

(19) World Intellectual Property Organization
International Bureau



(43) International Publication Date
4 October 2007 (04.10.2007)

PCT

(10) International Publication Number
WO 2007/111189 A1

(51) International Patent Classification:

B29C 65/78 (2006.01) B29L 9/00 (2006.01)
G02B 5/20 (2006.01)

(21) International Application Number:

PCT/JP2007/055589

(22) International Filing Date: 13 March 2007 (13.03.2007)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:

2006-072947 16 March 2006 (16.03.2006) JP

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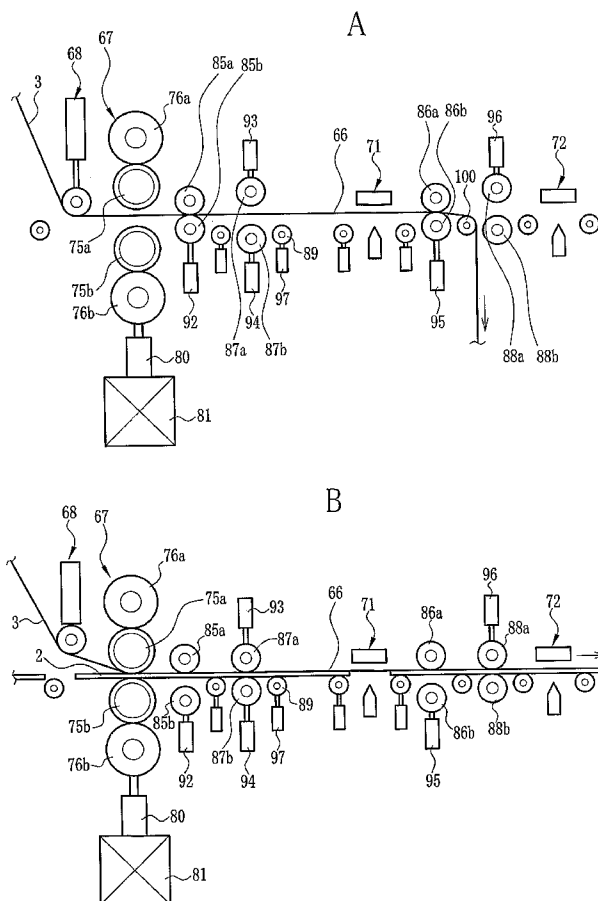
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(81) Designated States (unless otherwise indicated, for every kind of national protection available): AE, AG, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BW, BY, BZ, CA, CH, CN, CO, CR, CU, CZ, DE, DK, DM, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, GT, HN, HR, HU, ID, IL, IN, IS, KE, KG, KM, KN, KP, KR, KZ, LA, LC, LK, LR, LS, LT, LU, LY, MA, MD, MG, MK, MN, MW, MX, MY, MZ, NA, NG, NI, NO, NZ, OM, PG, PH, PL, PT, RO, RS, RU, SC, SD, SE, SG, SK, SL, SM, SV, SY, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, ZA, ZM, ZW.

(84) Designated States (unless otherwise indicated, for every kind of regional protection available): ARIPO (BW, GH, GM, KE, LS, MW, MZ, NA, SD, SL, SZ, TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM),

[Continued on next page]

(54) Title: LAMINATING METHOD AND APPARATUS



(57) Abstract: At a start-up time of a laminating apparatus, only a film (3) is fed into a joining zone. At this time, actuators (92 to 97) are controlled to move film carrying rollers (85b, 86b) to carry positions where these rollers come into contact with a photosensitive resin layer of the film. Simultaneously, substrate carrying rollers (87a, 87b, 88a) and auxiliary rollers (89) are moved to evacuation positions where these rollers are separated from the film. When a substrate (2) and the film joined thereto are carried, the film carrying rollers are moved to evacuation positions where these rollers are separated from the substrate. Simultaneously, the substrate carrying rollers (87a, 87b, 88a) and the auxiliary rollers (89) are moved to carry positions where these rollers come into contact with the substrate and a base film of the film.



European (AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HU, IE, IS, IT, LT, LU, LV, MC, MT, NL, PL, PT, RO, SE, SI, SK, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG).

For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.

Published:

— *with international search report*

DESCRIPTION

LAMINATING METHOD AND APPARATUS

5 Technical Field

The present invention relates to laminating method and apparatus for joining a film and a substrate sent to a passage in this order.

10 Background Art

Conventionally, a laminating apparatus is employed in a liquid-crystal production line, a semiconductor production line and so forth wherein a film and the like having photosensitivity is joined to a glass substrate, a semiconductor substrate and so forth. In the laminating apparatus, the film is superimposed on one surface of the respective substrates successively fed at predetermined intervals, and a pair of laminating rollers pinches the substrate and the film to joint them with pressure (see Japanese Patent Laid-Open Publication Nos. 2003-062906, 2001-328171, 2001-152098, 2004-249510 and 2003-072724, for instance).

In the laminating apparatus, the film is sent first into a passage wherein the substrate and the film are joined. When the substrate has been sent into the passage, a transport route of the film is moved to superimpose the film on the substrate. The film includes a base film, a resin layer formed on the base film to join to the substrate, and a protective layer stacked on the resin layer. The protective layer is peeled before the film is sent into the passage. The resin layer is melted by heating to tightly adhere to the substrate. However, the resin layer has adhesion also in a state that the protective layer is peeled at room temperature. Due to this, the resin layer adheres to a

carrying roller and the like coming into contact therewith.

In the conventional laminating apparatus, the film and the substrate are carried by the carrying roller commonly provided inside the passage. The film is prevented from coming into
5 contact with the carrying roller by changing the transport route until the film is joined to the substrate. In rare cases, however, the film sometimes comes into contact with the carrying roller to have the resin layer adhere thereto. If the resin layer adheres to the carrying roller, the resin layer is transferred from the
10 carrying roller to the substrate to soil this substrate. In addition, it is necessary to halt the laminating apparatus for the purpose of cleaning the resin layer adhering to the carrying roller. Due to this, production efficiency deteriorates.

A primary object of the present invention is to provide
15 laminating method and apparatus in which it is prevented that a substrate is soiled due to a resin layer.

