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(54) **Method and device for providing a printed, self-adhesive foil**

(57) A method and device are described for providing printed, self-adhesive foil (17). As starting material, use is made of non-printed self-adhesive foil (12), comprising a foil (12) with a first main surface (13) and a second main surface (15), wherein an adhesive material (14) has been applied on the first main surface (13). On the second main surface (15), the ink, paint, paste or the like (26) of the text and/or image to be applied, is applied. After the ink or the like (26) has dried, a finishing coating (41) is applied over it. The finishing coating

is comprised of a thin, substantially transparent layer of a suitably chosen material to which the glue layer (14) will adhere hardly or not at all. By this, it is achieved that when winding the foil, the glue layer (14) can not contact the ink (26) such that the ink (26) will not be damaged when unwinding.

The finishing coating is applied by a roll (410), the rotational speed of which is driven in accordance with the speed of passing foil.

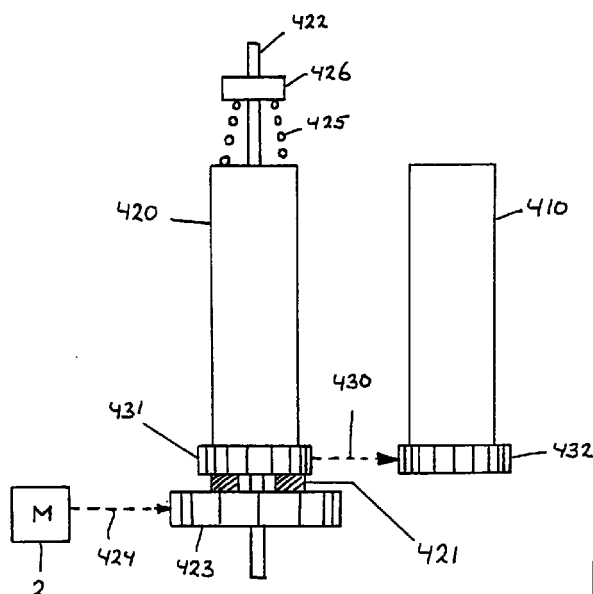


FIG. 4B

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Description

[0001] The present invention relates to providing printed, self-adhesive foil, also indicated with the wording "tape". With this expression, a thin web is meant of a material, normally plastic, such as for instance PVC, PP, PE, etc., wherein one main surface of said web is provided with a layer of a self-adhesive material, such as for instance glue, gum, etc. This layer will hereinafter be indicated with the expression "glue layer".

[0002] Such a self-adhesive foil is among else usable as a packaging material for several applications. In general, packaging material is required to be as cheap as possible, and therefore the production process for a packaging material should be as simply as possible.

[0003] Among else with a view to the use as packaging material, there is a need for printed self-adhesive foil, i.e. self-adhesive foil with text and/or images, preferably in full colour, on the main surface thereof which is not provided with glue. It is customary to wind the self-adhesive foil, which is for instance intended for packaging purposes, to a roll. Herein, the problem occurs that the printed side of a foil winding contacts the glue layer of the next foil winding. When later the self-adhesive foil is unwound, chances are that the printed material applied on the foil is destroyed by removing the winding which is in contact therewith, because the ink or the like is being taken away by the glue layer of said other foil winding.

[0004] In practice, this problem appears to be serious to such extent that it has already been proposed to apply the glue layer after printing. First, a glueless foil, i.e. a foil wherein said glue layer is absent, is printed and the thus printed glueless foil is wound on a roll; subsequently, at the location of the application, the foil roll is unwound and glue or a similar adhesive material is applied on the printed surface of the foil, after which the thus formed printed and glued foil is used for the application in question.

[0005] In contrast, the invention aims to providing a method wherein a foil provided with a glue layer is used as a starting point, because this is a well available standard product, while the step of applying glue involves all kind of problems, too.

[0006] As alternative way of solving the earlier-mentioned problem that the glue layer tends to pull away the ink of a previous winding, it has already been proposed to apply a finishing coating over the printed material, which is also indicated with the wording "release-coating", of which the composition is chosen such that the glue layer sticks thereto hardly or not at all.

