(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) EP 2 264 516 B1

(12) EUROPEAN PATENT SPECIFICATION

(45) Date of publication and mention of the grant of the patent:
25.04.2012 Bulletin 2012/17

(21) Application number: **09731702.8**

(22) Date of filing: **30.03.2009**

(51) Int Cl.:
G02F 1/1335 (2006.01) ***G02F 1/13*** (2006.01)

(86) International application number:
PCT/JP2009/001440

(87) International publication number:
WO 2009/128207 (22.10.2009 Gazette 2009/43)

(54) METHOD AND APPARATUS FOR CONTINUOUSLY MANUFACTURING LIQUID CRYSTAL DISPLAY ELEMENT

VERFAHREN UND VORRICHTUNG ZUR KONTINUIERLICHEN HERSTELLUNG EINES FLÜSSIGKRISTALLELEMENTS

PROCÉDÉ ET APPAREILLAGE POUR LA FABRICATION CONTINUE D'UN ÉLÉMENT D'AFFICHAGE À CRISTAUX LIQUIDES

(84) Designated Contracting States:
AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HR HU IE IS IT LI LT LU LV MC MK MT NL NO PL PT RO SE SI SK TR

(30) Priority: **15.04.2008 PCT/JP2008/000987**

(43) Date of publication of application:
22.12.2010 Bulletin 2010/51

(73) Proprietor: **Nitto Denko Corporation**
Ibaraki-shi
Osaka 567-8680 (JP)

(72) Inventors:
- **KIMURA, Kouji**
  Ibaraki-shi,
  Osaka 567-8680 (JP)
- **YAMANO, Takayoshi**
  Ibaraki-shi,
  Osaka 567-8680 (JP)
- **NAKAZONO, Takuya**
  Ibaraki-shi,
  Osaka 567-8680 (JP)
- **KITADA, Kazuo**
  Ibaraki-shi,
  Osaka 567-8680 (JP)
- **YURA, Tomokazu**
  Ibaraki-shi,
  Osaka 567-8680 (JP)
- **SHIMANOE, Fumihito**
  Ibaraki-shi,
  Osaka 567-8680 (JP)
- **KOSHIO, Satoru**
  Ibaraki-shi,
  Osaka 567-8680 (JP)

(74) Representative: **Skone James, Robert Edmund**
Gill Jennings & Every LLP
The Broadgate Tower
20 Primrose Street
London EC2A 2ES (GB)

(56) References cited:
EP-A1- 2 237 249
WO-A1-2008/047712
JP-A- 57 052 017
JP-A- 2003 202 298
JP-A- 2004 361 741
JP-A- 2004 361 741
JP-A- 2005 114 624
JP-A- 2007 064 989
US-A1- 2005 016 670

EP 2 264 516 B1

Description

[0001] The present invention relates to a continuous method and system for manufacturing liquid-crystal display elements by sequentially laminating polarizing film sheets respectively on liquid-crystal panels each having a predefined size to produce liquid-crystal elements, said polarizing film sheet being formed from a continuous web of optical film laminate by cutting it into a size corresponding to the size of the liquid-crystal panel at predefined slitting positions, said optical film laminate comprising at least a polarizing film having an adhesive layer and a carrier film releasably laminated to the adhesive layer, said optical film laminate having a width corresponding to the width of said liquid-crystal panel, said slitting positions in said continuous web of optical film including defective-polarizing-sheet slitting positions for defining at least one defective polarizing sheet including at least one defect and normal -polarizing-sheet slitting positions for defining at least one defect-free normal polarizing sheet, the slitting positions being determined in accordance with position of a defect in said polarizing film detected through a preliminary inspection, slit-positon information relating to the defective-polarizing-sheet slitting positions and the normal-polarizing-sheet slitting positions being recorded on the continuous web in the form of encoded information.

[0002] Taking a widescreen television having a diagonal screen size of 42 inches as an example, a liquid-crystal panel W therefor comprises a layered liquid-crystal panel which includes a pair of rectangular-shaped glass substrates each having a size of about 540 to 560 mm in length × about 950 to 970 mm in width × about 0.7 mm (700 μm) in thickness, and a liquid-crystal layer having a thickness of about 5 μm having a transparent electrode, a color filter etc. and sandwiched between the glass substrates, as shown in FIG. 2. Therefore, the thickness of the liquid-crystal panel W itself is about 1.4 mm (1400 μm). The liquid-crystal display element typically has a polarizing sheet 11' commonly referred as "polarizing plate" adhesively applied to each of a front side (viewing side) and a back side (backlight side) of the liquid-crystal panel W thereof. The polarizing sheet 11' is formed from a polarizing composite film 11 included in a continuous web of a flexible optical film 10 of a laminated structure, as shown in the perspective view at (Before Use) part of FIG. 1, to have a rectangular shape with a size of 520 to 540 mm in length × 930 to 950 mm in width, as shown in the perspective view at (After Use) part of FIG. 1 and in FIG 2.

[0003] The continuous web of the optical film 10 for use in forming the polarizing sheet 11' to be laminated to the liquid-crystal panel W typically consists of a flexible film of a laminated structure which comprises the polarizing composite film 11, surface-protection film 13 having an adhesive surface, and a carrier film 14. The polarizing composite film 11 is shows a polarizing function, and generally includes a continuous layer of polarizer, two protective films laminated on respective ones of the opposite surfaces of the continuous polarizer layer, and an acrylic adhesive layer 12 formed on one side of the continuous polarizer layer which is to be applied to the liquid-crystal panel W. The carrier film 14 is a film releasably laminated to the adhesive layer 12 to provide a function of protecting the exposed side of the adhesive layer 12 of the polarizing composite film 11. The polarizing composite film 11 is formed through the following process, for example. A continuous polarizer layer having a thickness of 20 to 30 μm is first formed by subjecting a PVA (polyvinyl alcohol)-based film having a thickness of about 50 to 80 μm to a dyeing treatment using iodine and a cross-linking treatment, and subjecting the resultant PVA-based film to an orientation treatment based on stretching in a lengthwise or widthwise direction thereof. As a result, the iodine complex is oriented in the direction parallel to the stretching direction of the PVA-based film to acquire a property of absorbing a polarized light having a plane of oscillation matching with the orientation of the iodine complex to thereby provide a polarizer having absorption axes in the direction parallel to the stretching direction. Thus, in order to produce a polarizer having an excellent optical property in addition to excellent uniformity and accuracy, it is desirable that the stretching direction of the PVA-based film corresponds to the lengthwise or widthwise directions of the film. Therefore, generally, the absorption axis of a polarizer or an optical film including such polarizer is parallel to the lengthwise direction of the continuous web, and the polarizing axis is in the widthwise direction perpendicular to the absorption axis. Then, the protective film is laminated to one or each of the opposite surfaces of the formed continuous polarizer layer through an adhesive. Finally, on one side of the continuous polarizer layer with the protective film laminated, the acrylic adhesive layer 12 to be applied to the liquid-crystal panel W is formed. Generally, a transparent TAC (triacetylcellulose)-based film having a thickness of about 40 to 80 μm is often used as the protective film for protecting the continuous polarizer layer. In the following description, the continuous layer of polarizer may be simply referred as "polarizer".

[0004] According to the definition of terms in "SEMI (Semiconductor Equipment and Materials International) Draft Document" on polarizing films for flat-panel display elements including liquid-crystal display elements (FPD Polarizing Films), the term corresponding to the "polarizing composite film and layer" constituting an optical film for use in a liquid-crystal display element is referred as "films and layer composing polarizing films". Thus, the polarizing composite film 11 in the perspective view at (Before Use) part of FIG. 1 is interpreted as corresponding to the "films composing polarizing films". The polarizing sheet 11' in the perspective view at (After Use) part of FIG. 1, which is formed in a rectangular shape from the polarizing composite film 11, corresponds to " polarizing films ", so that it may be preferable to apply the term "polarizing sheet" to the latter, rather than the commonly called name "polarizing plate". In the following description, a film including a polarizer, a protective film laminated on one or both of opposite surfaces of the polarizer, and an adhesive layer formed on one side of the polarizer to be laminated to a liquid-crystal panel W, will be referred as "polarizing composite film", and a sheet commonly called by the name "polarizing plate", which is formed in a rectangular shape from the polarizing composite film, will be referred as "polarizing sheet" or simply "sheet". In addition, when a sheet is formed from a polarizing composite film having a surface-protection film and a carrier film attached thereto, and when this sheet has to be distinguished from "a polarizing sheet", the former is referred as "an optical film sheet", and a sheet formed from the surface-protection film or the carrier film included in the composite film is respectively referred as "a surface-protection film sheet" or "a carrier film sheet".

[0005] The thickness of the polarizing composite film 11 generally has a thickness of about 110 to 220 μm. The polarizing composite film 11 is generally comprised of a polarizer having a thickness of about 20 to 30 μm, two protection films which a total thickness may be about 80 to 160 μm when the protective films are laminated on respective ones of opposite surfaces of the polarizer, and an adhesive layer 12 which thickness formed on one side of the polarizer to be laminated to a liquid-crystal panel W is about 10 to 30 μm. The polarizing composite films 11 are laminated to respective ones of the front and back sides of the liquid-crystal panel W with the adhesive layer 12 in such a manner that polarizing axes intersect each other at an angle of 90 degrees. Thus, in manufacturing a liquid-crystal display element for a widescreen television having a diagonal screen size of 42 inch, on an assumption that a thickness of a liquid-crystal panel itself is about 1400 μm, and since a thickness of each of the polarizing composite films 11 is in the range of 110 to 220 μm, the liquid-crystal display element itself has an overall thickness of about 1620 to 1840 μm. The thickness of the liquid-crystal display element is still within 2.0 mm or less. In this case, the ratio of the thickness of the liquid-crystal display element to the overall thickness of the liquid-crystal panel W and the sheet 11' is about 10 : 1.5 to 10 : 3. If use is made of a polarizing composite film 11 having a protective film laminated to only one surface of the polarizer, and an adhesive layer formed on the other surface of the polarizer, from the view point of reducing the thickness of the liquid-crystal display element, the thickness of the polarizing composite film 11 itself can be reduced to 70 to 140 μm, so that an overall thickness of the resultant liquid-crystal display element is reduced to a range of about 1540 to 1680 μm. The ratio of a thickness of the liquid-crystal element to that of the liquid-crystal panel W and the sheet 11' will be in the range of about 10 : 1 to 10 : 2.

[0006] A continuous web of an optical film 10 for use in a liquid-crystal display element has a structure as shown in the perspective view at (Before Use) part of FIG. 1. The structure of the continuous web of the optical film 10 will be briefly described below, in connection with a manufacturing process thereof. A surface-protection film 13 with an adhesive surface having a thickness of about 60 to 70 μm is releasably laminated to the surface of a polarizing composite film 11 devoid of an adhesive layer, and a carrier film 14 is releasably laminated to an adhesive layer 12 provided on the surface of a polarizing composite film 11 which is to be laminated to the liquid-crystal panel W, for providing a function of protecting the adhesive layer 12. Typically, a PET (polyethylene terephthalate)-based film is used for each of the surface-protection film 13 and the carrier film 14. During the manufacturing process of the liquid-crystal display element, the carrier film 14 generally serves as a carrying medium (carrier) for the polarizing composite film 11, as well as the means to protect the adhesive layer 12. A film having such functions will hereinafter be referred as a "carrier film". Both of the surface-protection film 13 and the carrier film 14 are so-called "manufacturing-process materials" which are to be peeled and removed prior to the final stage of the manufacturing process of the liquid-crystal display elements, and which are to be used for protecting the non-adhesive surface from being soiled or damaged, and also protecting the exposed surface of the adhesive layer, of the polarizing composite film 11, during the manufacturing process of the liquid-crystal display elements.

[0007] In the polarizing composite film 11, one of the protective films for protecting the polarizer may be replaced with a phase difference film made of a cycloolefin-based polymer, a TAC-based polymer or the like and having an optical compensation function. It may further be provided as a layer of a transparent substrate, such as a TAC-based substrate, having a polymer material, such as a polyester-based polymer or a polyimide-based polymer applied/arranged thereto and then cured. Further, in the case of a polarizing composite film to be laminated to the backlight side of the liquid-crystal display element, it may be possible to provide an additional function by laminating a brightness enhancement film to the backlight side protective film of the polarizer. In addition, regarding the structure of the polarizing composite film 11, there have been proposed various other variations, such as a technique of laminating a TAC-based film to one of opposite surfaces of the polarizer and laminating a PET film to the other surface of the polarizer.

[0008] One of methods for providing a polarizing composite film 110 including a polarizer and a protective film laminated on one or both of opposite surfaces of the polarizer devoid of an adhesive layer for attaching to a liquid-crystal panel W comprises a step of laminating a carrier film 14 having a transferable adhesive layer formed thereon, to the surface of the polarizing composite film 110 to be laminated to the liquid-crystal panel W A specific transfer technique is as follows. In a manufacturing process of the carrier film 14, the carrier film is subjected to a releasing treatment at the surface which is to be laminated to the polarizing composite film 110 at the surface of the polarizing composite film 110 which is to be laminated to the liquid-crystal panel and then a solvent containing adhesive is applied to the treated surface and dried to form an adhesive layer on the carrier film 14. Then, the carrier film 14 having the formed adhesive layer is laminated to the polarizing composite film 110, for example, while continuously feeding out the carrier film 14 and feeding out the polarizing composite film 110 in the same manner, so that the adhesive layer formed on the carrier film 14 is transferred to the polarizing composite film 110, and the adhesive layer 12 is formed. Thus, instead of the adhesive layer formed in this manner, of course, the adhesive layer 12 may be formed by directly applying a solvent containing adhesive to the surface of the polarizing composite film 110 to be laminated to the liquid-crystal panel, and drying the same.

[0009] The surface-protection film 13 typically has an adhesive surface. Unlike the adhesive layer 12 on the polarizing composite film 11, the adhesive surface must be peeled from a polarizing sheet 11' of the polarizing composite film together with a surface-protection film sheet (not shown) when the surface-protection film sheet is peeled and removed from the polarizing sheet 11' during the manufacturing process of the liquid-crystal display elements. The reason is that the surface-protection film sheet which is formed together with the polarizing sheet 11' is adapted for protecting the surface of the polarizing sheet 11' devoid of an adhesive layer 12 from the risk of being soiled or damaged, but not an adhesive surface to be transferred to the surface of the polarizing sheet 11'. The perspective view at (After Use) part of FIG. 1 shows the state after the surface-protection film sheet is peeled and removed. It should further be noted that, irrespective of whether the polarizing composite film 11 has a surface-protection film 13 laminated thereon, it may be possible to provide the polarizing composite film 11 at the surface of the protective film on the front side of the polarizing composite film 11 with a hard coat treatment for protecting the outermost surface of the liquid-crystal display element, and/or a surface treatment for obtaining an anti-glare effect or the like, such as an anti-glare treatment.

[0010] By the way, for the function of the liquid-crystal display element, the direction of orientation of liquid-crystal molecules and the direction of polarization of the polarizer are closely related to each other. In liquid-crystal display element technologies, LCDs (liquid-crystal display) using a TN (Twisted Nematic) type liquid-crystal has first been put into practical use, and then LCDs using a VA (Vertical Alignment) type liquid-crystal, an IPS (Inplane Switching) type liquid-crystal etc. have been put into practical use. Although a technical explanation will be omitted, in an LCD using such TN-type liquid-crystal panel, liquid-crystal molecules are provided between two upper and lower orientation films having respective rubbing directions on the inner surfaces for glass substrates of the liquid-crystal panel so that the liquid-crystal molecules are twisted by 90 degrees along the optical axis wherein, when a voltage is applied, the liquid-crystal molecules are aligned in a direction perpendicular to the orientation films. However, in case where the LCD is designed to allow images as seen from right and left sides of a display screen to be formed in the same quality, the direction of rubbing on the orientation film at the viewing-side must be 45 degrees (the rubbing direction of the other orientation film is 135 degrees). It is therefore necessary that the polarizing sheets made from the polarizing composite films to be laminated respectively on the front and back sides of the liquid-crystal panel must have polarizers respectively oriented in directions inclined respectively by 45 degree with respect to a lengthwise or widthwise direction of the display screen so as to conform to the rubbing directions.

[0011] Therefore, in a polarizing sheet for use in producing a liquid-crystal element of a TN-type liquid-crystal panel, it is required that the optical film is punched-out or cut into a rectangular-shaped sheet having a long side or a short side determined in accordance with the size of the TN liquid-crystal panel, from the optical film, the optical film comprising a polarizing composite film which includes a polarizer subjected to an orientation treatment by stretching in the lengthwise or widthwise direction, a protective film laminated on the polarizer, and an adhesive layer formed on the side of the polarizer which is to be attached to the liquid-crystal panel, and inclined by 45 degrees with respect to the orientation direction of the polarizer produced by stretching in the lengthwise or widthwise direction. This is described in Japanese Laid-Open Patent Publication JP 2003-161935A (Patent Document 1) or Japanese Patent 3616866B (Patent Document 2), for example. Needless to say, the width of the sheet to be processed into the rectangular shape, that is, the short side of the sheet, is smaller than the width of the continuous web.

[0012] The punching or cutting the optical film sheet into the rectangular-shaped sheet from the continuous web of an optical film may be collectively referred as "individualized sheets" or "a method and system for manufacturing individualized sheets" for liquid-crystal display elements. The optical film sheet thus punched-out or cut is produced by punching or cutting not only the surface protection film contained in the optical film but also the carrier film protecting the exposed surface of the adhesive layer in the polarizing composite film together. The integrally punched-out or cut carrier film sheet may be referred as "separator", rather than "carrier film sheet". Thus, the manufacturing process of the liquid-crystal display elements includes the first step of peeling the separator from each of optical film sheet to have the adhesive layer of the polarizing sheet exposed. Subsequently, the optical film sheet each having the adhesive layer exposed are conveyed one-by-one by for example under a vacuum suction irrespective of whether the surface protective film sheets are laminated or not, and laminated to respective ones of a plurality of liquid-crystal panels. According to the abovementioned manufacturing process of the liquid-crystal display elements, it has been required that the integrally punched-out or cut sheet from the continuous web of the optical film is in the form of an individualized sheet having four trimmed sides and a certain level of stiffness of less deflection or bend and which can be conveyed and laminated easily. In an initial period in the history of the manufacturing process of the liquid-crystal display elements, this optical film sheet or the polarizing sheet contained in the optical film sheet has generally been called as "polarizing plate" which is still used as a common name.

[0013] In the manufacturing process of TN-type liquid-crystal display elements, an optical film fed out from a roll of the optical film laminate is integrally and sequentially punched-out or cut in a direction transverse to the feed direction, to form a plurality of optical film sheets. A plurality of the polarizing sheets simultaneously formed is to be comprised in respective ones of the optical film sheet. However, in this case, it is impossible to obtain a finished crystal display element simply by sequentially laminating the sheets formed by a process subsequent to the punching or cutting process to respective ones of a plurality of liquid-crystal panels. This is because the sheets each formed with a long or short side extending in a direction 45 degrees with respect to the orientation direction of a polarizer produced by stretching in a lengthwise or widthwise direction (i.e., with respect to the feed direction of the optical film prior to the punching or cutting process) cannot be laminated sequentially to respective ones of the liquid-crystal panels with the same posture. In an effort to providing a finished liquid-crystal display element by transporting a polarizing sheet to a position for lamination with a liquid-crystal panel, and then laminating the polarizing sheet to the liquid-crystal panel, an optical film having a width greater than a long side of a liquid-crystal panel is fed out in a lengthwise direction, and punched-out at an angled direction of 45 degrees with respect to the lengthwise direction for each of the optical film, using for example a die, into a plurality of individual sheets, and appropriately fed to the laminating process of the liquid-crystal panel as seen in the Patent Document 1 or 2. Alternatively, an optical film having a substantial longitudinal length may be provided by preparing a continuous web of optical film having a substantially large width and punching or cutting the web at an angle of 45 degrees with respect to the longitudinal direction to provide a film sheet which can be used as an optical film having a substantial length, or may be provided by connecting together a plurality of such obliquely cut sheets of the optical film, as seen in the Patent Document 3, and the optical film as produced in such process of forming sheets from an optical film having the width of the liquid-crystal panel is then continuously fed and cut in the widthwise direction with respect to its feeding direction to provide a plurality of sheet strips each having a required length and each including a plurality of polarizing sheet, the plurality of polarizing sheets in the sheet strip being then laminated to respective ones of a plurality of liquid-crystal panels sequentially conveyed to provide completed liquid-crystal display elements. At any rate, the above techniques are not beyond the system for manufacturing individualized sheets.

[0014] Patent Document 3 is a Japanese Patent Publication No. 62-14810B which has been published before the VA-type liquid-crystal and the IPS-type liquid-crystal are brought into practical use and discloses an apparatus to produce a liquid-crystal panel by sequentially laminating a plurality of sheets formed into a required length onto respective ones of a plurality of liquid-crystal panels while continuously feeding an optical film containing a polarizing composite film,. The Patent Document 3 discloses a technique of continuously feeding an optical film which comprises a polarizing composite film (in the Patent Document 3, termed as "elongated polarizing plate") and a separator for protecting an adhesive layer on the polarizing composite film, "cutting only the polarizing plate 4 and the adhesive layer 5 while leaving the separator 6 uncut (hereinafter referred to as "half-cut")", removing defective polarizing sheets formed by the half-cut process in the course of the feeding, and sequentially laminating the peeled sheets to respective ones of the plurality of liquid-crystal panels (in the Patent Document 3, termed as "liquid-crystal cells") for constituting small-size display screens of an electronic calculators or the like, while peeling the separator from the polarizing sheets which have been retained on the separator, to finish "products each having the polarizing composite film and the liquid-crystal cell laminated together". The apparatus is a labeler unit which produces an LCD using a TN-type liquid-crystal. Thus, the optical film to be used must be an elongated sheet produced from an optical film having substantially large width by cutting it in a direction 45 degrees oblique to the longitudinal direction of the optical film with a width corresponding to the liquid-crystal panel, or a film-like elongated optical film sheet formed by connecting a plurality of optical film sheets. Therefore, this apparatus is based on the use of an elongated sheet which is cut in a direction 45 degrees oblique to the stretching direction of the polarizing composite film with a width corresponding to the width of the liquid-crystal panel, so that it cannot be applied directly to a manufacturing apparatus adapted to perform steps of continuously forming a plurality of polarizing sheets from an optical film having a laminated structure and laminating respective sheets to respective ones of the liquid-crystal panel using VA-type liquid-crystal and the IPS-type liquid-crystal to make a liquid-crystal display element.

[0015] With respect to automatization of manufacturing process of liquid-crystal display elements using individualized sheets will generally be described below. A plurality of inspected rectangular individualized sheets are formed from a continuous web of an optical film containing a polarizing composite film in an optical film manufacturing line and preliminarily subjected to an inspection for the presence or absence of any defect. The formed individualized sheets inspected for the presence of defects are carried into a liquid-crystal display element manufacturing line in a batch comprising a plurality of such sheets. Generally, the carried-in individualized sheets are manually brought into an individualized-sheet magazine to be stored therein. Each of the stored individualized sheets has at least a polarizing composite film sheet having an adhesive layer thereon, and a separator laminated thereto to protect the exposed surface of the adhesive layer. The magazine having the individualized sheets stored therein is introduced into the liquid-crystal display element manufacturing line. As the liquid-crystal panel magazine is introduced into the manufacturing line with a plurality of liquid-crystal panels stored therein, a plurality of liquid-crystal panels are taken out one-by-one from the liquid-crystal panel magazine and conveyed through a cleaning/polishing process. In synchronization with the conveyance of the liquid-crystal panels, the individualized sheets are taken out one-by-one from the individualized-sheet magazine by means of a suction-type conveyor unit. The separator is peeled off each of the taken-out individualized sheets to have the adhesive layer of the sheet exposed. It will thus be understood that, in producing a liquid-crystal display element using such individualized sheet in this manner, the separator must be removed from respective ones of the individualized sheets. Then, the individualized sheet having the adhesive layer in exposed state is carried under suction to the laminating position for lamination with the liquid-crystal panel. Each of the conveyed individualized sheets is laminated to one side of the liquid-crystal panel to sequentially produce the liquid-crystal display elements. This method is disclosed, for example, in Japanese Laid-Open Patent Publication No. 2002-23151A (Patent Document 4). Flexible individualized sheets tend to be bowed or warped by being bent or distorted at its edge portions, and such tendencies have caused a serious technical impediment to accuracy and speed in registration and lamination with liquid-crystal panels. Thus, it will be understood that the individualized sheet is required to have a certain level of thickness and stiffness to facilitate transport under suction and lamination to the liquid-crystal panel. For example, the disclosures in the Japanese Laid-Open Patent Publication No. 2004-144913A (Patent Document 5), Japanese Laid-Open Patent Publication No. 2005-298208A (Patent Document 6) or Japanese Laid-Open Patent Publication No. 2006-58411A (Patent Document 7) can be considered as measures addressing such technical problems.

[0016] On the other hand, the VA-type and IPS-type liquid-crystal panels are not designed to to have a twisted structure of liquid-crystal molecules. Thus, in producing liquid-crystal display elements using these types of liquid-crystal panels, it is no longer required to have the polarization axis of the polarizing sheet oriented 45 degrees with respect to the direction of the long or short side of the liquid-crystal display element in order to obtain an increased viewing angle characteristics inherent to the orientation of the liquid-crystal, as in the case of using the TN-type liquid-crystal panel. In the case of liquid-crystal display elements using these types of liquid-crystal panels, the liquid-crystal display element is formed by applying the polarizing sheets to the opposite sides of the liquid-crystal display panel oriented with their polarization axes crossed at 90 degrees each other. In the case of the VA-type and IPS-type liquid-crystal panels, with respect to the viewing angle characteristics, maximum contrast can be obtained along the direction of the polarizing axis of the polarizing sheet, so that it is preferable that the sheets have optical axes oriented in parallel with the longitudinal or transverse direction of the liquid-crystal panel from the technical view point of symmetry of the viewing angle characteristics and visibility. Thus, it will be understood that these sheets to be applied to the liquid-crystal panel have a feature that the optical film including a polarizing composite film which has been subjected to longitudinal or transverse stretching can be continuously fed out from a roll and cut along transverse lines with respect to the feed direction of the optical film to sequentially produce rectangular sheets including the polarizing sheets having same width as the optical film width.

[0017] It should further be pointed out that, from the view point of improving the viewing angle characteristics, there is a trend that, for liquid-crystal used in a display element for widescreen televisions, the VA-type or the IPS-type liquid-crystal are more widely adopted than the TN-type. As described, the conventional display element using the TN-type liquid-crystal had to be manufactured using the individualized sheets. Due to limitations in both product accuracy and manufacturing speed, it has been difficult to enhance the manufacturing efficiency in this method anymore. In view of such trend in environments of technical developments, there has been made a proposal such as the one described in Japanese Laid-Open Patent Publication No. 2004-361741A (Patent Document 8) which is a technique for enhancing manufacturing efficiency based on use of the VA-type or IPS-type liquid-crystal panels and comprises steps of continuously feeding an optical film, cutting the optical film in conformity to the size of a liquid-crystal panel and sequentially laminating a plurality of cut rectangular sheets comprising the polarizing sheets which have been produced by the cutting step to respective ones of a plurality of the liquid-crystal panels.

[0018] The subjects and the concepts of the present invention are close to and inseparably linked with manufacture of a liquid-crystal display element based on a liquid-crystal such as the VA-type and IPS-type liquid-crystals which are different in principle from the TN-type liquid-crystal, as described later.

[0019] However, the mainstream of manufacture of liquid-crystal display elements is still based on the manufacturing technology utilizing individualized sheets, due to the following technical problems. In manufacturing liquid-crystal display elements, a critical technical challenge is to detect any defect which may otherwise be retained in the display elements to be formed, and to prevent any defective product from being produced. This makes it possible to significantly improve manufacturing yield. Most of the product defects primarily arise from defects in the polarizing composite film contained in the optical film. However, it is not actually a practical way to provide an optical film after completely removing all defects contained in individual films before they are laminated together to form the optical film. The reason is that, an observation on all of the polarizer and the protective film laminated on the polarizer to provide a polarizing composite film having no adhesive layer formed thereon, and an adhesive layer formed on the polarizing composite film has revealed that there are various modes of defects, including defects inherent in the PVA film of the polarizer itself, defects arose in connection with the lamination of the protective film to the polarizer or defects generated in the adhesive layer of the formed polarizing composite film, distributed in 20 to 200 positions over a unit length of the polarizing composite film of 1000 m, so that, under existing circumstances, it is extremely difficult to produce a defect-free optical film. Nonetheless, in view of maintaining quality of a liquid-crystal display element itself, it is not permitted to use an optical film sheet having visible flaws or defects as a sheet for television even if such a flaw or defect is small. Given that the long side dimension of a polarizing sheet formed from the polarizing composite film is about 1 m, if a defective region cannot be preliminarily removed, 20 to 200 defective liquid-crystal display elements out of 1,000 products will be produced according to a simple calculation.

[0020] Thus, under the existing circumstances, normal regions are defined as regions divided in rectangular shape having no defect and defect-free sheet product (hereinafter referred as "normal polarizing sheets") are punched-out or cut from the polarizing composite film, appropriately avoiding defective regions also divided in rectangular shape having defects therein. The defective regions are also punched-out or cut from the polarizing composite film, as defective polarizing sheet product (hereinafter referred as "defective polarizing sheets"), and only the rectangular shaped defective polarizing sheets are selectively removed in the later process.

[0021] The applicant of this application has proposed a preliminary inspection apparatus for a polarizing composite film, as disclosed, for example, in Japanese Patent No. 3974400B (Patent Document 9), Japanese Laid-Open Patent Publications 2005-62165A (Patent Document 10) and 2007-64989A (Patent Document 11). These proposals relate to apparatus based on the use of individualized sheets, and primarily include the following two steps. The first step comprises inspecting defects contained in the polarizing composite film being continuously fed out to determine positions or coordinates of the detected defects through image processing, encoding the information obtained by the image processing, and then directly printing the encoded information on a marginal or edge portion of the polarizing composite film which will be left in the web after punching or cutting the polarizing composite film during the production of the individualized sheets, and winding the resulting polarizing composite film to form a roll. The second step comprises reading the encoded information printed on the polarizing composite film unrolled from the roll, and providing marks at the positions of the defects based on the results of determination on the presence of defects, followed by subsequent steps of punching or cutting for producing individualized sheets from the polarizing composite film, and based on the marks provided beforehand, sorting the individualized sheets produced by punching or cutting into normal products and defective product. The above steps have been technical means essential to improving yield in the manufacture of such individualized sheets.

[0022] Just for reference, in the Patent Document 9 or 11, the polarizing composite film is termed as "sheet-shaped member", and "for example, a polarizing composite film, a phase difference film, a plastic sheet for organic electroluminescent (EL) elements, a plastic sheet for liquid-crystal cells, and a plastic sheet for solar battery boards" are described. In an example illustrated in FIGS. 1 (a) and 1 (b) of the Patent Document 9 or 11, the sheet-shaped member includes a polarizing composite film which has a polarizer and two protective films laminated to respective ones of opposite surfaces of the polarizer, and a sheet to be punched-out or cut is termed as "product". In the Patent Document 10, a polarizing composite film is termed as "polarizing plate stock", and a punched-out or cut piece is termed as "sheet-shaped product".

[0023] More specifically, the Patent Documents 9 to 11 first describes the following points. A preliminary inspection device is used to detect positions or coordinates of defects present in the "sheet-shaped member" or the "polarizing plate stock". Then the detected information is encoded. The encoded information is printed by a recording device to print onto the "sheet-shaped member" or "polarizing plate stock". The encoded information is printed in such a manner as to be readable by a reading device when a "product" or a "sheet-shaped product" is punched-out or cut from the "sheet-shaped member" or "polarizing plate stock". A roll having the encoded information printed on the "sheet-shaped member" or "polarizing plate stock" is formed. The first manufacturing process is as described above. In addition to the first manufacturing process, the Patent Documents 9 to 11 also disclose a second manufacturing process of the "sheet-shaped member" or "polarizing plate stock" using a wound roll. The second manufacturing process comprises the steps of making a mark directly to a position or coordinate of a defect of the "sheet-shaped member" or "polarizing plate stock", based on encoded information on the "sheet-shaped member" or "polarizing plate stock" and read by the reading device; punching or cutting the "sheet-shaped member" or "polarizing plate stock" being unrolled from the wound roll; and allowing a "product" or "sheet-shaped product" punched-out or cut from the "sheet-shaped member" or "polarizing plate stock" unrolled from the wound roll to be sorted into a normal product and a defective product in the next process.

[0024] It should be noted that there is a significant difference in the surrounding circumstances between the conventional liquid-crystal display element manufacturing method and system where a plurality of individualized sheets are preliminarily formed from a continuous web of an optical film, and then carried into the manufacturing process of the liquid-crystal display element for lamination on respective ones of a plurality of the liquid-crystal panel, and a liquid-crystal display element manufacturing method and system of the present invention where an optical film including a polarizing composite film is used, wherein while the optical film is transported so as to correspond to a plurality of liquid-crystal panels being sequentially conveyed, only the polarizing composite film including the adhesive layer is cut into a predetermined size along a plurality of slit lines, leaving the carrier film uncut, to form a plurality of liquid-crystal display element by laminating the plurality of cut polarizing composite film sheets on one of respective sides of the liquid-crystal panel.

[0025] In a process of continuously manufacturing a plurality of liquid-crystal display elements while continuously forming a plurality of sheets, it is required to provide additional technical measures for identifying defective regions which have preliminarily been determined based on the locations or coordinate positions of defects in the polarizing composite film and for defining defective polarizing sheets when the optical film is continuously unrolled from a roll of the optical film laminate which includes a polarizing composite film, and then for removing the defective polarizing sheets so that the defective polarizing sheets will not be fed to the position for lamination with the liquid-crystal panel. The process to remove the defective polarizing sheet so as not to be fed to the position for lamination with the liquid-crystal panel may make the feed of the optical film inevitably interrupted. If the defective regions of the polarizing composite film are left as they are in order to avoid interruption of the feed of the optical film, it becomes difficult to avoid formation of defective liquid-crystal display elements. Thus even though a manufacturing speed can be maintained, it is compelled to sacrifice product yield. This is one of technical problems to be solved by the present invention.

[0026] The applicant has already proposed a manufacturing method by the Japanese Laid-Open Patent Publication 2007-140046A (Patent Document 12). wherein the method comprises:peeling a carrier film (in the Patent Document 12, termed as "releasable film") from an optical film (in the Patent Document 12, termed as "polarizing plate stock") fed out continuously from a roll of an optical film laminate to expose a polarizing composite film (in the Patent Document, terms as "polarizing plate") having an adhesive layer; detecting a defect or defects present in the polarizing composite film; punching or cutting only normal regions of a polarizing composite film into a rectangular shape, while leaving the defective region or regions of the polarizing composite film untouched; and transporting the resulting normal polarizing sheet (in the Patent Document 12, termed as "sheet-shaped products") to a lamination station with the liquid-crystal panel using another conveyance medium. It should however be noted that this process is not the one which makes it possible to transport the normal polarizing sheets formed from the continuous web of the optical film to the lamination station with the liquid-crystal panel by means of the carrier film. It should be referred that this technique is not beyond the individualized sheet manufacturing system of the liquid-crystal display element where the plurality of cut individualized sheets are laminated to another conveyance medium and transported to the lamination station with the liquid-crystal panel.

[0027] The applicant has further disclosed by the Japanese Patent Application No. 2007-266200 an invention relating to a method and system for laminating a polarizing film sheet to a liquid-crystal panel, as shown in FIG. 4. This invention relates to a method and system for manufacturing liquid-crystal display elements comprising the following steps. First, the method comprises a step of peeling a first carrier film which is provided for protecting an adhesive layer of a polarizing composite film contained in the optical film. The method further comprises a step of preliminarily inspecting a defect or defects present in the polarizing composite film having the adhesive layer exposed by peeling the first carrier film. The method further comprises a step of then feeding a second carrier film and releasably laminating the second carrier film to the exposed adhesive layer of the polarizing composite film to provide again a protection for the adhesive layer while maintaining a continuous feeding of the optical film comprising the polarizing composite film. Then, this method comprises a step of forming a plurality of slit lines in the continuous web of the optical film along a direction transverse to the feed direction of the continuous web at a slitting station, the slit lines being formed to a depth reaching the inner surface of the second carrier film to thereby define defective polarizing sheets and defect-free normal polarizing sheets between respective longitudinally adjacent two of the slit lines formed sequentially on the continuous web along the feed direction, while the defective polarizing sheet and the defect-free normal polarizing sheet respectively corresponds to a defective region including a defect or defects and normal region including no defect of the polarizing composite film segmented in a plurality of rectangular shape as determined by the result of the inspection for the existence of a defect or defects in the polarizing composite film. This method also comprises a step of automatically removing only the defective polarizing sheets from the second carrier film and feeding only the normal polarizing sheets left on the second carrier film to a lamination station with the liquid-crystal panels. Finally, the method further comprises a step of peeling the normal polarizing sheet from the second carrier film, and laminating each of the peeled normal polarizing sheets to one of opposite surfaces of each of the liquid-crystal panels. This invention contains an innovative proposal allowing for shifting from a liquid-crystal display element manufacturing system designed to carry a plurality of preliminarily formed individualized sheets in the manufacturing process of the liquid-crystal display element, to a serial-type liquid-crystal display element manufacturing system designed to continuously form a plurality of polarizing film sheets in the manufacturing process of liquid-crystal display element, and directly laminate respective ones of the sheets to respective ones of a plurality of liquid-crystal panels.

[0028] The technical problem which the aforementioned invention intends to solve has been how to realize technical measures for forming a plurality of slit lines in the continuous web of the optical film along a direction transverse to the feed direction of the continuous web to a depth reaching the inner surface of the second carrier film, to form defective polarizing sheets and normal polarizing sheets, between respective longitudinally adjacent two of the slit lines formed sequentially on the continuous web along the feed direction, while the defective polarizing sheets and the normal polarizing sheets respectively correspond to the preliminarily defined defective regions including defects and normal regions including no defect in the polarizing composite film as determined by the result of the inspection for the existence of defects in the polarizing composite film, and keeping only the defective polarizing sheets from being conveyed to the lamination station with the liquid-crystal panel. As a result, the technical challenge was solved by providing steps of, for the inspection for defining the defective and normal regions, separating the continuous web of the optical film from the carrier film and/or the surface-protection film, and after the inspection, laminating a substitute carrier film and/or a substitute surface-protection film again on the continuous web of the optical film, and including these steps to a series of the manufacturing process of the liquid-crystal display element. These steps are essential to protect the surface of the polarizing composite film devoid of the adhesive layer and the exposed surface of the adhesive layer of the polarizing composite film during the manufacturing process of the liquid-crystal display elements. However, these steps cause not only substantial complexity in the entire system for laminating the normal polarizing sheets to corresponding ones of the liquid-crystal panels but also an increase in the number of steps and difficulty in control for each step, and as a matter of course, cause corresponding reduction in the manufacturing speed.

[0029] The present invention has been made based on the above related inventions and through intensive researches and considerations for significantly enhancing product accuracy and manufacturing speed, and drastically improving production yield, in the manufacture of liquid-crystal display elements.

[0030]

Patent Document 1:Japanese Laid-Open Patent Publication 2003-161935A

Patent Document 2:Japanese Patent No. 3616866B

Patent Document 3:Japanese Patent Publication 62-14810B

Patent Document 4:Japanese Laid-Open Patent Publication 2002-23151A

Patent Document 5:Japanese Laid-Open Patent Publication 2004-144913A

Patent Document 6:Japanese Laid-Open Patent Publication 2005-298208A

Patent Document 7:Japanese Laid-Open Patent Publication 2006-58411A

Patent Document 8:Japanese Laid-Open Patent Publication 2004-361741A

Patent Document 9:Japanese Laid-Open Patent Publication 3974400B

Patent Document 10:Japanese Laid-Open Patent Publication 2005-62165A

Patent Document 11:Japanese Laid-Open Patent Publication 2007-64989A

Patent Document 12:Japanese Laid-Open Patent Publication 2007-140046A

DISCLOSURE OF THE INVENTION

[PROBLEM TO BE SOLVED BY THE INVENTION]

[0031] As described above, the polarization axes of the polarizing composite films laminated to respective ones of front and rear surfaces of the liquid-crystal panel are oriented in substantially parallel with respect to the direction of the sides of the liquid-crystal panel which extend in directions crossed by 90 degrees from each other, so that, in using the VA-type and IPS-type liquid-crystal panels, there is no technical constraint which has been experienced in using TN-type liquid-crystal panels that two polarizing film sheets shall necessarily be laminated to respective ones of front and rear surfaces of the liquid-crystal panel in such a manner that the polarization axis of each of the polarizing film sheets is oriented 45 degrees oblique with respect to the direction of the long or short side of the liquid-crystal display element, in order to obtain an increased viewing angle characteristics. Therefore, with such VA-type and IPS-type liquid-crystal panels, it becomes possible to realize a continuous manufacturing of the liquid-crystal display elements wherein a web of an optical film containing a polarizing composite film is continuously supplied and cut in the direction transverse to the feed direction of the optical film to form individualized polarizing sheets, and such polarizing sheets are sequentially laminated to respective ones of a plurality of liquid-crystal panels. In addition, if it becomes possible to define, while the optical film containing the polarizing composite film is being continuously fed, defective polarizing sheets including one or more defects detected by a preliminary inspection of the polarizing composite film contained in the optical film as well as normal polarizing sheets including no defect, and to advance only the normal polarizing sheets to the lamination station for lamination with respective ones of a plurality of sequentially supplied liquid-crystal panels to make liquid-crystal display elements, without interrupting the feed of the optical film, there will be remarkable improvements in accomplishing enhanced product accuracy and increased manufacturing speed as well as significantly improved production yield in the manufacture of liquid-crystal display elements.