Disclosure of Invention

In order to achieve the above objects and other objects,
20 the laminating method according to the present invention comprises the step of carrying a film in a passage with a first carrying roller, which is disposed in the passage, during a preparation operation for letting the film pass the passage. The laminating method further comprises the step of carrying a
25 substrate which is fed into the passage and to which the film is joined, with a second carrying roller disposed in the passage. The second carrying roller carries the substrate during lamination of the film and the substrate. The second carrying roller is kept in an evacuation state, in that the second carrying
30 roller is separated from the film, during the preparation operation. The first carrying roller is kept in an evacuation state, in that the first carrying roller is separated from the

substrate, during the lamination.

The other laminating method according to the present invention comprises the steps of feeding the film into the passage, evacuating the second carrying roller from the passage so as to
5 separate from the film while the film is carried in the passage by the first carrying roller, and feeding the substrate into the passage one by one after the film has passed the passage. This laminating method further comprises the steps of pressing and joining the successively-fed film to the substrate by a laminating
10 roller disposed in the passage, and evacuating the first carrying roller from the passage so as to separate from the substrate while the substrate and the film joined thereto are carried by the second carrying roller.

The film comprises a base film and a photosensitive resin
15 layer applied to the base film. The photosensitive resin layer is joined to the substrate.

The laminating apparatus according to the present invention comprises the laminating roller, the first carrying roller, the second carrying roller, a first roller-moving unit, a second
20 roller-moving unit, and a controller. The first roller-moving unit moves the first carrying roller between a first carry position, where the film is carried, and a first evacuation position separating from the passage. The second roller-moving unit moves the second carrying roller between a second carry
25 position, where the substrate and the film are carried, and a second evacuation position separating from the passage. The controller controls the first and second roller-moving units so as to move the second carrying roller to the second evacuation position while the first carrying roller carries the film, and
30 so as to move the first carrying roller to the first evacuation position while the second carrying roller carries the substrate and the film.

The first and second carrying rollers are respectively composed of a roller pair for pinching and carrying the film and the substrate. The first and second roller-moving units respectively move at least one roller of the roller pair located at a joining-surface side of the film.

It is preferable to provide a third carrying roller and a third roller-moving unit. The third carrying roller supports the substrate and rotates while the substrate and the film joined thereto are carried. The third roller-moving unit moves the third carrying roller between a support position for supporting the substrate, and a third evacuation position separating from the passage. The controller moves the third carrying roller to the third evacuation position while the first carrying roller carries the film. Further, the controller moves the third carrying roller to the support position while the second carrying roller carries the substrate and the film.

According to the laminating method and apparatus of the present invention, the first carrying roller used for carrying only the film is prevented from coming into contact with the substrate. In addition, the second carrying roller used for carrying the substrate is prevented from coming into contact with the joining surface of the film. Thus, it is prevented that the substrate is soiled due to the carrying roller.

As to the movement of the carrying roller, it is sufficient to move only the joining-surface-side roller of the roller pair composing the carrying roller. Thus, the roller-moving unit is simplified and its cost is lowered.

When a large-sized substrate is carried, the third carrying roller may be used. Since the third carrying roller is also evacuated, it is prevented that the substrate is soiled due to the third carrying roller.

Brief Description of Drawings

Figure 1 is a perspective view showing a film and a substrate joined by the laminating apparatus according to the present invention;

5 Figure 2 is a section view showing a layer structure of the film;

Figures 3A to 3F are illustrations showing a joining procedure of the laminating apparatus;

10 Figure 4 is a schematic illustration showing a structure of the laminating apparatus;

Figures 5A and 5B are schematic illustrations showing a structure of a joining area; and

Figure 6 is a flowchart showing the joining procedure of the laminating apparatus.

15

Best Mode for Carrying Out the Invention

Fig. 1 is a perspective view showing a substrate 2 to which a film is joined by the laminating method and apparatus according to the present invention. The substrate 2 is a thin plate made of transparent glass and plastic, for instance. The substrate 20 2 is used for a base of a color filter employed in a liquid-crystal display, a plasma display and so forth. Reference numeral 9 denotes a photosensitive resin layer composing the color filter. The photosensitive resin layer 9 is a part of a film 3 (see Fig. 25 2) to be joined to the substrate 2. After joining the photosensitive resin layer 9 to the substrate 2, a predetermined pattern is left on the substrate 2 by exposure, development and cleaning to compose the color filter.

Incidentally, if the photosensitive resin layer 9 adheres 30 to a lateral side of the substrate 2, a no-good product is caused. In view of this, a joining area of the photosensitive resin layer 9 is adapted to be smaller than the substrate 2. Consequently,

a joining surface of the substrate 2 is exposed around the photosensitive resin layer 9 so as to have a frame-like shape. Hereinafter, this frame-shaped portion is referred to as an outer frame 2a.

5 Figs. 3A to 3F are illustrations showing a procedure for joining the film 3 to the substrate 2. Fig. 3A shows an external shape of the film 3, which is a strip of film and is wound as a film roll 6 to be set to the laminating apparatus. As shown in the section view of Fig. 2, the film 3 is a layered product
10 including the photosensitive resin layer and having a multilayer structure in which plural layers are stacked. The film 3 is composed of a base film 8, the photosensitive resin layer 9 and a protective film 10 stacked in this order from the bottom. Since the respective layers have flexibility, these layers are not
15 damaged even though the layers are wound in the roll form.

The film 3 set to the laminating apparatus is drawn out of the film roll 6 such as shown in Fig. 3B. And then, the protective film 10 is cut at two intervals of lengths L1 and L2. This process is called as half-cut process and is successively performed for
20 the film 3 under the condition that the two intervals L1 and L2 are alternately used. The interval L1 is a joining length of the photosensitive resin layer 9 to be joined to the substrate 2. The interval L2 defines a half-cut interval between areas of the joining length L1. Although the protective film 10 becomes a
25 sheet-like shape by the half-cut process, the protective film 10 stays on the photosensitive resin layer 9 without peeling therefrom. Hereinafter, the portion for which the half-cut process has been performed is referred to as half-cut portion 3a, and the region for which the half-cut process has been performed
30 at the interval L2 is referred to as residual region 3b.

As shown in Fig. 3C, attachment labels 13 are attached onto the sheet-shaped protective films 10a and 10b, for which the

half-cut process has been performed, so as to straddle the residual region 3b. The attachment labels 13 are attached to a posterior end of the preceding sheet-shaped protective film 10a and an anterior end of the succeeding sheet-shaped protective film 10b. When the protective film 10 is peeled from the film 3, the protective film 10 cut in the sheet shape is continuously peeled by the attachment labels 13 in a web-like form such as shown in Fig. 3D. In this regard, the attachment labels 13 are not attached to the residual region 3b for the purpose of staying the residual region 3b of the protective film 10 on the film 3 at the time when the protective film 10 is peeled.