[0007] Known machines for applying said release-coating have the disadvantage, however, that they diminish the quality of the printed matter. Two factors play an important roll in this respect. A first factor is that for the release-coating, a solvent is used in which the ink of the printed matter is dissolved to some extent. A second factor is that the glued foil is subjected to ten-

sion stresses in such machines, causing the occurrence of elongation in the foil. These tension stresses, and thereby said elongation, will fluctuate in time due to variations in the friction forces caused by the glue layer, as caused by, inter alia, adhesion and cohesion forces. The release-coating is applied by means of a roller, which is driven to rotate with a predetermined speed. Because of said elongation and variations in said elongation, said predetermined speed does not always correspond to the true speed with which the foil passes the roller. This means that a varying speed difference exists between the foil and the surface of the roller (slip). As a consequence of that, the thickness of the release-coating may locally be insufficient for protecting the printed matter against the glue layer of a subsequent winding. Another consequence, which relates to the fact that the ink may dissolve somewhat in the solvent of the release-coating, is that the ink of the printed matter ("dots") may be smeared somewhat in the longitudinal direction (transport direction) of the foil, causing a diminishing of the sharpness of the printed matter. This is particularly unacceptable with four-colour print, where the sharpness to be reached is a necessity for obtaining a realistic image with a depth effect. It also is unacceptable with multi-colour print for achieving a realistic result by raster build-up of colours, such as for instance full-colours.

[0008] The invention aims to solve the problems as mentioned.

[0009] For that reason, according to an important aspect of the present invention, the release-coating is applied such that a friction force acting on the ink in the longitudinal direction of the foil is avoided.

[0010] This is possible by applying the release-coating without contact. According to another aspect of the present invention, the release-coating is applied by means of a roller, of which the rotational speed is controlled such that it is always equal to the momentary speed of the foil, causing to substantially eliminate the speed difference between the foil and the roller surface.

[0011] In an embodiment which is preferred because of simplicity, said roller is driven at least in part by the passing foil.

[0012] The present invention also relates to situations wherein a finishing coating is applied over the printed matter, such as for instance a glossy varnish, a matting varnish, a metallic varnish, etc. Herein, too, it is desired to apply the finishing coating as evenly as possible. This objective is attained by the measures proposed by the invention, too.

[0013] Said and other aspects, features and advantages of the present invention will be further clarified by the following detailed discussion of an embodiment with reference to the drawing, in which:

figure 1 schematically shows a device for printing self-adhesive foil according to the present invention;

figure 2 schematically shows a cross section of a

part of a self-adhesive foil;

figure 3 schematically shows a cross section of a part of a self-adhesive, printed and coated foil; and figure 4 schematically illustrates a coating applying station.

[0014] Now, reference is made to figure 1, where the reference number 1 indicates a device for manufacturing printed self-adhesive foil. The device comprises a supply station 10 for accommodating a supply roll 11 of foil 12. The foil 12 is a web of a sheet-shaped plastic material such as for instance PVC, PP, PE, etcetera, although other materials are also possible. The foil 12 has a first main surface 13 which, in the example shown, is provided with an adhesive layer 14 of glue, gom or a similar suitable material, and has a second main surface 15.

[0015] The device 1 has a printing station 20 for applying an image and/or text on the second main surface 15 of the foil 12. The printing station 20 comprises a plurality of printing unit 21, 22, 23, 24, 25, etc., arranged behind each other, five of them in the example as shown, which are controlled by a controlling device 60, wherein each printing unit is adapted for applying ink, paint, paste or the like of one specific colour or constitution. For applying an image in "full-colour", four printing units are necessary: three printing units for applying three different colours, and a fourth printing unit for applying black. The fifth printing unit serves for being able, if desired, to apply a so-called "support colour". Eventual further colours can be printed in-line.

[0016] The printed foil will hereafter be indicated with the reference number 16. The applied ink, paint, paste or the like will hereafter be indicated with the reference number 26.

[0017] After each printing unit 21-25, a drying station can be present, in order to be able to dry the ink which has just been applied; these drying stations can be based on blowing hot or cold air. For sake of simplicity, however, the drying stations are not shown in the figure.