[0032] The present invention is directed, as described later, to a continuous manufacture of liquid-crystal display elements wherein a continuous web of an optical film is provided, the optical film having a width corresponding to the width of the liquid crystal panel having predefined dimensions and at least comprising a polarizer film having an adhesive layer thereon and a carrier film releasably attached to the adhesive layer, the continuous web of the optical film having a plurality of defective-polarizing-sheet slitting positions and normal-polarizing-sheet slitting positions defined thereon in the form of lines extending in the widthwise direction of the continuous web of the optical film, based on positions of defects present in the continuous web of the optical film and detected through a preliminary inspection of a polarizing composite film, the defective-polarizing-sheet slitting positions being for defining regions containing one or more defects and the normal-polarizing-sheet slitting positions being for defining regions having no defect, the defective-polarizing-sheet slitting positions and the normal-polanizing-sheet slitting positions being recorded on the web as encoded information, wherein individualized polarizing film sheets being formed from the continuous web of the optical film to have dimensions corresponding to those of the liquid crystal panels and applied to the liquid crystal panels to form liquid crystal display elements, wherein the continuous web of the optical film is continuously fed to a lamination station while measuring a feed distance of the continuous web and calculating the feed-length measurement data based on the feed distance, and reading the encoded information recorded on the continuous web, wherein a plurality of slit-lines are formed in the continuous web by slitting the continuous web from the surface opposite to the carrier film to a depth reaching the surface of the carrier film adjacent to the adhesive layer, along the slitting positions, based on the encoded information and the feed-length measurement data, when the slitting position defined in the continuous web thereon comes to a slitting station, the encoded information being used for determining whether the polarizing sheets being formed between an adjacent pair of the slit-lines sequentially formed in the continuous web is a defective polarizing sheet having defects or a normal polarizing sheet having no defect, wherein the polarizing sheet determined to be the normal polarizing sheet, among the polarizing sheets being formed between an adjacent pair of the slit-lines sequentially formed in the continuous web of the optical film is then peeled from the carrier film, and transported to the lamination station, wherein a liquid-crystal panel is transported to the lamination station in synchronization with the transportation of the normal polarizing sheet to the lamination station and the normal polarizing sheet is applied to the liquid-crystal panel. Specifically, the technical target of the present invention is to realize an uninterruped sequential lamination of normal polarizing sheets to liquid crystal panels by sequentially supplying formed normal polarizing sheets without any interruption of feed of the continuous web of optical film by providing means wherein a continuous web of an optical film containing a polarizing composite film is fed to a lamination station for lamination with a liquid-crystal panel, followed by sequentially forming defective polarizing sheets including one or more defects detected through a preliminary inspection of the polarizing composite film contained in the optical film and normal polarizing sheets including no defect respectively, from the continuous web at a slitting station, while the continuous web is being fed, the formed defective polarizing sheet being prevented from being laminated to the liquid-crystal panel..

US2005/0016670 describes a method and apparatus for bonding a polarizing plate high in operating efficiency and yield. The apparatus includes a cutting unit for cutting at least a polarizing plate of a strip-shaped film, composed of the polarizing plate and a release film bonded to the polarizing plate, leaving the release film uncut, when a forward end side pre-severed end face of the strip-shaped film perpendicular to the longitudinal direction of the strip-shaped film has travelled up to a length corresponding to a length of a substrate, to form a film piece, a release film separating unit for separating the release film from the film piece thus severed, and a bonding unit for bonding the tacky surface of the film piece freed of the release film to a mating position of the substrate so that the forward end side end face of the transported substrate is parallel to the pre-severed end face of the film piece.

JP2004-361741 discloses belt-like film formed by pasting a release film on an optical film via an adhesion layer is sent out in its longitudinal direction, at least the optical film and the adhesion layer of the belt-like film is cut leaving the release film in the direction orthogonal to the longitudinal direction when the length of the belt-like film is made to be a prescribed length, the release film is separated from the film piece cut out by cutting, a substrate is conveyed so that one end surface of the substrate is made to be orthogonal to its progressing direction, conveyance of the substrate is stopped, positioning in the direction orthogonal to the progressing direction of the substrate is performed based on the position in the width direction of the film piece and an adhesion surface of the film piece is pasted on the corresponding position of the substrate.

JP 2007 064989 discloses a method of manufacturing liquid-crystal display elements and a system for implementing it. The method involves applying sheets of polarizing film to respective ones of liquid crystal panels each having predefined dimensions, the sheets of polarizing film being formed from a continuous web of an optical film at least including a polarizing film having an adhesive layer, and a carrier film releasably laminated to the adhesive layer, of the polarizing composite film in said web of optical film, the sheets of polarizing film being cut from the continuous web of optical film to a size corresponding to the dimensions of the liquid crystal panel. The method comprising the steps of: providing a continuous web of an optical film and defining in the continuous web of optical film a plurality of slitting positions for forming defect-containing defective sheets and defect-free normal sheets; recording any defect on the web in the form of coded information; feeding the continuous web of optical film to a lamination station; measuring a feed distance of the continuous web to calculate feed-length measurement data based on the feed distance; reading the encoded information recorded on the continuous web of optical film; forming a slit line in the continuous web, when each of the slitting position defined in the continuous web reaches a slitting station, along the slitting position from a surface of the continuous web opposite to the carrier film based on the encoded information and the feed-length measurement data; using the encoded information to determine whether each of the polarizing sheets to be formed between adjacent ones of the slit lines sequentially formed in the continuous web is a defective polarizing sheet having one or more defects or a normal polarizing sheet having no defects; and applying the normal polarizing sheets to respective ones of the liquid-crystal panels.

[MEANS FOR SOLVING THE PROBLEM]

[0033] The present invention is based on findings that solutions of the aforementioned technical problems can be achieved in a method as in claim 1 Preferably the method further comprises a step of preventing the polarizing sheet determined to be a defective sheet among the polarizing sheets each formed between adjacent ones of the slit lines sequentially formed in the continuous web of optical film, from being laminated to the liquid-crystal panel.

[0034] Preferably, the step of applying the normal polarizing sheet to the liquid-crystal panel at the lamination station includes the step of laminating the normal polarizing sheet to the liquid-crystal panel in the lamination station includes sub-steps of providing a pair of lamination rollers in the lamination station for movement toward and away from each other, and detecting a position of the normal polarizing sheet being fed to the lamination station in synchronization with the conveyance of the liquid-crystal panel to the lamination station, to adjust a lamination position between the normal polarizing sheet and the liquid-crystal panel (W) in the lamination station, wherein the sub-steps include adjusting alignment between a leading edge of the normal polarizing sheet fed toward a gap between the lamination rollers which are in a spaced-apart relation and a leading edge of the liquid-crystal panel conveyed in synchronization with the feed of the normal polarizing sheet, and then moving the lamination rollers to a closed position to thereby laminate the normal polarizing sheet to the liquid-crystal panel.

[0035] Preferably the method further comprises a slit position-checking step of checking whether a position of a slit actually formed in the continuous web of optical film coincides with a position where a slit is to be formed.

[0036] In an embodiment the slitting position verifying step is characterized in that the slit position-checking step includes adjusting a position of a slit line formed in the continuous web of optical film, based on a deviation between the position of the slit actually formed in the continuous web of optical film and the position where a slit is to be formed in a feed direction of the continuous web

[0037] In an embodiment the preferred step of preventing the step of the polarizing sheet determined to be a defective sheet from being laminated to the liquid-crystal panel further includes providing a dummy-film feed path for feeding a dummy film for laminating the defective polarizing sheet thereto, and a movable roller adapted to move the continuous web of optical film toward the dummy-film feed path, and, when the defective polarizing sheet formed in the continuous web of optical film reaches a removal station, moving the continuous web of optical film by the movable roller in such a manner that the defective polarizing sheet is peeled from the continuous web by being brought into contact with the dummy film - in the dummy film feed path, so as to allow the defective polarizing sheet to be laminated to the dummy-film feed path.

[0038] In an embodiment the step of preventing the polarizing sheet determined to be a defective sheet from being laminated to the liquid-crystal panel further includes providing a dummy-film feed path for feeding a dummy film for laminating the defective polarizing sheet thereto, and a movable roller providing a part of the dummy-film feed path, whereby, when the defective polarizing sheet formed in the continuous web of optical film reaches a gap between the pair of laminated rollers which are in a spaced-apart position, moving the movable roller in such a manner that one of the lamination rollers is replaced with the movable roller, and the movable roller and the other lamination roller are interlockingly moved to allow the defective polarizing sheet to be peeled from the continuous web and laminated to the dummy film in the dummy film feed path.

[0039] Preferably, the method further comprises the steps of; preliminarily storing a plurality of liquid-crystal panels in a liquid-crystal panel magazine; sequentially carrying out the liquid-crystal panels from the liquid-crystal magazine; and, when the normal polarizing sheets formed on the continuous web of optical film are fed to the lamination station, controlling the orientation of each of the liquid-crystal panels conveyed to the lamination station, in synchronization with feed of a respective one of the normal polarizing sheets.

[0040] In an embodiment the step of controlling the orientation of each of the liquid-crystal panels further includes a sub-step of detecting a position of a leading edge of the normal polarizing sheet extending in a crosswise direction with respect to a feed direction of the continuous web of optical film and a position of a leading edge of the liquid-crystal panel extending in a crosswise direction with respect to the feed direction of the liquid-crystal panel, and controlling the orientation of the liquid-crystal panel based on information about the respective positions of the leading edge of the normal polarizing sheet and the leading edge of the liquid-crystal panel.

[0041] In a further aspect there is provided a system as in claim 10.

[0042] Preferably the system further comprises a defective sheet-ejecting unit adapted to prevent the polarising sheet determined to be a defective sheet among the polarizing sheets each formed between adjacent ones of the slit lines sequentially formed in the continuous web, from being laminated to the liquid-crystal panel.

[0043] Preferably, the lamination unit for applying a normal polarizing sheet to a liquid-crystal panel further includes the lamination unit for laminating the normal polarizing sheet to the liquid-crystal panel includes a pair of lamination rollers provided in the lamination station and adapted to be moved toward and away from each other, and a mechanism adapted to detect a position of the normal polarizing sheet being fed to the lamination station in synchronization with the conveyance of the liquid-crystal panel to the lamination station, to adjust a lamination position between the normal polarizing sheet and the liquid-crystal panel in the lamination station, wherein the mechanism is operable to adjust alignment between a leading edge of the normal polarizing sheet fed toward a gap between the lamination rollers which are in a spaced-apart position and a leading edge of the liquid-crystal panel conveyed in synchronization with the feed of the normal polarizing sheet, and then move the lamination rollers to a closed position to thereby laminate the normal polarizing sheet to the liquid-crystal panel.

[0044] Preferably the system further comprises a slit position-checking unit adapted check whether a position of a slit actually formed in the continuous web of optical film coincides with a position where a slit is to be formed.

[0045] In an embodiment the slit position-checking unit is operable to adjust a position of a slit line to be formed in the continuous web of optical film, based on a deviation between the position of the slit actually formed in the continuous web and the position where the slit is to be formed in a feed direction of the continuous web.

[0046] In an embodiment the optional defective-polarizing-sheet removal unit comprises the defective sheet-ejecting unit includes a dummy film-drive mechanism having a dummy-film feed path for feeding a dummy film for laminating the defective polarizing sheet formed in the continuous web of optical film, thereto, and a moving mechanism adapted to move the continuous web toward the dummy-film feed path, wherein the defective sheet-ejecting unit is operable, when the defective polarizing sheet formed in the continuous web of optical film reaches a removal station, to move the continuous web by the moving mechanism in such a manner that the defective polarizing sheet is peeled form the continuous web by being brought into contact with the dummy film-in the dummy film feed path, so as to allow the defective polarizing sheet to be laminated to the dummy-film in the dummy film feed path.

[0047] In an embodiment the optional defective-polarizing-sheet removal unit comprises the defective sheet-ejecting unit includes a dummy film-drive mechanism having a dummy-film feed path for feeding a dummy film for laminating the defective polarizing sheet formed in the continuous web of optical film, thereto, and a movable roller providing a part of the dummy-film feed path, wherein the defective sheet-ejecting unit is operable, when the defective polarising sheet formed in the continuous web of optical film reaches a gap between the pair of lamination rollers which are in a spaced-apart position, to move the movable roller in such a manner that one of the lamination rollers is replaced with the movable roller, and the movable roller and the other lamination roller are interlockingly moved to allow the defective polarizing sheet to be peeled from the continuous web and laminated to the dummy film in the dummy film feed path.

[0048] Preferably the system further comprises a liquid-crystal panel magazine for preliminarily storing a plurality of liquid-crystal panels; a carry-out unit adapted to sequentially carry out the liquid-crystal panels (W) from the liquid-crystal magazine; and a liquid-crystal panel-conveying unit including a liquid-crystal panel orientation control mechanism adapted, when the normal polarizing sheets (Xα) formed on the continuous web of optical film (10) are fed to the lamination station, to control the orientation of each of the liquid-crystal panels (W) conveyed to the lamination station, in synchronization with feed of a respective one of the normal polarizing sheets.

[0049] In an embodiment the liquid-crystal orientation controlling unit further comprises; the liquid-crystal panel orientation control mechanism includes; an edge position-detecting device adapted to detect a position of a leading edge of the normal polarizing sheet extending in a crosswise direction with respect to a feed direction of the continuous web of optical film; a liquid-crystal panel edge position-detecting device adapted to detect a position of a leading edge of the liquid-crystal panel extending in a crosswise direction with respect to the feed direction of the liquid-crystal panel; and an orientation control device adapted to control the orientation of the liquid-crystal panel based on information about the respective positions of the leading edge of the normal polarizing sheet and the leading edge of the liquid-crystal panel calculated by the edge position-detecting device and the liquid-crystal panel edge position-detecting device.

BRIEF DESCRIPTION OF THE DRAWINGS

[0050]

FIG. 1 is a schematic diagram showing the structure of an optical film for use in manufacturing of a liquid-crystal display element according to the present invention.

FIG. 2 illustrates a typical example of a liquid-crystal display element for a widescreen television having a diagonal screen size of 42 inches.

FIG. 3 is a schematic diagram showing defective regions including defects existing in an optical film for use in a liquid-crystal display element, and normal regions having no defect according to the present invention.

FIG. 4 is a conceptual diagram of a comparative example showing a system for continuously manufacturing liquid-crystal display elements to which embodiments of the invention may be applicable wherein polarizing sheets are laminated on liquid-crystal panels through inspection of defects in the polarizing composite films, without interrupting the feed of the continuous web of the optical film being fed.

FIG. 5 is a conceptual diagram showing a continuous manufacturing system for liquid-crystal display elements according to one embodiment of the present invention, wherein the system comprises an optical-film feed apparatus for feeding a web of an optical film from a roll of the optical film laminate, and a liquid-crystal-panel conveyance apparatus for conveying a liquid-crystal panel to be laminated with a normal polarizing sheet cut by forming slit lines in the continuous web of optical film being fed.

FIG. 6 is a flow chart showing a manufacturing process or steps in continuous manufacturing system for liquid-crystal display elements in FIG. 5 according to the present invention.

FIG. 7 is a schematic diagram showing the relationship between a control unit for controlling device of the optical-film feed apparatus and the liquid-crystal-panel conveyance apparatus illustrated in FIG. 5, and encoded information read by a reading unit and processed by an information processing device in the continuous manufacturing system for liquid-crystal display elements, according to one embodiment of the present invention.

FIG. 8 is a schematic diagram showing a defective-polarizing-sheet removal unit comprising (1) a dummy-film drive mechanism disposed in a feed passage for an optical film or (2) a dummy-film drive mechanism adapted to be moved in and away from a gap between a pair of lamination rollers movable closer to and away from each other in the continuous manufacturing system for liquid-crystal display elements, according to one embodiment of the present invention.

FIG. 9 is a schematic diagram showing the operation of a slitting positon checkup unit, together with the inspection method for checking a difference between feed-length measurement data on an optical-film feed length measured based on a slit line formed in the continuous web of the optical film being fed, and the position for forming a slit-line read by a reading device in the continuous manufacturing system for liquid-crystal display elements, according to one embodiment of the present invention.

FIG. 10 is a schematic diagram showing the state when encoded information recorded on the continuous web of optical film is read by the reading unit, and a pre-alignment unit, a final-alignment unit, a lamination position-directed conveyance unit and a panel-edge detection unit in the liquid-crystal-panel conveyance apparatus are controlled based on the encoded information to allow a liquid-crystal panel to be conveyed in a controlled posture in the continuous manufacturing system for liquid-crystal display elements, according to one embodiment of the present invention.

FIG. 11 is a schematic diagram showing a lamination unit comprising a sheet-edge detection unit for detecting a leading edge of a normal polarizing sheet of a polarizing composite film formed from the continuous web of optical film, and straight-ahead-posture detection unit for detecting an alignment with a feed direction of the formed normal polarizing sheet of the polarizing composite film.

FIG. 12 is a schematic diagram showing a manufacturing method and system for a roll of an optical film laminate according to a first embodiment of the present invention.

FIG. 13 is a schematic diagram showing a manufacturing method and system for a roll of an optical film laminate according to a second embodiment of the present invention.

FIG. 14 is a schematic diagram showing a manufacturing method and system for a roll of an optical film laminate according to a third embodiment of the present invention.

FIG. 15 is a flowchart showing a manufacturing process or process steps in the manufacturing method and system for a roll of an optical film laminate illustrated in FIG. 12.

FIG. 16 is a flowchart showing a manufacturing process or process steps in the manufacturing method and system for a roll of an optical film laminate illustrated in FIG. 13.

FIG. 17 is a flowchart showing a manufacturing process or process steps in the manufacturing method and system for a roll of an optical film laminate illustrated in FIG. 14.

FIG. 18 is a schematic diagram showing a technique of calculating a position for forming a slit line in a continuous web of an optical film being fed to segment a region of a polarizing composite film into a defective region and a normal region, in the continuous manufacturing system for liquid-crystal display element, according to one embodiment of the present invention.

FIG. 19 is a flowchart showing a technique of calculating a position for forming a slit line in a continuous web of an optical film being fed.

FIG. 20 is a flowchart showing another technique of calculating a position for forming a slit line in a continuous web of an optical film being fed.

FIG. 21 is a flowchart showing yet another technique of calculating a position for forming a slit line in a continuous web of an optical film being fed.

FIG. 22 is a table showing an example of encoding and recording of positional information to an optical film, in the continuous manufacturing system for liquid-crystal display element, according to one embodiment of the present invention.

FIG. 23 is a diagram showing an example of encoding of a position for forming a slit line in an optical film, in a technique of identification information or defect-including information X_0 in FIG. 19, in the continuous manufacturing system for liquid-crystal display element, according to one embodiment of the present invention.

FIG. 24 is a diagram showing an example of encoding of a slit-position information indicative of the positon for forming a slit line in an optical film, in a technique of modifying a distance to a next-slit-line formation position to $(X' + X_0)$, wherein $X_0' > X_0$, in FIG. 20, in the continuous manufacturing system for liquid-crystal display element, according to one embodiment of the present invention.

FIG. 25 is a diagram showing an example of encoding of a slit-position information indicative of the position for forming a slit line in an optical film, in a technique of modifying a distance to a next-slit-line formation position to $[(X' + X_0) / m]$, wherein m = 2 or more, in FIG. 21, in the continuous manufacturing system for liquid-crystal display element, according to one embodiment of the present invention.

FIG. 26 is a schematic diagram showing a manufacturing system for a roll of an optical film laminate having two inspection units, according to a second embodiment of the present invention.

FIG. 27 is a schematic diagram showing a manufacturing system for a roll of an optical film laminate having four inspection units, according to a third embodiment of the present invention.

FIG. 28 is a table showing a defect inspection device, a type of defect and a defect detection method.

[BEST MODE FOR CARRYING OUT THE INVENTION]

[0051] The present invention will now be described with reference to specific embodiments illustrated in the accompanying drawings.

I. A CONTINUOUS MANUFACTURING SYSTEM AND METHOD FOR LIQUID-CRYSTAL DISPLAY ELEMENTS

(General Description of a Continuous Manufacturing System for Liquid-crystal Display Elements)

[0052] FIG. 5 is a schematic diagram showing a continuous manufacturing system for liquid-crystal display elements 1, which comprises an optical-film feed apparatus 100 having a roll of an optical film laminate for manufacturing liquid-crystal display elements according to the present invention, and a liquid-crystal-panel conveyance apparatus 300 for conveying liquid-crystal panels to be laminated with normal polarizing sheets formed from a continuous web of the optical film fed from the roll. The continuous manufacturing system 1 comprises at least a slitting station A for forming a plurality of polarizing sheets from the continuous web of the optical film, a removal station C for removing defective polarizing sheets and a lamination station B for laminating normal polarizing sheets to liquid-crystal panels, and the lamination station B and the removal station C may be positioned redundantly as described later. FIG. 6 is a flowchart showing a manufacturing process or process steps in the continuous manufacturing system for liquid-crystal display elements 1 illustrated in FIG. 5.

[0053] The optical-film feed apparatus 100 comprises a support rack 110 for rotatably mounting a roll of optical film laminate 10 according to one embodiment of the present invention, a reading unit 120 for reading encoded information, a film feed unit 130 including a feed roller, a speed adjustment unit 140 including a dancer roller for providing a constant speed film feeding, a slitting unit 150 provided at a slitting station A for forming a plurality of slits in the continuous web of the optical film in a direction transverse to the feed direction of the continuous web from the surface opposite to the carrier film to a depth reaching the adhesive layer surface of the carrier film to form slit lines, a slit-position check unit 160 provided also at the slitting station A for checking the formed slit lines, a film feed unit 170 including a feed roller, a speed adjustment unit 180 including a dancer roller for providing a constant speed film feeding, a defective-polarizing-sheet removal unit 190 provided at a removal station C for removing a slit defective polarizing sheet from the carrier film, a lamination unit 200 provided at a lamination station B including a pair of lamination rollers for applying a normal polarizing sheet which has been slit and peeled from the carrier film to a liquid-crystal panel, a carrier-film take-up mechanism 210 for taking up the carrier film, an edge detection unit 220 for detecting a leading edge of the normal polarizing sheet provided also at the lamination station B and an advance direction detection unit 230 for detecting an advance direction of the normal polarizing sheets having slit lines to be comprised in the continuous web of the optical film.

(Provisions of the Roll of the Optical Film Laminate 10)

[0054] It is preferable that the roll of the optical film laminate 10 according to this embodiment installed in the optical-film feed apparatus 100 has a width approximately equal to a length of a long or short side of a liquid-crystal panel to which it is applied. It is preferable that a transparent protective film is used for the protective film laminated on one or each of the opposite surfaces of the polarizer as shown in the schematic diagram of FIG. 1. The roll of the optical film laminate 10 comprises a roll of an optical film laminate comprising a continuous web of an optical film comprised of a polarizing composite film 11 including a polarizer having an adhesive layer 12 provided on the surface of the polarizer which has a transparent protective film laminated thereon and which is to be attached to a liquid-crystal panel, a surface-protection film 13 having an adhesive surface which is releasably laminated on the surface of the polarizing composite film 11 opposite to the surface having the adhesive layer 12, and a carrier film 14 releasably laminated on the adhesive layer 12 of the polarizing composite film 11. The carrier film 14 is a releasable film adapted to protect the adhesive layer 12 of the polarizing composite film 11 during the manufacturing process of liquid-crystal display elements and to be removed by being taken up when the polarizing sheet formed in the continuous web of optical film is peeled prior to or during lamination process for attaching the polarizing sheet to the liquid-crystal panel. In this embodiment, the term "carrier film" is used since the film has a function of carrying the normal polarizing sheets in the polarizing composite film 11 to the lamination station B.

[0055] The roll of the optical film laminate 10 is formed as follows. Details of the method for manufacturing the roll of the optical film laminate 10 will be described later. During the manufacturing process of the roll of the optical film laminate 10, defects existing in the polarizing composite film 11 of the optical film being continuously fed are first detected using an inspection unit. Then, based on the detected locations or coordinate positions of the defects in the polarizing composite film 11, defective regions and defect-free, normal regions are preliminarily defined in the polarizing composite film 11 as shown in FIG. 3. Then, information including slit-position information and optional identification information for identifying the defective regions and the normal regions is recorded on the optical film being continuously fed. The slit-position information is indicating the positions at which respective ones of the slit lines are to be formed in the continuous web of the optical film, and the slit lines are formed in pairs by slitting unit 150 at the slitting station A based on the defective and normal regions of the polarizing composite film 11, during the manufacturing process of the liquid-crystal display element, in a manner as to slit sequentially the continuous web of optical film being fed in a direction transverse to the feed direction of the continuous web to a depth reaching the adhesive layer surface of the carrier film. The information including the slit-position information and the optional identification information to be recorded on the continuous web of the optical film is encoded information created together with or in association with additional information, such as information relating to the manufacturing lot and the length of the web in the roll. Preferably, the encoded information is recorded on the carrier film 14 in the optical film to be continuously fed. It is to be understood that the encoded information may be recorded on the carrier film 14 in any of variety of modes, such as a mode in which encoded information including all necessary information is recorded on a single storage location, or a mode in which a plurality of encoded information each including different information are recorded on a plurality of storage locations at given intervals (e.g., at intervals of 1 m or 100 m). The encoded information may be recorded on the surface-protection film 13, instead of the carrier film 14. In either case, the encoded information is configured to be readable by the reading unit 120 of the continuous manufacturing system 1.

[0056] The slitting unit 150 provided at the slitting station A in the continuous manufacturing system 1 having the roll of the optical film laminate 10 mounted thereon is operated, during the manufacturing process of the liquid-crystal display element, by having the feed-length measurement data on an optical-film fed-out distance calculated when the optical film is unrolled from the roll of the optical film laminate 10 related with the slit-position information included in the encoded information and read by the reading unit 120 of the continuous manufacturing system 1. The region of the polarizing composite film defined by respective longitudunally adjacent two slit lines may include a defect-free normal region having a given length determined by the length of a side of a liquid-crystal panel to be laminated with the polarizing composite film, and a defective region having a length generally less than the given length. During the manufacturing process of the liquid-crystal display element, the defective region of the polarizing composite film 11 which is cut along pairs of slit lines by means of the slitting unit 150 is defined as a defective polarizing sheet X_{β} which is to be removed from the continuous web of optical film (specifically, the carrier film 14) by the defective-polarizing-sheet removal unit 190 of the continuous manufacturing system 1 at the removal station C. The normal region of the polarizing composite film 11 is cut in the same manner and defined as a normal polarizing sheet X_{α} which is to be peeled from the continuous web of the optical film (specifically, the carrier film 14) and laminated to one of opposite surfaces of a liquid-crystal panel by means of the lamination unit 200 of the continuous manufacturing system 1 at the lamination station B.

[0057] Referring to Figure 3, a specific formation of the slit lines into the polarizing composite film 11 based on the normal region and the defective region of the polarizing composite film is described as follows. The length (X_{α}) of the normal region preliminarily defined in accordance with the locations or the coordinate positions of defects in the polarizing composite film 11 is determined to a constant value in accordance with the length of one of the sides of the liquid-crystal panel which is to be laminated with the normal polarizing sheet. Similarly, with respect to the defective region which is also preliminarily defined, the upstream side slit line for defining the defective region is defined by the downstream side slit line defining the normal region which is located immediately upstream side of the defective region, as seen in the feed direction of the web. Thus, the length ($X_ß$) of the defective region is determined by the upstream side slit line and a downstream side slit line which is formed slightly downstream side of the location or coordinate position of a defect. Since the length between the upstream side slit line of the defective region and the location or coordinate position of defects of the polarizing composite film as seen in the feed direction may not be fixed, the length ($X_ß$) of the defective region varies accordingly. In accordance with one embodiment, the length ($X_ß$) of the defective region is determined through an information processing, when a processing is made for determining the slit-position information which designates the position at which the slit line is to be formed, so that it is always different from the length (X_α) of the normal region, e.g., to establish the relationship $X_ß < X_\alpha$, in any case. In accordance with another embodiment, it may be possible that identification information X_γ is produced to identify the defective region from the normal region, when the length ($X_ß$) of the defective region becomes equal to the length (X_α) of the normal region. In this case, the produced identification information X_γ is incorporated into the encoded information together with and in association with the slit-position information. It may be possible that the continuous manufacturing apparatus 1 is configured such that, during the manufacturing process of liquid-crystal display elements, at the slitting station, the slitting unit 150 functions to form the normal polarizing sheet X_α and the defective polarizing sheet $X_ß$ according to the slit-position information read by the reading unit 120, and the defective-polarizing-sheet removal unit 190 at the removal station functions to readily discriminate and remove only defective polarizing sheets having lengths ($X_ß$) different from the length (X_α) of the normal polarizing sheet. In case where the encoded information includes the identification information X_γ for identifying the defective region over the normal region, the defective-polarizing-sheet removal unit 190 functions, based on the identification information, to discriminate and remove only defective polarizing sheets. The specific manufacturing process of the roll of the optical film laminate 10 used in the continuous manufacturing system 1 will be described later.

[0058] The roll of the optical film laminate 10 is mounted on the support rack 110 of the continuous manufacturing system 1. Preferably, the support rack 110 is provided with an encoder (not shown) for determining the feed length of the optical film, the feed-length measurement data obtained by the encoder is stored in a storage device 420 of a control unit 400. Alternatively, a measurement device may additionally be provided in the optical-film feed apparatus 100 for calculating the feed length of the continuous web of the optical film.

[0059] In operation of the entire system, a roll of dummy film is first installed on the support rack 110. A continuous web of dummy film is unrolled from the roll of dummy film under tension by means of first and second film feed units 130, 170 each including feed rollers. The dummy film is advanced until its leading edge reaches a position where, under a normal operation, the carrier film 14 from which the normal polarizing sheet X_α is peeled, is passed through the lamination unit 200 provided at the lamination station B and taken up by the carrier-film take up drive mechanism 210. Then, the trailing end of the dummy film is connected to the leading end of the optical film unrolled from the roll of the optical film laminate 10, and a supply of the optical film is initiated. In order to allow the continuous web of the optical film to be maintained at a constant speed under tension even if the feed of the optical film is temporarily stopped at the slitting station A where the slit lines are formed in the polarizing composite film by the slitting unit 150 or at the lamination station B where the normal polarizing sheet is laminated on a liquid-crystal panel, there are provided first and second speed adjustment units 140, 180 each including the aforementioned dancer rollers immediately before these positions.

[0060] By the way, in the continuous manufacturing system, assuming that a single roll of the optical film laminate includes 1000 meters of length of the web of the laminate for example, and the production capacity of the continuous manufacturing system 1 amounts to the order of 5,000 to 20,000 meters a day, a single such continuous manufacturing system 1 will be operated by being sequentially connected with 5 to 20 rolls of the optical film laminate in a day. t can be said that the continuous manufacturing system for liquid-crystal display elements 1 using the roll of the optical film laminate 10 according to this embodiment to make liquid-crystal display elements, makes it possible to enhance product accuracy and double the manufacturing speed compared to the conventional manufacturing system using individualized sheets, on the condition that a plurality of liquid-ciystal panels W can be sequentially fed without any problem. In this case, the number of the rolls of the optical film laminate to be handled will increase significantly, which gives rise to a new technical need for automatic replacement of the roll of the optical film laminate.

(Reading and Information Processing of Encoded Information)

[0061] In this embodiment, slit lines are sequentially formed on the continuous web of the optical film leaving the carrier film 14 uncut by the slitting unit 150 at the slitting station A, the normal polarizing sheet X_α of the polarizing composite film 11 cut along the adjacent two of slit lines is then peeled from the carrier film 14 immediately before the lamination unit 200 at the lamination station B, and the peeled normal polarizing sheet X_α is laminated to a liquid-crystal panel through the exposed adhesive layer 12 to make a liquid-crystal display element. During this process, the carrier film 14 is taken up by the carrier-film take up drive mechanism 210. Generally, the surface-protection film 13 is made to be a sheet configuration which is held together with a normal polarizing sheet X_α of polarizing composite film 11 which is to be laminated to a liquid-crystal panel, and the sheet of the surface-protection film is peeled and removed after the final step including cleaning/drying is carried out on the liquid-crystal display element to be produced. Both of the carrier film and the surface-protection film are manufacturing-process materials required for carrying out the process, but are removed in the final stage of the manufacturing process and discarded. Thus, it is one of the features of the roll of the optical film laminate 10 in accordance with this embodiment to use such a manufacturing-process material as an information storing medium necessary for the manufacturing process. In the followings, description will solely be made with regard to an example wherein only the carrier film is utilized as a manufacturing-process material used for the information storing medium.

[0062] FIG. 7 is a schematic diagram showing a relation between the encoded information 20 to be read by the reading unit 120 of the continuous manufacturing system 1 and processed by an information processing device 410, and the previously described control unit 400 for controlling each of the units respectively provided in the optical-film feed apparatus 100 (see FIG. 5) and the liquid-crystal-panel conveyance apparatus 300 (see FIG. 5) for sequentially conveying the liquid-crystal panels. Just for reference, the encoded information 20 recorded in the roll of the optical film laminate 10 includes the slit-position information indicating the positions at which respective ones of the slit lines are formed in pairs in the continuous web of the optical film, and optionally the identification information for identifying the defective region over the normal region of the polarizing composite film. Defects existing in the polarizing composite film 11 included in the optical film are detected by the inspection unit in the manufacturing process of the continuous web of roll of the optical film laminate 10, as described later, and based on defective and normal regions in the polarizing composite film determined from the locations or the coordinate positions of the detected defects, at the slitting station of the continuous manufacturing system 1, the slitting unit 150 forms a plurality of slits in the continuous web of the optical film in a direction transverse to the feed direction of the optical film sequentially fed, from the surface opposite to the carrier film to a depth reaching the adhesive layer surface of the carrier film.

[0063] As shown in FIG. 7, the encoded information 20 is preferably recorded on the carrier film contained in the optical film. The recorded encoded information 20 is read by the reading unit including a code reader or a CCD camera, and the encoded information 20 read in this manner is transmitted to the information processing device 410 included in the control unit 400 of the continuous manufacturing system 1. As is clear from the control of each unit and the manufacturing process flow illustrated in FIGS. 5 and 6, and the schematic diagram of FIG. 7, the encoded information 20 read by the reading unit 120 is transmitted to the information processing device 410, and then the information processing device 410 functions to process the received encoded information 20. The control unit 400 is also operable, based on the encoded information 20 processed by the information processing device 410, to systematically control respective units included in the liquid-crystal-panel W conveyance apparatus 300, and the optical-film feed apparatus 100, such as the slitting unit 150 provided at the slitting station A, the defective-polarizing-sheet removal unit 190 provided at the removal station C and the lamination unit 200 provided at the lamination station B, in an inter-related manner.

[0064] The outline of the control of the entire system will be described below. Based on the slit-position information included in the processed encoded information, the control unit 400 functions to control the operation of the film feed unit 130 including the feed rollers to feed the optical film and then control the operation of the first speed adjustment unit 140 to temporarily stop the feed of the optical film. Then, the control unit 400 functions to control the operation of the slitting unit 150 at the slitting station A to form a plurality of slit lines in the continuous web of the optical film in a direction transverse to the feed direction of the continuous web of the optical film, from the surface opposite to the carrier film to a depth reaching to the adhesive layer surface of the carrier film.

[0065] The continuous web of the optical film having the slit lines formed thereon is transported to the slitting positon checkup unit 160 where the slit line positions on the web are confirmed. Then, the defective polarizing sheets X_β and the normal polarizing sheets X_α formed by the slit lines in the continuous web of the optical film are identified or discriminated from each other based on the difference in length, and only the defective polarizing sheets X_β are peeled and removed from the carrier film 14 using the defective-polarizing-sheet removal unit 190 at the removal station C inter-related with the film feed unit 170 including feed rollers and the speed adjusting unit 180. In the case where encoded information includes the identification information for identifying the defective region over the normal region, it is possible for the defective-polarizing-sheet removal unit 190 to peel and remove only the defective polarizing sheets X_β from the carrier film 14 based on the identification information. The continuous web of the optical film from which the defective polarizing sheets X_β are removed is then transported by the carrier-film take-up drive mechanism 210 to the lamination station B, in synchronization with the feed of the liquid-crystal panels being sequentially conveyed. The carrier film 14 is taken up at a position where the leading edge of the normal polarizing sheet X_α defined by the slit lines in the polarizing composite film reaches the leading edge of the conveyed liquid-crystal panel, where the normal polarizing sheet X_α is peeled and the lamination unit 200 including the pair of lamination rollers at the lamination station B starts laminating operation to attach the normal polarizing sheet X_α to a corresponding one of the liquid-crystal panels.

[0066] The manufacturing process of liquid-crystal display elements will now be described with respect to specific operations of the respective units operated by the control unit 400, including the laminating operation at the lamination station B to attach the normal polarizing sheet X_α to a corresponding one of the liquid-crystal panels.

(Removal of Defective Polarizing Sheet)

[0067] The defective-polarizing-sheet removal unit 190 is operated under the control of the control unit 400 to identify or discriminate only the defective polarizing sheet $X_ß$ having a length different from that of the normal polarizing sheet X_α, or only the defective polarizing sheet $X_ß$ associated with the identification information as a defective polarizing sheet, from the carrier film 14 on which the normal polarizing sheets X_α and the defective polarizing sheets $X_ß$ of the polarizing composite film 11 formed by the slit lines are laminated in a releasable manner in the continuous web of the optical film, and peel and remove only the defective polarizing sheet $X_ß$ from the carrier film 14. FIGS. 8 (1) and 8 (2) show such defective-polarizing-sheet removal units 190 adapted, under control of the control unit 400, to identify or discriminate only the defective polarizing sheets $X_ß$.

[0068] The defective-polarizing-sheet removal unit 190 illustrated in FIG. 8 (1) comprises a dummy-film drive mechanism 191 having a function of attaching to thereon and peeling the defective polarizing sheet from the carrier film 14, and a move mechanism 192 adapted to be activated when the defective polarizing sheet $X_ß$ reaches a position in a feed path where removal of the defective polarizing sheet is to be initiated, wherein the move mechanism 192 is adapted to move the feed path of the optical film so that the feed path of the optical film is moved toward and away from the dummy-film feed path of the dummy-film drive mechanism 191.

[0069] The defective-polarizing-sheet removal unit 190 illustrated in FIG. 8 (2) is configured, at the lamination station B, under control of the control unit 400, to be moved in an inter-related manner with the lamination unit 200 including the pair of lamination rollers, and comprises a dummy-film drive mechanism 191 having a function of attaching to thereon and peeling the defective polarizing sheet $X_ß$ from the carrier film 14, and a movable roller 192 defining a dummy-film feed path of the dummy-film drive mechanism 191. The removal unit illustrated in FIG. 8 (2) is different from the removal unit illustrated in FIG. 8 (1) in that, in the removal unit illustrated in FIG. 8 (2), at the lamination station B, the movable roller 192 defining the dummy-film feed path is disposed adjacent to the pair of lamination rollers of the lamination unit 200, and adapted to be moved in an inter-related manner with the lamination rollers of the lamination unit 200. More specifically, when the defective polarizing sheet $X_ß$ reaches the end position (i.e., the removal initiation position) of the feed path of the optical film at the lamination station B, the pair of lamination rollers are moved apart from each other, and the movable roller 192 defining the dummy-film feed path is moved to a nip between the lamination rollers located in spaced-apart relation, and moving the movable roller 192 and one of the lamination roller in an inter-related manner by replacing the movable roller 192 with the other of the lamination roller. In this instance, since the carrier film 14 is taken up by the carrier-film take up drive mechanism 210, the defective polarizing sheet $X_ß$ is peeled from the carrier film 14, and the peeled defective polarizing sheet $X_ß$ is attached to the dummy-film feed path by means of the movable roller 192 operated in an inter-related manner with another roller of the pair of the lamination roller and removed.

