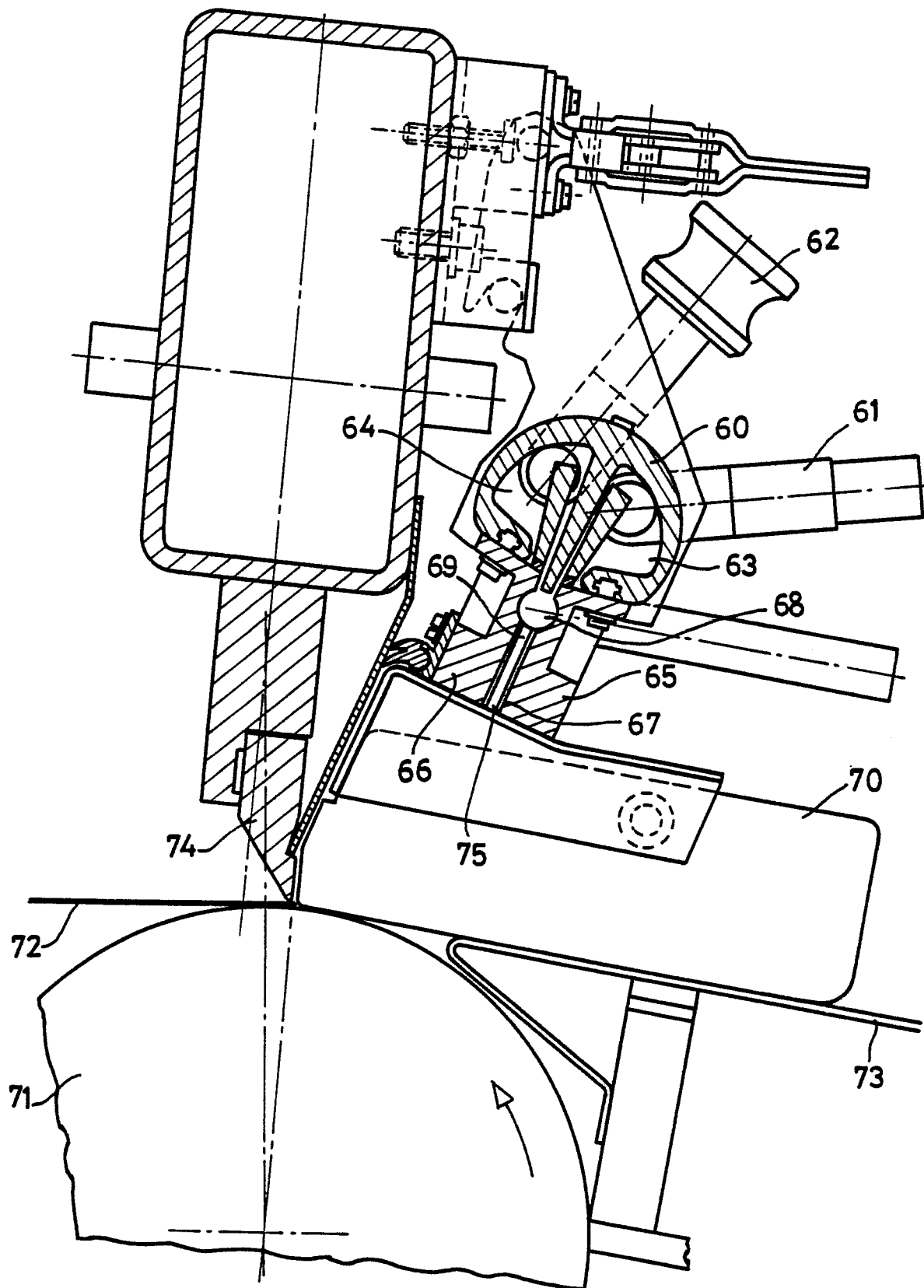