As shown in Fig. 3E, the film 3 from which the protective film 10 is peeled is reversed and the photosensitive resin layer 9 is joined to an upper surface of the substrate 2. At the joining time, the substrate 2 and the film 3 are pressed by a pair of laminating rollers 16a and 16b. The laminating roller 16a is rotated by a motor 17. In virtue of this, the substrate 2 and the film 3 are joined and simultaneously carried.

Meanwhile, the substrates 2 are successively fed in order to join with the photosensitive resin layer 9. In consideration of variation of joining accuracy, the half-cut interval L2 is set to a length calculated by adding a feeding interval of the substrates 2 to the outer frames 2a of two substrates 2 of the preceding and following sides in the feeding direction. For example, when the feeding interval of the substrates 2 is 5 ± 4 mm and a length L3 of the outer frame 2a is 1 to 9 mm in the feeding direction, the half-cut interval L2 is 3 to 27 mm.

As shown in Fig. 3F, the base film 8 is peeled after joining the photosensitive resin layer 9 to the substrate 2. In this way, only the photosensitive resin layer 9 remains on the substrate 2 and the state shown in Fig. 1 is obtained. Incidentally, the base film 8 may be peeled in a web state (hereinafter referred

to as continuous type), and may be peeled after being cut into a sheet shape corresponding to each substrate (hereinafter referred to as sheet type).

Fig. 4 is a schematic illustration showing a structure of the laminating apparatus according to the present invention. The laminating apparatus 20 joins the substrate 2 and the film 3 while continuously carrying them. The laminating apparatus 20 comprises a film supplying zone 21 for supplying the film 3, a joining zone 22 for joining the substrate 2 and the film 3, a substrate heating zone 23 for heating and feeding the substrate 2, a substrate cooling zone 24 for cooling the substrate 2 after completion of joining, and a base peeling zone 25 for peeling the base film 8 from the film 3.

In the laminating apparatus 20, a first clean room 29a and a second clean room 29b are partitioned by a partition wall 28. The first clean room 29a contains the film supplying zone 21. The second clean room 29b contains the joining zone 22, the substrate heating zone 23, the substrate cooling zone 24 and the base peeling zone 25. The first and second clean rooms 29a and 29b are connected via a through hole 28a.

In the substrate heating zone 23, the substrate 2 contained in a substrate stocker 33 is taken out by a robot 34 and is supplied to a substrate conveying mechanism 35. The substrate 2 heated in the substrate conveying mechanism 35 is fed to the joining zone 22. In the cooling zone 24, the substrate 2 to which the film 3 is joined in the joining zone 22 is cooled by a cooling mechanism 37. In the base peeling zone 25, the base film 8 is peeled from the film 3 by a base peeling mechanism 39 to obtain the substrate 2 to which only the photosensitive resin layer 9 adheres. Further, a joining position of the photosensitive resin layer 9 is measured by a measuring unit 40, and then the substrate 2 is loaded into a processed-substrate stocker 42 by a robot 41.

The film supplying zone 21 comprises a film advancing mechanism 57, a processing mechanism 59, a label attaching mechanism 60 and a peeling mechanism 61. The film advancing mechanism 57 contains the film roll 6, in which the film 3 is wound
5 in the roll form, and advances the film 3 from the film roll 6. The processing mechanism 59 performs the half-cut process for the protective film 10 of the advanced film 3. The label attaching mechanism 60 sticks the attachment label 13 on the protective film 10. The peeling mechanism 61 peels the protective film 10 from
10 the film 3 at predetermined intervals.

The joining zone 22 includes a tension control mechanism 65 for controlling tension of the film 3, a passage 66 onto which the substrate 2 and the film 3 are sent, and a joining mechanism 67 disposed at the passage 66. The photosensitive resin layer
15 9 exposed by peeling the protective file 10 is joined to the substrate 2 by the joining mechanism 67. A contact prevention roller 68, a preheater 69 and a detection camera 70 are disposed at an upstream side of a joining position of the joining mechanism 67. When the film is stopped and when preparation is conducted,
20 the contact prevention roller 68 changes a transport route of the film 3 to be sent into the joining mechanism 67 for the purpose of separating the film 3 from the laminating roller and preventing thermal influence. The preheater 69 preheats the film 3 up to a predetermined temperature. The detection camera 70 detects the
25 half-cut portion of the film 3. At a downstream side of the joining mechanism 67, an end-portion cutting mechanism 71 and a middle-portion cutting mechanism 72 are disposed. The end-portion cutting mechanism 71 cuts an anterior end of the film 3 at a time of commencement of operation. The middle-portion
30 cutting mechanism 72 cuts the film 3 between the substrates 2 when a trouble has occurred in the apparatus.

Fig. 5A is a schematic illustration showing a structure of

the passage 66 wherein the joining mechanism 67 and so forth are disposed. The joining mechanism 67 comprises laminating rollers 75a and 75b vertically arranged and heated up to a predetermined temperature. The respective laminating rollers 75a and 75b are
5 composed of a columnar core, which is made of a metal and so forth, and a resilient material of silicon rubber and so forth coating the periphery of the core. Backup rollers 76a and 76b respectively come into contact with the peripheries of the laminating rollers 75a and 75b. The laminating roller 75a is
10 rotated by a motor to join the photosensitive resin layer 9 to the substrate 2 while interposing and carrying the film 3 and the substrate 2 with the laminating roller 75b.

The laminating roller 75b and the backup roller 76b are vertically movable. The backup roller 76b is vertically moved
15 by an actuator 80 comprising a cylinder device, a solenoid and so forth. The laminating roller 75b is moved in association with the vertical movement of the backup roller 76b and is pressed against the laminating roller 75a. Incidentally, the backup roller 76b is vertically moved by a roller clamper 81 as well via
20 the actuator 80. The roller clamper 81 performs vertical movement of the backup roller 76b by a motor and a cam mechanism, for example, to press the laminating roller 75b against the substrate 2 via the backup roller 76b.