[0018] The device 1 is provided with transport means 100 for unwinding the foil 12 from the supply roll 11 and to transport the foil 12 past printing units 21- 25, which transport means 100 comprise a transport drum 101 in the preferred embodiment as shown, wherein said printing units 21-25 are positioned along the circumference of the transport drum 101. For guiding the foil within the device 1, the transport means 100 comprise guiding rollers 102, several of which are shown in figure 1.

[0019] At a position between the supply roll 11 and the printing station 20, the device 1 comprises a felt bed 34, and eventually a primer applying station 30 for applying a suitable primer 33 on the second main surface 15 of the foil 12. The primer applying station 30 comprises means 31 for applying the primer 33, and means 32 for drying the primer 33 after this has been applied on the second main surface 15.

[0020] Said primer 33 can be any suitable, known per

se primer.

[0021] The means 31 for applying the primer can be means known per se for applying primer, such as for instance a grid roller.

5 **[0022]** The means for drying the primer can be any suitable drying means known per se, such as for instance a flow of hot or cold air.

[0023] The felt bed 34 serves for cleaning the surface 13 of the foil 12 to be printed. The primer 33 serves for turning the surface 13 of foil 12 printable, if this appears to be necessary. As alternative, the foil 12 can be treated with a corona in a corona treatment station 35. Preferably, the device 1 comprises a corona treatment station 35 as well as a primer applying station 30, such that the user of the device 1 can choose which pretreatment he uses, depending on the material to be printed.

[0024] In order to obtain an accurate full-colour image on the foil 12, it is important that the five sub-images are applied very accurately on the foil 12 by the five printing units. For that purpose, the five printing units 21-25 should be very accurate, and in particularly they should be free of play. By axial rotation of the axles in combination with toothings under a certain angle, register shifts caused by play can be corrected.

25 **[0025]** The device 1 comprises further a coating applying station 400 for applying a finishing coating 41 on the printed second main surface 15 of the foil 16. This finishing coating 41 can for instance be a glossy varnish, a matting varnish, a metallic varnish, a release-coating, etc., which is to be applied as evenly as possible. In the following discussion, the invention will be explained further for the case of a release-coating. This release-coating is comprised of a thin, substantially transparent layer of a suitably chosen material to which the glue layer 14 of the foil will stick hardly or not at all. In most cases of application, a coating manufactured on the basis of silicones will perform well. Such a coating is known per se.

[0026] In the following, the self-adhesive, printed foil provided with a release-coating, will be indicated with the reference number 17.

[0027] The device 1 comprises further a winding station 50 for winding the printed self-adhesive foil 17 on a roller 51. In practice, the foil 17 provided with a glue layer 14 is supplied as a web with a relatively large width, i.e. the supply roll 11 has a relatively large axial length, for instance in the order of about 150 mm. It is possible that the printed foil 17 is integrally wound on said roll 51. However, it is also possible that the broad foil 17 is cut in the longitudinal direction for providing a plurality of webs next to each other, each with a reduced width, in which case the roll 51 in fact comprises a plurality of rolls. For that purpose, if desired, a cutting station 70 can be placed before the winding station 50, comprising one or more cutting knives 71 for longitudinally cutting the foil 17 passing said station 70.

55 **[0028]** Before winding the foil 17, the release-coating must dry and the foil 17 must cool down to a tempera-

ture as low as possible. There are two important reasons for this. In the first place, a hot foil will be subjected to more elongation. In the second place, hot glue tends to stick to the cutting knives 71. Therefore, the trajectory 42 to be passed by the foil 17 in the device 1 between the coating applying station 400 and the winding station 50 is relatively long, wherein the foil 17 can pass several guiding rollers 102 and a ventilator 43. It is schematically indicated in figure 1 that the drying and cooling trajectory 42 is positioned before the cutting station 70.

[0029] Since the foil 17 now comprises a release-coating 41, a winding will stick hardly or not at all to the underlying winding when unwinding the roll 51, such that the printed matter stays intact.

Now reference is made to figure 4, where some details of a coating application station 400 are illustrated. Herein, figure 4A schematically shows a side view, and figure 4B schematically shows a top view of the station 400.