(Checkup of Slit Lines in the Continuous Web of the Optical Film)

[0070] In the manufacturing process of the continuous web of roll of the optical film laminate 10, there are preliminarily defined two regions comprising the defect-free normal region and the defective region having a defect or defects, based on the locations or coordinate positions of defects existing in the inspected polarizing composite film 11, and based on such regions, the continuous web of the optical film unrolled from the roll of the optical film laminate has the slit-position information which is in the form of a coded information 20, the slit-position information indicating the positions at which respective ones of the slit lines are to be formed in the carrier film contained in the optical film being fed during the manufacturing process of liquid-crystal display elements. The slit-position information is read by the reading unit 120 in the continuous manufacturing system 1 during the manufacturing process of liquid-crystal display elements. Then at the slitting station A, the slitting unit 150 functions, based on the read slit-position information, to form the slit lines sequentially in the continuous web of the optical film in the direction transverse to the feed direction. If the sequential slit lines are not accurately formed, it will become meaningless to control the operation of the slitting unit 150 in association with the feed-length measurement data obtained from the optical film fed-out distance measured during transportation of the optical film from the roll of the optical film laminate 10.

[0071] FIG. 9 is a schematic diagram showing the operation of the slitting positon checkup unit 160 including the manner of inspection for determining a difference between the position of a slit line actually formed in the continuous web of optical film in the direction transverse to its feed direction, and the slit line formation position at which the slit-line is to be formed as read by the reading unit 120 in connection with the feed-length measurement data of the optical film fed-out distance. Two slitting positon checkup units 160 are provided at the upstream and downstream sides as seen in the feed direction of the optical film with respect to the slitting unit 150. The film feed unit 170 including the feed rollers is disposed at the downstream side of the downstream slitting positon checkup unit 160, so that the downstream slitting positon checkup unit 160 functions to restart the feed of the continuous web of the optical film which is temporarily stopped when the slit lines are formed. The speed adjustment unit 140 including the dancer roller is disposed at the upstream side of the upstream slitting positon checkup unit 160, so that it is possible to maintain the feed of the continuous web of optical film by the film feed unit 130 including the feed rollers, even if the feed of the continuous web of optical film is temporarily stopped when the slit lines are formed.

[0072] Coincidence of the position of the slit line actually formed in the direction transverse to the feed direction of the continuous web of the optical film with the position obtained based on the feed-length measurement data about the optical-film feed length can be affirmed by determining the accurate positions in the traveling direction (X direction) and the transverse direction (Y direction) of the optical film. One preferable way is to carry out measurements, at two locations at the opposite sides of the position of the optical film where the slit line is to be formed, for the deviations in X and Y directions on the position of the actually formed slit-line and the edge of the optical film (the side end) with respect to respective reference lines. For example, the cut-position checkup unit 160 may be provided with a CCD camera to take images of the position of the actually formed slit-line and the position of the edge of the optical film, and produce picturized images. The reference lines are preliminarily provided in the image-taking regions. The position of the actually formed slit-line and the position of the edge of the optical film can be determined in terms of differences in contrasts in the taken images. Then, a calculation is made to determine the distance (deviation) between the predetermined reference lines and the positions of the actually formed slit-line and the edge of the optical film, and the location and the angular position of the slitting unit 150 is corrected forwardly or backwardly with respect to the feed direction of the continuous web of optical film, based on the calculated distance (deviation).

[0073] More specifically, as shown in FIG. 6, Steps 3, 4 and 7 are performed to feed the continuous web of the optical film under tension, and in Step 5, a slit line is formed in the continuous web of the optical film. Then, a further step is carried out by the two slitting positon checkup units 160 to determine whether there is any deviation between the position of the actually formed slit-line of the optical film and the position where the slit-line is to be formed, the latter position being determined based on the slit-position information read by the reading unit 120, and in case where there is any deviation, Steps 6 and 8 are carried out, for example, in the following manner.

[0074] The manner of the inspection for determining the deviation between the position of the actually formed slit-line of the continuous web of the optical film and the position where the slit-line is to be formed as read by the reading unit 120 is carried out for example in accordance with the following procedures. (1) Images of the position (X) of the actually formed slit line of the optical film and two positions (Y1, Y2) of the edge of the optical film are taken by the CCD camera of the slitting positon checkup unit 160, and the images are picturized for measurement of the position of the actually formed slit-line (X) of the optical film and the positions of the edges (Y1, Y2) of the optical film in terms of the differences in contracts. (2) There is a slit line reference position in the form of a line extending in Y direction at a position intermediate between a reference line extending in Y direction at an upstream position as seen in X direction in the imaging area of one of the slitting positon checkup units 160 and another reference line extending in Y direction at a downstream position as seen in X direction in the imaging area of the other of the slitting positon checkup units 160, and data γ representing the distance between the upstream and downstream reference lines is preliminarily stored in the storage device 420 via the information processing device 410. Furthermore, there are upstream and downstream reference lines extending in the X direction in respective ones of the image-taking regions of the slitting positon checkup units 160. (3) A correction value α for the position of the slit-line and a correction value δ for the angular position of the slit-line are calculated based on the reference lines and the measured positions of the slit-line (X) and the edge of the optical film. The correction value α for the position of the slit-line in the optical film correspond to the measured deviation α, or the deviation α between the actual slit-line position (X) and the downstream side reference line extending in the Y direction. The correction value δ for the angular position of the slit line can be calculated according to the following formula, based on the deviations in Y direction of the edge of the optical film at two positions, or the deviations ($\beta 1$, $\beta 2$) of the edge of the optical film with respect to respective ones of the upstream and downstream reference lines extending in the X direction, and the distance data γ between the two reference lines.

【Equation 1】

$$\delta = \cos^{-1}\left\{\frac{\gamma}{\sqrt{\gamma^2 + (\beta_1 - \beta_2)^2}}\right\}$$

(4) The storage device 420 is used to store correction values (α, δ) for applying an instruction to the slitting unit 150 to perform an angular position correction by a value δ and a positional correction by value α in the X direction based on the measured and calculated data so as to make the slit line conform to the reference slit-line position extending in the Y direction. (5) The slitting unit 150 receives instruction from the control unit 400 for the next operation of forming a slit line in the optical film to perform a positional correction in the feed direction and an angular position correction in a crosswise direction with respect to the feed direction, based on the stored correction values (α, δ). (6) Thereafter, the slitting unit 150 forms a next slit line in the continuous web of the optical film.

(Removal of Defective Polarizing Sheet $X_ß$ and Lamination of Normal Polarizing Sheet X_α on Liquid-crystal Panel W)

[0075] The first feature concerning the roll of the optical film laminate 10 according to this embodiment is that, in advance of laminating the normal polarizing sheet X_α cut from the polarizing composite film 11 contained in the continuous web of the optical film being supplied on the liquid-crystal panel W, only the defective polarizing sheet $X_ß$ cut from the polarizing composite film 11 can be taken away by the defective-polarizing-sheet removal unit 190, without interrupting the feed of the optical film. The second feature of this embodiment is that only the normal polarizing sheet X_α cut from the polarizing composite film 11 can be fed to the lamination unit 200 for lamination with respective ones of the liquid-crystal panel W at the lamination station B by the carrier-film take-up drive mechanism 210, while eliminating a need for interrupting the feed of the optical film, such feature having been inconceivable in the case of a individualized sheet or in the manufacture of individualized sheet. It is apparent that the uses of such roll of the optical film laminate 10 in the manufacturing process of the liquid-crystal display element leads to a significant increase in the speed and a significant improvement in accuracy of applying the normal polarizing sheet X_α to the liquid-crystal panel W.

(Transportation of Liquid-crystal Panel W and Lamination with Normal Polarizing Sheet X_α)

[0076] Before specifically describing in detail the lamination unit 200 including the pair of lamination rollers adapted to be vertically moved toward and away from each other for laminating the liquid-crystal panel W with the normal polarizing sheet X_α, which has been cut from the polarizing composite film 11, description will briefly be made on the transportation or conveyance apparatus 300 for the liquid-crystal panel W which is to be laminated with the normal polarizing sheet of the polarizing composite film 11 formed from the continuous web of the optical film which is also being supplied.

[0077] Taking a large size television having a diagonal screen dimension of 42 inches as an example, a rectangular-shaped liquid-crystal panel W has a size of about 540 to 560 mm in length and about 950 to 970 mm in width. During the manufacturing process of liquid-crystal display elements, the liquid-crystal panel W is slightly trimmed along its peripheries during a wiring stage including mounting operations of electronic components. Alternatively, the liquid-crystal panel W may be transported or conveyed with peripheries already trimmed. The liquid-crystal panels W are taken out one-by-one from a magazine containing a large number of liquid-crystal panels, by means of a liquid-crystal-panel supply apparatus, and as shown in FIG. 6 and FIG. 10, conveyed through cleaning/polishing stage to the lamination unit 200 at the lamination station B for lamination with respective ones of the normal polarizing sheet, by the conveyance apparatus 300, by being adjusted to equal intervals and a constant transportation speed, for example. The normal polarizing sheet X_α is formed from the continuous web of the optical film to have a size slightly less than that of the liquid-crystal panel W. As shown in FIG. 10, in synchronization with the transportation of the normal polarizing sheet X_α when the normal polarizing sheet X_α is transported to the lamination station B, in a final stage of the liquid-crystal panel W sequentially conveyed to the lamination station B for lamination of the normal polarizing sheet X_α on the liquid-crystal panel W, the conveyance apparatus 300 includes a liquid-crystal panel orientation controlling unit comprising a pre-alignment unit 310 and a final-alignment unit 320 for controlling the orientation of the liquid-crystal panel W, a conveyance unit 330 to transport the panel to the lamination position, and a panel-edge detection unit 340 for detecting the leading edge of the liquid-crystal panel W.

[0078] FIG. 10 is a schematic diagram showing the transportation of the liquid-crystal panels W in an aligned orientation, by means of the pre-alignment unit 310, the final-alignment unit 320, the conveyance unit 330 for conveying the panels to the lamination position, and the panel-edge detection unit 340 which are provided in the liquid-crystal-panel conveyance apparatus 300, based on the encoded information 20 which is read from the continuous web of the optical film by the reading unit 120 during the manufacturing process of liquid-crystal display elements. Further, FIG. 11 is a schematic diagram showing the lamination unit 200 for laminating the polarizing composite film sheet with the liquid-crystal panel W, comprising the sheet-edge detection unit 220 for detecting the leading edge of the normal polarizing sheet X_α formed from the continuous web of the optical film being fed, and the straight-ahead-posture detection unit 230 for detecting the alignment with the feed direction of the normal polarizing sheet X_α, and a peeling plate 211 for peeling the carrier film 14 by being bent at an acute angle from the normal polarizing sheet X_α.

[0079] Preferably, the normal polarizing sheet X_α is fed to the lamination unit 200 at the lamination station B at a constant speed by the carrier film 14. As shown in FIG. 10 or 11, at the lamination station B, only the carrier film 14 is peeled by being bent at an acute angle, via the peeling plate 211, by the carrier-film take-up drive mechanism 210. By having the carrier film 14 peeled by being bent at an acute angle, the adhesive layer on the normal polarizing sheet X_α may be gradually exposed. This makes it possible to slightly expose the leading edge of the normal polarizing sheet X_α to allow the leading edge of the liquid-crystal panel W to be easily aligned with the leading edge of the normal polarizing sheet X_α.

[0080] As shown in FIG. 10, the leading edge of the normal polarizing sheet X_α is moved to the nip defined between the pair of lamination rollers of the lamination unit 200 which are now in the vertically spaced apart relation to each other, and detected by the sheet-edge detection unit 220. Although the normal polarizing sheet X_α is fed in a state laminated on the carrier film 14, it is seldom that the normal polarizing sheet X_α is accurately fed so that the angle θ between the feed direction and the lengthwise direction of the carrier film 14 becomes zero. Therefore, deviations of the normal polarizing sheet X_α in the feed direction and the transverse direction are measured, for example, by taking images of the sheet using the CCD camera of the straight-ahead-posture detection unit 230 and subjecting the taken images to an image processing, whereby the measured deviations are calculated in terms of x, y and θ, and the calculated data is stored in the storage device 420 by the control unit 400.

[0081] Then, a plurality of liquid-crystal panels W are sequentially supplied from a transportation unit including a magazine containing a plurality of the liquid-crystal-panels illustrated in FIG. 5 at even intervals and a constant speed, furthermore, the liquid-crystal panels W are supplied one-by-one and subjected to the alignment control by the liquid-crystal-panel conveyance apparatus 300 illustrated in FIG. 10. This alignment control will now be described with reference to FIG. 10.

[0082] The liquid-crystal panels W are sequentially positioned by the pre-alignment unit 310, so that they are aligned in lengthwise and widthwise directions respectively with the transport direction and the direction perpendicular to the transport direction in the conveyance path. The positioned liquid-crystal panel W is conveyed to and placed on the final-alignment unit 320 which includes an alignment table adapted to be turned by a drive mechanism which is controlled by the control unit 400. The leading edge of the liquid-crystal panel W placed on the alignment table is detected by the panel-edge detection unit 340. The position of the detected leading edge of the liquid-crystal panel W is checked for match with the reference lamination position stored in the storage device, specifically, the calculation data in terms of x, y and θ to represent the orientation of the normal polarizing sheet X_α to be laminated to the liquid-crystal panel W. For example, the deviation between the leading edge of the liquid-crystal panel W and the reference lamination position is measured using an alignment mark of the liquid-crystal panel W illustrated in FIG. 2 to calculate the angular displacement θ, and the alignment table 321 having the liquid-crystal panel W placed thereon is turned by the angular displacement θ. Then, the alignment table 321 is connected to the conveyance unit 330 directed for the lamination station B. The liquid-crystal panel W is conveyed to the lamination position while keeping the same orientation, by the conveyance unit 330 directed for the lamination station B, and the leading edge of the liquid-crystal panel W is registered with and laid on the leading edge of the normal polarizing sheet X_α. In the final stage, the normal polarizing sheet X_α and the liquid-crystal panel W which are in aligned relation with each other are held between the pair of lamination rollers and conveyed thereby to obtain a finished liquid-crystal display element.

[0083] The normal polarizing sheet X_α is fed to the lamination unit 200 for lamination with the liquid-crystal panel W together with the carrier film 14 within the continuous web of the optical film advanced under tension, so that there is least possibility that the periphery of the normal polarizing sheet X_α is bent or sagged. Thus, the normal polarizing sheet X_α is less likely be flexed or bent. This makes it easy to have orientation of the liquid-crystal panel W aligned with the normal polarizing sheet X_α which is fed to the lamination station B, so that the manufacturing speed of the liquid-crystal display element can be increased and the product accuracy can be improved. Such method and system can never be applied to the manufacturing process utilizing individualized sheets wherein, after peeling a separator from each of the individualized sheets to expose the adhesive layer, and feeding under a vacuum suction each of the sheets to a lamination position, adjusting the position of the sheet with respect to the liquid-crystal panel W, the sheet is laminated to the liquid-crystal panel W to complete a liquid-crystal display element. Thus, this embodiment is a continuous manufacturing method and system for liquid-crystal display elements based on the features of providing and using a roll of a continuous web of an optical film 10 having a width corresponding to the width of a liquid-crystal panel having predefined dimensions and at least comprising a polirizing composite film 11 having an adhesive layer 12 provided thereon and a carrier film 14 releasably attached to the adhesive layer 12, the continuous web of optical film 10 having a plurality of defective-polarizing-sheet slitting positons and normal-polarizing-sheet slitting positons defined thereon as lines extending in the widthwise direction of the continuous web of the optical film, based on positions of one or more defects existing in the continuous web of the optical film detected through a preliminary inspection of a polarizing composite film 11, the defective-polarizing-sheet slitting positons defining regions having one or more defects and the normal-polarizing-sheet slitting positons defining regionshaving no defect, information for the slitting positions relating to the defective-polarizing-sheet slitting positons and normal-polarizing-sheet slitting positons being recorded as encoded information 20.

II. ROLL OF OPTICAL FILM LAMINATE, MANUFACTURING METHOD AND SYSTEM THEREFOR

[0084] Description will now be made on the roll of the optical film laminate, a manufacturing method and system therefor according to a preferred embodiment of the present invention taking reference to the drawings.

(Structure of Polarizing Composite Film)

[0085] As shown in FIG. 1, the sheet of the optical film to be laminated to the liquid-crystal panel is typically comprised of a flexible optical film including a polarizing composite film formed with an acrylic adhesive layer for lamination with a glass substrate of the liquid-crystal panel W. The polarizing composite film includes a polarizer (continuous polarizer layer) having a thickness of 20 to 30 μm comprising a substrate made of a PVA-based film which has been subjected to a dyeing treatment using iodine and a cross-linking treatment, and thereafter subjected to an orienting treatment by a lengthwise or widthwise stretching, and the polarizer is provided on one or each surface with a transparent protective film which is laminated thereon and comprises a substrate of TAC-based film having a thickness of about 40 to 80 μm for protecting the polarizer. Typically, an acrylic adhesive layer is formed on the surface of the polarizer for lamination with the liquid-crystal panel W

(Process using Conventional Individualized Sheets)

[0086] As already described, in an individualized sheet manufacturing process, individualized sheets are prepared by punching or cutting a continuous web of the optical film into pieces of rectangular shape, each being laminated with a separator through an adhesive layer. The individualized sheets each formed into a rectangular shape and laminated with the separator are preliminarily stored in a magazine in a liquid-crystal display element manufacturing line. Then, in a process of laminating the individualized sheets with respective ones of a plurality of liquid-crystal panels W, the individualized sheets stored in the magazine are conveyed under suction to a lamination position one-by-one. The separator releasably laminated to the adhesive layer formed on each of the individualized sheets is peeled to expose the adhesive layer, and the individualized sheet is laminated to a corresponding one of the liquid-crystal panels W through the exposed adhesive layer. During this process, since the individualized sheet is flexible, problems are experienced in that the periphery of the rectangular-shaped individualized sheet is bowed or warped. Thus, in a liquid-crystal display element manufacturing process using such individualized sheet, in order to quickly perform alignment and lamination with a liquid-crystal panel with a high degree of accuracy, there is no other choice but to use individualized sheets which may have less problem of bowing or warping. For the purpose, for example, protective films each having a thickness of 40 to 80 μm are laminated to both of the opposite surfaces of a polarizer, but not to one of the surfaces, to impart stiffness to the individualized sheet by increasing thickness.

(Method and System for Manufacturing Roll of Optical Film Laminate)

[0087] FIGS. 12 to 14 are schematic diagrams showing methods and systems for manufacturing rolls of the optical film laminate including a polarizing composite film, used for the present invention. FIGS. 15 to 17 are flowcharts showing respective manufacturing processes or manufacturing steps in the manufacturing methods and systems according the first to third embodiments.

[0088] In the first to third embodiments, the polarizing composite film 11 constituting the roll of the optical film laminate 10 may be made of a polarizer including a substrate of a PVA based material having at least one surface laminated with a protective film, preferably of a transparent material, with an adhesive layer 12 provided on the other surface. A carrier film 14 adopted as a manufacturing-process material is releasably attached to the adhesive layer 12. In the conventional manufacturing process of liquid-crystal display elements using individualized sheets, the polarizing composite film used therein has two protective films laminated thereon at the opposite surfaces to impart stiffness to the polarizing sheet. However, in a liquid-crystal display element manufacturing process using the roll of the optical film laminate in accordance with the first to third embodiments, the normal polarizing sheet X_α formed from the polarizing composite film 11 in the roll of the optical film laminate 10 is peeled from the carrier sheet 14 at the lamination position, and will gradually be separated from the web. It is to be understood as a matter of course that there is no need of peeling the separator on a piece-by-piece basis as in the manufacturing process using the individualized sheets.

[0089] When the normal polarizing sheet X_α is peeled from the carrier film 14, the leading edge of the normal polarizing sheet X_α is registered with the leading edge of a corresponding one of a plurality of liquid-crystal panels W being sequentially conveyed one-by-one toward the lamination position, and then, the normal polarizing sheet X_α and the corresponding liquid-crystal panel W are laminated together by being pressed against each other by the pair of lamination rollers of the lamination unit 200 at the lamination station B. In this process, there is no risk that the periphery of the normal polarizing sheet X_α is bowed or warped since the sheet gradually comes out. Thus, differently from the individualized sheet, in the polarizing composite film 11 included the optical film in the first to third embodiments, the protective film may be laminated to only one of the surfaces of the polarizer, and additionally it is possible to make the thickness of the protective film to be 40 μm or less.

[0090] Description will now be made on the manufacturing methods and systems of the roll of the optical-film laminate, according to the first to third embodiments, taking reference to FIGS. 12 and 15, FIGS. 13 and 16, and FIGS. 14 and 17, respectively.

(Method and System for Manufacturing Roll of Optical Film Laminate According to the First Embodiment)

[0091] FIG. 12 is a schematic diagram showing the system 500 for manufacturing the roll of the optical film laminate which comprises a polarizer manufacturing line 510 for producing a continuous polarizer layer (hereinafter referred to as "polarizer" as in the previous description), a protective film manufacturing line 520 for producing a protective film to be laminated on the polarizer, a polarizing composite film manufacturing line 530 for producing a laminate consisting of the polarizer and the protective film (the laminate will hereinafter be referred as "polarizing composite film 110" to distinguish it from the polarizing composite film 11 which does not have an adhesive layer), and an optical film manufacturing line 580 for laminating a carrier film and a surface-protection film, to the polarizing composite film to produce the optical film. FIG. 15 is flowchart showing the manufacturing process or steps in the system 500.

[0092] The polarizing composite film manufacturing line 530 includes an inspection sub-line for inspecting a defect existing in the polarizing composite film 110 by an inspection unit 560, a carrier film feed sub-line for laminating a carrier film 14 having a transferable adhesive layer 12 formed thereon, to one of the opposite surfaces of the polarizing composite film 110, an information recording sub-line for recording encoded information including slit-position information, on a surface of the carrier film 14, a surface-protection film feed sub-line for laminating a surface protection film 13 through an adhesive surface to the surface of the polarizing composite film 110 opposite to the surface on which the carrier film 14 is laminated, and a taking up sub-line for taking up the continuous web of the optical film having the encoded information recorded thereon to form a roll of the optical film. The carrier film feed sub-line has mounted thereon a roll of the carrier film 14 having a releasing film attached thereto, and the surface-protection-film feed sub-line has mounted thereon a roll of the surface protection film 13 having a releasing film attached thereto at its adhesive surface. The slit-position information is obtained by processing the information about a normal region (region having no defect) and a defective region (region having a defect or defects) which are preliminarily defined in the polarizing composite film 110 based on the location or coordinate position of the defect therein detected at the inspection sub-line, and used to, in forming a normal polarizing sheet and a defective polarizing sheet comprising an adhesive layer, designate at least positions at which slit lines are to be formed in the continuous web of the optical film being fed.

[0093] The polarizer manufacturing line 510 has a roll of PVA-based film which constitute the substrate of the polarizer and is mounted thereon in a rotatable manner, and includes a sub-line for subjecting the PVA-based film being unrolled from the roll by means of a lamination drive mechanism 540 or other drive mechanism (not shown), to processes of dyeing, cross-linking, stretching and then drying. The protective film manufacturing line 520 has rotatably mounted thereon a roll of a typically transparent TAC-based film constituting a substrate of the protective film, and includes a sub-line for subjecting the transparent TAC-based film being unrolled from the roll by means of the lamination drive mechanism 540 or other drive mechanism (not shown), to a saponifying treatment followed by drying. Each of the protective film manufacturing line 520 and the polarizing composite film 110 manufacturing line 530 includes a sub-line for applying an adhesive consisting primarily of a polyvinyl alcohol-based resin to an interface between the polarizer and the protective film, and drying the adhesive to bond them together through an adhesive layer having a thickness of only several μm.

[0094] The manufacturing line 530 for the polarizing composite film 110 comprises the lamination drive mechanism 540 including a pair of lamination rollers. The lamination drive mechanism 540 comprises a length or distance measurement device 550 having an encoder incorporated in one of the lamination rollers for calculating the length fed from the leading edge of the formed polarizing composite film 110. The lamination rollers are adapted to laminate the protective film to the polarizer by pressing them against each other, to form a polarizing composite film 110, and feed the polarizing composite film 110.

[0095] This manufacturing system 500 includes the inspection unit 560 for detecting defects in the surface and the inside of the polarizing composite film 110. It is required to provide the polarizing composite film 110 with the adhesive layer 12 only after the defects are detected, to complete the polarizing composite film 11. Therefore, the present manufacturing system 500 further comprises a carrier-film supply mechanism 570 having mounted thereon the roll of the carrier film 14 having the adhesive layer 12. The adhesive layer 12 on the carrier film 14 is formed in advance in the manufacturing process of the carrier film 14, by subjecting one of the opposite surfaces of the carrier film 14 which is to be releasably laminated to one of the opposite surfaces of the polarizing composite film 110 to be laminated to the liquid-crystal panel W to a releasing treatment, and then applying to that surface a solvent containing an adhesive drying the solvent. When the carrier film 14 fed from the carrier-film supply mechanism 570 is laminated on the polarizing composite film 110 in a releasable manner, the adhesive layer 12 preliminarily formed on the carrier film14 is transferred to the polarizing composite film 110 to provide the adhesive layer 12 on the polarizing composite film 11.

[0096] The present manufacturing system 500 further comprises an information recording unit 630 for recording encoded information, for example, on a surface of the carrier film 14. More specifically, the information recording unit 630 is operable to record, on a continuous web of optical film being fed during the liquid-crystal display element manufacturing process using the produced roll of the optical-film laminate, encoded information including the slit-position information indicative of the positions at which slit lines are to be formed in the continuous web of the optical film to form normal polarizing sheets and defective polarizing sheets having the adhesive layer. The manufacturing system 500 may further comprise a surface-protection-film supply mechanism 640 for laminating a surface-protection film 13 through an adhesive surface to the surface of the polarizing composite film 110 opposite to the surface on which the carrier film 14 is laminated. Finally, the manufacturing system 500 comprises an optical-film take up drive mechanism 580 for drivingly taking up the optical film which is constituted by the polarizing composite film 110 with the carrier film 14 having a transferable adhesive layer and the surface-protection film 13 laminated on the opposite surfaces of the polarizing composite film 110.

[0097] In case where protective films are laminated on the opposite surfaces of the polarizer, the present manufacturing system 500 will include two protective film manufacturing lines 520, 520' (the protective film manufacturing line 520' is omitted in the drawing). Further, the protective film manufacturing line 520 may additionally include a treatment sub-line for, before a protective film is laminated to the polarizer, subjecting the surface of the protective film to a hard coat treatment and/or an anti-dazzling or anti-glare treatment.

[0098] The inspection unit 560 comprises an image-reading device 590 including for example a CCD camera. The image-reading device 590 is electrically connected to an information processing device 610 included in a control unit 600, wherein image data read by the image-reading device 590 is processed in association with feed-length measurement data measured by the length or distance measurement device 550 electrically connected to the information processing device 610. The control unit 600 functions to operate the information processing device 610 and a storage device 620 to process the image data from the image-reading device 590 in association with the feed-length measurement data based on the delivered length measured by the length or distance measurement device 550 as a length from the leading edge of the polarizing composite film 110, so as to produce position data representing locations or coordinate positions of a defect or defects in the polarizing composite film 110, the position data being then stored in the storage device 620. The control unit 600 functions, based on the position data on the detected locations or coordinate positions of a defect or defects, to define defective regions and normal regions in the polarizing composite film 11.

[0099] The control unit 600 functions, based on the position data on the detected locations or coordinate positions of a defect or defects, to define defective regions and normal regions in the polarizing composite film 11. Further, the control unit 600 functions, based on the defective and normal regions of the polarizing composite film 11, to create slit-position information. The slit-position information is provided for indicating positions at which respective ones of the slit lines are to be formed in the continuous web of the optical film, furthermore, the slit lines are formed in pairs by the slitting unit 150 during the manufacturing process of the liquid-crystal display elements, in a manner as to slit the continuous web of the optical film being fed in a direction transverse to the feed direction of the continuous web, from the surface opposite to the carrier film to a depth reaching the adhesive layer surface of the carrier film. The produced slit-position information is also stored in the storage device 620. Then, the information processing device 610 functions, based on the stored slit-position information, to create encoded information, together with additional information, such as information on the manufacturing lot and a length in meters of the optical film in the roll, or in association with the additional information. As already mentioned, the encoded information is preferably recorded on the carrier film 14 included in the continuous web of the optical film, during the manufacturing process of liquid-crystal display elements using the roll of the optical film laminate. It is to be understood that the manner of recording the encoded information on the carrier film 14 can vary in various ways, such as the one in which encoded information is entirely recorded on a single storage location, and the one in which encoded information is recorded on a plurality of storage areas disposed at given intervals (e.g., at intervals of 1 m or 100 m). Alternatively, the encoded information may be recorded on the surface-protection film 13, if any, instead of the carrier film 14.

[0100] It is to be noted that the regions defined by respective pairs of slit lines may include defect-free normal regions having a give length determined by the length of a side of the liquid-crystal panel to be laminated with the polarizing composite film, or defective regions having a length usually less than the given length. During the manufacturing process of the liquid-crystal display element, it is necessary to allow the slitting unit 150 to cut defective regions and normal regions of the polarizing composite film 11 along corresponding ones of the pairs of slit lines based on the slit-position information included in the encoded information, so that the formed defective polarizing sheets X_{β} are removed from the carrier film 14 by the defective-polarizing-sheet removal unit 190, and the similarly foremed normal polarizing sheets X_{α} are peeled from the carrier film 14 to be laminated to one surface of the liquid-crystal panels W.

[0101] Therefore, the length (X_{α}) of the normal region is determined based on the position data relating to the location or coordinate position of the defect existing in the polarizing composite film 11 in accordance with the length of a side of the liquid-crystal panel to be laminated with the normal polarizing sheet, so that the length always has a constant value. Regarding the defective region which is defined in the same manner, however, the upstream one of the two slit lines for the normal region located just upstream of the defective region in a feed direction can be used as the downstream one of the two slit lines for the defective region, so that the length ($X_ß$) of the defective region is determined by the downstream slit line and an upstream one which is located slightly upstream of the location or coordinate position of the defect. Since the length between the downstream slit line and the location or coordinate position of a defect may not be the same, the length ($X_ß$) of the defective region varies. Preferably, a calculation algorithm for producing the slit-position information indicating the positions for forming the slit lines is configured such that the length ($X_ß$) of the defective region is different from the length (X_α) of the normal region, for example, to have a relation $X_ß < X_\alpha$, in any case, as described later. The procedure of creating the encoded information is common in the first to third embodiments, so that the procedure will be described later in connection with reference to FIGS. 18 and FIGS 19 to 21.

[0102] The carrier-film lamination mechanism 570 for laminating the carrier film 14 to the polarizing composite film 110 will now be described below. The carrier film 14 is preliminarily formed in the carrier film manufacturing line (not shown) using a PET (polyethylene terephthalate)-based film of about 20 to 40 μm in thickness as a substrate. A transferable adhesive layer having a thickness of about 10 to 30 μm can be formed on one of the opposite surfaces of the carrier film 14 by, after subjecting one of the opposite surfaces of the PET-based film to a releasing treatment, applying a solvent containing an acrylic adhesive to the treated surface, and drying the solvent. By having the carrier film 14 laminated in a releasable manner on the polarizing composite film 110, the adhesive layer is transferred to the polarizing composite film 110 to form the optical film which comprises the polarizing composite film 11 having the adhesive layer12. During the manufacturing process of liquid-crystal display elements using the roll of the optical film laminate 10 formed in the above described manner, the adhesive layer 12 is peeled together with the normal polarizing sheet from the carrier film 14 when the normal polarizing sheet is peeled from the carrier film 14 and attached to the liquid-crystal panel W. The carrier film 14 preliminarily produced in the carrier film manufacturing line is wound into a roll by a length corresponding to the wound length of the polarizing composite film 11.

[0103] In a process of producing a roll of a provisional optical film laminate in accordance with the second and third embodiments, a transferable adhesive layer may be formed on the provisional optical film in the same manner. In the second and third embodiments, when a provisional carrier film and/or a provisional surface-protection film are peeled, the adhesive layer formed on the provisional carrier film is transferred to the polarizing composite film 11, so that the adhesive layer 12 may be formed on one of the opposite surfaces of the polarizing composite film 11, in the same manner, as described later.

[0104] The roll of the carrier film 14 is mounted for rotation on a support rack 571, and the carrier film 14 unrolled from the roll is releasably laminated on the polarizing composite film 110 by the carrier-film lamination mechanism 570. A releasable-film take up drive mechanism 572 is provided to function, when the carrier film 14 is releasably laminated on the polarizing composite film 110, to take up a releasable film provided for protecting the adhesive layer formed on the carrier film 14 and to expose the adhesive layer.

[0105] Referring to the flowchart of FIG.15, in Step 1, the lamination drive mechanism 540 functions to laminate the protective film to one surface of the polarizer to thereby produce the polarizing film 110 which is then fed while being produced. In Step 2, defects existing in the polarizing composite film 110 thus produced and being fed are detected by the inspection unit 560. In Step 3, the roll of the carrier film 14 is rotatably mounted on the support rack 571. In Step 4, the releasable-film take up drive mechanism 572 and the optical-film take up drive mechanism 580 functions to unroll the carrier film 14 formed with the transferable adhesive layer from the roll with the adhesive layer in exposed state. In Step 5, the carrier film 14 is releasably laminated on the polarizing composite film 110 through the adhesive layer by the carrier-film lamination mechanism 570, to form the polarizing composite film 11 having the adhesive layer 12.

[0106] The information processing device 610 functions to define defective and normal regions in the polarizing composite film 11 based on the locations or coordinate positions of the defects detected in Step 2, and then, based on the defined defective and normal regions, creates slit-position information for forming defective polarizing sheets $X_ß$ and normal polarizing sheets X_α in the polarizing composite film 11. In Step 6, the created slit-position information is recorded on a surface of the carrier film 14 laminated on the polarizing composite film 11, by the information recording unit 630. Finally, in Step 7, an optical film formed through the above Steps is taken up by the optical-film take up drive mechanism 580, to form a roll of the optical film laminate.

[0107] Although the descriptions have been made herein with respect to a process wherein the step of forming the adhesive layer 12 on the polarizing composite film 11, simultaneously with the step of releasably laminating the carrier film 14 on the adhesive layer 12, it is to be understood that the adhesive layer 12 may be preliminarily formed on the polarizing composite film 11. Further, in advance of Step 7, the adhesive surface of the surface-protection film 13 may be additionally laminated on the surface of the polarizing composite film 11 opposite to the surface on which the carrier film 14 is laminated by means of the surface-protection-film lamination mechanism 640, irrespective of whether the protective film is subjected to the hard coating treatment or the anti-dazzling or anti-glare treatment, before the protective film is laminated to the polarizer. In this case, the resulting optical film has a structure having the carrier film 14 and the surface-protection film 13 laminated on respective ones of the opposite surfaces of the polarizing composite film 11.

(Method and System for Manufacturing Roll of Optical Film Laminate According to the Second Embodiment)

[0108] FIG. 13 is a schematic diagram showing the manufacturing system of the roll of the optical film laminate, wherein a roll of a provisional optical film laminate 10' is mounted on a support rack, the roll comprising a polarizing composite film 11 including a polarizer laminated with a protective film, and a provisional carrier film 14' releasably laminated on the polarizing composite film 11 through an adhesive layer, and wherein a continuous web of the provisional optical film is continuously unrolled and the provisional carrier film 14' is peeled from the continuous web of the provisional optical film to be subjected to an inspection for detecting defects existing in the polarizing composite film 11 with the adhesive layer12 in an exposed state, a carrier film 14 being thereafter laminated in a releasable manner on the adhesive layer 12 of the polarizing composite film 11, the slit-position information being recorded on a surface of the carrier film 14 in the same manner as in the first embodiment, to produce a roll of the optical film laminate 10. FIG. 16 is flowchart showing the manufacturing process or steps in the system.

[0109] It may be repeated that, in the process of producing the roll of a provisional optical film laminate 10', a transferable adhesive layer is preliminary formed on the provisional carrier film 14'. Thus, when the provisional carrier film 14' is peeled from the continuous web of the provisional optical film being continuously drawn from the roll, the adhesive layer12 formed on the provisional carrier film is transferred to the polarizing composite film so as to be incorporated into the polarizing composite film 11. In place of the provisional carrier film 14' formed with the transferable adhesive layer, an adhesive layer 12 may be preliminary formed on the polarizing composite film, and then a provisional carrier film 14" formed as a simple film subjected to a releasing treatment may be laminated to the adhesive layer 12. Further, a surface of the protective film to be laminated to the polarizer may be subjected to a hard coating treatment or an anti-dazzling or anti-glare treatment.

[0110] The manufacturing system 500 for a roll of the optical film laminate 10 according to the embodiment illustrated in FIG. 13 comprises the following elements in common with the manufacturing system according to the first embodiment illustrated in FIG. 12; the inspection unit 560 including the image-reading device 590 for detecting a defect or defects existing in the polarizing composite film 11 including an adhesive layer 12; the carrier-film lamination mechanism 570 including the support rack 571 having the roll of the carrier film 14 mounted thereon for rotation; the optical-film take up drive mechanism 580 for driving and taking up the produced optical film into a roll; the control unit 600 including the information processing device 610 for performing an information processing and the storage device 620 for storing therein processed information; and the information recording unit 630 for recording produced encoded information on the optical film (final optical film). The manufacturing system 500 further comprises a provisional-optical-film feed line 530 including a support rack 531 having a roll of the provisional optical film laminate 10' mounted thereon for rotation, and a film-feeding drive mechanism 540 including a pair of feeding drive rollers for continuously feeding the provisional optical film. The film-feeding drive mechanism 540 includes a length or distance measurement device 550 having an encoder incorporated in one of the feeding drive rollers to calculate a length fed from the leading edge of the provisional optical film. Additionally, the manufacturing system 500 comprises a provisional-carrier-film peeling unit 575 including a provisional-carrier-film rewinding drive mechanism 576.

[0111] Referring to the manufacturing process illustrated in Fig. 16, in Step 1, the roll of the provisional optical film laminate 10' is mounted in the support rack 531. The provisional optical film comprises a polarizing composite film 11 including a polarizer having a protective film laminated to one or each of opposite surfaces of the polarizer, and a provisional carrier film 14' formed with a transferable adhesive layer and laminated to the polarizing composite film 11. In Step 2, a continuous web of the provisional optical film is fed to the lamination line 530 by the film-feeding drive mechanism 540. In Steps 3 and 4, the provisional carrier film 14' is peeled and detached by the provisional-carrier-film take up drive mechanism 576 of the provisional-carrier-film peeling unit 575, and then, in Step 5, a defect or defects existing in the polarizing composite film 11 with the adhesive layer12 in an exposed state is detected by the inspection unit 560.

[0112] The inspection unit 560 comprises an image-reading device 590 including for example a CCD camera. The image-reading device 590 is electrically connected to the information processing device 610 included in the control unit 610, whereby in the image data read by the image-reading device 590 is processed in association with measurement data measured by the distance measurement device 550 electrically connected to the information processing device 610. The control unit 600 functions to operate the information processing device 610 and the storage device 620 to process the image data from the image-reading device 590 in association with the feed-length measurement data on the fed-out distance measured in terms of the length from the leading edge of the provisional optical film by the distance measurement device 550, so as to create position data representing the locations or coordinate positions of defects in the polarizing composite film 11 having the adhesive layer12 in exposed state, and then store the position data in the storage device 620. The control unit 600 is operable at first, based on the position data on the detected defect locations or coordinate positions, to define defective regions and normal regions in the polarizing composite film 11. Further, the control unit 600 functions, based on the defective and normal regions defined in the polarizing composite film 11, to create slit-position information. The slit-position information is information indicating the positions at which respective ones of the slit lines are to be formed in the continuous web of the optical film (final optical film), and the slit lines are formed in pairs by the slitting unit 150 during the manufacturing process of liquid-crystal display elements, in a manner as to slit the continuous web of the optical film being fed in a direction transverse to the feed direction of the continuous web, from the surface opposite to the carrier film to a depth reaching the adhesive layer surface of the carrier film. The slit-position information thus created is also stored in the storage device 620. Then, the information processing device 610 functions, based on the stored slit-position information, to create encoded information, together with additional information, such as the manufacturing lot and the length in meters of the web in the roll of the optical film, or in association with the additional information. The manner of creating the encoded information is common in the first to third embodiments so that it will be described later in connection with FIGS. 18 and FIGS. 19 to 21.