At the downstream side of the joining mechanism 67, upstream
25 film carrying rollers 85a, 85b and downstream film carrying rollers 86a, 86b are disposed as a first carrying roller group for carrying only the film 3 at the start-up time of the laminating apparatus 20. Moreover, upstream substrate carrying rollers 87a, 87b and downstream substrate carrying rollers 88a, 88b are
30 disposed as a second carrying roller group for simultaneously carrying the substrate 2 and the film 3 at the joining time thereof. Further, between these rollers, auxiliary rollers 89 for

assisting the transport of the substrate 2 are disposed as a third carrying roller group rotating in association with the substrate 2 placed thereon. The upstream film carrying roller 85a, the downstream film carrying roller 86a, the upstream substrate carrying roller 87a and the downstream substrate carrying roller 88a are rotated by motors not shown, and the other rollers are rotated in association with the transport of the substrate 2 and the film 3.

The rollers 85b, 87a, 87b, 86b, 88a and 89 are vertically moved by roller moving units, or by actuators 92 to 97 respectively. When only the film 3 is carried, the upstream film carrying roller 85b and the downstream film carrying roller 86b are moved to carry positions where these rollers come into contact with the photosensitive resin layer 9 of the film 3. Further, the upstream substrate carrying rollers 87a and 87b, the downstream substrate carrying roller 88a and the auxiliary rollers 89 are moved to evacuation positions where these rollers are separated from the film 3. Meanwhile, as shown in Fig. 5B, when the substrate 2 and the film 3 are joined, the upstream substrate carrying rollers 87a and 87b, the downstream substrate carrying roller 88a and the auxiliary rollers 89 are moved to carry positions where these rollers come into contact with the substrate 2 and the base film 8 of the film 3. At this time, the upstream film carrying roller 85b and the downstream film carrying roller 86b are moved to evacuation positions where these rollers are separated from the substrate 2.

In this way, it is prevented that the photosensitive resin layer 9 adheres to the upstream substrate carrying rollers 87a and 87b, the downstream substrate carrying roller 88a and the auxiliary rollers 89. Thus, it is prevented that the substrate 2 is soiled by the substrate carrying rollers and the auxiliary rollers. Incidentally, when only the film 3 is carried, the

transport route of the film 3 is changed by the contact prevention roller 68 so as to prevent the film 3 from coming into contact with the laminating roller 75a for the purpose of protecting the film 3 from thermal influence of the laminating roller 75a.

5 The laminating apparatus 20 is totally controlled via a laminate process controller 50. For example, a substrate heating controller 51, a laminate controller 52 and a base peeling controller 53 are provided for the respective function parts of the laminate apparatus 20 and are connected via a process network.

10 The laminate process controller 50 is connected to a factory network to perform production information processing of operation management and production management regarding instruction information (condition setting and production information) sent from a factory CPU not shown.

15 The substrate heating controller 51 controls the substrate heating zone 23, and the base peeling controller 53 controls the base peeling zone 25. The laminate controller 52 controls the film supplying zone 21, the joining zone 22 and the substrate cooling zone 24. At the same time, the laminate controller 52
20 controls the respective function parts as a master of the entire process. Further, the laminate controller 52 controls the actuators 92 to 97 to also work as a member for vertically moving the respective rollers.

By the way, only the upstream film carrying roller 85b and
25 the downstream film carrying roller 86b disposed under the film 3 are vertically movable. This is because the upstream film carrying roller 85a and the downstream film carrying roller 86a disposed above the film 3 are adapted not to come into contact with the photosensitive resin layer 9. The downstream substrate
30 carrying roller 88b is not vertically movable as well, since this roller 88b is prevented from being soiled. This is because the film 3 sent into the joining zone 22 is advanced downward via an

auxiliary roller 100, which is disposed at an upstream side of the downstream substrate carrying roller 88b, when the film 3 is carried at the start-up time of the laminating apparatus 20.

Next, an operation of the above embodiment is described below with reference to a flowchart shown in Fig. 6. Upon starting the laminating apparatus 20, the laminate controller 52 controls the film supplying zone 21 to forward the film 3, from which the protective film 10 is peeled, to the joining zone 22. Further, in the joining zone 22, the laminate controller 52 controls the actuators 92 through 97 to move the upstream film carrying roller 85b and the downstream film carrying roller 86b to the carry positions where these rollers come into contact with the photosensitive resin layer of the film 3, such as shown in Fig. 5A. At this time, the laminate controller 52 moves the upstream substrate carrying rollers 87a and 87b, the downstream substrate carrying roller 88a and the auxiliary rollers 89 to the evacuation positions where these rollers are separated from the film 3. In virtue of this, the photosensitive resin layer 9 is prevented from coming into contact with the upstream substrate carrying rollers 87a and 87b, the downstream substrate carrying rollers 88a and 88b, and the auxiliary rollers 89.

After completing the preparation of the film 3, the substrate 2 is fed from the substrate heating zone 23 into the joining zone 22. The joining mechanism 67 pinches and presses the substrate 2 and the film 3 to join them. The laminate controller 52 controls the actuators 92 through 97 to move the upstream film carrying roller 85b and the downstream film carrying roller 86b to the evacuation positions where these rollers are separated from the substrate 2, such as shown in Fig. 5B. At this time, the laminate controller 52 moves the upstream substrate carrying rollers 87a and 87b, the downstream substrate carrying roller 88a and the auxiliary rollers 89 to the carry positions

where these rollers come into contact with the substrate 2 and the base film 8 of the film 3. In virtue of this, it is possible to carry the substrate 2 and the film 3 under conditions that the photosensitive resin layer 9 stuck to the upstream film carrying roller 85b and the downstream film carrying roller 86b is prevented from adhering to the substrate 2.

The above embodiment relates to the successive manner in which the base film 8 is peeled without cutting the film 3. The present invention, however, may be adopted to a sheet manner in which the base film 8 is peeled after cutting the film 3 every substrate 2. Further, in the above-described laminating apparatus, one strip of the film 3 is joined to the substrates 2. The present invention, however, may be adopted to another laminating apparatus in which plural film strips are joined to the substrates in parallel. Furthermore, in the foregoing laminating apparatus, the photosensitive resin layer is formed on the glass substrate of the color filter. The present invention, however, may be adopted to laminating apparatuses used for other products.

The object of the present invention is to prevent the adhesive photosensitive resin layer from adhering to the substrate. The present invention, however, may be adopted to a substrate and a film having a nonadhesive joining surface. In this case, the carrying roller is prevented from coming into contact with the joining surface of the film more than necessary so that the joining surface is kept in a clean state.