[0030] With the reference number 410 in figure 4, a grid roll is indicated which is in contact with the printed second main surface 15 of the foil 16. Adjacent to the grid roll 410, an auxiliary roll 420 is arranged, preferably upstream of the grid roll 410, said auxiliary roll 420 being in contact with the glued first main surface 13 of the foil 16. The auxiliary roll 420 is positioned with respect to the grid roll 410 such that these rolls force the foil 16 to follow a Z-shaped path, wherein the foil 16 at all times is in contact with a substantial angular portion of the mantle surface of said rolls.

[0031] The device 1 comprises a motor 2 for driving the transport means 100. In conventional devices, the motor 2 directly drives the grid roll 410. In the illustrated exemplary embodiment of the device 1 according to the present invention, the motor 2 drives the auxiliary roll 420, via a slip coupling 421, and the auxiliary roll 420 is coupled with the grid roll 410 through a fixed coupling 430, as will be explained more elaborately later. This fixed coupling 430 is designed such that the circumferential speed of the mantle surface of the grid roll 410 is substantially equal to the circumferential speed of the mantle surface of the auxiliary roll 420.

[0032] The operation is as follows. Under normal circumstances the auxiliary roll 420 rotates with a speed which is determined by the motor 2, i.e. the slip coupling 421 does not slip. If, for any reason, the speed of the foil 16 deviates from the motor speed, at all times the auxiliary roll 420 will maintain a circumferential speed which is equal to the speed of the foil 16 and which, consequently, deviates from the speed as determined by the motor 2, wherein then the slip coupling 421 slips. An important role herein is played by the fact that the foil 16 is in contact with the auxiliary roll 421 through its glued main surface 13, such that substantially no slip occurs between the foil 16 and the auxiliary roll 421. Furthermore, since the circumferential speed of the mantle surface of the grid roll 410 is, as mentioned, substantially equal to the circumferential speed of the mantle surface

of the auxiliary roll 420, it is therefore assured that at all times the circumferential speed of the mantle surface of the grid roll 410 is substantially equal to the speed of the passing foil 16, and more specifically, slip between the foil 16 and the grid roll 410 is substantially eliminated.

[0033] Figure 4B illustrates some details of a possible embodiment of the couplings 421 and 430. The auxiliary roll 420 is rotatably mounted on a shaft 422 mounted fixedly in a frame of the device 1 (not shown for simplicity's sake). A first gear wheel 431 is fixedly connected to the auxiliary roll 420. The first gear wheel 431 is, possibly through a gear system which is not shown for simplicity's sake, coupled to a second gear wheel 432 which is fixedly connected to the grid roll 410, as illustrated by the broken line 430. Further, on said shaft 422 a pulley 423 is rotatably arranged, which is coupled to the motor 2 by means of a toothed belt which is not shown for simplicity's sake, as illustrated by the broken line 424. Between the pulley 423 and the combination of the auxiliary roll 420 and the first toothed wheel 431, a friction coupling or slip coupling 421 is included, for instance in the form of one or more annular coupling plates as will be clear to a person skilled in the art. In figure 4B, the slip coupling 421 is shown between the pulley 423 and the first toothed wheel 431; the slip coupling 421 can, of course, also be positioned between the pulley 423 and the auxiliary roll 420 itself.

[0034] The coating application device 400 is further provided with means for pushing the pulley 423 and the combination of the auxiliary roll 420 and the first toothed wheel 431 together with a presettable force, to thereby define the force which can maximally be transferred by the friction coupling 421 (slip threshold). In the embodiment as shown, the pulley 423 is fixed in axial direction, while the auxiliary roll 420 is slidable in axial direction on the shaft 422. Adjacent to the auxiliary roll 420, on the side facing away from the pulley 423, a compression spring 425 is arranged around the shaft 422. With its one end, the compression spring 425 presses against the auxiliary roll 420, and with its other end, it presses against a seat 426, which is fixedly mounted on the shaft 422. Advantageously, the axial position of the seat 426 is adjustable, for instance by the seat 426 being formed as a nut which can be screwed on a screwthread arranged on the shaft 422.

[0035] It will be clear for a person skilled in the art that the scope of the present invention is not limited to the examples discussed in the foregoing, but that several amendments and modifications thereto are possible without deviating from the scope of the invention as defined in the appending claims. For instance, it is possible that the toothed wheel 431 is an integrated part of the auxiliary roll 420; the same is valid for the toothed wheel 432 and the grid roll 410. Further it will be clear that the invention is applicable to various types of coating.