[0113] In Steps 6 and 7, the carrier film 14 subjected to only a releasing treatment is taken out by the carrier-film lamination mechanism 570 which also serves as a film-feeding drive mechanism. In Step 8, the taken out carrier film 14 is laminated to the exposed adhesive layer 12. The information processing device 610 defines defective regions and normal regions in the polarizing composite film 11, based on the locations or coordinate positions of the defects detected in Step 5, and then, based on the defined defective and normal regions, creates slit-position information for forming defective polarizing sheets X_β and normal polarizing sheets X_α in the polarizing composite film 11. In Step 9, the created slit-position information is recorded on a surface of the carrier film 14 laminated on the polarizing composite film 11, by the information recording unit 630. Finally in Step 10, the optical film formed through the above Steps is wound by the optical-film take up drive mechanism 580 into a roll of the optical film laminate. The second embodiment is different from the first embodiment in that the roll of the provisional optical film laminate 10' is preliminarily produced and prepared. Further, the second embodiment is different from the first embodiment in that when the provisional carrier film 14' having the transferable adhesive layer 12 provided thereon is peeled, the polarizing composite film 11 is formed, on the surface exposed by peeling, with the transferred adhesive layer 12, and the inspection of defects existing in the polarizing composite film 11 is conducted on the polarizing composite film having such exposed adhesive layer 12.

[0114] Although not illustrated in FIGS. 13 or 16, it may be possible, particularly in the process of manufacturing roll of the provisional optical film laminate, in advance of Step 10, to laminate a surface-protection film 13 having an adhesive surface on the surface of the polarizing composite film 11 opposite to the surface on which the carrier film 14 is laminated by means of a separately provided surface-protection-film lamination mechanism 640, before the protective film is laminated to the polarizer, irrespective of whether the protective film is subjected to a hard coat treatment or an anti-dazzling or anti-glare treatment on one surface. In this case, the resulting optical film has a structure having the carrier film 14 and the surface-protection film 13 laminated to respective ones of the opposite surfaces of the polarizing composite film 11.

(Method and System for Manufacturing Roll of Optical Film Laminate According to Third Embodiment)

[0115] FIG. 14 is a schematic diagram showing the optical-film manufacturing system for a roll of an optical film laminate 10, wherein a roll of a provisional optical film laminate 10" is mounted on a support rack, the provisional optical film laminate comprising a polarizing composite film 11 including a polarizer and a protective film laminated thereon, and a provisional carrier film 14' releasably laminated on the polarizing composite film 11 through an adhesive layer; and a provisional surface-protection film 13' laminated on the surface of the polarizing composite film 11 opposite to the surface on which the provisional carrier film 14' is laminated, and wherein the provisional carrier film 14' and the provisional surface-protection film 13' are continuously peeled from the continuous web of the provisional optical film being continuously unrolled from the roll to have the adhesive layer exposed and the optical film having the exposed adhesive layer is subjected to an inspection for the existence of defects in the polarizing composite film 11, a carrier film 14 being then releasably laminated on the adhesive layer 12 of the polarizing composite film 11, and a surface-protection film 13 being releasably laminated through the adhesive surface on the surface of the polarizing composite film opposite to the surface on which the carrier film 14 is not laminated, in a sequential manner; slit-position information being thereafter recorded on a surface of the carrier film 14 in the same manner as in the first and second embodiments. FIG. 17 is a flowchart showing the manufacturing process or steps in the system.

[0116] It is to be repeated that, in the process of producing the roll of the provisional optical film laminate 10", a transferable adhesive layer is preliminary provided on the provisional carrier film 14'. Thus, when the provisional carrier film 14' is peeled from the continuous web of the provisional optical film being continuously fed out from the roll, the adhesive layer12 formed on the provisional carrier film is transferred to the polarizing composite film

11 so as to be incorporated into the polarizing composite film 11. In place of the provisional carrier film 14' formed with the transferable adhesive layer, an adhesive layer 12 may be preliminary provided on the polarizing composite film, and then a provisional carrier film 14" may be laminated on the adhesive layer 12 after being subjected to a releasing treatment. Further, as the protective film to be attached to the polarizer, it may be possible to use a film which is subjected to a hard coat treatment or an anti-dazzling or anti-glare treatment at the surface to which the surface-protection film is attached. The provisional surface-protective film 13' and the surface-protective film 13 are formed with non-transferable adhesive surfaces at the sides which are to be laminated on the polarizing composite film 11. Typically, the surface-protection film 13 is formed as a sheet integral with the normal polarizing sheet to be laminated to a liquid-crystal panel, thus the surface-protection film sheet 13 having the adhesive surface is used as means to protect the surface of an associated liquid-crystal display element during the liquid-crystal display element manufacturing process, and, after completion of the manufacturing process, it is peeled and removed together with the adhesive surface.

[0117] The manufacturing system 500 for a roll of the optical film laminate 10 according to the third embodiment illustrated in FIG. 14 comprises the a provisional-optical-film feed line 530 including a support rack 531 having a roll of the provisional optical film laminate 10" rotatably mounted thereon as in the embodiment illustrated in FIG. 13, and the feed line 530 includes a film-feeding drive mechanism 540 including a pair of feeding drive rollers for continuously feeding the provisional optical film. The film feeding drive mechanism 540 comprises a length or distance measurement device 550 having an encoder incorporated in one of the feeding drive rollers to calculate the fed-out distance in terms of a length from the leading edge of the provisional optical film. The manufacturing system 500 further comprises a provisional-carrier-film peeling unit 575 including a provisional-carrier-film take up drive mechanism 576. The manufacturing system 500 also comprises the following elements as in the system according to the first embodiment illustrated in FIG. 12; an inspection unit 560 including an image-reading device 590 for inspecting existence of defects in the polarizing composite film 11; a carrier-film lamination mechanism 570 comprising a support rack 571 having a roll of the carrier film 14 rotatably mounted thereon; an optical-film take up drive mechanism 580 for drivingly winding the produced optical film into a roll; a control unit 600 including an information processing device 610 for performing information processing and a storage device 620 for storing therein processed information; and the information recording unit 630 for recording encoded information on the optical film. Additionally, the manufacturing system 500 comprises a provisional surface-protection-film peeling unit 645 including a provisional surface-protection-film take up drive mechanism 646 for taking up and peeling the provisional surface-protection film 13', and a surface-protection film lamination mechanism 640 for attaching the final surface-protection film 13 to the polarizing composite film at the surface opposite to the surface on which the final carrier film 14 is laminated, the mechanism 640 also serving as a film-feeding drive mechanism.

[0118] Referring to the respective ones of the manufacturing steps illustrated in FIG. 17, in Step 1, the roll of the provisional optical film laminate 10" is mounted on the support rack 531. The provisional optical film comprises a polarizing composite film 11 including a polarizer having a protective film laminated to one or each of the opposite surfaces of the polarizer, and a provisional carrier film 14' formed with a transferable adhesive layer and laminated on the polarizing composite film 11. In Step 2, a continuous web of the provisional optical film is fed by the film-feeding drive mechanism 540. In Steps 3 and 4, the provisional carrier film 14' is peeled and detached by the provisional-carrier-film take up drive mechanism 576 of the provisional-carrier-film peeling unit 575. Next, in Steps 5 and 6, the provisional surface-protection film 13' which is laminated through an adhesive surface on the polarizing composite film at the surface on which the provisional carrier film 14' is laminated, is peeled and detached by the provisional surface-protection-film take up drive mechanism 646 of the provisional surface-protection-film peeling unit 645. In Step 7, an inspection is conducted by the inspection unit 560 on the polarizing composite film 11 having the adhesive layer in an exposed state, for existence of defects therein..

[0119] The inspection unit 560 comprises an image-reading device 590 including for example a CCD camera. The image-reading device 590 is electrically connected to the information processing device 610 included in the control unit 610, wherein image data read by the image-reading device 590 is processed in association with feed-length measurement data measured by the length or distance measurement device 550 electrically connected to the information processing device 610. The control unit 600 is operable to cause the information processing device 610 and the storage device 620 to process the image data from the image-reading device 590 in association with the feed-length measurement data relating to the fed-out distance measured in terms of a length from the leading edge of the provisional optical film by the length or distance measurement device 550, so as to create position data representing locations or coordinate positions of defects in the polarizing composite film 11 which has the adhesive layer12 in the exposed state, and then store the position data in the storage device 620. Then, the control unit 600 functions, based on the position data relating to the detected locations or coordinate positions of defects, to define defective regions and normal regions in the polarizing composite film 11. Further, the control unit 600 functions, based on the defective and normal regions of the polarizing composite film 11 thus defined, to create slit-position information. The slit-position information is the one which indicates the positions at which respective ones of the slit lines are to be formed in the continuous web of the optical film, and the slit lines are formed in pairs by the slitting unit 150 during the manufacturing process of liquid-crystal display elements, in a manner as to slit the continuous web of the optical film being fed in a direction transverse to the feed direction of the continuous web, from the surface opposite to the carrier film to a depth reaching the adhesive layer surface of the carrier film. The created slit-position information is also stored in the storage device 620. Then, the information processing device 610 functions, based on the stored slit-position information, to create encoded information, together with additional information, such as the manufacturing lot and the length in meters of the optical film in the roll, or in association with the additional information. The manner of creating the encoded information is identical with those in the first to third embodiments, so that it will be described later in connection with FIGS. 18 and FIGS. 19 to 21.

[0120] In Steps 8 and 9, the carrier-film lamination mechanism 570 which also serves as a film-feeding drive mechanism feeds the carrier film 14 which has been subjected only to a releasing treatment. In Step 10, the delivered carrier film 14 is laminated on the exposed adhesive layer 12 in a releasable manner. Further, in Steps 11 and 12, the surface-protection film 13 having the adhesive surface is fed out by the surface-protection film lamination mechanism 640 which also serves as the film-feeding drive mechanism. In Step 13, the adhesive surface of the fed final surface-protection film 13 is laminated through the adhesive surface on the surface of the polarizing composite film opposite to the surface on which the carrier film 14 will not be laminated. This is the Step 13.

[0121] Then, the information processing device 610 functions to define defective regions and normal regions in the polarizing composite film 11, based on locations or coordinate positions of the defects detected in Step 7, and then, based on the defined defective and normal regions, creates slit-position information for forming defective polarizing sheets X_β and normal polarizing sheets X_α in the polarizing composite film 11. In Step 14, the created slit-position information is recorded on a surface of the carrier film 14 laminated on the polarizing composite film 11, by the information recording unit 630. Finally, in Step 15, the optical film formed through the above Steps is wound by the optical-film take up drive mechanism 580, to form a roll of the optical film laminate.

[0122] The third embodiment is different from the second embodiment, in that the roll of the provisional optical film laminate 10" is preliminarily prepared with a structure wherein not only the provisional carrier film 14' but also the provisional surface protection film 13' are laminated on the polarizing composite film 11. Therefore, in the third embodiment, the inspection of defects is carried out with respect to the polarizing composite film including the adhesive layer 12 exposed by sequentially peeling the provisional carrier film 14' and the provisional surface-protection film 13'.

[0123] In the first embodiment, the optical-film take up drive mechanism 580 is configured to operate in an inter-related manner with the operation of at least the lamination drive mechanism 540, the inspection unit 560 and the carrier-film lamination mechanism 570, to take up the optical film having the encoded information 20 recorded on a surface of the carrier film 14. In the second and third embodiments, the optical-film take up drive mechanism 580 is configured to operate in an inter-related manner with at least the film-feeding drive mechanism 540, the rewinding drive mechanism (576, 646), the carrier-film lamination mechanism 570 and the surface-protection film lamination mechanism 640, to take up the optical film having the encoded information 20 recorded on a surface of the carrier film 14. The manufacturing systems 500 may be provided with a speed adjustment mechanism (not shown) including a feed roller in order to adjust the take up speed of the optical film, when needed. Further, the encoded information may be recorded on the surface-protection film 13, instead of the carrier film 14.

(Creation of Encoded Information)

[0124] An embodiment of creating the encoded information 20 including information relating to the positions of the defects in the above embodiments is shown in the tables and schematic diagrams of FIGS. 22 to 25. It is to be understood that the encoded information 20 may be recorded in variety of ways including, for example a mode in which encoded information is entirely recorded on a single storage medium, and a mode in which encoded information is recorded on a plurality of storage media disposed at given intervals (e.g., at intervals of 1 m or 100 m). The selection of the recording modes or the content of position information to be stored as the encoded information may be determined depending on the function required for the liquid-crystal display element manufacturing method and system.

[0125] Thus, it should be noted that the embodiments illustrated in the schematic diagram and the flowcharts of FIGS. 18 and FIGS. 19 to 21 are shown only by way of examples.

[0126] The encoded information 20 comprises encoded information recorded on the continuous web unrolled from the roll of the optical film laminate 10 and is comprised of information for identifying the preliminarily defined defective and normal regions in the polarizing composite film 11 including an adhesive layer12, and slit-position information for forming defective polarizing sheets and normal polarizing sheets corresponding to the defective and normal regions, together with or in association with additional information, such as the manufacturing lot and the length in meters of the web in the roll. The encoded information 20 may be any type of code, as long as it is readable by the reading unit 120 of the liquid-crystal display element continuous manufacturing system 1 during the liquid-crystal display element manufacturing process.

[0127] FIG. 18 is a schematic diagram showing the manner of calculating the positions at which respective ones of the slit lines are to be formed for delimiting the defective and normal regions in the continuous web of the optical film which is being transported.

[0128] The control unit 600 functions to operate the information processing device 610 and the storage device 620 to process image data from the image-reading device 590 in association with feed-length measurement data relating to the length fed from the leading edge of the polarizing composite film 11 by the length or distance measurement device 550, so as to create position data representing the locations or coordinate positions of defects existing in the polarizing composite film, and then store the position data in the storage device 620. Then, the control unit 600 functions to define defective regions and normal regions in the polarizing composite film 11, based on the position data relating to the detected locations or coordinate positions of defects. Further, the control unit 600 functions to create slit-position information, based on the defective and normal regions of the polarizing composite film 11. The slit-position information is the one which indicates the positions at which respective ones of the slit lines are to be formed in the continuous web of the optical film, and the slit lines are formed in pairs by the slitting unit 150 during the manufacturing process of liquid-crystal display element, in a manner as to slit the continuous web of the optical film being fed in a direction transverse to the feed direction of the continuous web, from the surface opposite to the carrier film to a depth reaching the adhesive layer surface of the carrier film. The created slit-position information is also stored in the storage device 620. Then, the information processing device 610 operates to create encoded information based on the stored slit-position information, together with additional information, such as the manufacturing lot and the length in meters of the web in the roll of the optical film laminate, or in association with additional information. FIGS. 19 to 21 are flowcharts showing three different processes for calculating the positions at which the respective ones of the slit lines are to be formed in the continuous web of optical film being fed.

[0129] The calculation processes will be described below based on the schematic diagram and the flowcharts of FIGS. 19 to 21. The schematic diagram of FIG. 18 shows the polarizing composite film 110 consisting of a polarizer having a protective film laminated thereon, or the polarizing composite film 11 having an adhesive layer (both of the polarizing composite film 110 and the polarizing composite film 11 will hereinafter be referred collectively as "polarizing composite film 11") being continuously fed in right direction by the feed roller of the carrier-film lamination mechanism 570. However, in view of the fact that the optical film is formed by the carrier-film lamination mechanism 570 by laminating the carrier film 14 formed with a transferable adhesive layer thereon is releasably laminated on the polarizing composite film 110 consisting of the polarizer having the protective film laminated thereon, the polarizing composite film being continuously supplied by the feed roller will herein be referred generically as the "optical film". The flowcharts of FIGS. 19 to 21 show a specific steps up to the time when the encoded information 20 created by the control unit 600 is recorded on the optical film, preferably, on the surface of the carrier film 14, and the optical film having the encoded information recorded thereon is taken up by the optical-film take up drive mechanism 580.

[0130] In either case, in Step 1, the control unit 600 operates to instruct the lamination drive mechanism 540 and the optical-film take up drive mechanism 580 to feed the optical film. In Step 2, the control unit 600 instructs the inspection unit 560 including the image-reading device 590 to detect the locations or coordinate positions of defects existing in the optical film, and store the detected locations or coordinate positions of the defects together with the type and size of the detected defects. In Steps 3 and 4, the control unit 600 functions to determine the relationship between the length of a sheet of the optical film and the length (X_α) corresponding to that of a normal region. The method of determining the relationship is as follows.

[0131] In Step 3, the control unit 600 functions to operate the information processing device 610 to calculate the distance X between a reference position of the optical film being fed and the location of the defect, and store the calculated distance X in the storage device 620. As shown in FIG. 18, the distance X is a distance for example between the position of the carrier-film lamination mechanism 570 (the reference position of the optical film) and the position of the inspection unit 560 (or the image-reading device 590) (the defect position).

[0132] In Step 4, the control unit 600 further functions to operate the information processing device 610 to subtract the length (X_α) corresponding to that of the normal region from the distance X to obtain a distance ($X - X_\alpha$) =X', and then store the distance X' in the storage device 620. The length (X_α) corresponding to that of the normal region of the optical film is determined by a system manager based on the size of the liquid-crystal panel and prestored in the storage device 620. Then, the control unit 600 functions to operate the information processing device 610 to determine whether the calculated distance X' is greater or less than the length (X_α) corresponding to that of the normal region of the optical film.

[0133] Specifically, if the relation X' (or X") in FIG. 18 > X_α is established, it is understood that the normal region (X_α) of the optical film can be ensured, so that the control unit 600 instructs the lamination drive mechanism 540 and the optical-film take up drive mechanism 580 to have the optical film delivered under tension by the length (X_α) of the normal region. The value of the length (X_α) in this instance is the slit-position information for forming a normal polarizing sheet X_α corresponding to the normal region in the optical film.

[0134] To the contrary, if the relation is $X' \leq X_\alpha$, i.e., X''' in FIG. 18 $\leq X_\alpha$, it is understood that the normal region (X_α) of the optical film cannot be ensured. In this instance, the region of the optical film having the length ($X_ß$) provides the defective polarizing sheet ($X_ß$), so that the control unit 600 functions to operate the information processing device 610 to calculate the length ($X'+X_0$)= $X_ß$ corresponding to the defective region ($X_ß$) by adding a constant value X_0 to X' (X''' in FIG. 18), and to instruct the lamination drive mechanism 540 and the optical-film winding drive mechanism 580 to feed the optical film under tension by the length ($X_ß$) of the defective region. The value ($X_ß$) in this instance is the slit-position information for forming a defective polarizing sheet $X_ß$ corresponding to the defective region of the optical film.

[0135] Specifically, the control unit 600 operates to calculate the following (a) and (b) to create slit-position information indicative of the positions at which respective ones of the slit lines are to be formed in a continuous web of the optical film to be fed during the manufacturing process of liquid-crystal display elements to form normal polarizing sheets X_α and defective polarizing sheets X_β of a polarizing composite film, and then store the slit-position information in the storage device 620:

(a) a distance (X_α) to the position for forming a next slit line, if $X' > X_\alpha$; and
(b) a distance ($X' + X_0 = X_\beta$) to the position for forming a next slit line, if $X' \leq X_\alpha$.

[0136] By the way, if the length ($X' + X_0 = X_\beta$) corresponding to that of the defective region becomes equal to the length (X_α) corresponding to that of the normal region, i.e., if ($X' + X_0$) = (X_α), the control unit 600 cannot identify or discriminate the normal region (X_α) over the defective region (X_β). This means that the region to be recognized as the defective region (X_β) may not be recognized as the defective region (X_β), so that, for example, the normal region (X_α) and the defective region (X_β) cannot be discriminated from each other based on feed-length measurement data on the feed length of the optical film, and the encoded information created based on the feed-length measurement data ($X' + X_0$) inevitably becomes imperfect. It is assumed that such a situation occurs when the location or coordinate position of a defect in the optical film is infinitely close to the position for forming a next slit line in the optical film, or when a series of defects are distributed over a length (X_α) corresponding to that of the normal region.

[0137] In Step 5, if ($X' + X_0$) becomes equal to (X_α), the control unit 600 functions to operate the information processing device 610 to perform a calculation based on at least one of the following methods to create information for identifying or discriminating the normal region (X_α) over the defective region (X_β).

[0138] In Step 5 illustrated in FIG. 19, even if, as the result of calculation conducted by the information processing device 610, the distance ($X' + X_0$) to the position for forming a next slit line becomes equal to the length (X_α) corresponding to that of the normal region, the region in said distance is not essentially the normal region (X_α). In order to make it possible to recognize such difference, for example, as defect-including information X_γ illustrated in FIG. 23, a numerical suffix "0" may be associated with the slit-position information indicating the position for forming a slit-line corresponding to the normal region, and a numerical suffix "1" with the slit-position information indicating the position for forming α-slit-line corresponding to the defective region. In Step 5 illustrated in FIG. 20, if, as a result of calculation of the information processing device 610, the distance ($X' + X_0$) to the position where a next-slit-line is to be formed becomes equal to the length (X_0) corresponding to that of the normal region, an information processing is conducted so that the distance to the position where a next-slit-line is to be formed satisfies the relation ($X' + X_0'$), wherein $X_0' > X_0$, and store the distance ($X' + X_0'$) in the storage device 620. As shown in FIG. 24, this information processing makes it possible by calculating the distance ($X' + X_0'$) different from X_α, to allow the region having the length ($X' + X_0'$) to be identified or discriminated over the normal region (X_α). Further, in Step 5 illustrated in FIG. 21, if, as the result of calculation conducted by the information processing device 610, the distance ($X' + X_0$) to the position where a next-slit-line is to be formed becomes equal to the length (X_α) corresponding to that of the normal region, an information processing is carried out to allow the distance to the position where the next-slit-line is to be formed to become [($X' + X_0$) / m], wherein m = 2 or more, preferably 2 or 3, and store the distance [($X' + X_0$) / m] in the storage device 620. As in the case of FIG. 20, this information processing illustrated in FIGS 25 is also configured to calculate the [($X' + X_0$) / m] different from X_α to allow the region having the length [($X' + X_0$) / m] to be identified or discriminated over the normal region (X_α).

[0139] Summarizing the above, in the process for creating information for identifying or discriminating the defective and normal regions, either of the following methods may be adopted:

(1) A method of creating defect-including information X_γ as information for identifying or discriminating a region having a length ($X' + X_0$) calculated by the information processing device 610 over the normal region (X_α);
(2) A method of creating a distance to the position where a next-slit-line is to be formed which is calculated by the information processing device 610, as a distance ($X' + X_0'$) (wherein $X_0' > X_0$) which is different from X_α; and
(3) A method of creating a distance to the position where a next-slit-line is to be formed which is calculated by the information processing device 610, as a distance [($X' + X_0$) / m] (wherein m = 2 or more) which is different from X_α. Particularly, in cases

where the method (2) or (3) is employed, $(X' + X_0) = (X_\alpha)$ is changed to $(X' + X_0') \neq X_\alpha$ or $[(X' + X_0) / m] \neq X_\alpha$ through the information processing illustrated in FIG. 20 or 21, thus the position where a next-slit-line is to be formed can be used as information indicating the defective region identified or discriminated over the normal region.

[0140] Next, in either case, in Step 6, the control unit 600 functions to operate the information processing device 610 to determine the length between the reference position and the position where a next-slit-line is to be formed, based on the calculation result in Steps 4 and 5. In the methods (2) or (3), in Step 7, the control unit 600 operates to cause the information processing device 610 to store the length to the position where a next-slit-line is to be formed as determined in Step 6, in the storage device 620. However, in case of the method (1), the control unit 600 functions to operate the information processing device 610 to store the length to the position of forming a next-slit-line in association with the defect-including information X_γ, in the storage device 620.

[0141] In either case, in Step 8, the control unit 600 functions to operate the information processing device 610 to convert, based on the position for forming a next-slit-line stored in Step 7, into encoded information, the slit-position information indicating the position where a slit-line is to be formed with respect to the leading edge of the optical film being fed, together with or in association with additional information, such as the manufacturing lot and the length in meters of the optical-film in the roll. In the method (1), it is to be understood that the defect-including information X_γ is simultaneously converted to the encoded information.

[0142] In Step 9, the control unit 600 functions to operate the information recording unit 630 to record the encoded information converted in Step 8 by the information processing device 610, on the optical film, preferably on the surface of the carrier film. In the method (1), it should be understood that the encoded defect-including information X_γ is also recorded together with the encoded information. Finally, in Step 10, the control unit 600 functions to operate the lamination drive mechanism 540 and the optical-film take up drive mechanism 580 to wind the finished optical film. The roll of the optical film laminate is thus completed. Then, examples of the encoded information are shown in FIGS. 22 to 25.

(Details of the Manufacturing System for a Roll of Optical Film Laminate Specifically showing Defect Inspection Process)

[0143] With reference to FIGS. 26 and 27, the manufacturing system for a roll of the optical film laminate will be more specifically described in connection with a specific method of inspecting defects existing in the polarizing composite film 11. FIG. 26 is a schematic diagram showing a manufacturing system of a roll of the optical film laminate 700 having two inspection units, which is based on the manufacturing system according to the second embodiment.

[0144] In the manufacturing process of the provisional optical film 10', a polarizing composite film 110 is formed with a structure comprising a polarizer having a protective film laminated on at least one of the opposite surfaces of the polarizer, and an adhesive layer 12 is formed on the other surface of the polarizing composite film 110 to form a polarizing composite film 11. Then, a provisional carrier film 14' is releasably laminated on the adhesive layer 12 of the polarizing composite film 11, and the resulting provisional optical film is wound into a roll to form the roll of the provisional optical film laminate 10'. The roll of the provisional optical film laminate 10' is rotatably mounted on a support rack 711 of a provisional-optical-film feed unit 710. In addition to the provisional-optical-film feed unit 710, the system 700 comprises a provisional-carrier-film take up drive mechanism 720, a first inspection unit 730, a second inspection unit 731, a control unit 740, a carrier-film feed unit 750, a carrier-film lamination mechanism 760, an optical-film take up drive mechanism 770, and an information recording unit 780.

[0145] The provisional optical film is continuously delivered from the roll of the provisional optical film laminate 10' by the provisional-optical-film feed unit 710. The provisional-carrier-film take up drive mechanism 720 is disposed along the feed direction of the provisional optical film, and adapted to take up the provisional carrier film 14' by peeling and detaching it from the provisional optical film. Each of the first and second inspection units 730, 731 is adapted to detect one or more defects in the surface and the interior of the polarizing composite film 11 with the adhesive layer12 exposed as a result of the peeling the provisional carrier film 14'. The first inspection unit 730 is comprised of a transmission inspection device illustrated in FIG. 26. The transmission inspection method is designed such that a visible light emitted from a light source is projected perpendicularly to the polarizing composite film 11, the light which has passed through the polarizing composite film 11 being received by an optical detection unit to detect one or more defects existing in the polarizing composite film 11 in the form of a shade. The second inspection unit 731 is comprised of a cross-Nicol transmission inspection device illustrated in FIG. 26. The cross-Nicol transmission inspection method is designed such that a visible light from a light source is introduced perpendicularly or obliquely into the polarizing film 11 associated with a polarization filter which is disposed immediately before an optical detection unit in such a manner that the absorption axis of the polarization filter is oriented at a right angle with respect to the absorption axis of the polarizing composite film11, the light which has passed through the polarizing composite film 11 being received by the optical detection unit to detect one or more defects existing in the polarizing composite film11 as a bright spot.

[0146] The control unit 740 functions to define defective regions and normal regions in the polarizing composite film 11, based on locations or coordinate positions of one or more defects detected by the first inspection unit 730 and the second inspection unit. Then, the control unit 740 functions to operate an information processing device 741 to create slit-position information for forming defective polarizing sheets X_{β} and normal polarizing sheets X_{α} in the polarizer film, based on the defined defective and normal regions, and convert the slit-position information into encoded information 20. The information recording unit 780 is adapted to record the encoded information on a surface of the carrier film 14 newly laminated on the polarizing composite film 11.

[0147] The carrier-film feed unit 750 disposed downstream the second inspection unit 731 is adapted to continuously unroll the carrier film 14 from a roll of the carrier film14 rotatably mounted in the support rack 751, along the feed direction of the polarizer film 11. The carrier-film lamination mechanism 760 is provided with a pair of rollers, and adapted to releasably laminate the carrier film 14 on the exposed adhesive layer 12 after completion of the inspection by the inspection units. It may be repeated that, the encoded information is recorded on the surface of the carrier film 14 newly laminated on the adhesive layer, by the information recording unit 780. The created optical film is wound by the optical-film take up drive mechanism 770, and formed into a roll of the optical film laminate 10. The control unit 740 functions to control respective operations of the units, the mechanisms and the devices in an inter-related manner.

[0148] FIG. 27 is a schematic diagram showing a manufacturing system of the roll of the optical film laminate 800 having four inspection units, which is based on the manufacturing system according to the third embodiment.

[0149] In the manufacturing process of the provisional optical film 10", a polarizing composite film 110 is produced as comprising a polarizer having a protective film laminated on at least one of the opposite surfaces of the polarizer, and an adhesive layer 12 is formed on the other surface of the polarizing composite film 110 to form a polarizing composite film 11. Then, a provisional carrier film 14' is releasably laminated on the adhesive layer 12 of the polarizing composite film 11, and a provisional surface-protection film 13' is releasably laminated on the surface of the polarizing composite film 11 opposite to the surface on which the provisional surface-protection film 14' is laminated, the resulting provisional optical film is wound into a roll of the provisional optical film laminate 10" The roll of provisional optical film laminate 10" is rotatably mounted in a support rack 811 of a provisional-optical-film feed unit 810.

[0150] In addition to the provisional-optical-film feed unit 810,the system 800 comprises a provisional-carrier-film take up drive mechanism 820, a provisional-surface-protection-film take up drive mechanism 830, a first inspection unit 840, a second inspection unit 850, a third inspection unit 851, a fourth inspection unit 852, a control unit 860, a provisional-surface-protection-film feed unit 870, a carrier-film feed unit 880, two sets of lamination mechanisms 890 (a carrier-film lamination mechanism 891, a surface-protection-film lamination mechanism 892), an optical-film take up drive mechanism 910, and an information recording unit 920.

[0151] The provisional optical film 10' is continuously unrolled from the roll of the provisional optical film laminate 10" by the provisional-optical-film feed unit 810. The provisional-surface-protection-film take up drive mechanism 830 is disposed along the feed direction of the provisional optical film, and adapted to take up the provisional surface-protection film 13' by peeling and detaching it from the provisional optical film. The provisional-carrier-film take up drive mechanism 820 is disposed downstream the provisional-surface-protection-film take up drive mechanism 830 and along the feed direction of the provisional optical film, and adapted to take up the provisional carrier film 14' by peeling and detaching it from the provisional optical film.

[0152] As shown in FIG. 27, the inspection units are disposed at respective four positions in the system 800. The first inspection unit 840 is located between the provisional- surface-protection-film take up drive mechanism 830 and the provisional-carrier-film take up drive mechanism 820, and adapted to inspect the provisional optical film in a state where only the provisional surface-protection film 13' is peeled and the provisional carrier film 14' is still on the web. Specifically, the inspection is made to detect one or more defects in the surface of the polarizing composite film 11, based on the reflected light from the protective film of the exposed polarizing composite film 11. The second inspection unit 850, the third inspection unit 851 and the fourth inspection unit 852 are located between the provisional-carrier-film take up drive mechanism 820 and the carrier-film feed unit 880, so that they inspect one or more defects on the surface and the interior of the polarizing composite film by having light transmit through the polarizing composite film 11 having the adhesive layer 12 in exposed state as a result of the peeling the provisional carrier film 13' by the provisional-carrier- film take up drive mechanism 820.

[0153] More specifically, each of the second to fourth inspection units is configured as follows. The second inspection unit 850 is designed for the transmission inspection illustrated in FIG. 27. The transmission inspection method is designed such that a visible light from a light source is projected perpendicularly to the polarizing composite film 11, the light which has passed through the polarizing composite film 11 being received by an optical detection unit to detect one or more defects existing in the polarizing composite film 11 in the form of a shade. The third inspection unit 851 is designed for the oblique transmission inspection illustrated in FIG. 27. The oblique transmission inspection method is designed such that a visible light emitted from an oblique-transmission light source is projected to the polarizing composite film 11 in an oblique angle, the light which has passed through the polarizing composite film being received by an optical detection unit to detect one or more defects existing in the optical film as a shade. The fourth inspection unit 852 is comprised of a cross-Nicol transmission inspection device illustrated in FIG. 27. The cross-Nicol transmission inspection method is designed such that a visible light from a light source is introduced perpendicularly or obliquely into the polarizing film 11 associated with a polarization filter which is disposed immediately before an optical detection unit in such a manner that the absorption axis of the polarization filter is oriented at a right angle with respect to the absorption axis of the polarizing composite film 11, the light which has passed through the polarizing composite film 11 being received by the optical detection unit to detect one or more defects existing in the polarizing composite film11 as a bright spot.

[0154] The control unit 860 functions to define in the polarizing composite film 11 defective regions and normal regions, based on locations or coordinate positions of one or more defects detected by the first inspection unit 840, the second inspection unit 850, the third inspection unit 851 and the fourth inspection unit 852. Then, the control unit 860 functions to operate an information processing device 861 to create slit-position information for forming defective polarizing sheets X_β and normal polarizing sheets X_α in the polarizer composite film, based on the defined defective and normal regions, and convert the slit-position information into encoded information 20. The information recording unit 920 is adapted to record the encoded information on a surface of the carrier film 14 newly laminated to the polarizing composite film 11.

[0155] The carrier-film feed unit 880 disposed downstream the fourth inspection unit 852 is adapted to continuously unroll the carrier film 14 from the roll of the carrier film laminate 14 rotatably mounted in a support rack 881, along the feed direction of the polarizer film 11. The surface-protection-film feed unit 870 disposed downstream the carrier-film feed unit 880 is adapted to continuously unroll the surface-protection film 13 from a roll of the surface-protection film 13 rotatably mounted in a support rack 871, along the feed direction of the polarizer film 11. The lamination mechanisms 890, or the carrier-film lamination mechanism 891 and the surface-protection-film lamination mechanism 892 each having a pair of rollers function to releasably laminate the carrier film 14 and the surface-protection film 13 respectively on the exposed adhesive layer 12 and the surface of the polarizing composite film which does not have an adhesive layer, after completion of the inspection by the inspection units disposed at the four positions. It may be repeated that, the encoded information is recorded on the surface of the carrier film 14 newly laminated on the adhesive layer, by the information recording unit 920. The created optical film is wound by the optical-film take up drive mechanism 910, and formed into a roll of the optical film laminate 10. The control unit 860 is operable to control respective operations of the units, the mechanisms and devices in an inter-related manner.

[0156] Although the present invention has been described in connection with preferred embodiments thereof, it will he appreciated that various changes and modifications will he made by those skilled in the art without departing from the scope of the invention, defined in the following claims . Accordingly, the present invention is not limited to the specific embodiments disclosed as the best mode for carrying out the invention, but intended to cover all embodiments included within the scope thereof.

EXPLANATION OF NUMERICAL CHARACTERS

[0157]

10:	a roll of an optical film laminate
10', 10":	a roll of a provisional optical film laminate
11:	polarizing composite film with an adhesive layer formed
110:	polarizing composite film without an adhesive layer
12:	adhesive layer
13:	surface-protection film
13':	provisional surface-protection film
14:	carrier film
14', 14":	provisional carrier film
20:	encoded information
100:	optical-film feed apparatus
110:	support rack
120:	reading unit
130, 170:	film feed unit
140, 180:	speed adjustment unit
150:	slitting unit
160:	slitting positon checkup unit
190:	defective-polarizing-sheet removal unit
200:	lamination unit
210:	carrier-film rewinding drive mechanism
220:	sheet-edge detection unit
230:	straight-ahead-posture detection unit
300:	liquid-crystal-panel conveyance apparatus
400:	control unit
410:	information processing device
420:	storage device
500, 700, 800:	manufacturing system for a roll of an optical film laminate
510:	polarizer manufacturing line
520:	protective film manufacturing line
530:	lamination line or provisional-optical-film feed line
540:	film-feeding drive mechanism
550:	measurement device
560:	inspection unit
570:	carrier-film lamination mechanism
571:	support rack

572:	releasable-film rewinding drive mechanism
575:	provisional-carrier-film peeling unit
576:	provisional-carrier-film take up drive mechanism
580:	optical-film take up drive mechanism
590:	image-reading device
600:	control unit
610:	information processing device
620:	storage device
630:	information recording unit
640:	surface-protection film lamination mechanism
645:	provisional surface-protection-film peeling unit
646:	provisional surface-protection-film rewinding drive mechanism
710:	provisional-optical-film feed unit
720:	provisional-carrier-film rewinding drive mechanism
730:	first inspection unit
731:	second inspection unit
740:	control unit
741:	information processing device
742:	storage device
750:	carrier-film feed unit
760:	carrier-film lamination mechanism
770:	optical-film winding drive mechanism
780:	information recording unit
810:	provisional-optical-film feed unit
820:	provisional-carrier-film rewinding drive mechanism
830:	provisional-surface-protection-film rewinding drive mechanism
840:	first inspection unit
850:	second inspection unit
851:	third inspection unit
852:	fourth inspection unit
860:	control unit
861:	information processing device
862:	storage device
870:	provisional-surface-protection-film feed unit
880:	carrier-film feed unit
890:	lamination mechanism
891:	carrier-film lamination mechanism
892:	surface-protection-film lamination mechanism
910:	optical-film winding drive mechanism
920:	information recording unit

Claims

1. A method of manufacturing liquid-crystal display elements by applying sheets of polarizing film to respective ones of liquid crystal panels each having predefined dimensions, said sheets of polarizing film being formed from a continuous web of an optical film at least including a polarizing film having an adhesive layer, and a carrier film releasably laminated to the adhesive layer, of the polarizing composite film (11) in said web of optical film (10), the sheets of polarizing film being cut from the continuous web of optical film to a size corresponding to the dimensions of the liquid crystal panel, the method comprising the steps of:

providing a continuous web of an optical film (10) having a width corresponding to the width of the liquid crystal panel (W) and

defining in the continuous web of optical film (10) a plurality of slitting positions for forming defect-containing defective sheets and defect-free normal sheets in the form of lines extending in the widthwise direction of the continuous web of optical film (10), where by the distance between adjacent slits of a defective sheet (X_β) is based on positions of one or more defects present in the continuous web of the optical film (10) detected through a preliminary inspection,

recording the slitting positions on the web in the form of coded information (20),

continuously feeding the continuous web of optical film (10) to a lamination station;

measuring a feed distance of the continuous web to calculate feed-length measurement data based on the feed distance;

reading the encoded information recorded on the continuous web of optical film (10);

forming a slit line in the continuous web, when each of the slitting position defined in the continuous web (10) reaches a slitting station, along the slitting position from a surface of the continuous web (10) opposite to the carrier film, to a depth reaching a surface of the carrier film adjacent to the adhesive layer, based on the encoded information (20) and the feed-length measurement data;

using the encoded information to determine whether each of the polarizing sheets to be formed between adjacent ones of the slit lines sequentially formed in the continuous web is a defective polarizing sheet ($X\beta$) having one or more defects or a normal polarizing sheet having no defects; peeling, from the carrier film, the polarizing sheet determined to be the normal sheet, among the polarizing sheets formed between adjacent ones of the slit lines sequentially formed in the continuous web, and transporting the peeled polarizing sheets to the lamination station; and

conveying the liquid-crystal panels (W) to the lamination station in synchronization with the transportation of the respective normal polarizing sheets ($X\alpha$) to the lamination station, and applying the normal polarizing sheets (Xα) to respective ones of the liquid-crystal panels (W).

2. The method in accordance with claim 1, which further comprises a step of preventing the polarizing sheet determined to be a defective sheet (Xβ) among the polarizing sheets each formed between adjacent ones of the slit lines sequentially formed in the continuous web of optical film (10), from being laminated to the liquid-crystal panel.

3. The method in accordance with claim 1 or 2, wherein the step of laminating the normal polarizing sheet (Xα) to the liquid-crystal panel in the lamination station includes sub-steps of providing a pair of lamination rollers in the lamination station for movement toward and away from each other, and detecting a position of the normal polarizing sheet (Xα) being fed to the lamination station in synchronization with the conveyance of the liquid-crystal panel (W) to the lamination station, to adjust a lamination position between the normal polarizing sheet (Xα) and the liquid-crystal panel (W) in the lamination station, wherein the sub-steps include adjusting alignment between a leading edge of the normal polarizing sheet (Xα) fed toward a gap between the lamination rollers which are in a spaced-apart relation and a leading edge of the liquid-crystal panel (W) conveyed in synchronization with the feed of the normal polarizing sheet (Xα), and then moving the lamination rollers to a closed position to thereby laminate the normal polarizing sheet (Xα) to the liquid-crystal panel (W).

