



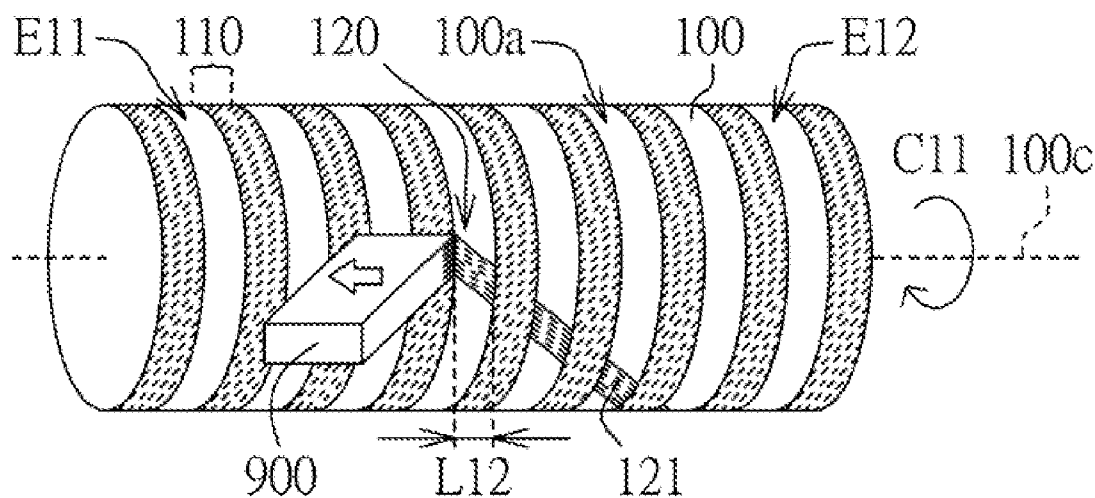
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(19) **United States**(12) **Patent Application Publication**
WU(10) **Pub. No.: US 2013/0025342 A1**(43) **Pub. Date: Jan. 31, 2013**(54) **MANUFACTURING METHOD OF ROLLER
FOR MANUFACTURING PATTERNED
RETARDER FILM****Publication Classification**(51) **Int. Cl.**
B21D 31/00 (2006.01)(52) **U.S. Cl.** **72/370.21**(57) **ABSTRACT**

A method for producing a roller used for manufacturing a retarder film is provided. The method includes providing a roller having a roller axis and a roller surface; providing an embossing tool having an embossing end; rotating the roller with respect to the roller axis; embossing the roller surface with the embossing tool with a first depth in a first predetermined distance and a second depth in a second predetermined distance; and removing the embossing from the roller surface. The embossing end has a plurality of parallel microgroove structures. The embossing tool embosses the roller surface to generate a first embossing area having a plurality of first embossing patterns and a second embossing area having a plurality of second embossing patterns.

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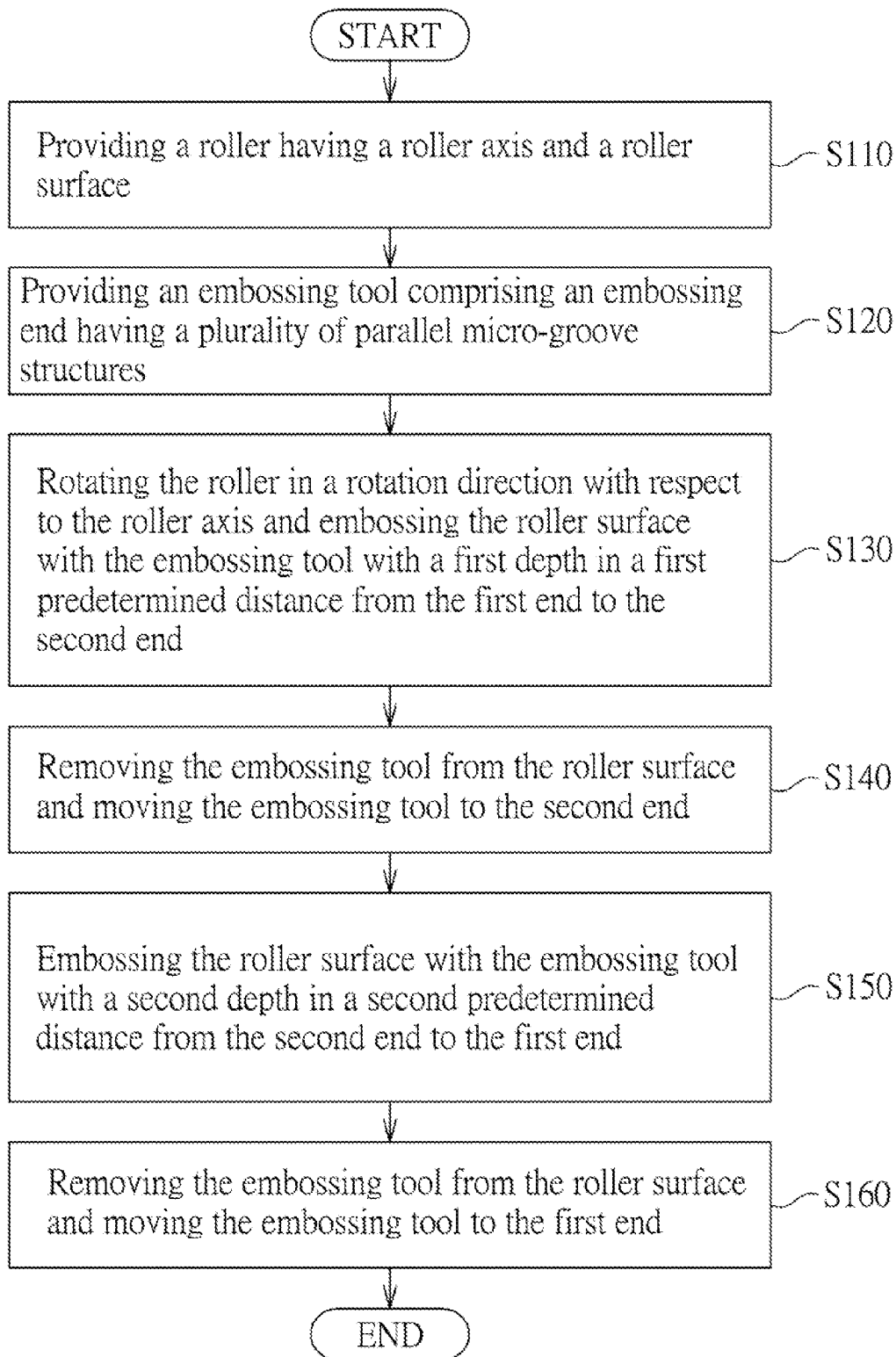