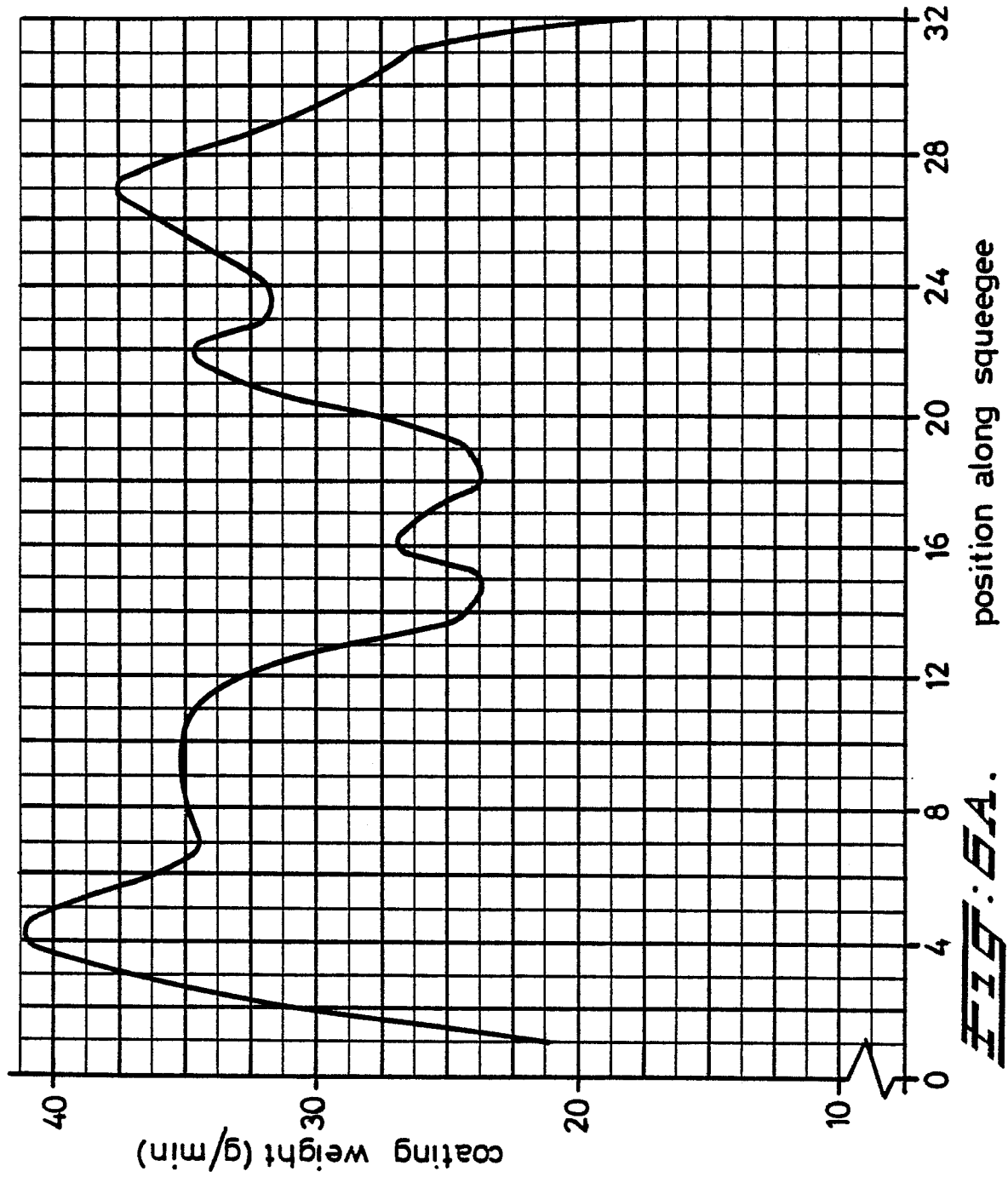