Industrial Applicability

The present invention is preferably applied to laminating method and apparatus for joining a film and a substrate sent to a passage in this order.

CLAIMS

1. A laminating method wherein a substrate and a film are carried on a passage to join said film to said substrate by pressure
5 of a laminating roller, comprising:

carrying said film with a first carrying roller, which is disposed in said passage, during a preparation operation for letting said film pass said passage, a second carrying roller disposed in said passage being kept in an evacuation state, in
10 that said second carrying roller is separated from said film, during said preparation operation; and

carrying the substrate to which said film is joined, with said second carrying roller during lamination in which said film is joined to said substrate fed into said passage, said first
15 carrying roller being kept in an evacuation state, in that said first carrying roller is separated from said substrate, during said lamination.

2. The laminating method according to claim 1, wherein said film includes a base film and a photosensitive resin layer formed
20 on said base film,

said laminating method further comprising the step of peeling said base film from said substrate after transferring said photosensitive resin layer to said substrate.

3. A laminating method for joining a film to a substrate,
25 comprising the steps of:

feeding said film into a passage;

carrying said film in said passage by a first carrying roller, at this time, a second carrying roller being evacuated from said passage so as to separate from said film;

30 feeding said substrate into said passage one by one after said film has passed said passage;

pressing and joining the successively-fed film to said

substrate by a laminating roller disposed in said passage; and
carrying said substrate and said film joined thereto by said
second carrying roller, at this time, said first carrying roller
being evacuated from said passage so as to separate from said
5 substrate.

4. The laminating method according to claim 3, wherein said
film includes a base film and a photosensitive resin layer applied
to said base film, and said photosensitive resin layer is joined
to said substrate.

10 5. The laminating method according to claim 4, further
comprising the step of:

peeling said base film after joining said photosensitive
resin layer to said substrate, said photosensitive resin layer
being transferred to said substrate.

15 6. A laminating apparatus for joining a substrate and a film,
comprising:

a laminating roller for carrying and pressing said
substrate and said film in said passage to join said film to said
substrate;

20 a first carrying roller disposed in said passage at a
downstream side of said laminating roller to carry said film in
advance;

a second carrying roller for carrying the substrate to which
said film is joined, in said passage;

25 a first roller-moving unit for moving said first carrying
roller between a first carry position, where said film is carried,
and a first evacuation position separating from said passage;

a second roller-moving unit for moving said second carrying
roller between a second carry position, where said substrate and
30 said film are carried, and a second evacuation position separating
from said passage; and

a controller for controlling said first and second

roller-moving units, said controller moving said second carrying roller to said second evacuation position while said first carrying roller carries said film, and said controller moving said first carrying roller to said first evacuation position while said
5 second carrying roller carries said substrate and said film.

7. The laminating apparatus according to claim 6, wherein said first carrying roller is a roller pair for pinching and carrying said film, and said second carrying roller is a roller pair for pinching and carrying said film and said substrate, each
10 of said first and second roller-moving units moving at least one roller of the respective roller pairs located at a joining-surface side of the film.

8. The laminating apparatus according to claim 7, further comprising:

15 a third carrying roller for supporting said substrate and rotating while said substrate and said film joined thereto are carried; and

a third roller-moving unit for moving said third carrying roller between a support position, where said substrate is
20 supported, and a third evacuation position separating from said passage,

wherein said controller moves said third carrying roller to said third evacuation position while said first carrying roller carries said film, and said controller moves said third carrying
25 roller to said support position while said second carrying roller carries said substrate and said film.

9. The laminating apparatus according to claim 6, wherein said film includes a base film and a photosensitive resin layer applied to said base film, and said photosensitive resin layer
30 is joined to said substrate.

10. The laminating apparatus according to claim 9, further comprising:

a base peeling mechanism for peeling said base film after joining said photosensitive resin layer to said substrate, in a state that said photosensitive resin layer is transferred to said substrate.

- 5 11. The laminating apparatus according to claim 6, wherein said laminating roller is a roller pair for pinching and carrying said film and said substrate.