4. The method in accordance with any one of claims 1 to 3, which further comprises a slit position-checking step of checking whether a position of a slit actually formed in the continuous web of optical film (10) coincides with a position where a slit is to be formed.

5. The method in accordance with claim 4, wherein the slit position-checking step includes adjusting a position of a slit line formed in the continuous web of optical film (10), based on a deviation between the position of the slit actually formed in the continuous web of optical film (10) and the position where a slit is to be formed in a feed direction of the continuous web.

6. The method in accordance with claim 2, wherein the step of preventing the polarizing sheet determined to be a defective sheet from being laminated to the liquid-crystal panel (W) further includes providing a dummy-film feed path for feeding a dummy film for laminating the defective polarizing sheet (Xβ) thereto, and a movable roller adapted to move the continuous web of optical film (10) toward the dummy-film feed path, and, when the defective polarizing sheet (Xβ) formed in the continuous web of optical film (10) reaches a removal station, moving the continuous web of optical film (10) by the movable roller in such a manner that the defective polarizing sheet (Xβ) is peeled from the continuous web by being brought into contact with the dummy film-in the dummy film feed path, so as to allow the defective polarizing sheet (Xβ) to be laminated to the dummy-film feed path.

7. The method in accordance with claim 2, wherein the step of preventing the polarizing sheet determined to be a defective sheet (Xβ) from being laminated to the liquid-crystal panel (W) further includes providing a dummy-film feed path for feeding a dummy film for laminating the defective polarizing sheet (Xβ) thereto, and a movable roller providing a part of the dummy-film feed path, whereby, when the defective polarizing sheet (Xβ) formed in the continuous web of optical film (10) reaches a gap between the pair of laminated rollers which are in a spaced-apart position, moving the movable roller in such a manner that one of the lamination rollers is replaced with the movable roller, and the movable roller and the other lamination roller are interlockingly moved to allow the defective polarizing sheet (Xβ) to be peeled from the continuous web and laminated to the dummy film in the dummy film feed path.

8. The method in accordance with any one of claims 1 to 7, which further comprises steps of: preliminarily storing a plurality of liquid-crystal panels (W) in a liquid-crystal panel magazine; sequentially carrying out the liquid-crystal panels (W) from the liquid-crystal magazine; and, when the normal polarizing sheets formed on the continuous web of optical film (10) are fed to the lamination station, controlling the orientation of each of the liquid-crystal panels (W) conveyed to the lamination station, in synchronization with feed of a respective one of the normal polarizing sheets (Xα).

9. The method in accordance with claim 8, wherein the step of controlling the orientation of each of the liquid-crystal panels (W) further includes a sub-step of detecting a position of a leading edge of the normal polarizing sheet (Xα) extending in a crosswise direction with respect to a feed direction of the continuous web of optical film (10) and a position of a leading edge of the liquid-crystal panel (W) extending in a crosswise direction with respect to the feed direction of the liquid-crystal panel (W), and controlling the orientation of the liquid-crystal panel (W) based on information about the respective positions of the leading edge of the normal polarizing sheet (Xα) and the leading edge of the liquid-crystal panel (W).

10. A system (1) for manufacturing liquid-crystal display

elements by applying sheets of polarizing film to respective ones of liquid crystal panels (W) each having predefined dimensions, the system is adapted to use a continuous web of an optical film (10) having a width corresponding to a dimension of said liquid crystal panel (W) and at least comprising a polarizing film (11) having an adhesive layer (12), and a carrier film (14) releasably laminated to the adhesive layer (12), said continuous web of optical film having a plurality of slitting positions for forming defect-containing defective sheets (Xβ) and defect-free normal sheets (Xα) in the form of lines extending in the widthwise direction of the continuous web of the optical film (10), wherein the distance between adjacent slits of a defective sheet ($X_ß$) is based on positions of one or more defects detected through a preliminary inspection of a polarizing film (11) by an inspection unit (560), the slitting positions being recorded as coded information, the sheets of polarizing film (11) being cut from the continuous web of optical film to a size corresponding to the size of the liquid crystal panel, and applied to the liquid crystal panel (W);
the system comprising:

a feed unit (100) adapted to continuously feed the continuous web of optical film (10) to a lamination station;
a measurement unit adapted to measure a feed distance of the continuous web of optical film (10) to calculate a feed-length measurement data based on the feed distance;
a read unit (120) adapted to read the encoded information (20) recorded on the continuous web of optical film (10);
a slitting unit (150) adapted to form a plurality of slit lines in the continuous web of optical film (10), when the slitting position set in the continuous web (10) reaches a slitting station, along the respective slitting positions from a surface of the continuous web (10) opposite to the carrier film (14), to a depth reaching a surface of the carrier film (14) adjacent to the adhesive layer (12), based on the encoded information (20) and the feed-length measurement data;
a control device (400) adapted to determine whether each of the polarizing sheets (11) formed between adjacent ones of the slit lines sequentially formed in the continuous web (10) is a defective sheet (Xβ) or a normal sheet (Xα);
a peeling unit (211) adapted to peel, from the carrier film (14), the polarizing sheet (11) determined to be the normal sheet (Xα), among the polarizing sheets each formed between adjacent ones of the slit lines sequentially formed in the continuous web (10), and transporting the peeled polarizing sheet (11) to the lamination station; and
a lamination unit (200) adapted to convey the liquid-crystal panels (W) to the lamination station in synchronization with the transportation of the respective normal polarizing sheets (Xα) to the lamination station, and applying each of the normal polarizing sheets (Xα) to respective liquid-crystal panels (W).

11. The system in accordance with claim 10, which further comprises a defective sheet-ejecting unit adapted to prevent the polarising sheet (11) determined to be a defective sheet (Xβ) among the polarizing sheets (11) each formed between adjacent ones of the slit lines sequentially formed in the continuous web (10), from being laminated to the liquid-crystal panel (W).

12. The system in accordance with any one of claims 10 or 11, wherein the lamination unit (200) for laminating the normal polarizing sheet (Xα) to the liquid-crystal panel (W) includes a pair of lamination rollers provided in the lamination station and adapted to be moved toward and away from each other, and a mechanism adapted to detect a position of the normal polarizing sheet (Xα) being fed to the lamination station in synchronization with the conveyance of the liquid-crystal panel (W) to the lamination station, to adjust a lamination position between the normal polarizing sheet (Xα) and the liquid-crystal panel (W) in the lamination station, wherein the mechanism is operable to adjust alignment between a leading edge of the normal polarizing sheet (Xa) fed toward a gap between the lamination rollers which are in a spaced-apart position and a leading edge of the liquid-crystal panel (W) conveyed in synchronization with the feed of the normal polarizing sheet (Xα), and then move the lamination rollers to a closed position to thereby laminate the normal polarizing sheet (Xα) to the liquid-crystal panel (W).

13. The system in accordance with any one of claims 10 to 12, which further comprises a slit position-checking unit adapted check whether a position of a slit actually formed in the continuous web of optical film (10) coincides with a position where a slit is to be formed.

14. The system in accordance with claim 13, wherein the slit position-checking unit is operable to adjust a position of a slit line to be formed in the continuous web of optical film (10), based on a deviation between the position of the slit actually formed in the continuous web (10) and the position where the slit is to be formed in a feed direction of the continuous web (10).

15. The system in accordance with claim 11, wherein the defective sheet-ejecting unit includes a dummy film-drive mechanism having a dummy-film feed path for feeding a dummy film for laminating the defective polarizing sheet (Xβ) formed in the continuous web of optical film (10), thereto, and a moving mechanism adapted to move the continuous web (10) toward the dummy-film feed path, wherein the defective sheet-ejecting unit is operable, when the defective polarizing sheet formed in the continuous web of optical film (10) reaches a removal station, to move the continuous web by the moving mechanism in such a manner that the defective polarizing sheet (Xβ) is peeled form the continuous web (10) by being brought into contact with the dummy film-in the dummy film feed path, so as to allow the defective polarizing sheet (Xβ) to be laminated to the dummy-film in the dummy film feed path.

16. The system in accordance with claim 11, wherein the defective sheet-ejecting unit includes a dummy film-drive mechanism having a dummy-film feed path for feeding a dummy film for laminating the defective polarizing sheet (Xβ) formed in the continuous web of optical film (10), thereto, and a movable roller providing a part of the dummy-film feed path, wherein the defective sheet-ejecting unit is operable, when the defective polarising sheet (Xβ) formed in the continuous web of optical film (10) reaches a gap between the pair of lamination rollers which are in a spaced-apart position, to move the movable roller in such a manner that one of the lamination rollers is replaced with the movable roller, and the movable roller and the other lamination roller are interlockingly moved to allow the defective polarizing sheet (Xβ) to be peeled from the continuous web (10) and laminated to the dummy film in the dummy film feed path.

17. The system in accordance with any one of claims 10 to 16, which further comprises: a liquid-crystal panel magazine for preliminarily storing a plurality of liquid-crystal panels; a carry-out unit adapted to sequentially carry out the liquid-crystal panels (W) from the liquid-crystal magazine; and a liquid-crystal panel-conveying unit including a liquid-crystal panel orientation control mechanism adapted, when the normal polarizing sheets (Xα) formed on the continuous web of optical film (10) are fed to the lamination station, to control the orientation of each of the liquid-crystal panels (W) conveyed to the lamination station, in synchronization with feed of a respective one of the normal polarizing sheets (Xα).

18. The system in accordance with claim 17, wherein the liquid-crystal panel orientation control mechanism includes: an edge position-detecting device adapted to detect a position of a leading edge of the normal polarizing sheet (Xα) extending in a crosswise direction with respect to a feed direction of the continuous web of optical film (10); a liquid-crystal panel edge position-detecting device adapted to detect a position of a leading edge of the liquid-crystal panel (W) extending in a crosswise direction with respect to the feed direction of the liquid-crystal panel (W); and an orientation control device adapted to control the orientation of the liquid-crystal panel (W) based on information about the respective positions of the leading edge of the normal polarizing sheet (Xα) and the leading edge of the liquid-crystal panel (W) calculated by the edge position-detecting device and the liquid-crystal panel edge position-detecting device.

Patentansprüche

1. Verfahren zum Herstellen von Flüssigkristallanzeigeelementen durch Aufbringen von Blättern einer polarisierenden Folie auf entsprechende Flüssigkristallpaneele, die jeweils vorbestimmte Abmessungen haben, wobei die Blätter der polarisierenden Folie aus einer Endlosbahn einer optischen Folie ausgebildet werden, die wenigstens eine polarisierende Folie, die eine Haftschicht hat, und eine Trägerfolie enthält, die lösbar an die Haftschicht der polarisierenden Verbundfolie (11) in der Bahn der optischen Folie laminiert sind, wobei die Blätter der polarisierenden Folie aus der Endlosbahn der optischen Folie in einer Größe geschnitten werden, die den Abmessungen des Flüssigkristallpaneels entsprechen, wobei das Verfahren die folgenden Schritte umfasst:

Bereitstellen einer Endlosbahn einer optischen Folie (10), die eine Breite hat, die der Breite des Flüssigkristallpaneels (W) entspricht, und
Definieren einer Vielzahl von Schlitzpositionen in der Endlosbahn der optischen Folie (10) zum Ausbilden von Fehler enthaltenden fehlerhaften Blättern und fehlerfreien normalen Blättern durch Linien, die sich in der Breitenrichtung der Endlosbahn der optischen Folie (10) erstrecken, wobei der Abstand zwischen benachbarten Schlitzen eines fehlerhaften Blattes (Xβ) auf Positionen wenigstens eines Fehlers basiert, der in der Endlosbahn der optischen Folie (10) vorhanden ist und durch vorhergehende Inspektion erfasst wird,
Aufzeichnen der Schlitzpositionen auf der Bahn in Gestalt codierter Informationen (20);
kontinuierliches Zuführen der Endlosbahn der optischen Folie (10) zu einer Laminierstation;
Messen eines Zuführabstandes der Endlosbahn, um Zuführlängen-Messdaten auf Basis des Zuführabstandes zu berechnen;
Lesen der codierten Informationen, die auf der Endlosbahn, der optischen Folie (10) aufgezeichnet sind;
Ausbilden einer Schlitzlinie in der Endlosbahn, wenn jede der Schlitzpositionen, die in der End-

losbahn (10) definiert sind, eine Schlitzstation erreicht, entlang der Schlitzposition von einer Oberfläche der Endlosbahn (10) gegenüberliegend der Trägerfolie in einer Tiefe, die eine Oberfläche der Trägerfolie benachbart der Haftschicht erreicht, basierend auf den codierten Informationen (20) und den Zuführlängen-Messdaten;

Verwenden der codierten Informationen, um zu bestimmen, ob jedes der polarisierenden Blätter, die zwischen benachbarten Schlitzlinien ausgebildet werden, die nacheinander in der Endlosbahn ausgebildet werden, ein fehlerhaftes polarisierendes Blatt (Xβ), das wenigstens einen Fehler hat, oder ein normales polarisierendes Blatt ist, das keine Fehler hat;

Abziehen des polarisierenden Blattes, das als normales Blatt aus den polarisierenden Blättern bestimmt ist, die zwischen benachbarten Schlitzlinien ausgebildet werden, die nacheinander in der Endlosbahn ausgebildet werden, von der Trägerfolie und Transportieren der abgezogenen polarisierenden Blätter zu der Laminierstation; und

Befördern der Flüssigkristallpaneele (W) zu der Laminierstation synchron mit dem Transport der entsprechenden normalen polarisierenden Blätter (Xα) zu der Laminierstation und Aufbringen der normalen polarisierenden Blätter (Xα) auf entsprechende Flüssigkristallpaneele (W).

2. Verfahren nach Anspruch 1, das weiterhin einen Schritt umfasst, bei dem verhindert wird, dass das polarisierende Blatt, das als fehlerhaftes Blatt (Xβ) aus den polarisierenden Blättern ermittelt wird, die jeweils zwischen benachbarten Schlitzlinien ausgebildet werden, die nacheinander in der Endlosbahn, der optischen Folie (10) ausgebildet werden, auf das Flüssigkristallpaneel laminiert wird.

3. Verfahren nach Anspruch 1 oder 2, bei dem der Schritt des Laminierens des normalen polarisierenden Blattes (Xα) auf das Flüssigkristallpaneel in der Laminierstation die Teilschritte des Bereitstellens von zwei Laminierwalzen in der Laminierstation zum Bewegen aufeinander zu und voneinander weg und das Erfassen einer Position des normalen polarisierenden Blattes (Xα) umfasst, das der Laminierstation synchron mit der Beförderung des Flüssigkristallpaneels (W) zu der Laminierstation zugeführt wird, um eine Laminierposition zwischen dem normalen polarisierenden Blatt (Xα) und dem Flüssigkristallpaneel (W) in der Laminierstation einzustellen, wobei die Teilschritte das Einstellen einer Ausrichtung zwischen einem vorderen Rand des normalen polarisierenden Blattes (Xα), das In Vorwärtsrichtung einem Spalt zwischen den Laminierwalzen zugeführt wird, die sich in einer beabstandeten Beziehung befinden, und einem vorderen Rand des Flüssigkristallpaneels (W), das synchron mit der Zufuhr des normalen polarisierenden Blattes (Xα) befördert wird, und das anschließende Bewegen der Laminierwalzen in eine geschlossene Stellung beinhalten, um **dadurch** das normale polarisierenden Blatt (Xα) auf das Flüssigkristallpeneel (W) zu laminieren.

4. Verfahren nach einem der Ansprüche 1 bis 3, das weiterhin einen Schlitzpositionsprüfschritt umfasst, ob eine Position eines Schlitzes, der tatsächlich in der kontinuierlichen Bahn der optischen Folie (10) ausgebildet wird, mit einer Position übereinstimmt, in der ein Schlitz auszubilden ist.

5. Verfahren nach Anspruch 4, bei dem der Schlitzpositionsprüfschritt das Einstellen einer Position einer Schlitzlinie umfasst, die in der Endlosbahn, der optischen Folie (10) ausgebildet wird, basierend auf einer Abweichung zwischen der Position des Schlitzes, der tatsächlich in der Endlosbahn der optischen Folie (10) ausgebildet wird, und einer Position, in der ein Schlitz in einer Zuführrichtung der Endlosbahn auszubilden ist.

6. Verfahren nach Anspruch 2, bei dem der Schritt des Verhindern, dass das polarisierende Blatt, das als ein fehlerhaftes Blatt bestimmt wird, auf das Fiüssigkristallpaneel (W) laminiert wird, weiterhin umfasst: Bereitstellen eines Blindfolien-Zuführweges zum Zuführen einer Blindfolie, um darauf das fehlerhafte polarisierende Blatt (Xβ) zu laminieren, und einer beweglichen Walze, die dazu eingerichtet ist, die Endlosbahn der optischen Folie (10) hin zu dem Blindfolien-Zuführweg zu bewegen, und, wenn das fehlerhafte polarisierende Blatt (Xβ), das in der Endlosbahn der optischen Folie (10) ausgebildet wird, eine Entfernstation erreicht, Bewegen der Endlosbahn der optischen Folie (10) durch die bewegliche Walze derart, dass das fehlerhafte polarisierende Blatt (Xβ) von der Endlosbahn abgezogen wird, indem es mit der Blindfolie in dem Blindfollen-Zuführwag in Kontakt gebracht wird, damit so das fehlerhafte polarisierende Blatt (Xβ) auf die Blindfolie in dem Blindfolien-Zuführweg laminiert werden kann.

7. Verfahren nach Anspruch 2, bei dem der Schritt des Verhinderns, dass das polarisierende Blatt, das als fehlerhaftes Blatt (Xβ) bestimmt wird, auf das Flüssigkristallpaneel (W) laminiert wird, weiterhin das Bereitstellen eines Blindfolien-Zuführweges zum Zuführen einer Blindfolie, um darauf das fehlerhafte polarisierende Blatt (Xβ) zu laminieren, und einer beweglichen Walze umfasst, die einen Teil des Blindfolien-Zuführweges bereitstellt, wobei, wenn das fehlerhafte polarisierende Blatt (Xβ), das in der Endlosbahn der optischen Folie (10) ausgebildet wird, einen Spalt zwischen den beiden Laminierwalzen erreicht, die sich in beabstandeter Position befinden, die bewegliche Walze derart bewegt wird, dass eine der Laminierwalzen durch die bewegliche Walze ersetzt wird und die bewegliche Walze sowie die andere Laminierwalze miteinander arretiert bewegt werden, damit das fehlerhafte polarisierende Blatt (Xβ) von der kontinuierlichen Bahn abgezogen und auf die Blindfolie in dem Blindfolien-Zuführnmeg laminiert werden kann.

8. Verfahren nach einem der Ansprüche 1 bis 7, weiterhin umfassend folgende Schritte: vorausgehendes Aufbewahren einer Vielzahl von Flüssigkristallpaneelen (W) in einem Flüssigkrlstallpaneel-Magazin; aufeinander folgendes Ausbringen der Flüssigkristallpaneele (W) aus dem Flüssigkristall-Magazin; und, wenn die normalen polarisierenden Blätter, die auf der Endlosbahn der optischen Folie (10) ausgebildet werden, der Laminierstation zugeführt werden, Steuern der Ausrichtung jedes der Flüssigkristallpaneele (W), die zu der Laminierstation befördert werden, synchron mit der Zufuhr eines entsprechenden der normalen polarisierenden Blätter (Xα).

9. Verfahren nach Anspruch 8, bei dem der Schritt des Steuerns der Ausrichtung jedes der Flüssigkristallpaneele (W) weiterhin umfasst: einen Teilschritt des Erfassens einer Position eines vorderen Randes des normale polarisierenden Blattes (Xα), das sich in einer Querrichtung im Bezug auf die Zuführrichtung der Endlosbahn der optischen Folie (10) erstreckt, und einer Position eines vorderen Randes des Flussigkristallpaneels (W), das sich in einer Querrichtung im Bezug auf die Zuführrichtung des Flüssigkfistallpaneels (W) erstreckt, sowie des Steuerns der Ausrichtung des Flüssigkristallpaneals (W) auf der Basis von informationen über die entsprechenden Positionen des vorderen Randes des normalen polarisierenden Blattes (Xα) und des vorderen Randes des Flüssigkristallpaneels (W).

10. System zum Herstellen von Flüssigkristall-Anzeigeelementen durch Aufbringen von Blättern einer polarisierenden Folie auf entsprechende Flüssigkristallpaneele (W), die jeweils vorbestimmte Abmessungen haben, wobei das System dazu eingerichtet ist, eine Endlosbahn einer optischen Folie (10) zu verwenden, die eine Breite entsprechend einer Abmessung des Flüssigkristallpaneels (W) hat und wenigstens eine polarisierende Folie (11), die eine Haftschicht (12) hat, sowie eine Trägerfolie (14) enthält, die lösbar auf die Haftschicht (12) laminiert ist, wobei die Endlosbahn der optischen Folie eine Vielzahl von Schlitzpositionen aufweist, die Fehler enthaltende fehlerhafte Blätter (Xβ) und fehlerfreie normale Blätter (Xα) durch Linien ausbilden, die sich in der Breitenrichtung der Endlosbahn der optischen Folie (10) erstrecken, wobei der Abstand zwischen benachbarten Schauen eines fehlerhaften Blattes (Xβ) auf Positionen wenigstens eines Fehlers basiert, der durch eine vorhergehende Inspektion einer polarisierenden Folie (11) durch eine inspektionseinheit (560) erfasst wird, wobei die Schlitzpositionen als codierte informationen aufgezeichnet sind und die Blätter der polarisierenden Folie (11) von der Endlosbahn, der optischen Folie in eine Größe geschnitten werden, die der Größe des Flüssigkristallpaneels entspricht, und auf das Flüssigkristallpaneel (W) aufgebracht werden;
wobei das System enthält:

eine Zuführeiflheit (100), eingerichtet für kontinuierliches Zuführen der Endlosbahn der optischen Folie (10) zu einer Laminierstation;
eine Messeinheit, eingerichtet zum Messen eines zuführabstsndes der Endlosbahn der optischen Folie (10), um Zuführlängen-Messdaten auf Basis des Zuführabstandes zu berechnen:
eine Leseeinheit (120), eingerichtet zum Lesen der codierten Informationen (20), die auf der Endlosbahn, der optischen Folie (10) aufgezeichnet sind;
eine Schlitzeinheit (150), eingerichtet zum Ausbilden einer Vielzahl von Schlitzlinien in der Endlosbahn der optischen Folie (10), wenn die Schlitzposition, die in der Endlosbahn definiert ist, eine Schlitzstation erreicht, entlang der entsprechenden Schlitzpositionen von einer Oberfläche der Endlosbahn (10) gegenüberliegend der Trägerfolie (14) in einer Tiefe, die eine Oberfläche der Trägerfolie (14) benachbart der Haftschicht (12) erreicht, basierend auf den codierten Informationen (20) und den Zuführlängen-Messdaten;
eine Steuervorrichtung (400), die dazu eingerichtet ist zu bestimmen, ob jedes der polarisierenden Blätter (11), die zwischen benachbarten Schlitzlinien ausgebildet werden, die nacheinander in der Endlosbahn, (10) ausgebildet werden, ein fehlerhaftes polarisierendes Blatt (Xβ) oder ein normales Blatt (Xα) ist;
eine Abzieheinheit (211), eingerichtet zum Abziehen des polarisierenden Blattes (11), das als normales Blatt (Xα) aus den polarisierenden Blättern bestimmt ist, die jeweils zwischen benachbarten Schlitzlinien ausgebildet werden, die nacheinander in der Endlosbahn (10) ausgebildet werden, von der Trägerfolie (14) und Transportieren des abgezogenen polarisierenden Blattes zu der Laminierstation, und
eine Laminiereinheit (200), eingerichtet zum Befördern der Flüssigkristallpaneele (W) zu der Laminierstation synchron mit dem Transport der entsprechenden normalen polarisierenden Blätter (Xα) zu der Laminierstation und Aufbringen jedes der normalen polarisierenden Blättern

($X\alpha$) auf entsprechende Flüssigkristallpaneele (W).

11. System nach Anspruch 10, das weiterhin eine Fehlblatt-Auswurfeinheit enthält, die dazu eingerichtet ist zu verhindern, dass das polarisierende Blatt (11), das als fehlerhaftes Blatt ($X\beta$) aus den polarisierenden Blättern (11) bestimmt ist, die jeweils zwischen benachbarten Schlitzlinien nacheinander in der Endlosbahn (10) ausgebildet werden, auf das Flüssigkristallpaneel (W) laminiert wird.

12. System nach einem der Ansprüche 10 oder 11, bei dem die Laminiereinheit (200) zum Laminieren des normalen polarisierenden Blattes ($X\alpha$) auf das Flüssigkristallpaneel (W) zwei Laminierwalzen, die in der Laminierstation vorgesehen und dazu eingerichtet sind, aufeinander zu und voneinander weg bewegt zu werden, und einen Mechanismus enthält, der dazu eingerichtet ist, eine Position des normalen polarisierenden Blattes ($X\alpha$) zu erfassen, das der Laminierstation synchron mit der Beförderung des Flüssigkristallpaneels (W) zu der Laminierstation zugeführt wird, um eine Laminierposition zwischen dem normalen polarisierenden Blatt ($X\alpha$) und dem Flüssigkristallpaneel (W) in der Laminierstation einzustellen, wobei der Mechanismus in Funktion eine Ausrichtung zwischen einem vorderen Rand des normalen polarisierenden Blattes ($X\alpha$), das in Vorwärtsrichtung einem Spalt zwischen den Laminierwalzen zugeführt wird, die sich in einer beabstandeten Beziehung befinden, und einem vorderen Rand des Flüssigkristallpaneels (W), das synchron mit der Zufuhr des normalen polarisierenden Blattes ($X\alpha$) befördert wird, einstellt und anschließend die Laminierwalzen in eine geschlossene Stellung bewegt, um **dadurch** das normale polarisierende Blatt ($X\alpha$) auf das Flüssigkristellpaneel (W) zu laminieren.

13. System nach einem der Ansprüche 10 bis 12, das weiterhin eine Schlitzpositions-Prüfeinheit enthält, die dazu eingerichtet ist zu prüfen, ob eine Position eines Schlitzes, der tatsächlich in der Endlosbahn der optischen Folie (10) ausgebildet wird, mit einer Position übereinstimmt, in der ein Schlitz auszubilden ist.

14. System nach Anspruch 13, bei dem die Schlitzpositions-Prüfeinheit in Funktion eine Postition einer Schlitzlinie, die in der Endlosbahn der optischen Folie (10) auszubilden ist, auf der Basis einer Abweichung zwischen der Position des Schlitzes, der tatsächlich in der Endlosbahn, (10) ausgebildet wird, und der Position einstellt, an der der Schlitz in einer Zuführrichtung der Endlosbahn (10) auszubilden ist.

15. System nach Anspruch 11, bei dem die Fehlblatt-Auswurfeinheit einen Blindfolien-Antriebsmechanismus, der einen Blindfolien-Zuführweg zum Zuführen einer Blindfolie enthält, um das fehlerhafte polarisierende Statt ($X\beta$), das in der Endlosbahn der optischen Folie ausgebildet wird, auf diese zu laminieren, und einen Bewegungsmechanismus enthält, der dazu eingerichtet ist, die Endlosbahn (10) hin zu dem Blindfolien-Zuführweg zu bewegen, wobei die Fehlblatt-Auswurfeinheit betätigt werden kann, wenn das fehlerhafte polarisierende Blatt, das in der Endlosbahn der optischen Folie (10) ausgebildet wird, eine Entfernstation ereicht, um die Endlosbahn durch den Bewegungsmechanismus derart zu bewegen, dass das fehlerhafte polarisierenden Blatt ($X\beta$) von der Endlosbahn (10) abgezogen wird, indem es mit der Blindfolie in dem Blindfolien-Zuführweg in Kontakt gebracht wird, damit so das fehlerhafte polarisierende Blatt ($X\beta$) auf die Blindfolie in dem Blindfollen-Zuführweg laminiert werden kann,

16. System nach Anspruch 11, bei dem die Fehlblatt-Auswurfeinheit einen Blindfolien-Antriebsmechanismus, der einen Blindfolien-Zuführweg zum Zuführen einer Blindfolie hat, um das fehlerhafte polarisierende Blatt ($X\beta$), das in der Endlosbahn der optischen Folie (10) ausgebildet wird, auf diese zu laminierten, und eine bewegliche Walze enthält, die einen Teil des Blindfolien-Zuführweges bereitstellt, wobei die Fehlblatt-Auswurfeinheit betätigt werden kann, wenn das fehlerhafte polarisierende Blatt ($X\beta$), das in der Endlosbahn der optischen Folie (10) ausgebildet wird, einen Spalt zwischen den beiden Laminierwalzen erreicht, die sich in einer beabstandeten Stellung befinden, um die bewegliche Walze derart zu bewegen, dass eine der Laminierwalzen durch die bewegliche Walze ersetzt wird, und die bewegliche Walze sowie die andere Laminierwalze arretiert bewegt werden, damit das fehlerhafte polarisierende Blatt ($X\beta$) von der Endlosbahn (10) abgezogen und auf die Blindfolie in dem Blindfolien-Zuführweg laminiert werden kann.

17. System nach einem der Ansprüche 10 bis 16, weiterhin enthaltend: ein Flüssigkristallpaneel-Magazin zum vorausgehenden Aufbewahren einer Vielzahl von Flüssigkristallpaneelen; eine Ausbringeinheit, eingerichtet zum aufeinander folgenden Ausbringen der Flüssigkristallpaneele (W) aus dem Flüssigkristall-Magen; und eine Flüssigkristallpaneel-Beförderungseinheft, die einen Flüssigkristallpaneel-Ausrichtungssteuermechanismus enthält, der dazu eingerichtet ist, wenn die normalen polarisierenden Blätter ($X\alpha$), die auf der Endlosbahn der optischen Folie (10) ausgebildet werden, der Laminierstation zugeführt werden, die Ausrichtung jedes der Flüsslgkristallpaneele (W), die zu der Laminierstation befördert werden, synchron mit der Zufuhr eines entsprechenden der normalen polarisierende Blätter ($X\alpha$) zu steuern.

18. System nach Anspruch 17, bei dem der Flüssigkristallpaneel-Ausrichtungssteuermechanismus enthält: eine Randpositions-Erfassungsvorrichtung, die dazu eingerichtet ist, eine Position eines vorderen Randes des normalen polarisierenden Blattes (Xα) zu erfassen, das sich in Querrichtung im Bezug auf eine Zuführrichtung der Endlosbahn der optischen Folie (10) erstreckt; eine Flüssigkristallpaneelrand-Positionserfassungsvorrichtung, die dazu eingerichtet ist, eine Position eines vorderen Randes des Flüssigkristallpaneels (W) zu erfassen, das sich in einer Querrichtung im Bezug auf die Zuführrichtung des Flüssigkdstallpaneels (W) erstreckt; und eine Ausrichtungssteuervorrichtung, die dazu eingerichtet ist, die Ausrichtung des Flüssigkristallpaneels (W) auf der Basis von informationen über die entsprechenden Positionen des vorderen Randes des normalen polarisierenden Blattes (Xα) und den vorderen Rand des Flüssigkristallpaneels (W) zu steuern, die von der Randpositiotiserfassungsvorrichtung und der Flüssigkfistallpaneelrand-Positionserfassungsvorrichtung berechnet werden.

Revendications

1. Procédé de fabrication d'éléments d'affichage à cristaux liquides en appliquant des feuilles de film polarisant sur des panneaux à cristaux liquides respectifs ayant chacun des dimensions prédéfinies, lesdites feuilles de film polarisant étant formées à partir d'une bande continue de film optique incluant au moins un film polarisant ayant une couche adhésive, et un film porteur laminé de manière amovible sur la couche adhésive, de film composite polarisant (11) dans ladite bande de film optique (10), les feuilles de film polarisant étant découpées dans la bande continue de film optique à une taille correspondant aux dimensions du panneau à cristaux liquides, le procédé comprenant les étapes consistant à :

fournir une bande continue de film optique (10) ayant une largeur correspondant à la largeur du panneau à cristaux liquides (W), et

définir dans la bande continue de film optique (10) une pluralité de positions de découpage pour former des feuilles défectueuses contenant un défaut et

des feuilles normales exemptes de défaut sous la forme de lignes s'étendant dans la direction de la largeur de la bande continue de film optique (10), la distance entre des coupes adjacentes d'une feuille défectueuse (Xβ) étant basée sur des positions d'un ou plusieurs défauts présents dans la bande continue de film optique (10) détectés lors d'une inspection préliminaire,

enregistrer les positions de découpage sur la bande sous la forme d'informations codées (20),

faire avancer en continu la bande continue de film optique (10) vers une station de lamination ;

mesurer une distance d'avance de la bande continue pour calculer des données de mesure de longueur d'avance sur la base de la distance d'avance ;

lire les informations codées enregistrées sur la bande continue de film optique (10);

former une ligne de coupe dans la bande continue, lorsque chaque position de découpage définie dans la bande continue (10) atteint une station de découpage, le long de la position de découpage à partir d'une surface de la bande continue (10) l'opposé du film porteur, à une profondeur atteignant une surface du film porteur adjacente à la couche adhésive, sur la base des informations codées (20) et des données de mesure de longueur d'avance ;

utiliser les informations codées pour déterminer si chacune des feuilles polarisantes devant être formées entre des lignes de coupe adjacentes parmi les lignes de coupe formées de manière séquentielle dans la bande continue est une feuille polarisante défectueuse (Xβ) ayant un ou plusieurs défauts ou

une feuille polarisante normale exempte de défaut;

peler, du film porteur, la feuille polarisante déterminée comme étant la feuille normale, parmi les feuilles polarisantes formées entre des lignes de coupe adjacentes formées de manière séquentielle dans la bande continue, et

transporter les feuilles polarisantes pelées vers la station de lamination ; et

transporter les panneaux à cristaux liquides (W) vers la station de lamination en synchronisation avec le transport des feuilles polarisantes normales (Xα) respectives vers la station de lamination et appliquer les feuilles polarisantes normales (Xα) sur les panneaux à cristaux liquides (W) respectifs.

2. Procédé selon la revendication 1, qui comprend en outre une étape consistant à empêcher la feuille polarisante déterminée comme étant une feuille défectueuse (Xβ) parmi les feuilles polarisantes formées chacune entre des lignes de coupe adjacentes formées de manière séquentielle dans la bande continue de film optique (10), d'être laminée sur le panneau à cristaux liquides.

3. Procédé selon la revendication 1 ou la revendication 2, dans lequel l'étape consistant à laminer la feuille polarisante normale (Xα) sur le panneau à cristaux liquides dans la station de lamination inclut des étapes secondaires consistant à fournir une paire de rouleaux de lamination dans la station de lamination capables de se rapprocher et de s'éloigner l'un de l'autre, et à détecter une position de la feuille polarisante normale (Xα) amenée à la station de lamination en synchronisation avec le transport du panneau à cristaux liquides (W) vers la station de lamination, pour ajuster une position de lamination entre la feuille polarisante normale (Xα) et le panneau à cristaux liquides (W) dans la station de lamination, dans lequel les étapes secondaires incluent un ajustement de l'alignement entre un bord avant de la feuille polarisante normale (Xα) amenée vers un écartement entre les rouleaux de lamination qui sont distants l'un de l'autre et un bord avant du panneau à cristaux liquides (W) transporté en synchronisation avec l'avance de la feuille polarisante normale (Xα), puis à déplacer les rouleaux de lamination dans une position fermée pour ainsi laminer la feuille polarisante normale (Xα) sur le panneau à cristaux liquides (W).

4. Procédé selon l'une quelconque des revendications 1 à 3, qui comprend en outre une étape de vérification de position de découpage pour vérifier si une position d'un découpage réellement formé dans la bande continue de film, optique (10) coïncide avec une position dans laquelle un découpage doit être formé.

5. Procédé selon la revendication 4, dans lequel l'étape de vérification de position de découpage inclut un ajustement d'une position d'une ligne de coupe formée dans la bande continue de film optique (10), sur la base d'un écart entre la position du découpage réellement formé dans la bande continue de film optique (10) et la position dans laquelle un découpage doit être formé dans une direction d'avance de la bande continue.

6. Procédé selon la revendication 2, dans lequel l'étape consistant à empêcher la feuille polarisante déterminée comme étant une feuille défectueuse d'être laminée sur le panneau à cristaux liquides (W) inclut en outre la fourniture d'un chemin d'avance d'un film factice pour faire avancer un film factice sur lequel la feuille polarisante défectueuse (Xβ) doit être laminée, et un rouleau mobile adapté pour déplacer la bande continue de film optique (10) vers le chemin d'avance de film factice, et, lorsque la feuille polarisante défectueuse (Xβ) formée dans la bande continue de film optique (10) atteint une station d'enlèvement, déplacer la bande continue de film optique (10) au moyen du rouleau mobile de telle manière que la feuille polarisante défectueuse (Xβ) soit pelée de la bande continue en la mettant en contact avec le film factice sur le chemin d'avance de film factice, afin de permettre de laminer la feuille polarisante défectueuse (Xβ) sur le chemin d'avance de film factice.

7. Procédé selon la revendication 2, dans lequel l'étape consistant à empêcher la feuille polarisante déterminée comme étant une feuille défectueuse (Xβ) d'être laminée sur le panneau à cristaux liquides (W) inclut en outre la fourniture d'un chemin d'avance d'un film factice pour faire avancer un film factice sur lequel la feuille polarisante défectueuse (Xβ) doit être laminée, et un rouleau mobile formant une partie du chemin d'avance de film factice, ainsi, lorsque la feuille polarisante défectueuse (Xβ) formée dans la bande continue de film optique (10) atteint un écartement entre la paire de rouleaux de lamination qui sont distants l'un de l'autre, le rouleau mobile est déplacé de telle manière que l'un des rouleaux de lamination soit remplacé par le rouleau mobile, et que le rouleau mobile et l'autre rouleau de lamination soient déplacés engagés ensemble pour permettre de peler la feuille polarisante défectueuse (Xβ) de la bande continue et de la laminer sur le film factice sur le chemin d'avance de film factice.

8. Procédé selon l'une quelconque des revendications 1 à 7, qui comprend en outre des étapes : de stockage préliminaire d'une pluralité de panneaux à cristaux liquides (W) dans un magasin de panneaux à cristaux liquides ; d'extraction séquentielle des panneaux à cristaux liquides (W) hors du magasin de panneaux à cristaux liquides ; et, lorsque les feuilles polarisantes normales formées sur la bande continue de film optique (10) sont amenées à la station de lamination, de commande de l'orientation de chacun des panneaux à cristaux liquides (W) transportés vers la station de lamination, en synchronisation avec l'avance de l'une respective des feuilles polarisantes normales (Xα).

9. Procédé selon la revendication 8, dans lequel l'étape de commande de l'orientation de chacun des panneaux à cristaux liquides (W) inclut en outre une étape secondaire consistant à détecter une position d'un bord avant de la feuille polarisante normale (Xα) s'étendant dans une direction transversale par rapport à une direction d'avance de la bande continue de film optique (10) et une position d'un bord avant du panneau à cristaux liquides (W) s'étendant dans une direction transversale par rapport à la direction d'avance du panneau à cristaux liquides (W), et à commander l'orientation du panneau à cristaux liquides (W) sur la base d'informations relatives aux positions respectives du bord avant de la feuille polarisante normale (Xα) et du bord avant du panneau à cristaux liquides (W).