Claims

1. Method for providing a printed, self-adhesive foil (17), comprising the following steps:

a) providing a foil (12) with a first main surface (13) and a second main surface (15), and an adhesive material (14) applied on the first main surface;

b) applying on the second main surface (15) one or more layers of ink, paint, paste or the like (26), in the form of a desired text and/or image;

c) subsequently, applying a finishing coating (41) over said layer or layers of ink, paint, paste or the like (26), for protection of the printed matter, wherein the material of the finishing coating (41) is chosen such that the glue layer (14) will adhere thereto hardly or not at all; wherein during step (c) the finishing coating is applied such that friction forces acting in the longitudinal direction of the foil on said layer or layers of ink, paint, paste or the like (26) are substantially avoided.

2. Method according to claim 1, wherein the finishing coating is applied by means of a roll (410), of which the rotational speed is controlled such that the circumferential speed thereof is at all times substantially equal to the momentary speed of the foil (16).

3. Method according to claim 2, wherein the roll (410) is driven at least partially by the passing foil.

4. Method for applying a finishing coating (41) on a printed, self-adhesive foil (16), such that friction forces in the longitudinal direction of the foil are substantially avoided.

5. Method according to claim 4, wherein the finishing coating is applied by means of a roll (410), of which the rotational speed is controlled such that the circumferential speed thereof is at all times substantially equal to the momentary speed of the foil (16).

6. Method according to claim 5, wherein the roll (410) is driven at least partially by the passing foil.

7. Coating application station (400) for applying a finishing coating (41) on a printed second main surface (15) of a foil (16), which foil (16) further has a glued first main surface (13), comprising:

- a coating applying grid roll (410);
- drive means (2, 423, 431, 432) for driving the grid roll (410);
- detection means (420) for detecting the momentary speed of the passing foil (16);

- wherein the detection means (420) are coupled with the drive means (2, 423, 431, 432) for regulating the rotational speed of the grid roll (410) in conformity with the momentary speed of the passing foil.

8. Coating application station according to claim 7, wherein said detection means (420) comprise an auxiliary roll (420) which is coupled to the grid roll (410) through a fixed coupling (430), and which is arranged for being in contact with the glued first main surface (13) of the foil (16).

9. Coating application station according to claim 8, wherein the auxiliary roll (420) is coupled with a motor (2) through a friction coupling (421).

10. Device (1) for providing printed, self-adhesive foil (17), comprising:

a supply station (10) for accommodating a supply roll (11) of foil (12);

a printing station (20) for providing an image and/or text on a main surface (15) of the foil (12);

a coating application station (400) according to one of the claims 7-9 for applying a finishing coating (41) on the printed main surface (15) of the foil (16);

and a winding station (50) for winding the printed self-adhesive (17) onto a roll (51);

and transport means (100) for winding the foil (12) from the supply roll (11) and for transporting the foil (12) to the printing station (20), to the coating application station (400), and to the winding station (50).