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FIG. 1

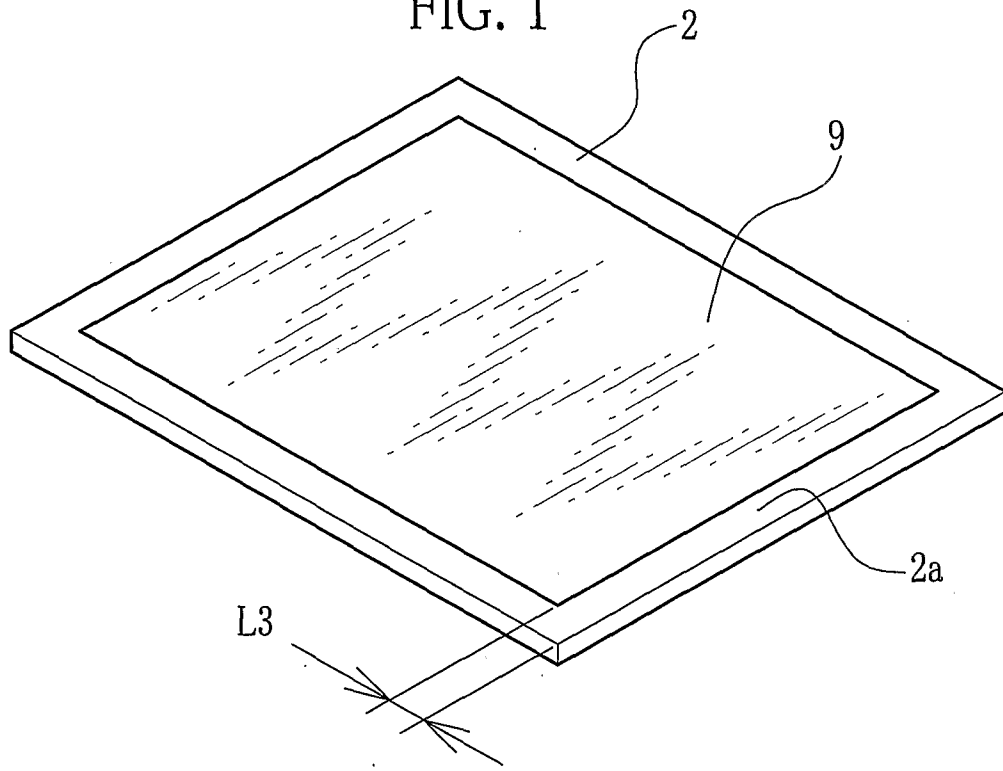
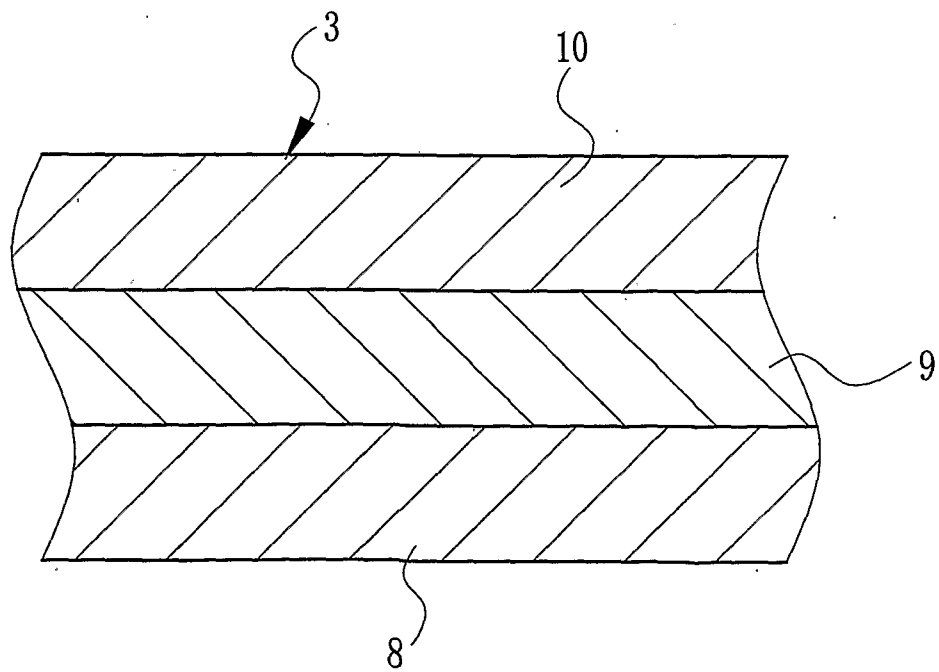


FIG. 2



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FIG. 3A

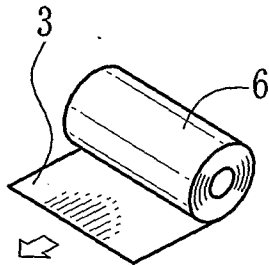


FIG. 3B

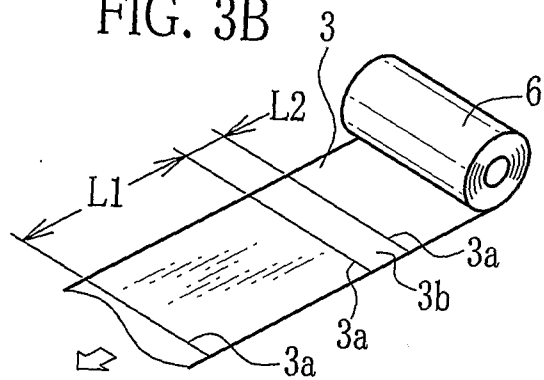


FIG. 3C

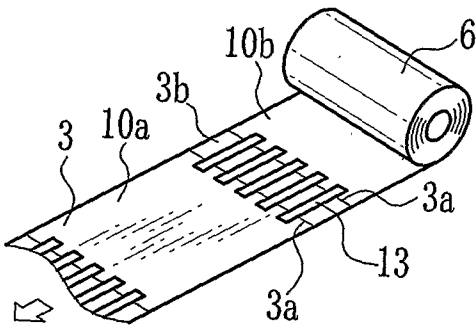


FIG. 3D

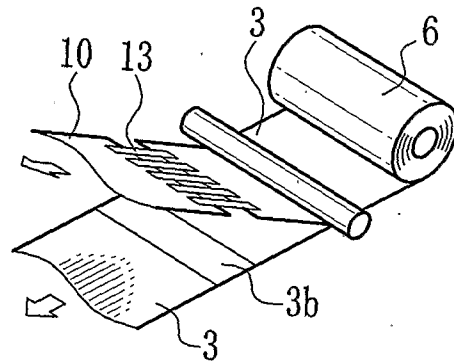


FIG. 3E

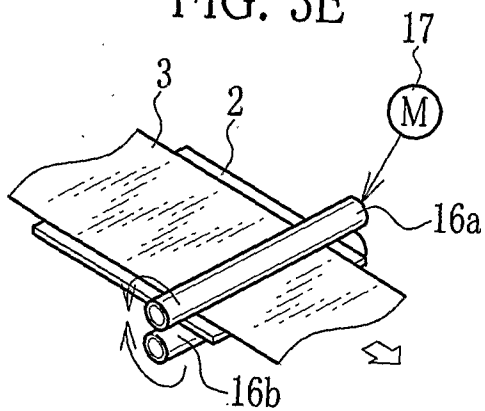
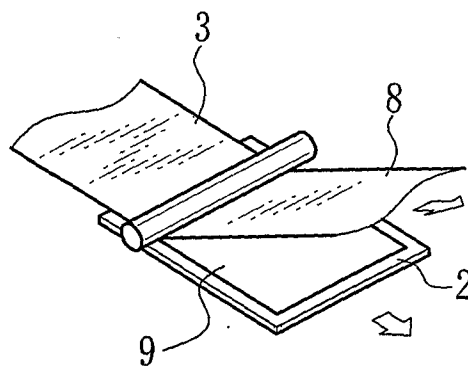