10. Système (1) pour fabriquer des éléments d'affichage à cristaux liquides en appliquant des feuilles de film polarisant sur des panneaux à cristaux liquides (W) respectifs ayant chacun des dimensions prédéfinies, le système étant adapté pour utiliser une bande con-

tinue de film optique (10) ayant une largeur correspondant à une dimension dudit panneau à cristaux liquides (W) et comprenant au moins un film polarisant (11) ayant une couche adhésive (12), et un film porteur (14) laminé de manière amovible sur la couche adhésive (12), ladite bande continue de film optique ayant une pluralité de positions de découpage pour former des feuilles défectueuses (Xβ) contenant un défaut et des feuilles normales (Xα) exemptes de défaut sous la forme de lignes s'étendant dans la direction de la largeur de la bande continue de film optique (10), dans lequel la distance entre des coupes adjacentes d'une feuille défectueuse (Xβ) est basée sur des positions d'un ou plusieurs défauts détectés lors d'une inspection préliminaire d'un film polarisant (11) par une unité d'inspection (560), les positions de découpage étant enregistrées sous la forme d'informations codées, les feuilles de film polarisant (11) étant découpées dans la bande continue de film optique à une taille correspondant à la taille du panneau à cristaux liquides, et appliquées sur le panneau à cristaux liquides (W) ;
le système comprenant :

une unité d'avance (100) adaptée pour faire avancer en continu la bande continue de film optique (10) vers une station de lamination ;
une unité de mesure adaptée pour mesurer une distance d'avance de la bande continue de film optique (10) pour calculer des données de mesure de longueur d'avance sur la base de la distance d'avance ;
une unité de lecture (120) adaptée pour lire les informations codées (20) enregistrées sur la bande continue de film optique (1Q) ;
une unité de découpage (150) adaptée pour former une pluralité de lignes de coupe dans la bande continue de film optique (10), lorsque la position de découpage définie dans la bande continue (10) atteint une station de découpage, le long des positions respectives de découpage à partir d'une surface de la bande continue (10) à l'opposé du film porteur (14), à une profondeur atteignant une surface du film porteur (14) adjacente à la couche adhésive (12), sur la base des informations codées (20) et des données de mesure de longueur d'avance;
un dispositif de commande (400) adapté pour déterminer si chacune des feuilles polarisantes (11) formées entre des lignes de coupe adjacentes parmi les lignes de coupe formées de manière séquentielle dans la bande continue (10) est une feuille défectueuse (Xβ) ou une feuille normale (Xα) ;
une unité de pelage (211) adaptée pour peler, du film porteur (14), la feuille polarisante (11) déterminée comme étant la feuille normale (Xα), parmi les feuilles polarisantes formées chacune entre des lignes de coupe adjacentes parmi les lignes de coupe formées de manière séquentielle dans la bande continue (10), et transporter les feuilles polarisantes (11) pelées vers la station de lamination ; et
une unité de lamination (200) adaptée pour transporter les panneaux à cristaux liquides (W) vers la station de lamination en synchronisation avec le transport des feuilles polarisantes normales (Xα) respectives vers la station de lamination et appliquer chacune des feuilles polarisantes normales (Xα) sur les panneaux à cristaux liquides (W) respectifs.

11. Système selon la revendication 10, qui comprend en outre une unité d'éjection de feuille défectueuse adaptée pour empêcher la feuille polarisante (11) déterminée comme étant une feuille défectueuse (Xβ) parmi les feuilles polarisantes (11) formées chacune entre des lignes de coupe adjacentes formées de manière séquentielle dans la bande continue (10), d'être laminée sur le panneau à cristaux liquides (W).

12. Système selon l'une des revendications 10 ou 11, dans lequel l'unité de lamination (200) destinée laminer la feuille polarisante normale (Xα) sur le panneau à cristaux liquides (W) inclut une paire de rouleaux de lamination placés dans la station de lamination et adaptés pour être rapprochés et éloignés l'un de l'autre, et un mécanisme adapté pour détecter une position de la feuille polarisante normale (Xα) amenée à la station de lamination en synchronisation avec le transport du panneau à cristaux liquides (W) vers la station de lamination, pour ajuster une position de lamination entre la feuille polarisante normale (Xα) et le panneau à cristaux liquides (W) dans la station de lamination, dans lequel le mécanisme peut être commandé pour ajuster l'alignement entre un bord avant de la feuille polarisante normale (Xα) amenée vers un écartement entre les rouleaux de lamination qui sont distants l'un de l'autre et un bord avant du panneau à cristaux liquides (W) transporté en synchronisation avec l'avance de la feuille polarisante normale (Xα), puis pour déplacer les rouleaux de lamination dans une position fermée pour ainsi laminer la feuille polarisante normale (Xα) sur le panneau à cristaux liquides (W).

13. Système selon l'une quelconque des revendications 10 à 12, qui comprend en outre une unité de vérification de position de découpage adaptée pour vérifier si une position d'un découpage réellement formé dans la bande continue de film optique (10) coïncide avec une position dans laquelle un découpage doit être formé.

14. Système selon la revendication 13, dans lequel l'unité de vérification de position de découpage peut être commandée pour ajuster une position d'une ligne de coupe devant être formée dans la bande continue de film optique (10), sur la base d'un écart entre la position du découpage réellement formé dans la bande continue de film optique (10) et la position dans laquelle le découpage doit être formé dans une direction d'avance de la bande continue (10).

15. Système selon la revendication 11, dans lequel l'unité d'éjection de feuille défectueuse inclut un mécanisme d'entraînement de film factice ayant un chemin d'avance de film factice pour faire avancer un film factice sur lequel la feuille polarisante défectueuse (Xβ) formée dans la bande continue de film optique (10) doit être laminée, et un mécanisme de déplacement adapté pour déplacer la bande continue (10) vers le chemin d'avance de film factice, dans lequel l'unité d'éjection de feuille défectueuse peut être commandée, lorsque la feuille polarisante défectueuse formée dans la bande continue de film optique (10) atteint une station d'enlèvement, pour déplacer la bande continue au moyen du mécanisme de déplacement de telle manière que la feuille polarisante défectueuse (Xβ) soit pelée de la bande continue (10) en la mettant en contact avec le film factice sur le chemin d'avance de film factice, afin de permettre de laminer la feuille polarisante défectueuse (Xβ) sur le film factice sur le chemin d'avance de film factice.

16. Système selon la revendication 11, dans lequel l'unité d'éjection de feuille défectueuse inclut un mécanisme d'entraînement de film factice ayant un chemin d'avance de film factice pour faire avancer un film factice sur lequel la feuille polarisante défectueuse (Xβ) formée dans la bande continue de film optique (10) doit être laminée, et un rouleau mobile formant une partie du chemin d'avance de film factice, dans lequel l'unité d'éjection de feuille défectueuse peut être commandée, lorsque la feuille polarisante défectueuse (Xβ) formée dans la bande continue de film optique (10) atteint un écartement entre la paire de rouleaux de lamination qui sont distants l'un de l'autre, pour déplacer le rouleau mobile de telle manière que l'un des rouleaux de lamination, soit remplacé par le rouleau mobile, et que le rouleau mobile et l'autre rouleau de lamination soient déplacés engagés ensemble pour permettre de peler la feuille polarisante défectueuse (Xβ) de la bande continue (10) et de la laminer sur le film factice sur le chemin d'avance de film factice.

17. Système selon l'une des revendications 10 à 16, qui comprend en outre: un magasin de panneaux à cristaux liquides pour un stockage préliminaire d'une pluralité de panneaux à cristaux liquides ; une unité d'extraction adaptée pour extraire de manière séquentielle les panneaux à cristaux liquides (W) hors du magasin de panneaux à cristaux liquides ; et; une unité de transport de panneau à cristaux liquides incluant un mécanisme de commande d'orientation de panneau à cristaux liquides adapté pour, lorsque les feuilles polarisantes normales (Xα) formées sur la bande continue de film optique (10) sont amenées à la station de lamination, commander l'orientation de chacun des panneaux à cristaux liquides (W) transportés vers la station de lamination, en synchronisation avec l'avance de l'une respective des feuilles polarisantes normales (Xα).

18. Système selon la revendication 17, dans lequel le mécanisme de commande d'orientation de panneau à cristaux liquides inclut : un dispositif de détection de position de bord adapté pour détecter une position d'un bord avant de la feuille polarisante normale (Xα) s'étendant dans une direction transversale par rapport une direction d'avance de la bande continue de film optique (10) ; un dispositif de détection de position de bord de panneau à cristaux liquides adapté pour détecter une position d'un bord avant du panneau à cristaux liquides (W) s'étendant dans une direction transversale par rapport à la direction d'avance du panneau à cristaux liquides (W) ; et un dispositif de commande d'orientation adapté pour commander l'orientation du panneau à cristaux liquides (W) sur la base d'informations relatives aux positions respectives du bord avant de la feuille polarisante normale (Xα) et du bord avant du panneau à cristaux liquides (W) calculées par le dispositif de détection de position de bord et par le dispositif de détection de position de bord de panneau à cristaux liquides.

FIG.1

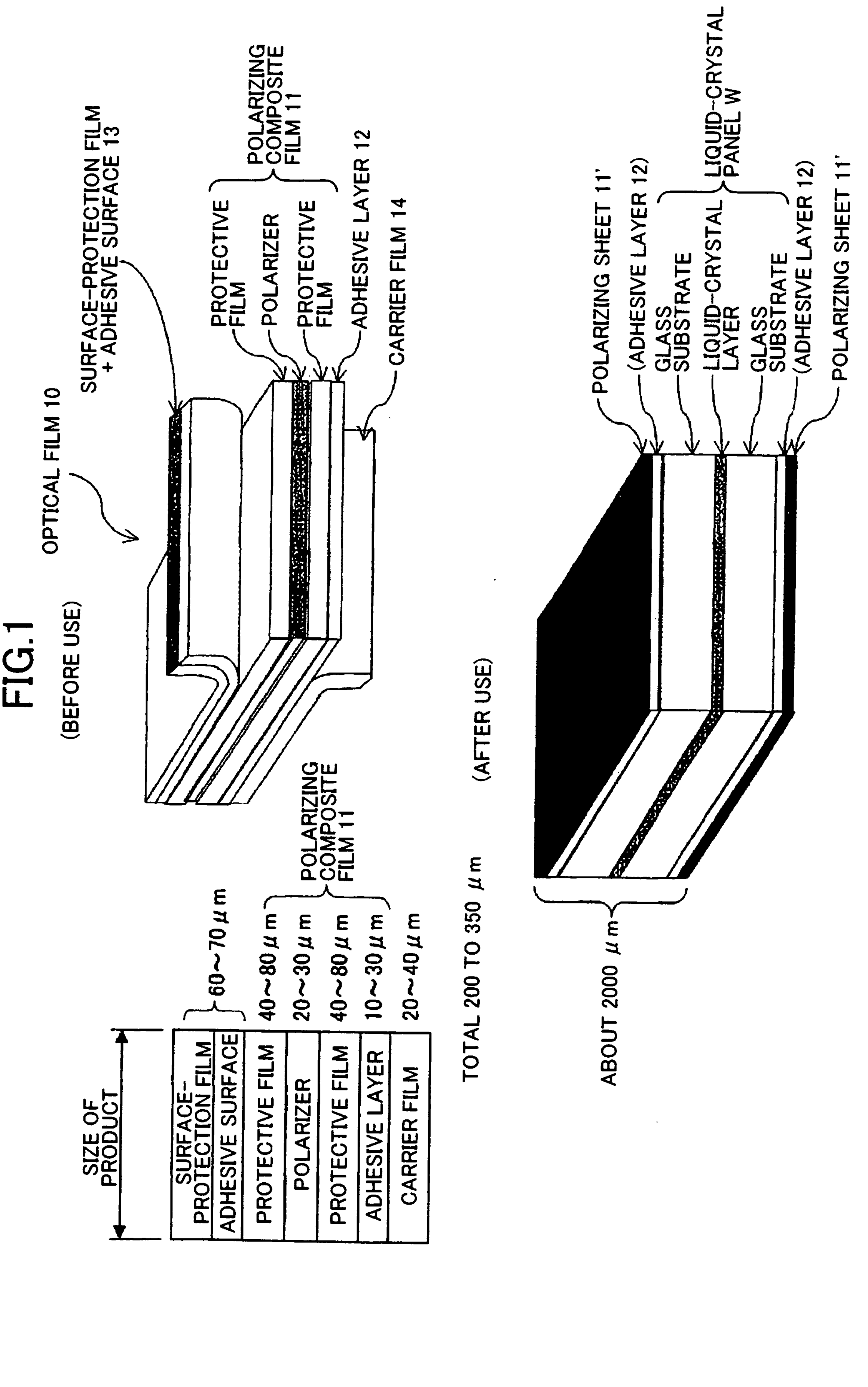

(BEFORE USE)
OPTICAL FILM 10
SURFACE-PROTECTION FILM + ADHESIVE SURFACE 13
PROTECTIVE FILM
POLARIZER
PROTECTIVE FILM
POLARIZING COMPOSITE FILM 11
ADHESIVE LAYER 12
CARRIER FILM 14
SIZE OF PRODUCT
SURFACE-PROTECTION FILM
ADHESIVE SURFACE
60～70 μm
PROTECTIVE FILM 40～80 μm
POLARIZER 20～30 μm
PROTECTIVE FILM 40～80 μm
ADHESIVE LAYER 10～30 μm
CARRIER FILM 20～40 μm
POLARIZING COMPOSITE FILM 11
TOTAL 200 TO 350 μm
(AFTER USE)
POLARIZING SHEET 11'
(ADHESIVE LAYER 12)
GLASS SUBSTRATE
LIQUID-CRYSTAL LAYER
GLASS SUBSTRATE
(ADHESIVE LAYER 12)
POLARIZING SHEET 11'
LIQUID-CRYSTAL PANEL W
ABOUT 2000 μm

FIG.2

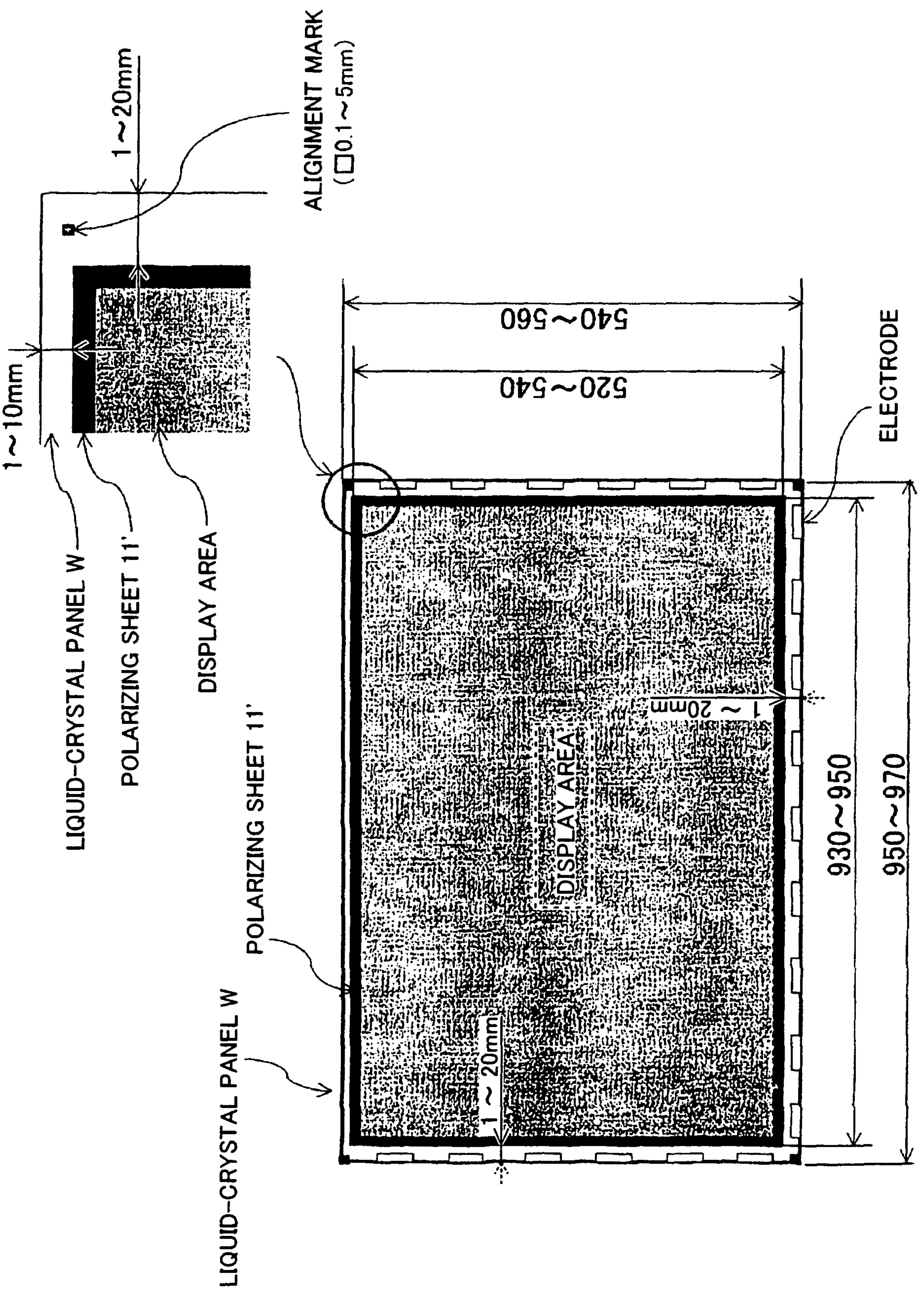

ALIGNMENT MARK
(□0.1~5mm)
1~20mm
1~10mm
LIQUID-CRYSTAL PANEL W
POLARIZING SHEET 11'
DISPLAY AREA
540~560
520~540
ELECTRODE
1 ~ 20mm
DISPLAY AREA
930~950
950~970
POLARIZING SHEET 11'
LIQUID-CRYSTAL PANEL W
1 ~ 20mm

FIG.3

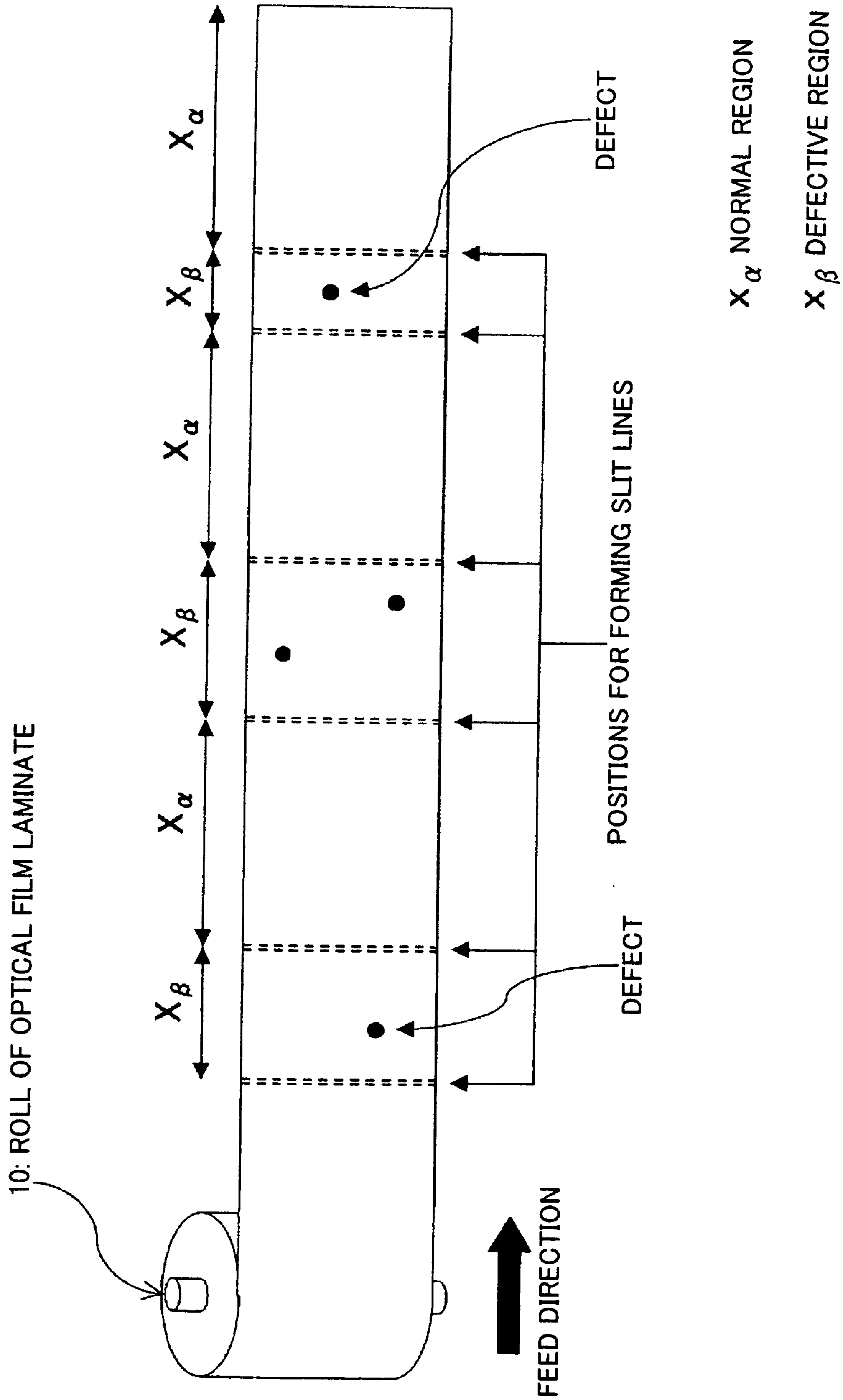
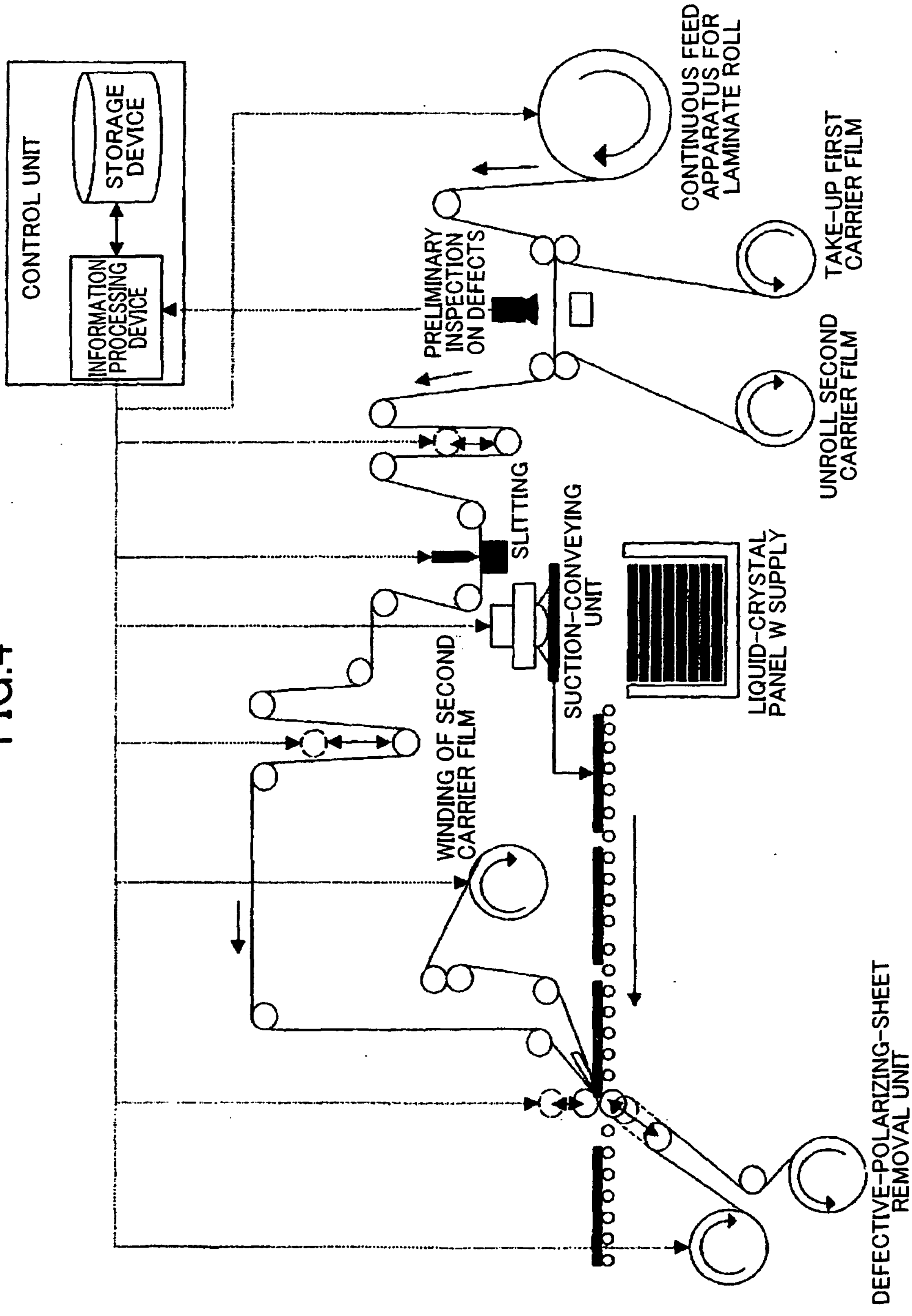

10: ROLL OF OPTICAL FILM LAMINATE
X_α
X_β
X_α
X_β
X_α
X_β
DEFECT
POSITIONS FOR FORMING SLIT LINES
DEFECT
FEED DIRECTION
X_α NORMAL REGION
X_β DEFECTIVE REGION

FIG.4


CONTROL UNIT
STORAGE DEVICE
INFORMATION PROCESSING DEVICE
CONTINUOUS FEED APPARATUS FOR LAMINATE ROLL
TAKE-UP FIRST CARRIER FILM
PRELIMINARY INSPECTION ON DEFECTS
UNROLL SECOND CARRIER FILM
SLITTING
SUCTION-CONVEYING UNIT
LIQUID-CRYSTAL PANEL W SUPPLY
WINDING OF SECOND CARRIER FILM
DEFECTIVE-POLARIZING-SHEET REMOVAL UNIT

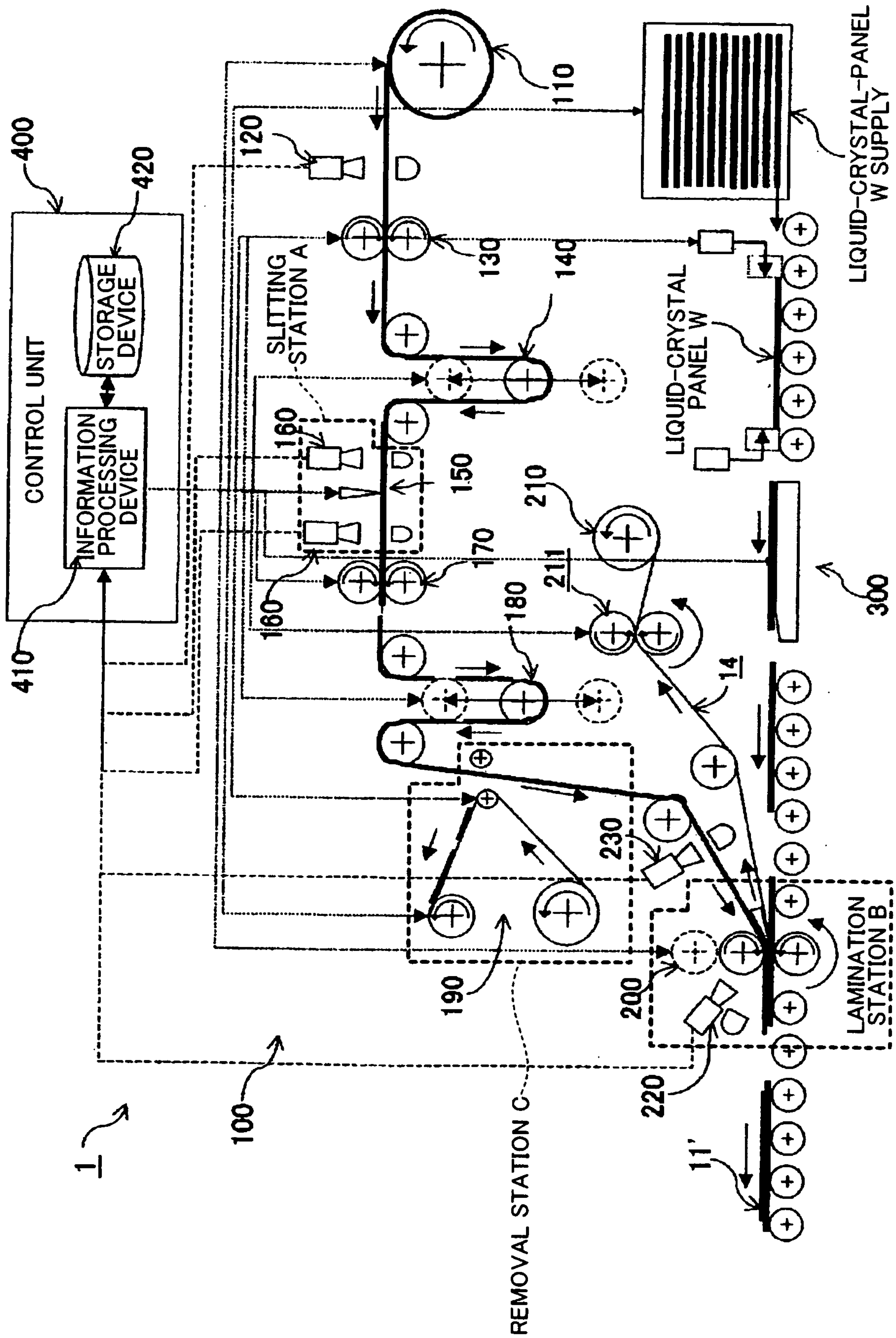

CONTROL UNIT
400
STORAGE DEVICE
420
INFORMATION PROCESSING DEVICE
410
110
120
130
140
SLITTING STATION A
160
150
170
180
190
200
210
211
14
300
230
220
100
1
11'
REMOVAL STATION C
LAMINATION STATION B
LIQUID-CRYSTAL PANEL W
LIQUID-CRYSTAL-PANEL W SUPPLY

FIG.5

FIG.6

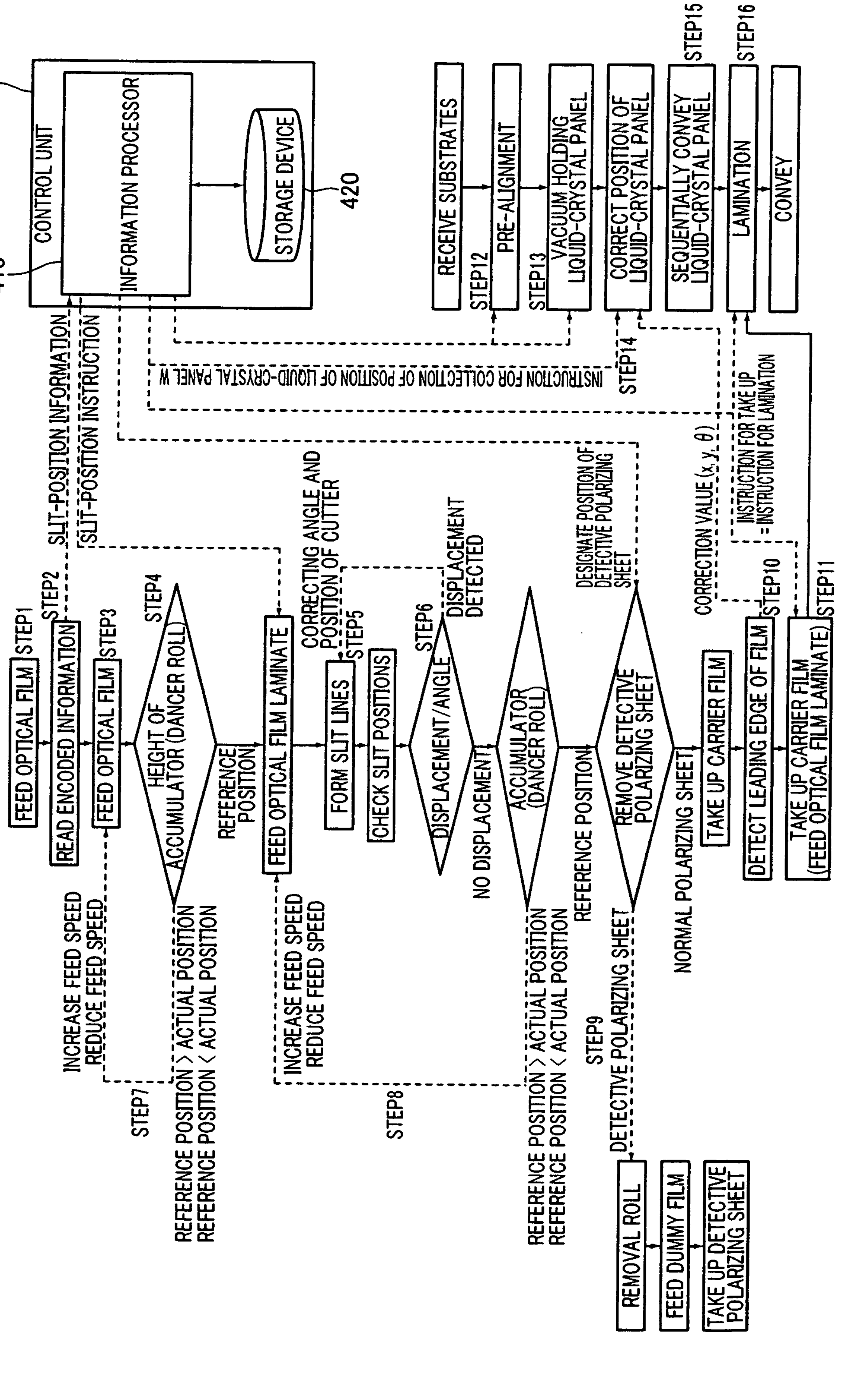

400
CONTROL UNIT
410
INFORMATION PROCESSOR
STORAGE DEVICE
420
SLIT-POSITION INFORMATION
SLIT-POSITION INSTRUCTION
FEED OPTICAL FILM
STEP1
READ ENCODED INFORMATION
STEP2
FEED OPTICAL FILM
STEP3
HEIGHT OF ACCUMULATOR (DANCER ROLL)
STEP4
INCREASE FEED SPEED
REDUCE FEED SPEED
STEP7
REFERENCE POSITION > ACTUAL POSITION
REFERENCE POSITION < ACTUAL POSITION
REFERENCE POSITION
FEED OPTICAL FILM LAMINATE
CORRECTING ANGLE AND POSITION OF CUTTER
STEP5
FORM SLIT LINES
CHECK SLIT POSITIONS
STEP6
DISPLACEMENT/ANGLE
DISPLACEMENT DETECTED
NO DISPLACEMENT
INCREASE FEED SPEED
REDUCE FEED SPEED
STEP8
ACCUMULATOR (DANCER ROLL)
REFERENCE POSITION > ACTUAL POSITION
REFERENCE POSITION < ACTUAL POSITION
REFERENCE POSITION
DESIGNATE POSITION OF DETECTIVE POLARIZING SHEET
REMOVE DETECTIVE POLARIZING SHEET
STEP9
DETECTIVE POLARIZING SHEET
REMOVAL ROLL
FEED DUMMY FILM
TAKE UP DETECTIVE POLARIZING SHEET
NORMAL POLARIZING SHEET
TAKE UP CARRIER FILM
CORRECTION VALUE (x, y, θ)
DETECT LEADING EDGE OF FILM
STEP10
INSTRUCTION FOR TAKE UP = INSTRUCTION FOR LAMINATION
TAKE UP CARRIER FILM (FEED OPTICAL FILM LAMINATE)
STEP11
INSTRUCTION FOR COLLECTION OF POSITION OF LIQUID-CRYSTAL PANEL W
STEP14
RECEIVE SUBSTRATES
STEP12
PRE-ALIGNMENT
STEP13
VACUUM HOLDING LIQUID-CRYSTAL PANEL
CORRECT POSITION OF LIQUID-CRYSTAL PANEL
SEQUENTIALLY CONVEY LIQUID-CRYSTAL PANEL
STEP15
LAMINATION
STEP16
CONVEY

FIG.7

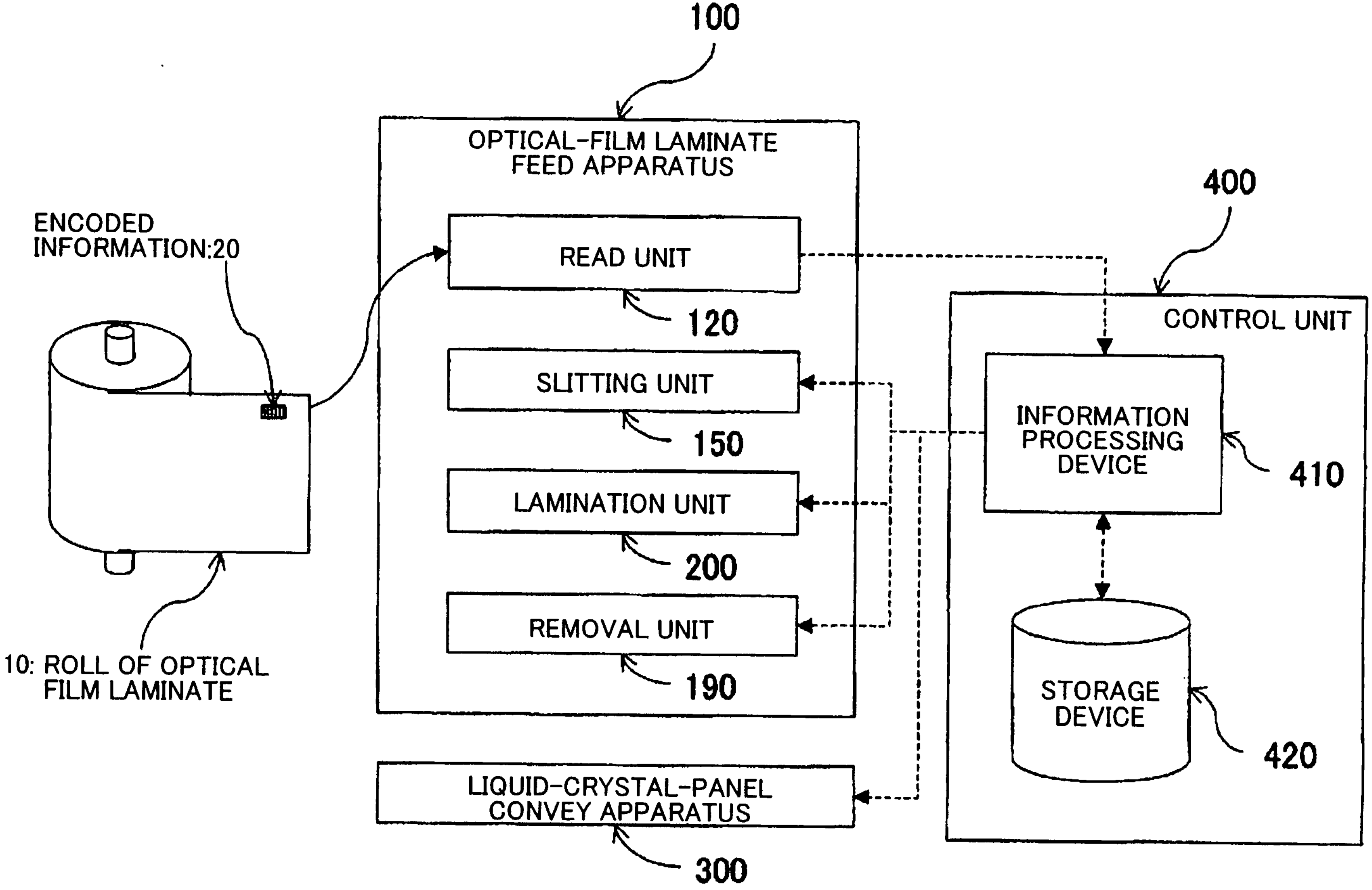

100
OPTICAL-FILM LAMINATE FEED APPARATUS
READ UNIT
120
SLITTING UNIT
150
LAMINATION UNIT
200
REMOVAL UNIT
190
LIQUID-CRYSTAL-PANEL CONVEY APPARATUS
300
400
CONTROL UNIT
INFORMATION PROCESSING DEVICE
410
STORAGE DEVICE
420
ENCODED INFORMATION:20
10: ROLL OF OPTICAL FILM LAMINATE