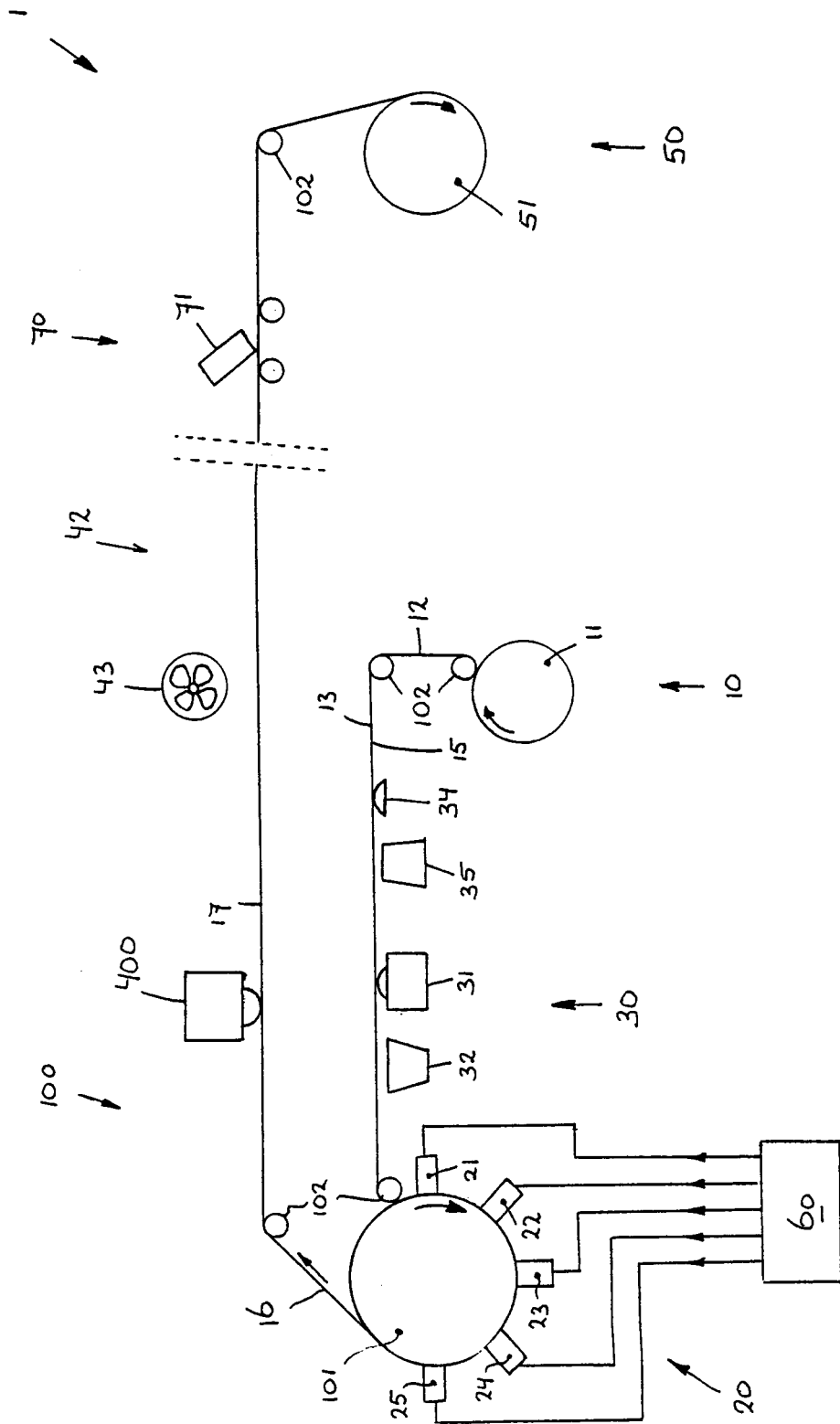


FIG. 1

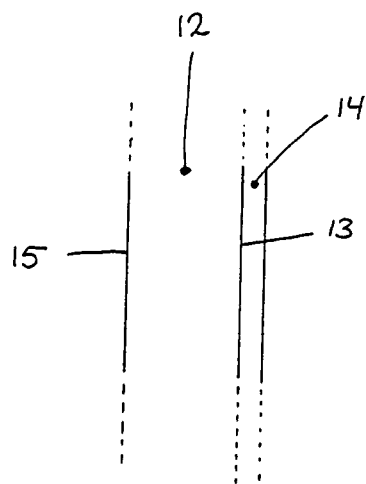


FIG. 2

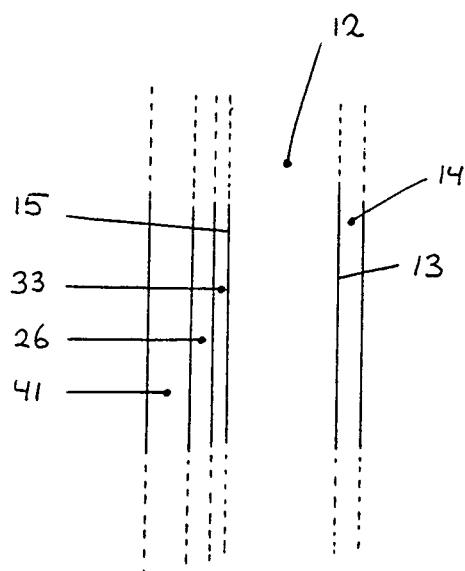


FIG. 3

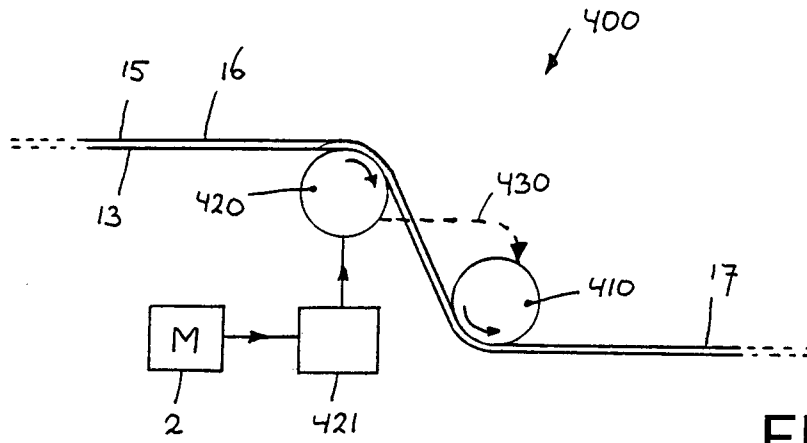


FIG. 4A

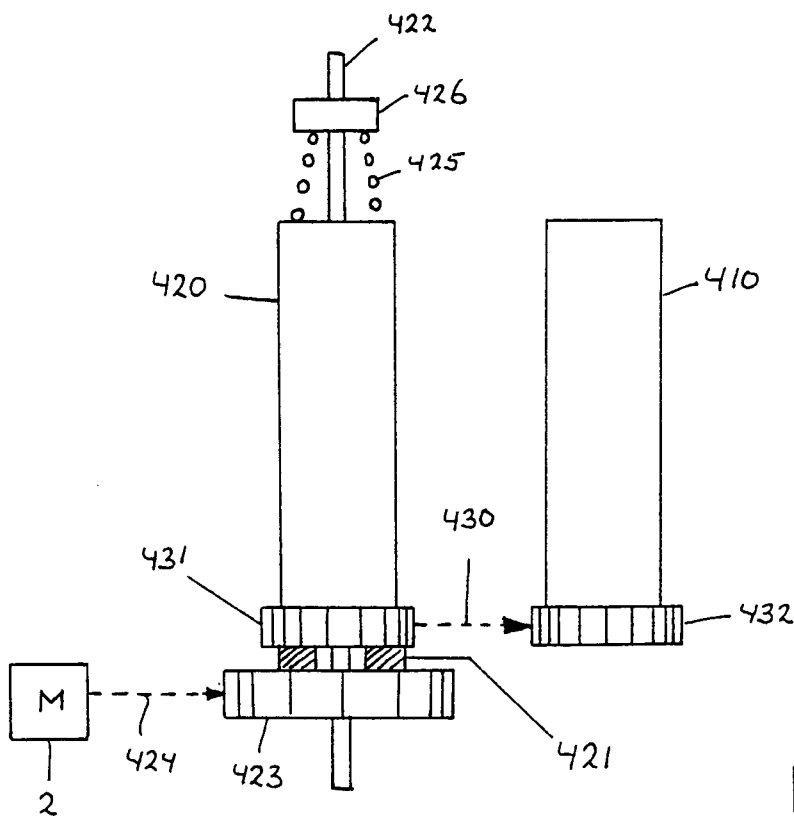


FIG. 4B



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EUROPEAN SEARCH REPORT

Application Number
EP 99 20 2146

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Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION
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A	* page 3, line 17-27; figure 2 *	2, 7, 8, 10	B41M1/30
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			TECHNICAL FIELDS SEARCHED
			G09F B31D
The present search report has been drawn up for all claims			
Place of search		Date of completion of the search	Examiner
THE HAGUE		14 September 1999	Puhl, A
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**ANNEX TO THE EUROPEAN SEARCH REPORT
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This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report. The members are as contained in the European Patent Office EDP file on
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