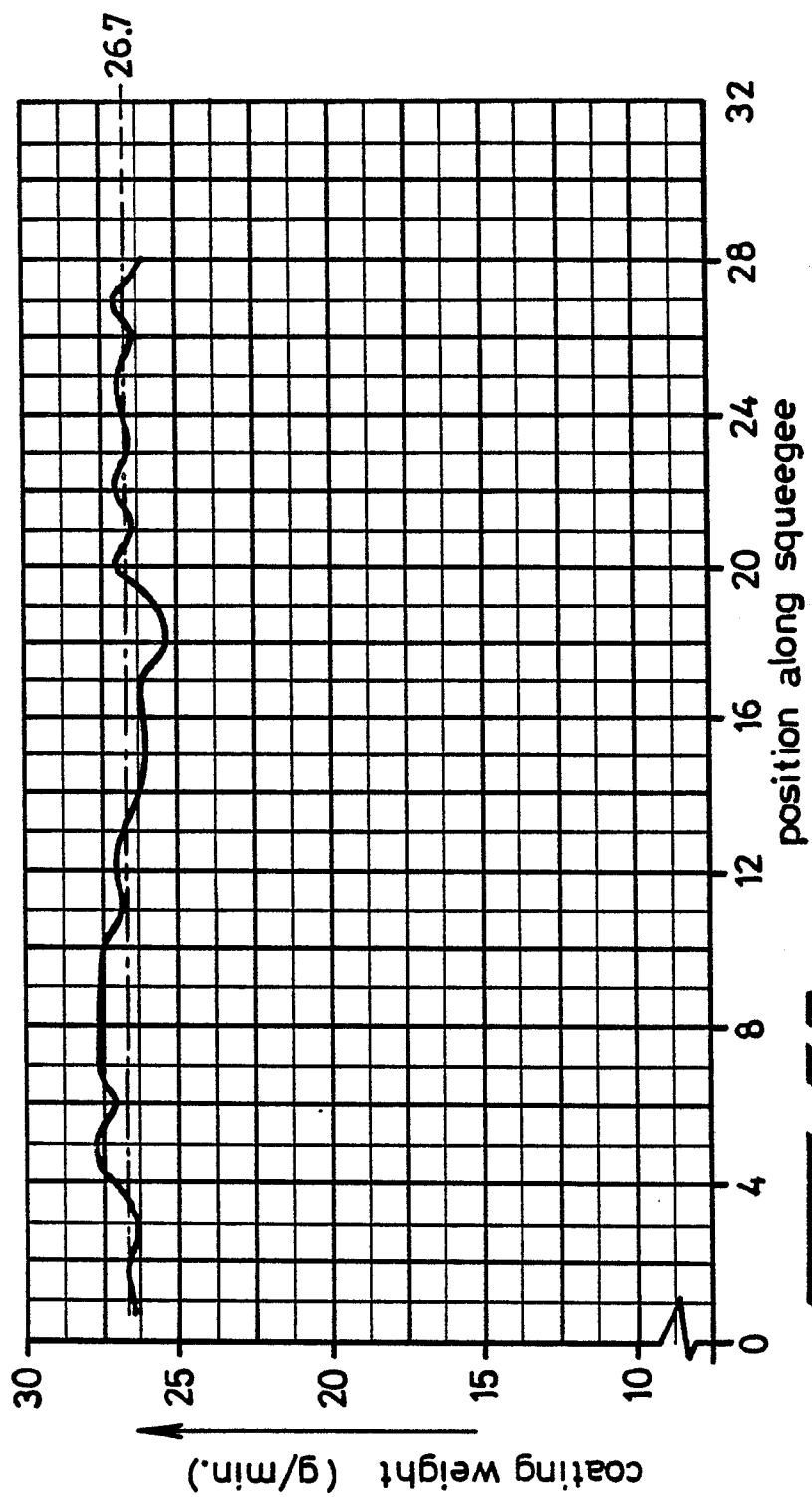
Fig. 2B.

**FIG. 3.**

**FIG. 4.**

**FIG. 5.**



**FIG. 5B.**



DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int. Cl.4)
X	DE-A-3 200 171 (M. MITTER) * Figure 1; page 7, line 23 - page 8, line 12; page 4, lines 1-5 *	1,2,9, 10,12	B 41 F 15/42
Y		5,6,11	
A		3,4	
Y	DE-A-2 450 309 (MITTER & CO.) * Claim 1; figures 2-4 *	5,6	
A		7,8	
Y	US-A-3 155 034 (G.W. REINKE) * Figure 9; column 7, lines 15-17 *	11	
			TECHNICAL FIELDS SEARCHED (Int. Cl.4)
			B 41 F
The present search report has been drawn up for all claims			
Place of search THE HAGUE		Date of completion of the search 01-07-1988	Examiner WEBER P.L.P.
CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document			