FIG.8

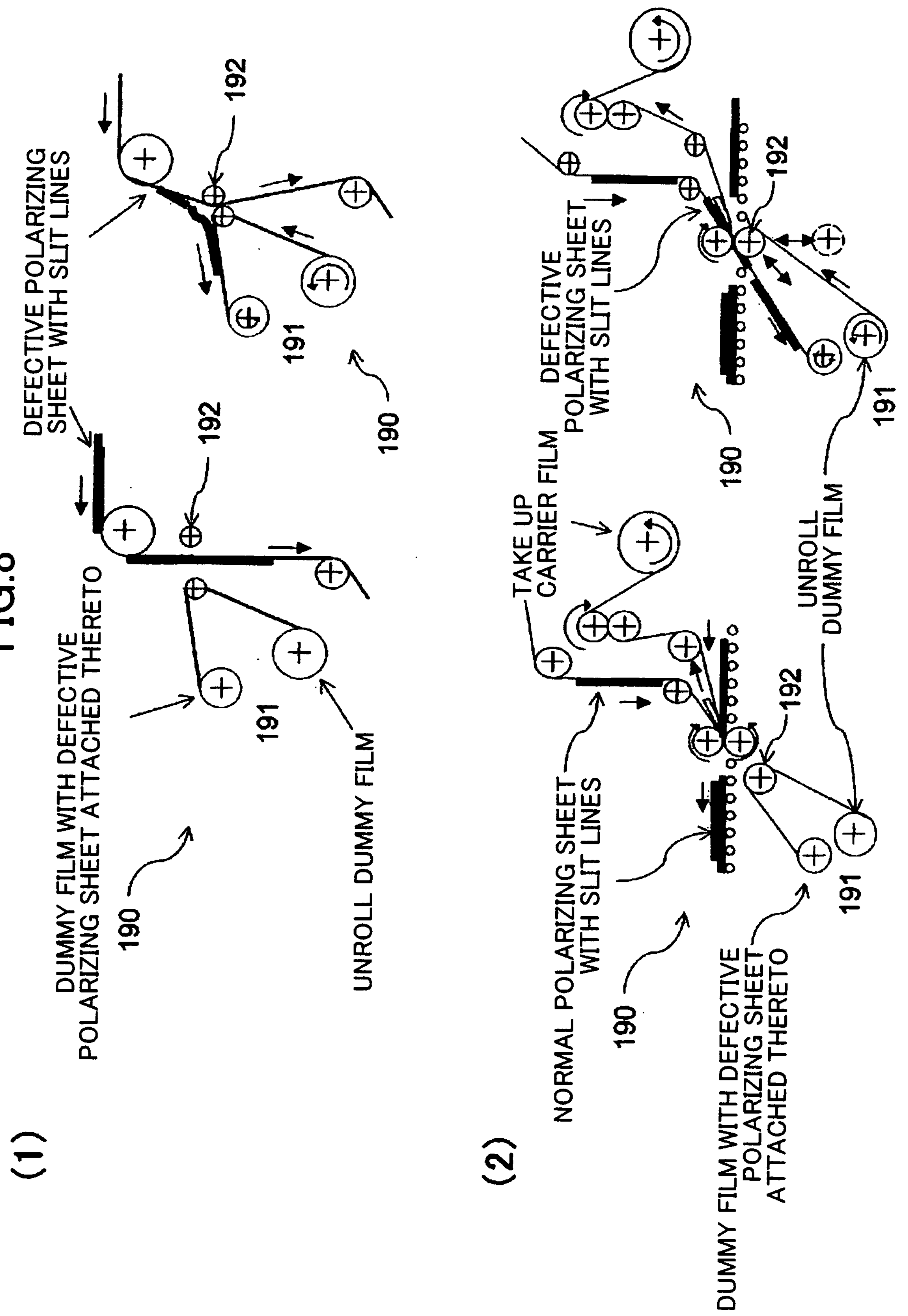

(1)
DUMMY FILM WITH DEFECTIVE POLARIZING SHEET ATTACHED THERETO
190
191
UNROLL DUMMY FILM
192
DEFECTIVE POLARIZING SHEET WITH SLIT LINES
192
191
190
(2)
NORMAL POLARIZING SHEET WITH SLIT LINES
190
DUMMY FILM WITH DEFECTIVE POLARIZING SHEET ATTACHED THERETO
191
192
TAKE UP CARRIER FILM
UNROLL DUMMY FILM
190
DEFECTIVE POLARIZING SHEET WITH SLIT LINES
192
191

FIG.9

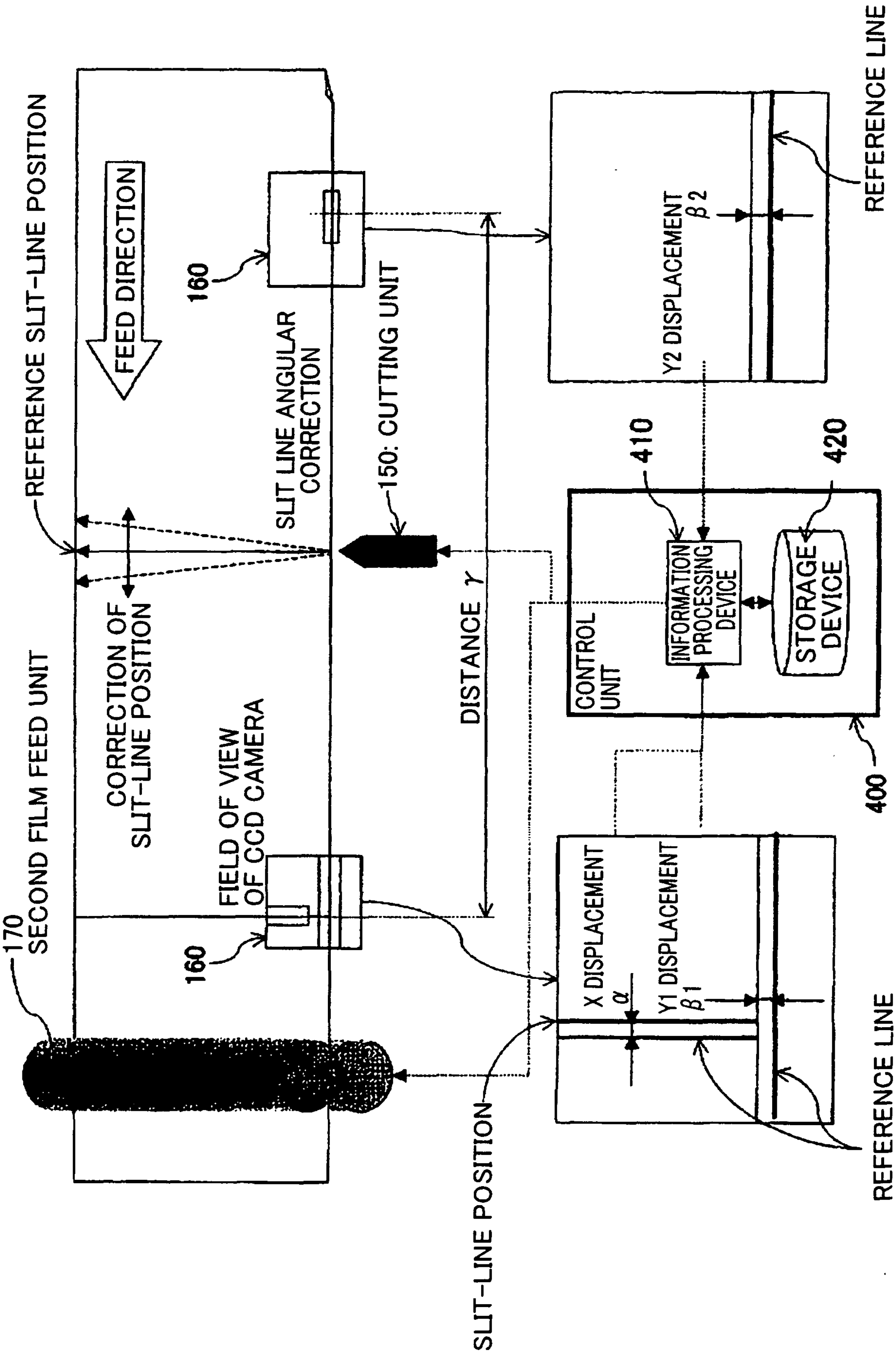

170
SECOND FILM FEED UNIT
REFERENCE SLIT-LINE POSITION
FEED DIRECTION
CORRECTION OF SLIT-LINE POSITION
FIELD OF VIEW OF CCD CAMERA
SLIT LINE ANGULAR CORRECTION
150: CUTTING UNIT
160
160
DISTANCE γ
SLIT-LINE POSITION
X DISPLACEMENT
α
Y1 DISPLACEMENT
β1
REFERENCE LINE
CONTROL UNIT
INFORMATION PROCESSING DEVICE
STORAGE DEVICE
410
420
400
Y2 DISPLACEMENT
β2
REFERENCE LINE

FIG.10

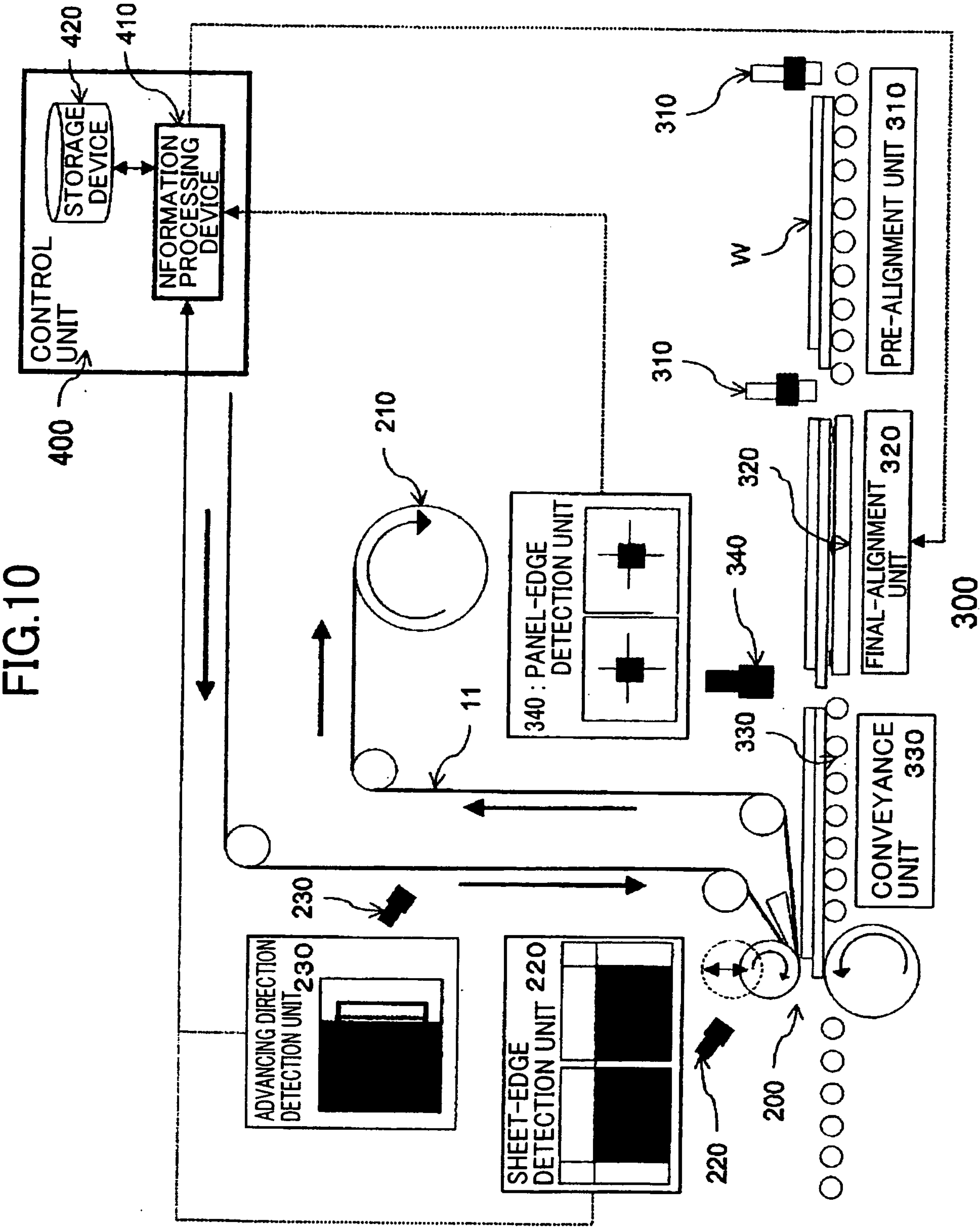

CONTROL UNIT
400
STORAGE DEVICE
420
NFORMATION PROCESSING DEVICE
410
210
11
340 : PANEL-EDGE DETECTION UNIT
340
310
W
PRE-ALIGNMENT UNIT 310
320
FINAL-ALIGNMENT UNIT 320
300
330
CONVEYANCE UNIT 330
230
ADVANCING DIRECTION DETECTION UNIT 230
SHEET-EDGE DETECTION UNIT 220
220
200

FIG.11

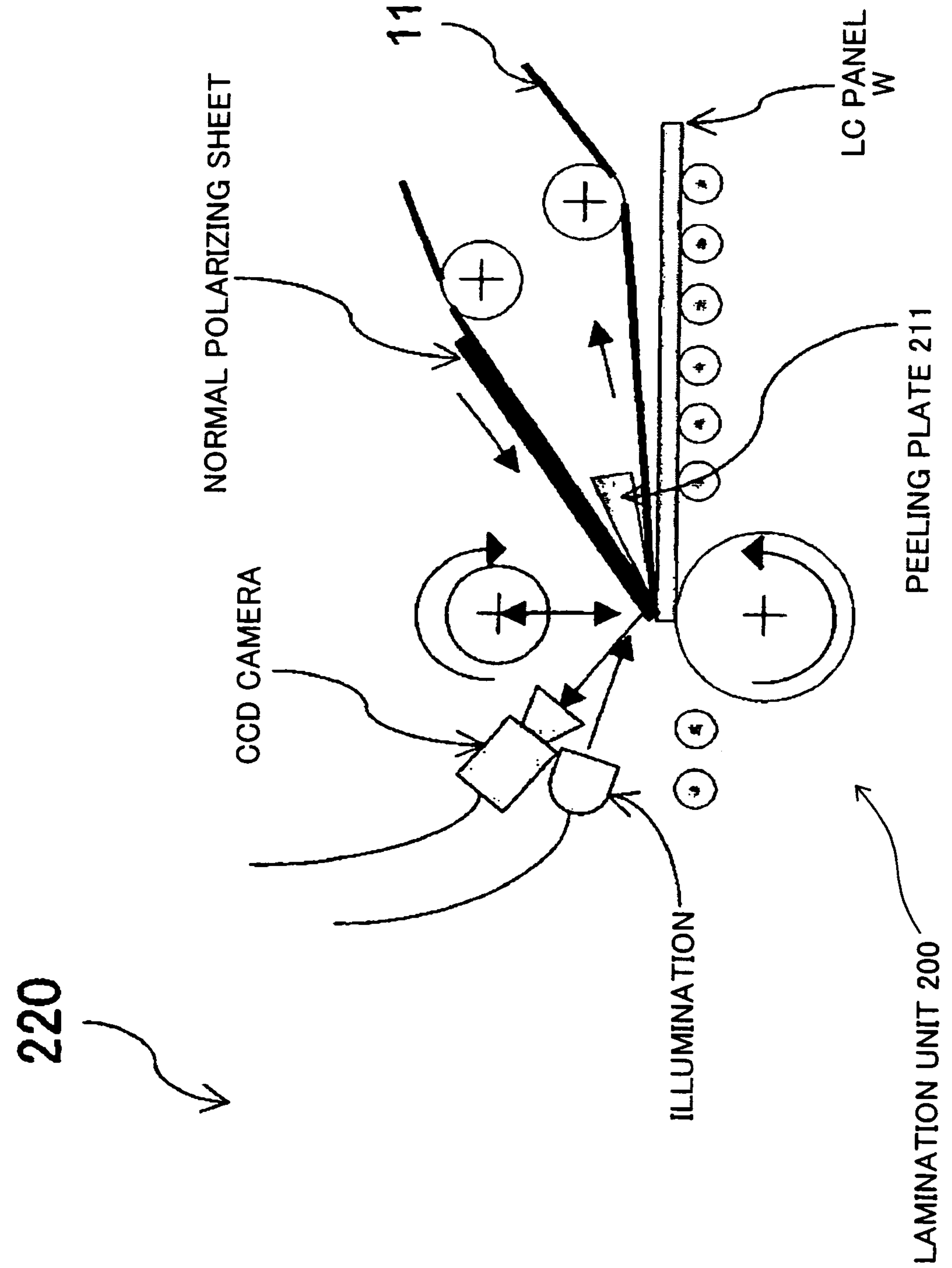

220
CCD CAMERA
NORMAL POLARIZING SHEET
11
ILLUMINATION
PEELING PLATE 211
LC PANEL
W
LAMINATION UNIT 200

FIG.12

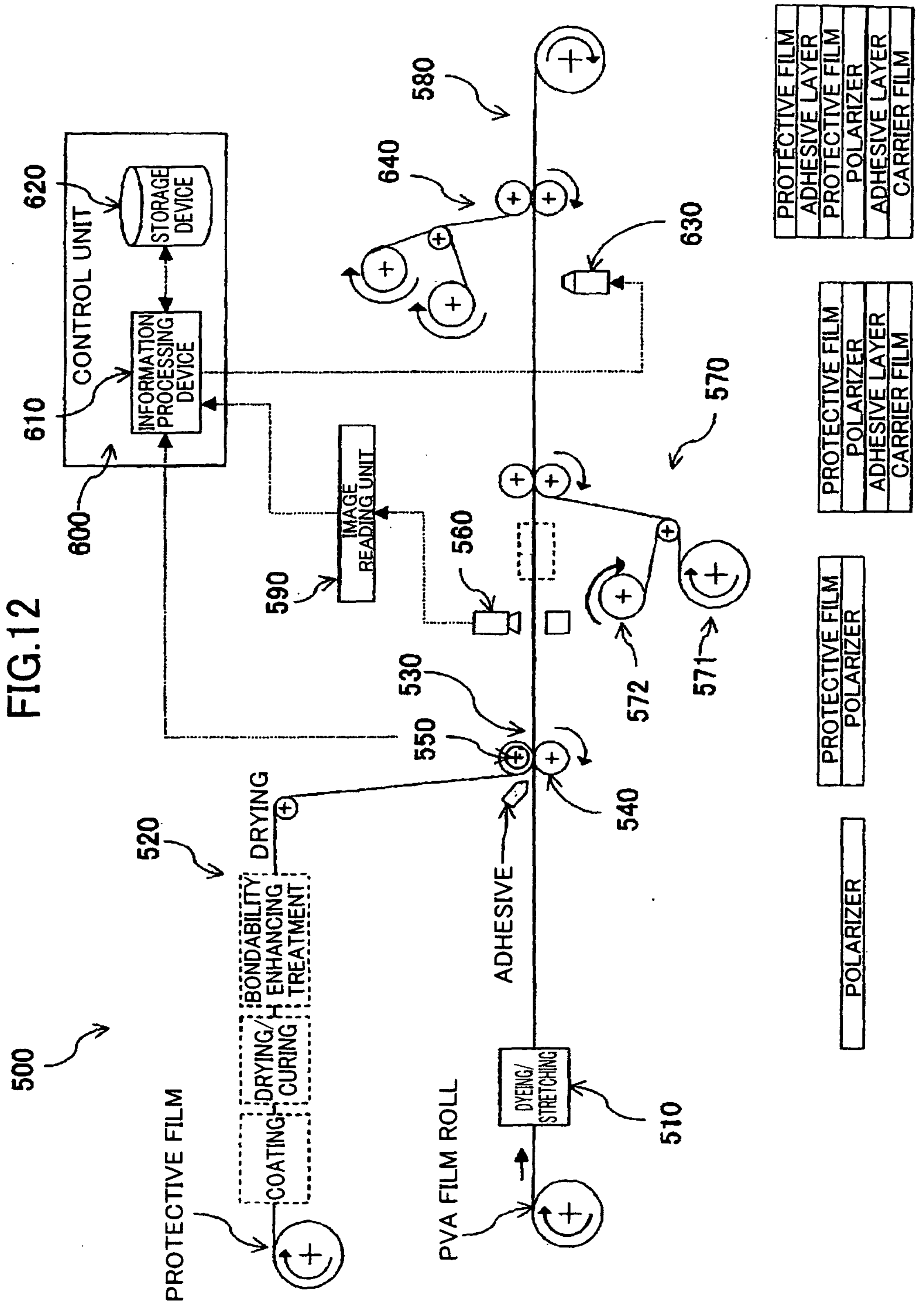

500
PROTECTIVE FILM
COATING
DRYING/ CURING
BONDABILITY ENHANCING TREATMENT
DRYING
520
PVA FILM ROLL
DYEING/ STRETCHING
510
ADHESIVE
550
530
540
560
590
IMAGE READING UNIT
572
571
570
600
610
CONTROL UNIT
INFORMATION PROCESSING DEVICE
STORAGE DEVICE
620
630
640
580
POLARIZER
PROTECTIVE FILM
POLARIZER
PROTECTIVE FILM
POLARIZER
ADHESIVE LAYER
CARRIER FILM
PROTECTIVE FILM
ADHESIVE LAYER
PROTECTIVE FILM
POLARIZER
ADHESIVE LAYER
CARRIER FILM

FIG.13

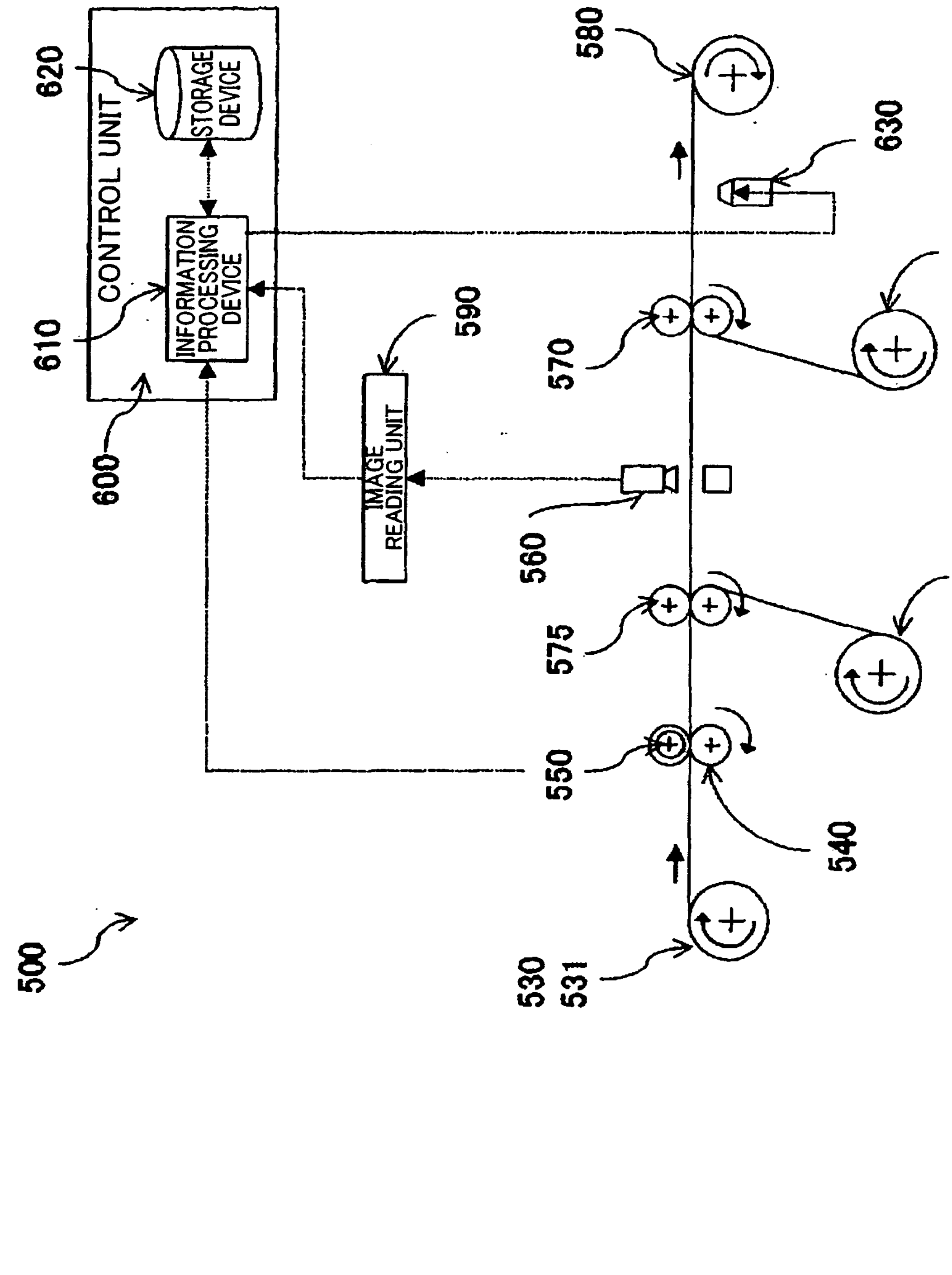

500
600
610
620
CONTROL UNIT
INFORMATION PROCESSING DEVICE
STORAGE DEVICE
590
IMAGE READING UNIT
530
531
540
550
575
576
560
570
571
630
580

FIG.14

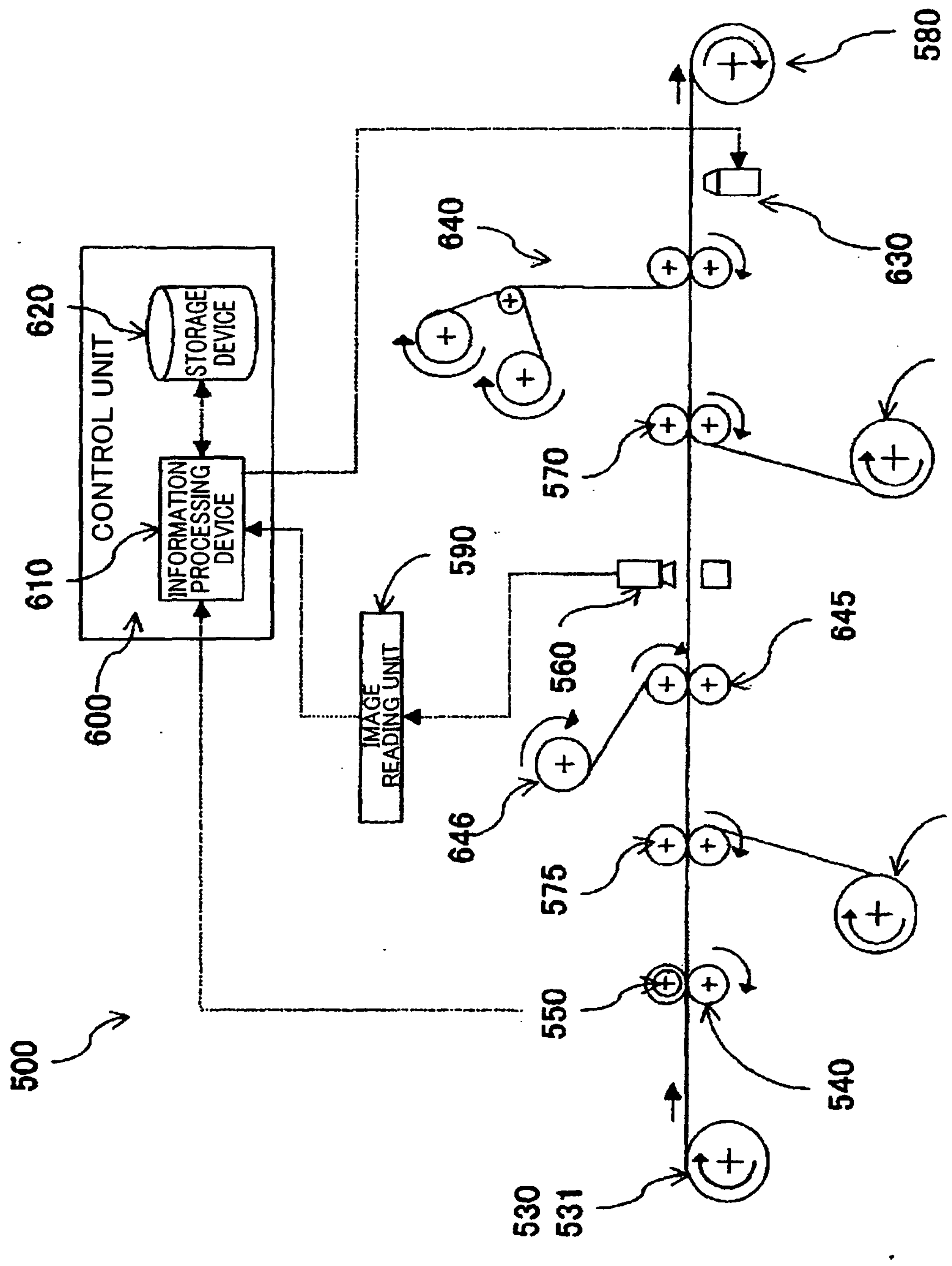

500
600
610
620
CONTROL UNIT
INFORMATION PROCESSING DEVICE
STORAGE DEVICE
IMAGE READING UNIT
590
560
645
646
575
576
550
540
530
531
570
571
640
630
580

FIG.15

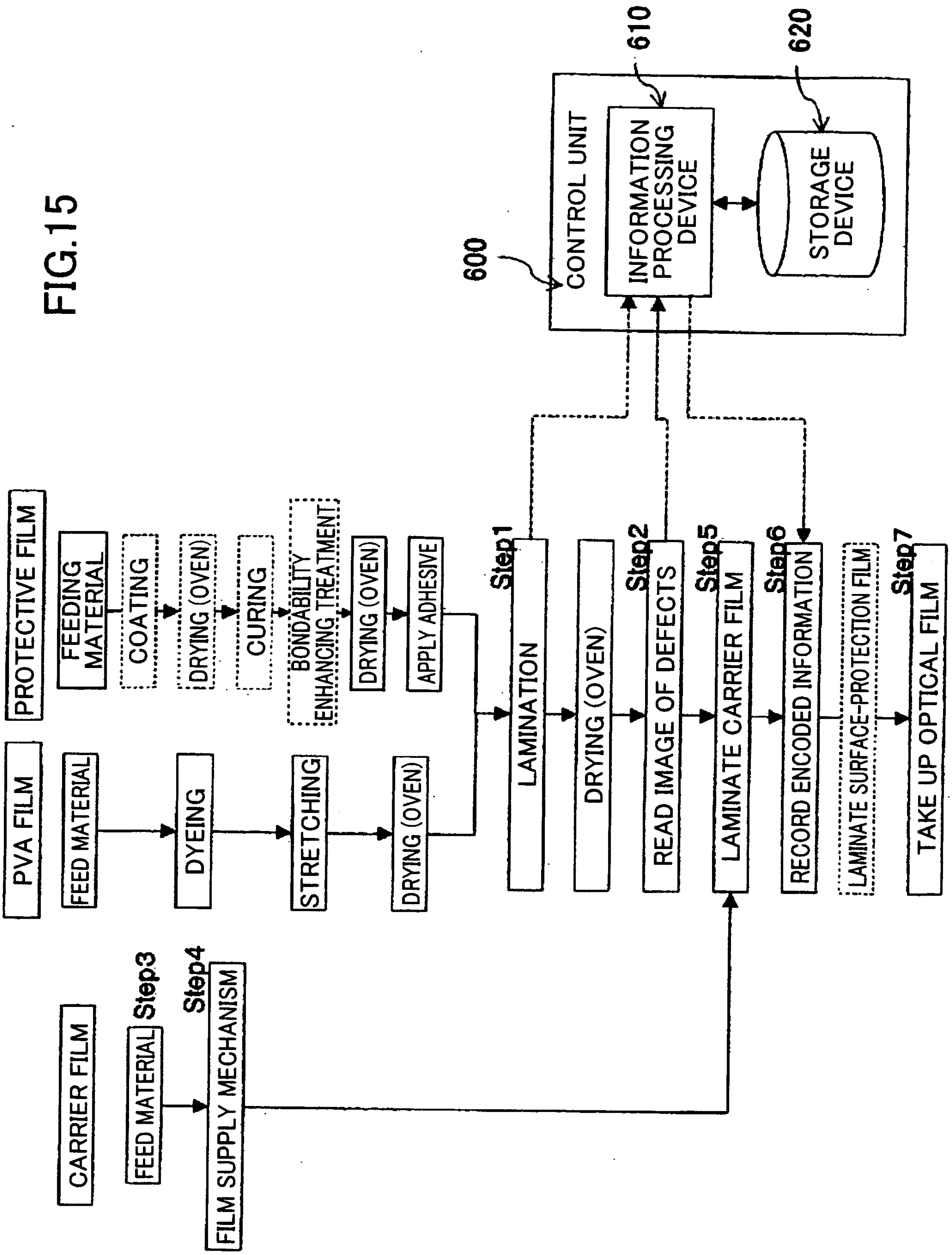

PROTECTIVE FILM
FEEDING MATERIAL
COATING
DRYING (OVEN)
CURING
BONDABILITY ENHANCING TREATMENT
DRYING (OVEN)
APPLY ADHESIVE
PVA FILM
FEED MATERIAL
DYEING
STRETCHING
DRYING (OVEN)
CARRIER FILM
FEED MATERIAL
Step3
Step4
FILM SUPPLY MECHANISM
Step1
LAMINATION
DRYING (OVEN)
Step2
READ IMAGE OF DEFECTS
Step5
LAMINATE CARRIER FILM
Step6
RECORD ENCODED INFORMATION
LAMINATE SURFACE-PROTECTION FILM
Step7
TAKE UP OPTICAL FILM
600
CONTROL UNIT
610
INFORMATION PROCESSING DEVICE
620
STORAGE DEVICE

FIG.16

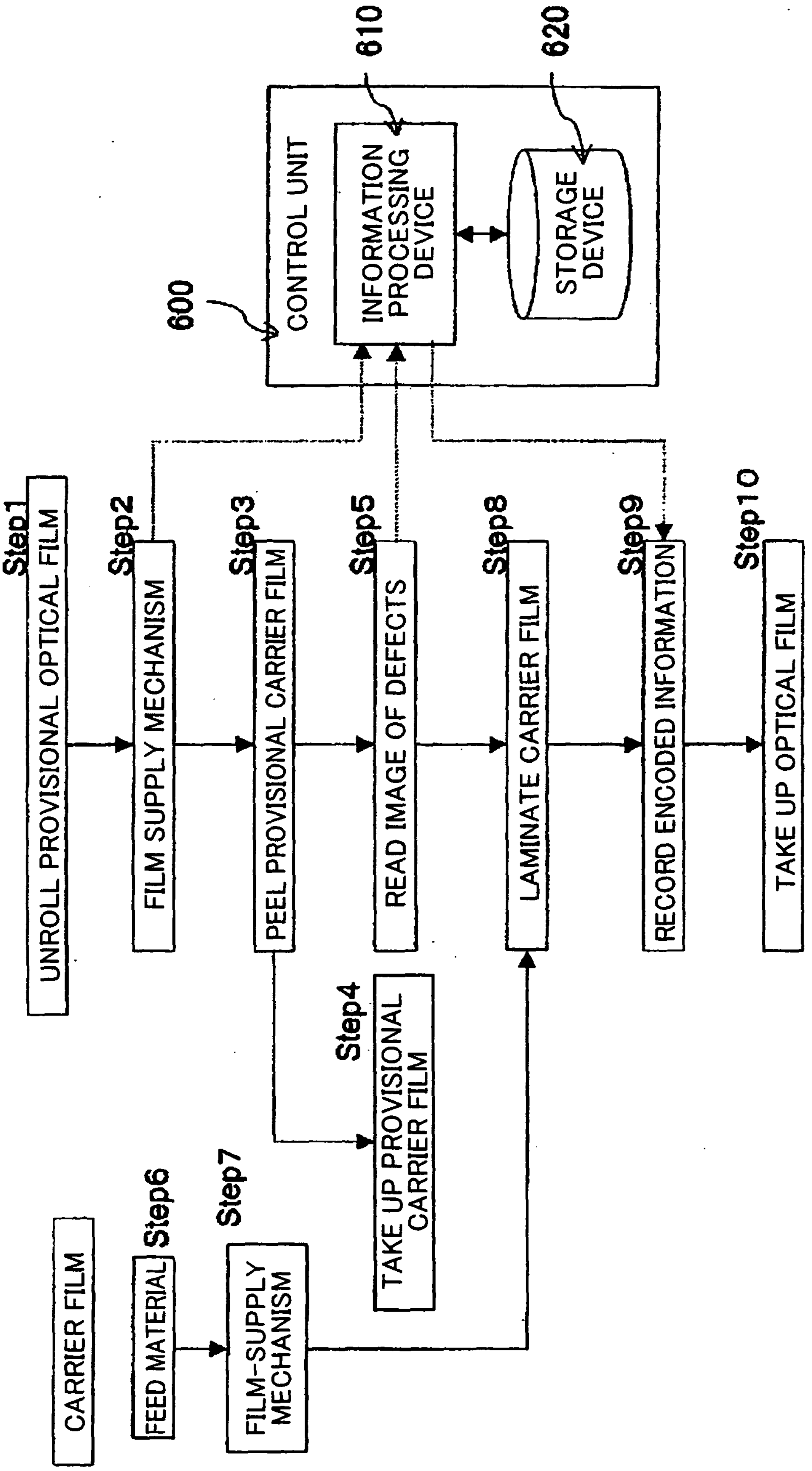

CONTROL UNIT
600
INFORMATION PROCESSING DEVICE
610
STORAGE DEVICE
620
Step1
UNROLL PROVISIONAL OPTICAL FILM
Step2
FILM SUPPLY MECHANISM
Step3
PEEL PROVISIONAL CARRIER FILM
Step4
TAKE UP PROVISIONAL CARRIER FILM
Step5
READ IMAGE OF DEFECTS
CARRIER FILM
Step6
FEED MATERIAL
Step7
FILM-SUPPLY MECHANISM
Step8
LAMINATE CARRIER FILM
Step9
RECORD ENCODED INFORMATION
Step10
TAKE UP OPTICAL FILM

FIG.17

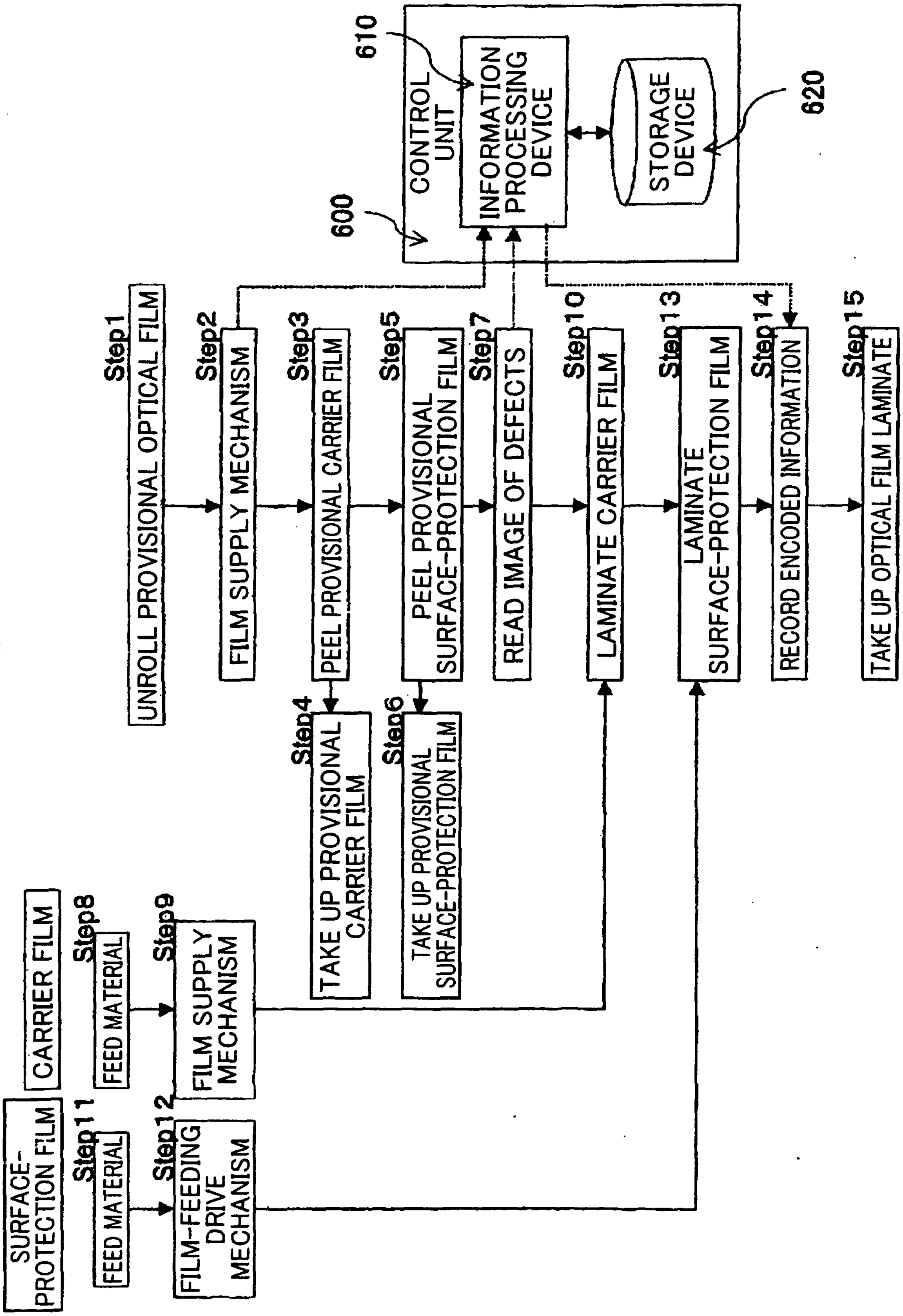

CONTROL UNIT
INFORMATION PROCESSING DEVICE
STORAGE DEVICE
600
610
620
Step1
UNROLL PROVISIONAL OPTICAL FILM
Step2
FILM SUPPLY MECHANISM
Step3
PEEL PROVISIONAL CARRIER FILM
Step4
TAKE UP PROVISIONAL CARRIER FILM
Step5
PEEL PROVISIONAL SURFACE-PROTECTION FILM
Step6
TAKE UP PROVISIONAL SURFACE-PROTECTION FILM
Step7
READ IMAGE OF DEFECTS
CARRIER FILM
Step8
FEED MATERIAL
Step9
FILM SUPPLY MECHANISM
Step10
LAMINATE CARRIER FILM
SURFACE-PROTECTION FILM
Step11
FEED MATERIAL
Step12
FILM-FEEDING DRIVE MECHANISM
Step13
LAMINATE SURFACE-PROTECTION FILM
Step14
RECORD ENCODED INFORMATION
Step15
TAKE UP OPTICAL FILM LAMINATE