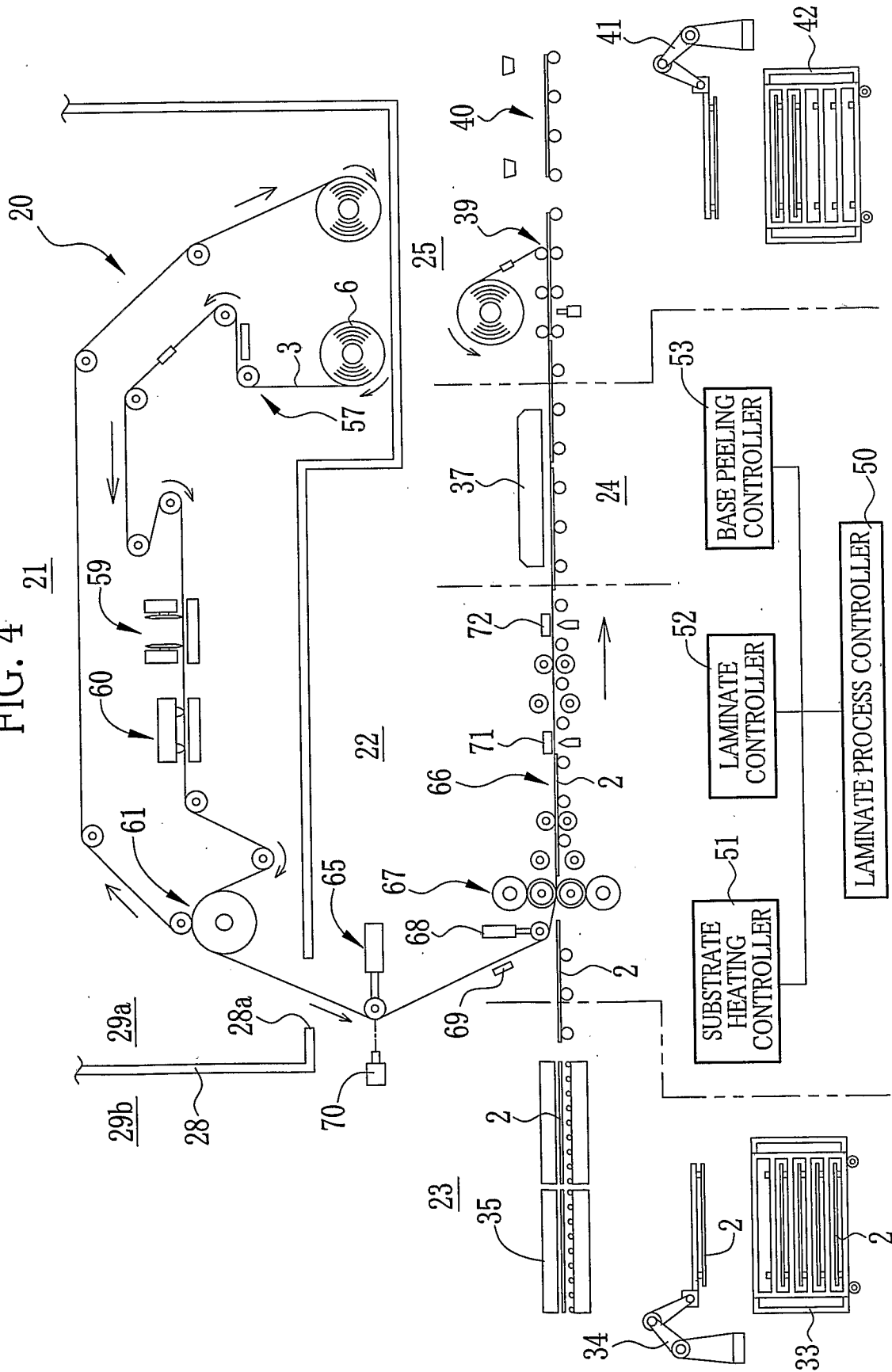
FIG. 3F



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FIG. 4

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FIG. 5A

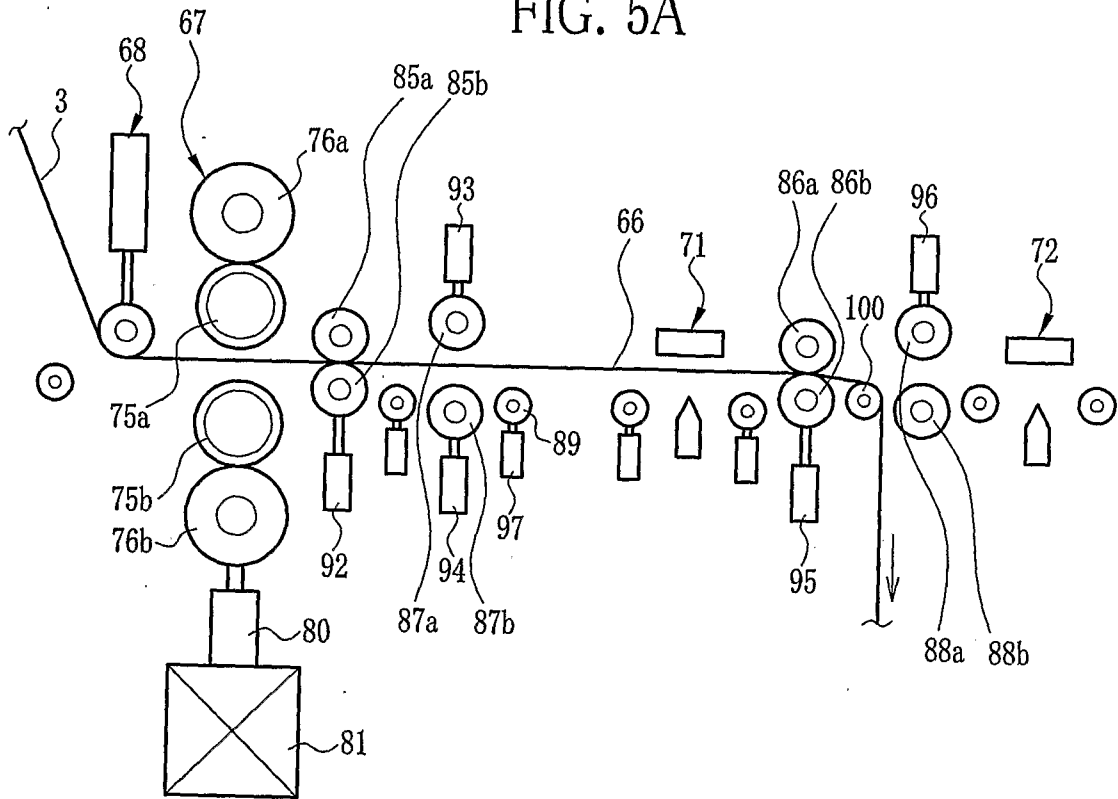
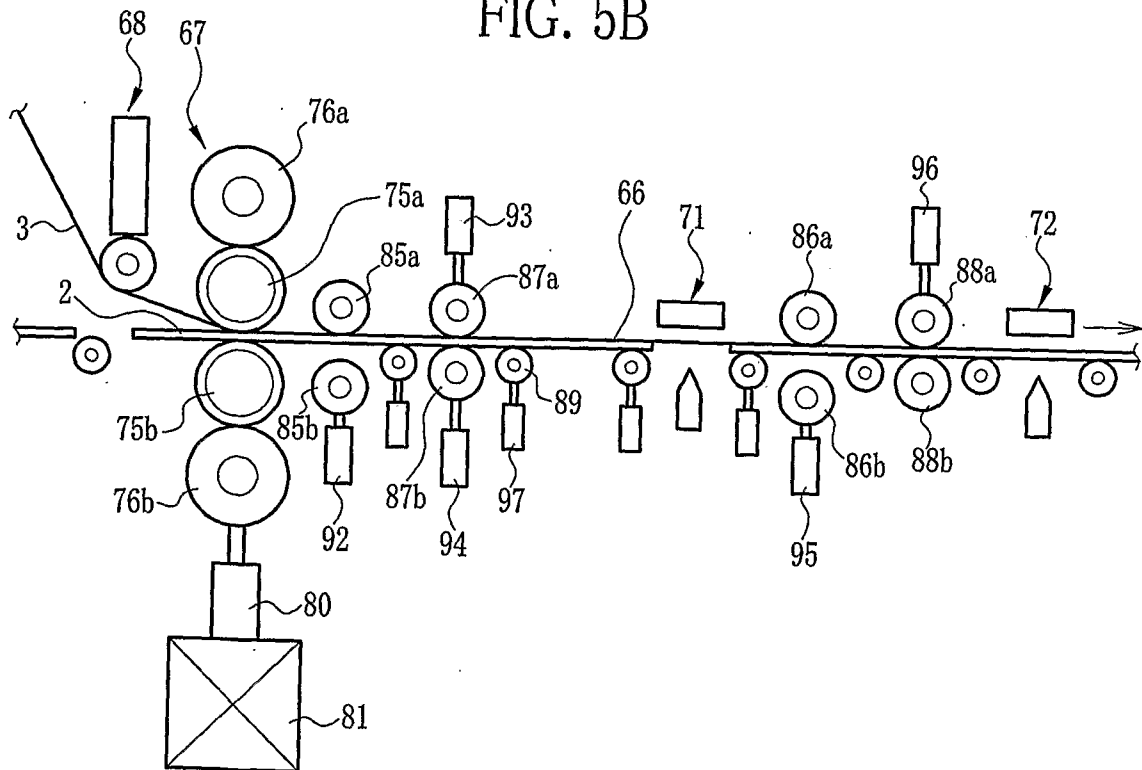
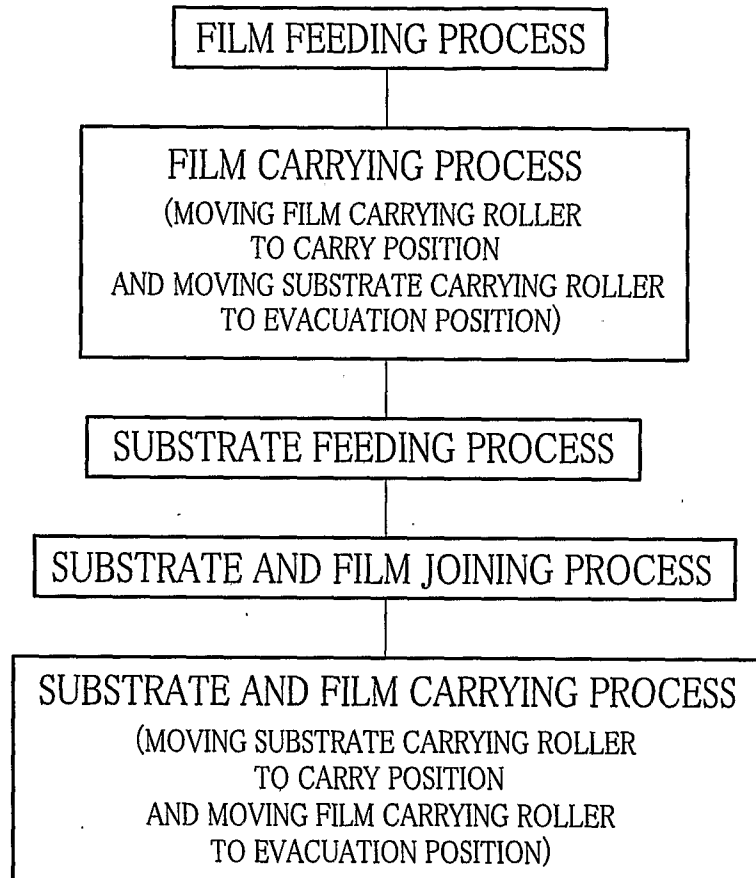


FIG. 5B



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FIG. 6



INTERNATIONAL SEARCH REPORT

International application No.

PCT/JP2007/055589

A. CLASSIFICATION OF SUBJECT MATTER

Int.Cl. B29C65/78 (2006.01) i, G02B5/20 (2006.01) i, B29L9/00 (2006.01) n

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

Int.Cl. B29C65/78, G02B5/20

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Published examined utility model applications of Japan 1922-1996
 Published unexamined utility model applications of Japan 1971-2007
 Registered utility model specifications of Japan 1996-2007
 Published registered utility model applications of Japan 1994-2007

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	JP 2003-62906 A (HITACHI INDUSTRIES CO., LTD.) 2003.03.05 , Claims, [0008] [0014] - [0017] [0022] [0030] [0031] Fig. 6, 7, 8 & KR 2003-0019101 A	1-11
E. X	JP 2007-130810 A (FUJIFILM CORPORATION) 2007.05.31 , Claims, [0030] [0031] Fig. 5 (family ; none)	1-11
A	JP 2004-249510 A (HITACHI INDUSTRIES CO., LTD.) 2004.09.09 , Claims, [0018] Fig. 1 (family ; none)	1-11

☐ Further documents are listed in the continuation of Box C.☐ See patent family annex.

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"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

"&" document member of the same patent family

Date of the actual completion of the international search

13.06.2007

Date of mailing of the international search report

26.06.2007

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