FIG.18

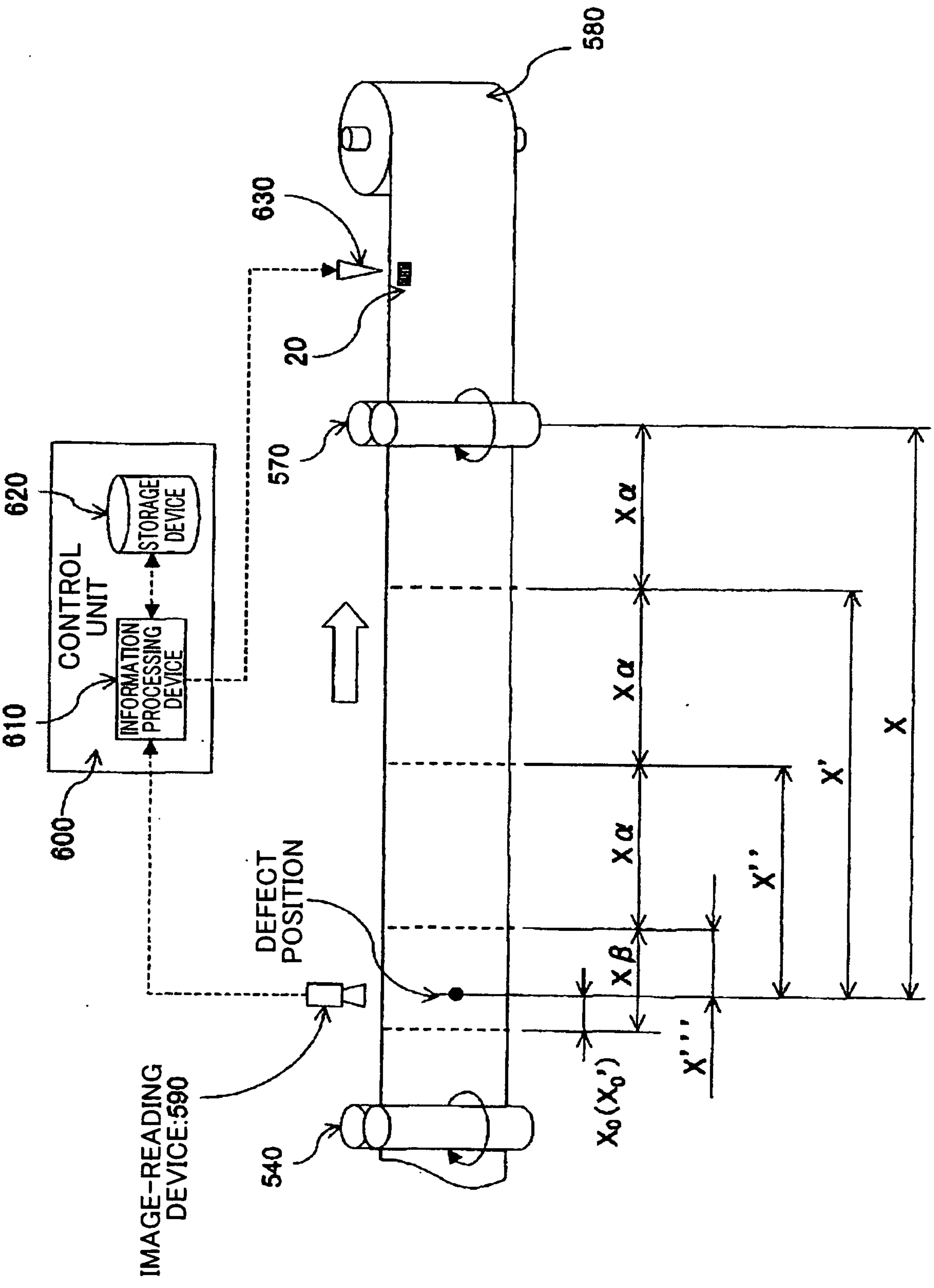

600
610
620
CONTROL UNIT
INFORMATION PROCESSING DEVICE
STORAGE DEVICE
630
20
580
570
540
IMAGE-READING DEVICE:590
DEFECT POSITION
X α
X α
X α
X β
X
X'
X''
X'''
X0(X0')

FIG.19

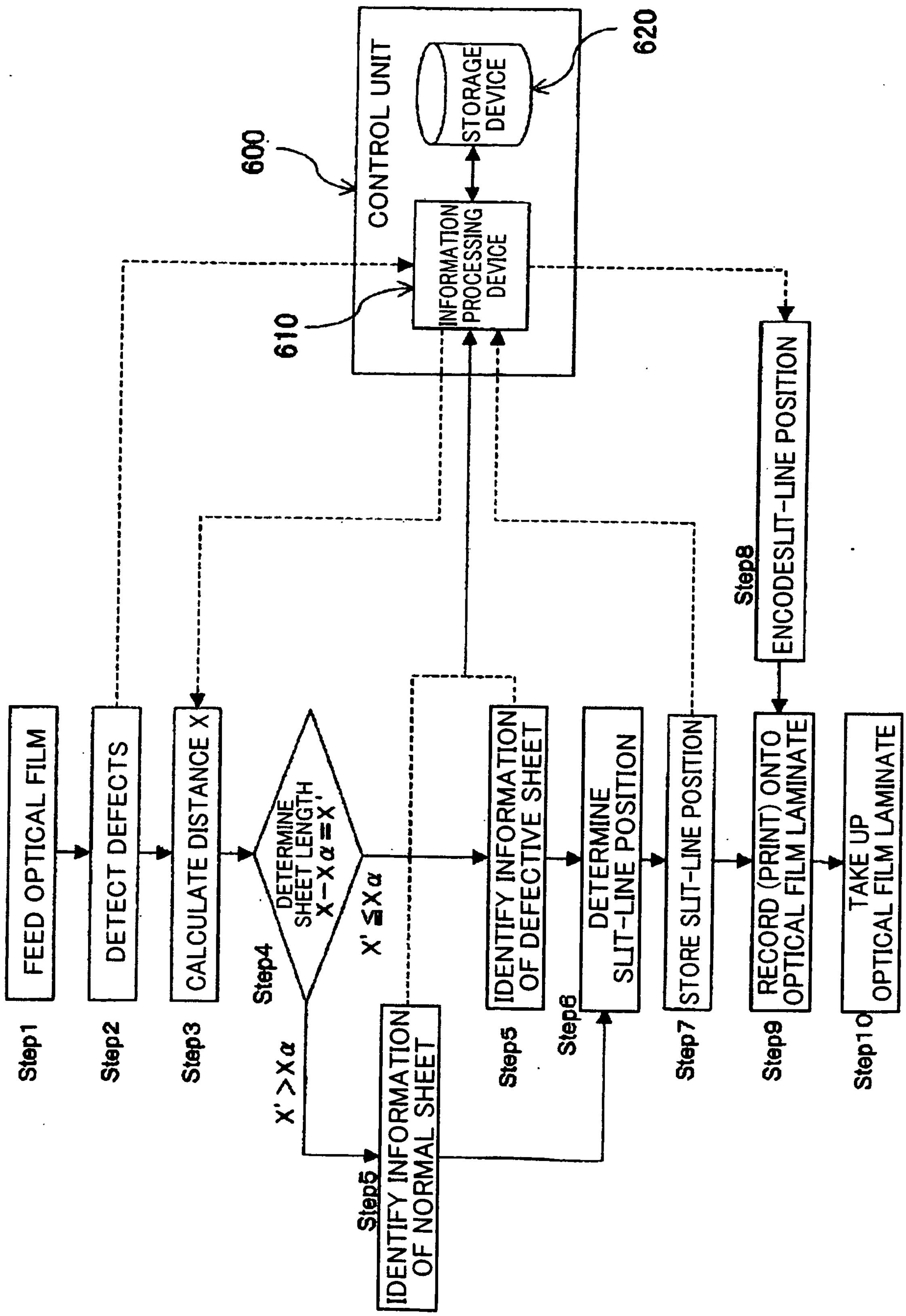
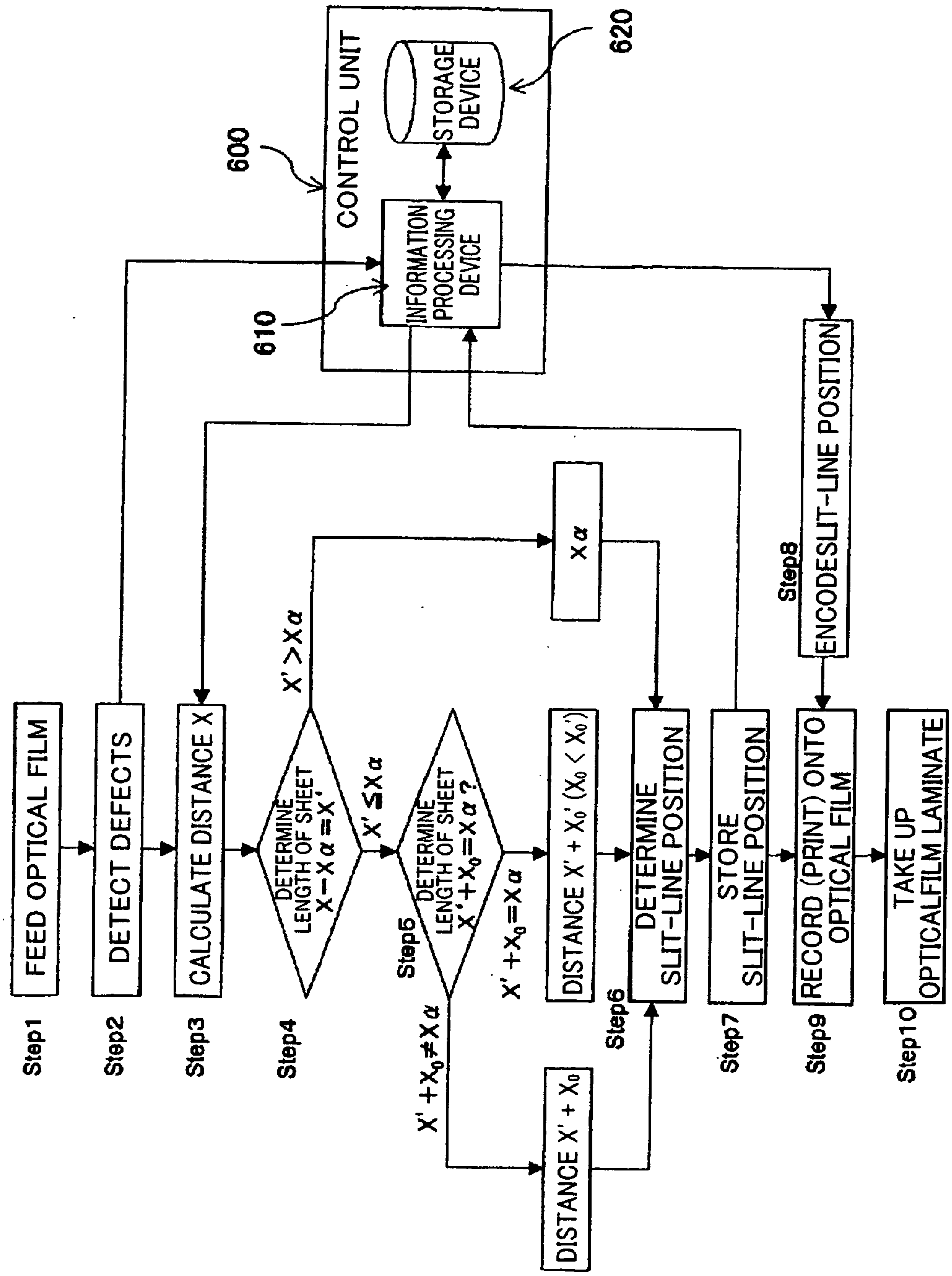
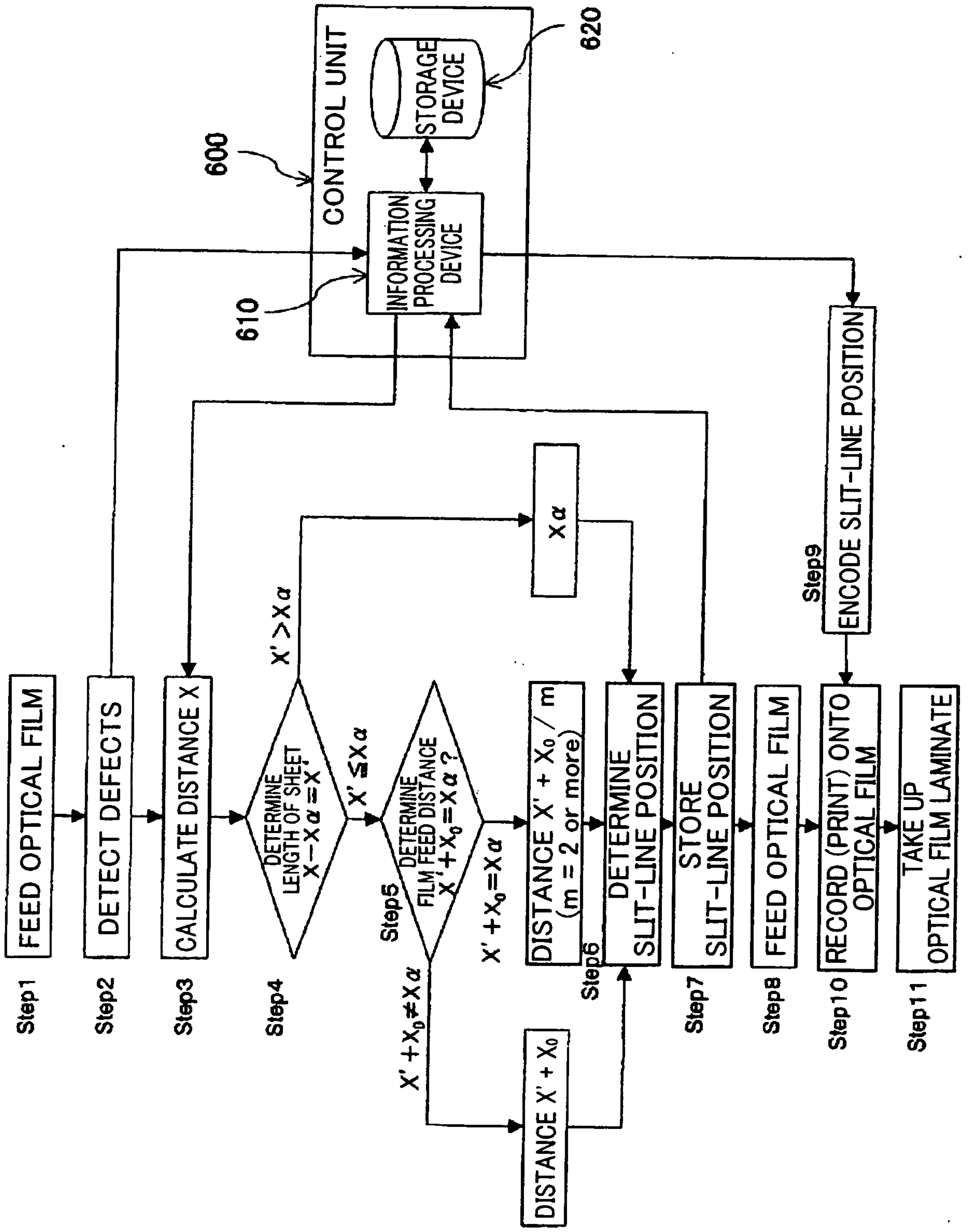

Step1
FEED OPTICAL FILM
Step2
DETECT DEFECTS
Step3
CALCULATE DISTANCE X
Step4
DETERMINE SHEET LENGTH X−Xα≡X'
X'>Xα
X'≦Xα
Step5
IDENTIFY INFORMATION OF NORMAL SHEET
Step5
IDENTIFY INFORMATION OF DEFECTIVE SHEET
Step6
DETERMINE SLIT-LINE POSITION
Step7
STORE SLIT-LINE POSITION
Step8
ENCODESLIT-LINE POSITION
Step9
RECORD (PRINT) ONTO OPTICAL FILM LAMINATE
Step10
TAKE UP OPTICAL FILM LAMINATE
600
CONTROL UNIT
610
INFORMATION PROCESSING DEVICE
620
STORAGE DEVICE

FIG.20



Step1
FEED OPTICAL FILM
Step2
DETECT DEFECTS
Step3
CALCULATE DISTANCE X
Step4
DETERMINE LENGTH OF SHEET X−Xα=X'
X'>Xα
X'≦Xα
Xα
Step5
DETERMINE LENGTH OF SHEET X'+X₀=Xα ?
X'+X₀=Xα
X'+X₀≠Xα
DISTANCE X'+X₀'(X₀<X₀')
DISTANCE X'+X₀
Step6
DETERMINE SLIT-LINE POSITION
Step7
STORE SLIT-LINE POSITION
Step8
ENCODESLIT-LINE POSITION
Step9
RECORD (PRINT) ONTO OPTICAL FILM
Step10
TAKE UP OPTICALFILM LAMINATE
600
CONTROL UNIT
610
INFORMATION PROCESSING DEVICE
620
STORAGE DEVICE

FIG.21



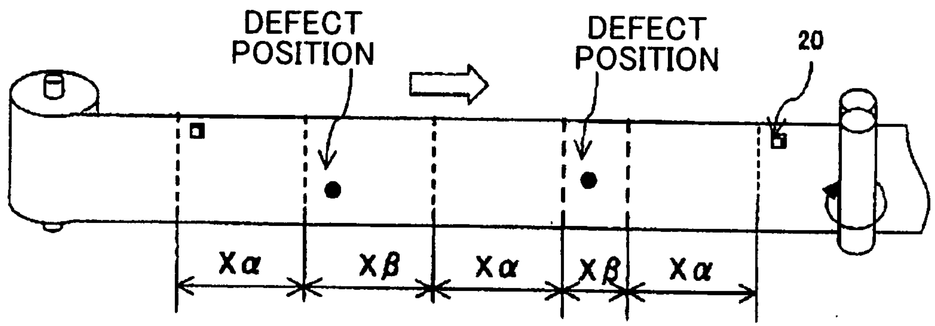
Step1
FEED OPTICAL FILM
Step2
DETECT DEFECTS
Step3
CALCULATE DISTANCE X
Step4
DETERMINE LENGTH OF SHEET X−Xα=X'
X'>Xα
Xα
X'≦Xα
Step5
DETERMINE FILM FEED DISTANCE X'+X0=Xα ?
X'+X0≠Xα
DISTANCE X'+X0
X'+X0=Xα
DISTANCE X'+X0 / m (m = 2 or more)
Step6
DETERMINE SLIT-LINE POSITION
Step7
STORE SLIT-LINE POSITION
Step8
FEED OPTICAL FILM
Step9
ENCODE SLIT-LINE POSITION
Step10
RECORD (PRINT) ONTO OPTICAL FILM
Step11
TAKE UP OPTICAL FILM LAMINATE
600
CONTROL UNIT
610
INFORMATION PROCESSING DEVICE
STORAGE DEVICE
620

FIG.22

No.	TYPE	CAPACITY	TYPE OF INFORMATION	DATA CONTENT	INTERVALS OF PRINTING TO WEB
1	ONE-DIMENSIONAL CODE EXAMPLE	20 CHARACTERS	ALPHANUMERIC CHARACTER	SEE JP 3974400B	1 to 2 m
2	TWO-DIMENSIONAL CODE (MATRIX CODE) EXAMPLE	2000 CHARACTERS	ALPHANUMERIC CHARACTER JAPANESE KANA CHARACTER CHINESE CHARACTER	· LOT No. · ROLL LENGTH · TYPE OF DEFECT · DEFECT POSITION · SIZE OF DEFECT · CONTRAST DIFFERENCE · CUT POSITION (SLIT LINE POSITION)	1 to 100 m
3	IC TAG EXAMPLE 	CHARACTERS SEVERAL THOUSANDS OR MORE	ALPHANUMERIC CHARACTER JAPANESE KANA CHARACTER CHINESE CHARACTER	· LOT No. · ROLL LENGTH · TYPE OF DEFECT · DEFECT POSITION · SIZE OF DEFECT · CONTRAST DIFFERENCE · CUT POSITION (SLIT LINE POSITION)	ONE POSITION AT LEADING EDGE

FIG.23

EXAMPLE OF DEFECT POSITION INFORMATION



EXAMPLE OF INFORMATION IN STORAGE DEVICE

LOT No.	SLIT POSITION	IDENTIFICATION INFORMATION Xγ	DETERMINATION
#A0001	400	0	Xα
	220	1	Xβ
	400	0	Xα
	400	1	Xβ
	400	0	Xα

Xα = PRODUCT SIZE

Xβ = DEFECTIVE SHEET ($X' + X_0$)

Xγ = IDENTIFICATION INFORMATION OF DEFECTIVE SHEET

EXAMPLE OF ENCODING (CUT-LINE FORMATION POSITION)

(EXAMPLE OF CONVERSION UNDER JIS 8-CODE STRING)

234130303031
3034303030
3032323031
3034303030
3034303031
3034303030

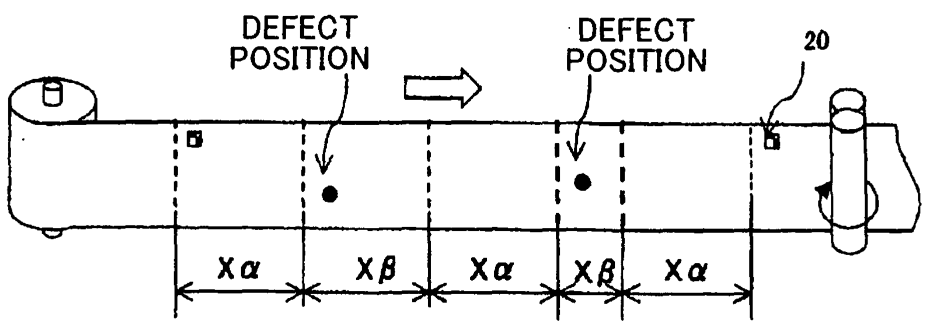
3034303031

SLIT-POSITION INFORMATION — IDENTIFICATION INFORMATION OF DEFECTIVE SHEET Xγ

EXAMPLE OF RECORDING ONTO CARRIER FILM (TWO-DIMENSIONAL (MATRIX) CODE)

FIG.24

EXAMPLE OF DEFECT POSITION INFORMATION



EXAMPLE OF INFORMATION IN STORAGE DEVICE

LOT No.	SLIT POSITION (IDENTIFICATION INFORMATION)	DETERMINATION
#A0001	400	Xα
	220	Xβ
	400	Xα
	405 ※	Xβ
	400	Xα

Xα = PRODUCT SIZE

Xβ = DEFECTIVE SHEET ($X' + X_0$)

($X' \leqq X\alpha$)

※ IN CASE OF Xβ ($X' + X_0$) = Xα

$X\beta = X' + X_0'$ ($X_0 < X_0'$) > Xα

(IN CASE OF TABLE, $X_0' = X_0 + 5mm$)

EXAMPLE OF ENCODING (CUT-LINE FORMATION POSITION)

(EXAMPLE OF CONVERSION UNDER JIS 8-CODE STRING)

234130303031
30343030
30323230
30343030
30343035
30343030

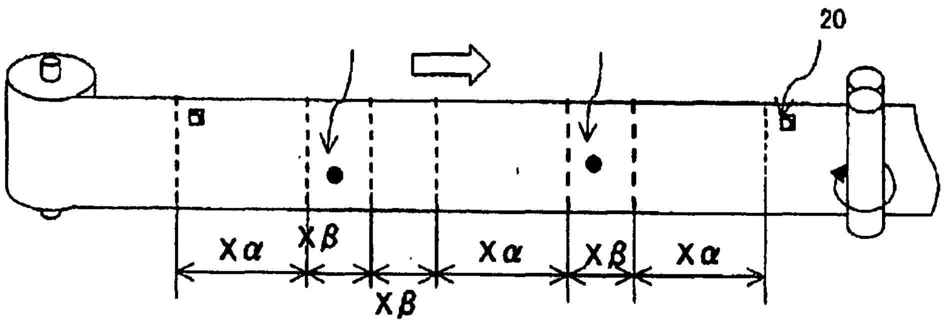
→ 30343035 SLIT-POSITION INFORMATION

EXAMPLE OF RECORDING ONTO CARRIER FILM (TWO-DIMENSIONAL (MATRIX) CODE)

20

FIG.25

EXAMPLE OF DEFECT POSITION INFORMATION



EXAMPLE OF INFORMATION IN STORAGE DEVICE

LOT No.	SLIT POSITION (IDENTIFICATION INFORMATION)	DETERMINATION
#A0001	400	Xα
	220	Xβ
	400	Xα
	200	Xβ
	200	Xβ
	400	Xα

Xα = PRODUCT SIZE

Xβ = DEFECTIVE SHEET (X' ≦ Xα)

※IN CASE OF Xβ (X' + X_0) = Xα

Xβ = (X' + X_0) / m < Xα

(IN CASE OF TABLE, IF m = 2,

Xβ = 400/2 = 200となる)

EXAMPLE OF ENCODING (CUT-LINE FORMATION POSITION)

(EXAMPLE OF CONVERSION UNDER JIS 8-CODE STRING)

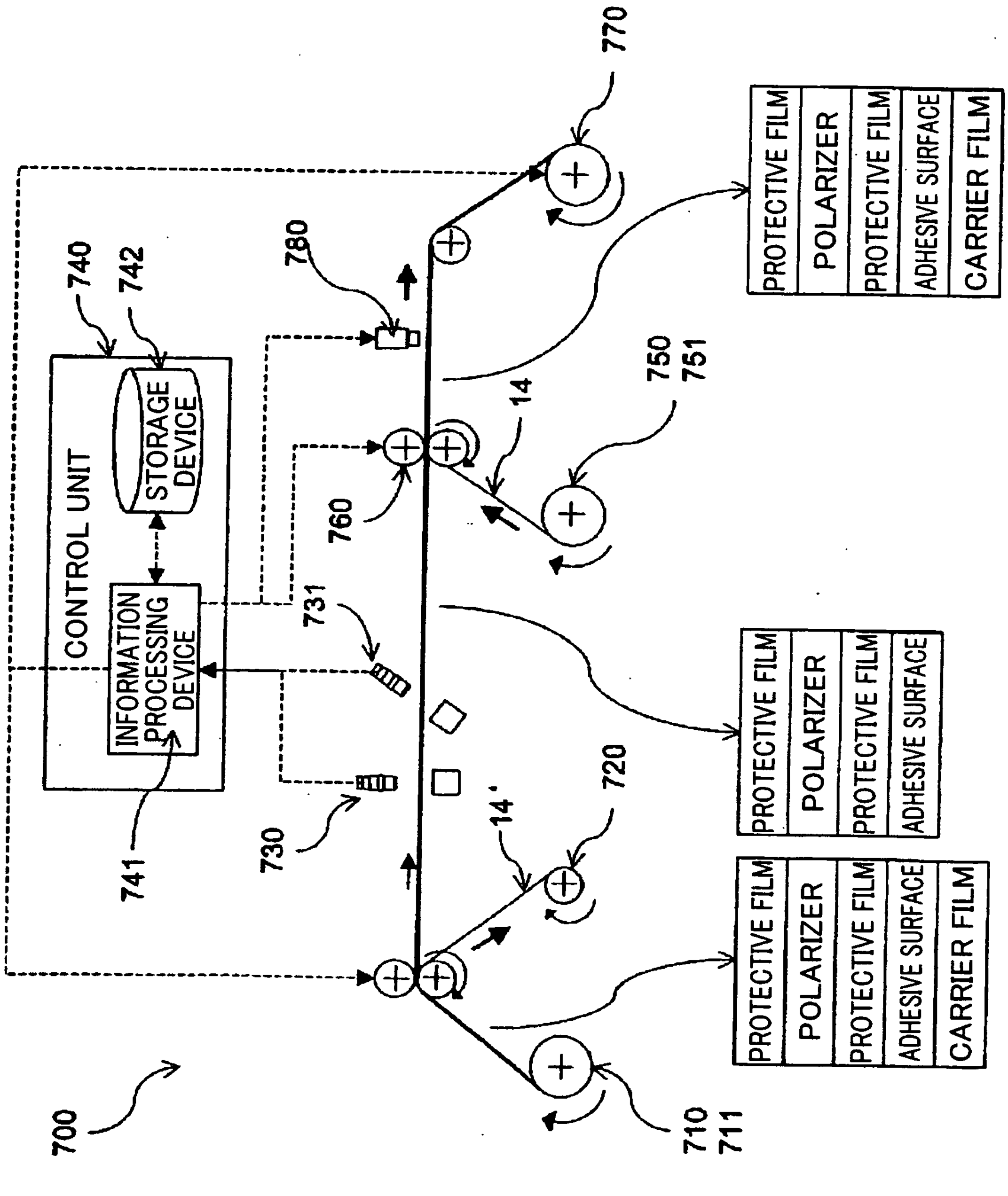
234130303031
30343030
30323230
30343030
30323030
30323030
30343030

30323030 — SLIT-POSITION INFORMATION

EXAMPLE OF RECORDING ONTO CARRIER FILM (TWO-DIMENSIONAL (MATRIX) CODE)

20

FIG.26



CONTROL UNIT
STORAGE DEVICE
INFORMATION PROCESSING DEVICE
740
742
741
700
710
711
720
730
731
750
751
760
770
780
14
14'
PROTECTIVE FILM
POLARIZER
PROTECTIVE FILM
ADHESIVE SURFACE
CARRIER FILM
PROTECTIVE FILM
POLARIZER
PROTECTIVE FILM
ADHESIVE SURFACE
PROTECTIVE FILM
POLARIZER
PROTECTIVE FILM
ADHESIVE SURFACE
CARRIER FILM

FIG.27

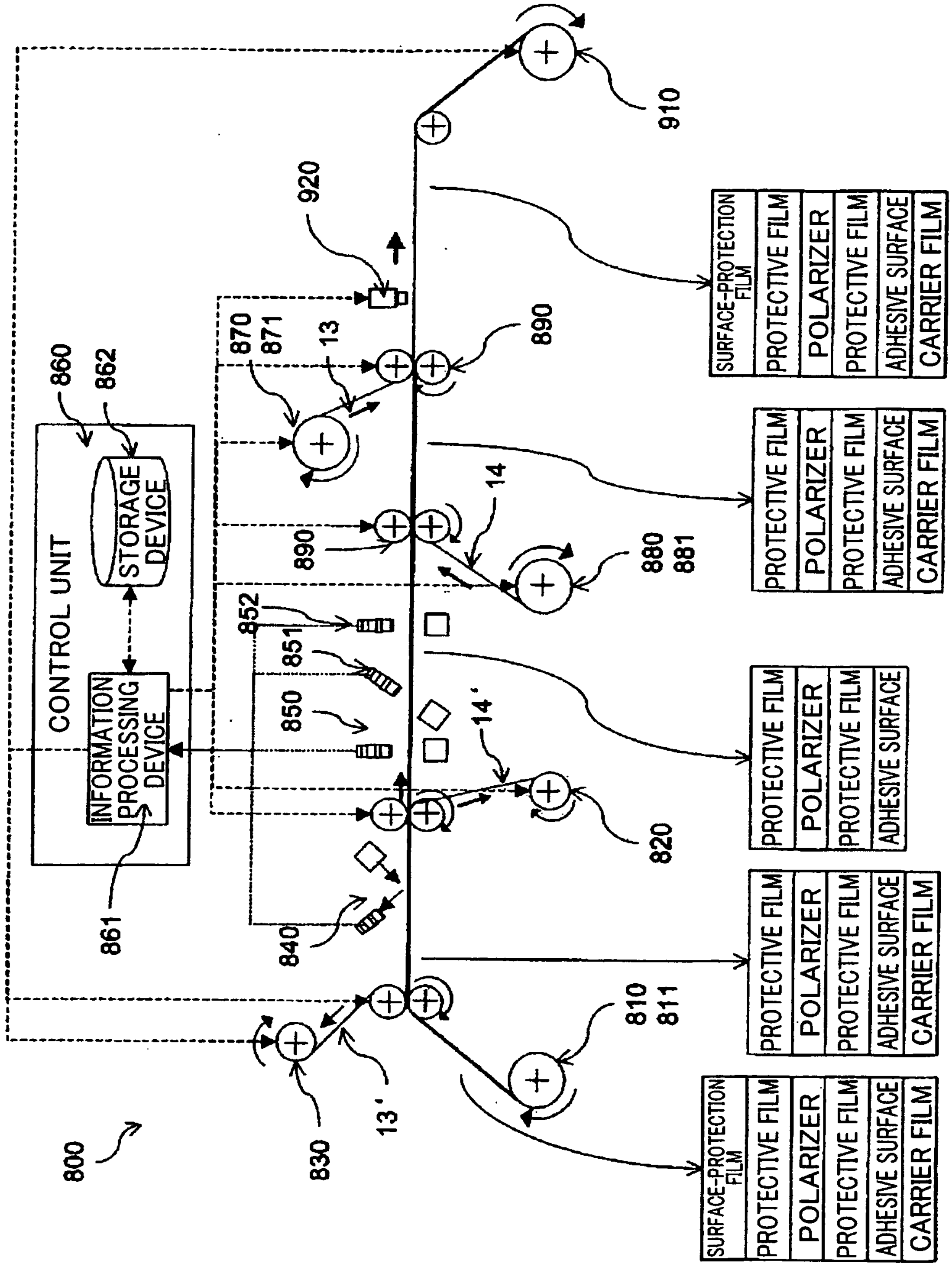

800
CONTROL UNIT
860
862
STORAGE DEVICE
INFORMATION PROCESSING DEVICE
861
830
13'
810
811
840
850
851
852
14'
820
14
880
881
890
870
871
13
920
910
SURFACE-PROTECTION FILM
PROTECTIVE FILM
POLARIZER
PROTECTIVE FILM
ADHESIVE SURFACE
CARRIER FILM

FIG.28

INSPECTION UNIT	TYPE OF DEFECT				
	INTERNAL FOREIGN SUBSTANCES	INTERNAL PORES	BRIGHT SPOTS	SURFACE IRREGULARITIES	FLAW/UNDULATION
REFLECTION	△	△	×	○	○
TRANSMISSION	○	○	△	△	×
CROSS-NICOL TRANSMISSION	○	○	○	×	○

※Transmission Inspection

An inspection method designed such that visible light is emitted from a light source to an optical sensor unit while passing through an optical film at an incidence angle perpendicular thereto, to detect a defect inherent in the optical film as a shade.

※Reflection

※Cross-Nicol transmission

An inspection method designed such that a polarization filter is disposed just before an optical sensor unit in such a manner as to allow an absorption axis thereof to extend at a right angle with respect to an absorption axis of a polarizing film, and visible light is emitted from a light source to the optical sensor unit while passing through the polarizing film at an incidence angle perpendicular or oblique thereto, to detect a defect inherent in the polarizing film as a bright spot.

REFERENCES CITED IN THE DESCRIPTION

This list of references cited by the applicant is for the reader's convenience only. It does not form part of the European patent document. Even though great care has been taken in compiling the references, errors or omissions cannot be excluded and the EPO disclaims all liability in this regard.

Patent documents cited in the description

- JP 2003161935 A **[0011] [0030]**
- JP 3616866 B **[0011] [0030]**
- JP 62014810 B **[0014] [0030]**
- JP 2002023151 A **[0015] [0030]**
- JP 2004144913 A **[0015] [0030]**
- JP 2005298208 A **[0015] [0030]**
- JP 2006058411 A **[0015] [0030]**
- JP 2004361741 A **[0017] [0030] [0032]**
- JP 3974400 B **[0021] [0030]**
- JP 2005062165 A **[0021] [0030]**
- JP 2007064989 A **[0021] [0030] [0032]**
- JP 2007140046 A **[0026] [0030]**
- JP 2007266200 A **[0027]**
- US 20050016670 A **[0032]**

patsnap

专利名称(译)	连续制造液晶显示元件的方法和设备		
公开(公告)号	EP2264516B1	公开(公告)日	2012-04-25
申请号	EP2009731702	申请日	2009-03-30
[标]申请(专利权)人(译)	日东电工株式会社		
申请(专利权)人(译)	日东电工株式会社		
当前申请(专利权)人(译)	日东电工株式会社		
[标]发明人	KIMURA KOUJI YAMANO TAKAYOSHI NAKAZONO TAKUYA KITADA KAZUO YURA TOMOKAZU SHIMANOE FUMIHITO KOSHIO SATORU		
发明人	KIMURA, KOUJI YAMANO, TAKAYOSHI NAKAZONO, TAKUYA KITADA, KAZUO YURA, TOMOKAZU SHIMANOE, FUMIHITO KOSHIO, SATORU		
IPC分类号	G02F1/1335 G02F1/13		
CPC分类号	B32B38/1841 B32B41/00 B32B2309/10 B32B2309/105 B32B2457/202 G02F1/1303 G02F1/133305 G02F1/133528 G02F2001/133635 G02F2201/50 G02F2202/28 G02F2203/69 Y10T156/10 Y10T156/1056 Y10T156/1057 Y10T156/1082 Y10T156/1084 Y10T156/1085 Y10T428/1036 Y10T428/1041 Y10T428/14 Y10T428/149 Y10T428/1495 Y10T428/23 Y10T428/24298 Y10T428/24314 Y10T428/24322 Y10T428/24331 Y10T428/24942		
优先权	PCT/JP2008/000987 2008-04-15 WO		
其他公开文献	EP2264516A4 EP2264516A1		
外部链接	Espacenet		

摘要(译)

[问题]提供一种用于液晶显示元件的连续制造方法和系统，其有助于提高液晶元件的连续产品的精度和提高速度，并且实现产量的显着提高。 [解决问题的手段]本发明提供一种用于制造液晶显示元件的连续方法和系统，包括并适于执行以下步骤：限定多个缺陷偏振片切割位置和正常偏振片切割位置在光学薄膜的连续卷材上，基于通过预检测检测到的光学薄膜的连续卷材中存在的缺陷的位置，并将正常偏光片施加到液晶面板上以制造液晶显示元件，其中形成的具有与液晶板的尺寸相对应的尺寸的偏振片由光学膜的连续网形成具有包括有缺陷偏振片切割位置和记录在其上的正常偏振片切割位置的切口位置信息作为编码信息，其中该步骤包括：根据连续卷材的送出距离计算送纸长度测量数据;读取连续网络上记录的编码信息;基于编码信息和进给长度测量数据，通过沿着切割位置从与载体膜相对的表面切割连续卷材，形成多条切割线;确定在连续卷材中顺序形成的切割线之间限定的偏光片是否是正常偏光片，从载体膜上剥离确定为正常偏光片的偏光片并输送到层压工位;将正常的偏振片应用于液晶面板。

【Equation 1】

$$\delta = \cos^{-1}\left\{\frac{\gamma}{\sqrt{\gamma^2 + (\beta_1 - \beta_2)^2}}\right\}$$