FIG. 1

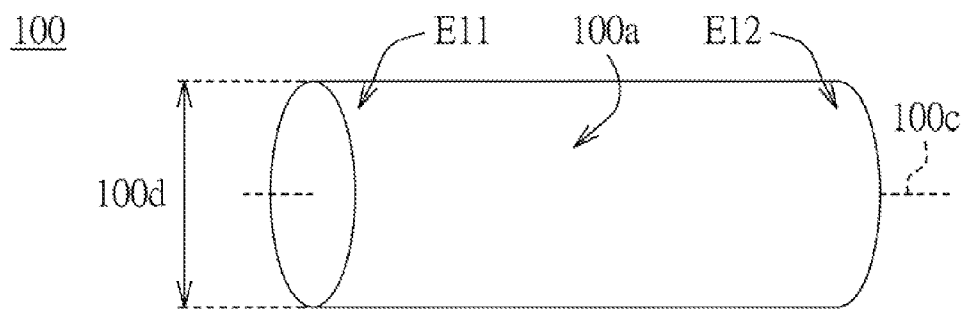


FIG. 2A

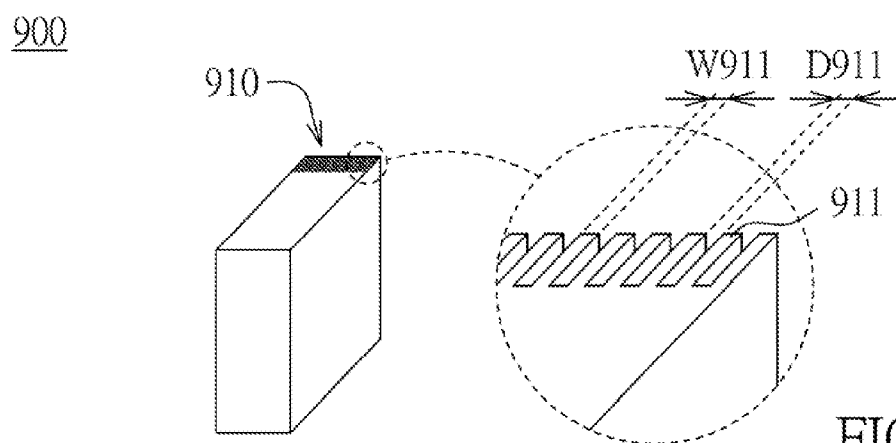


FIG. 2B

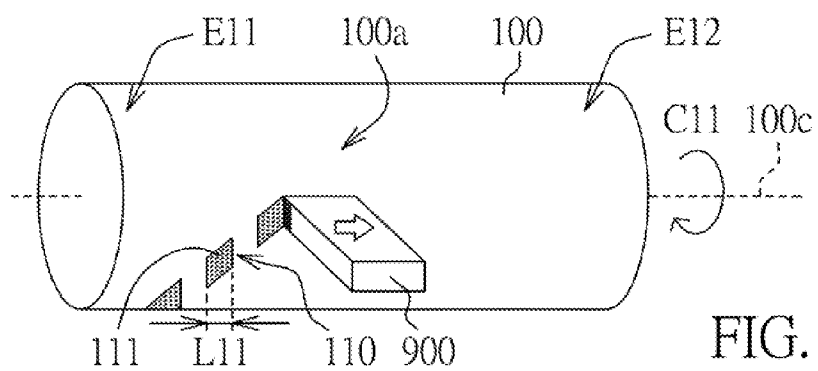


FIG. 2C

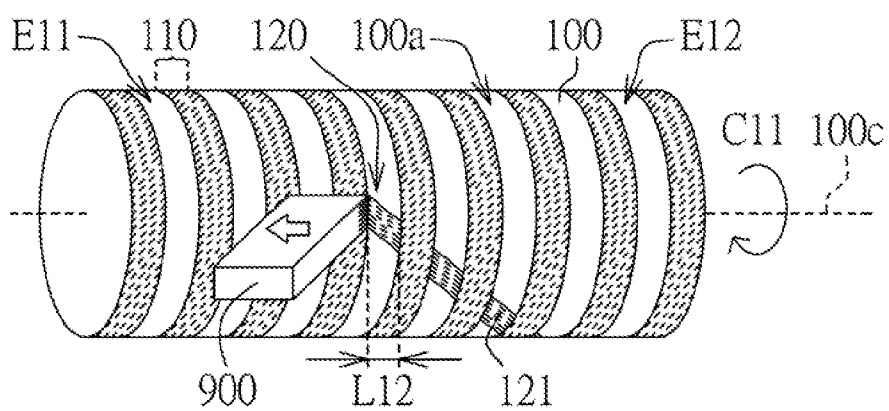


FIG. 2D

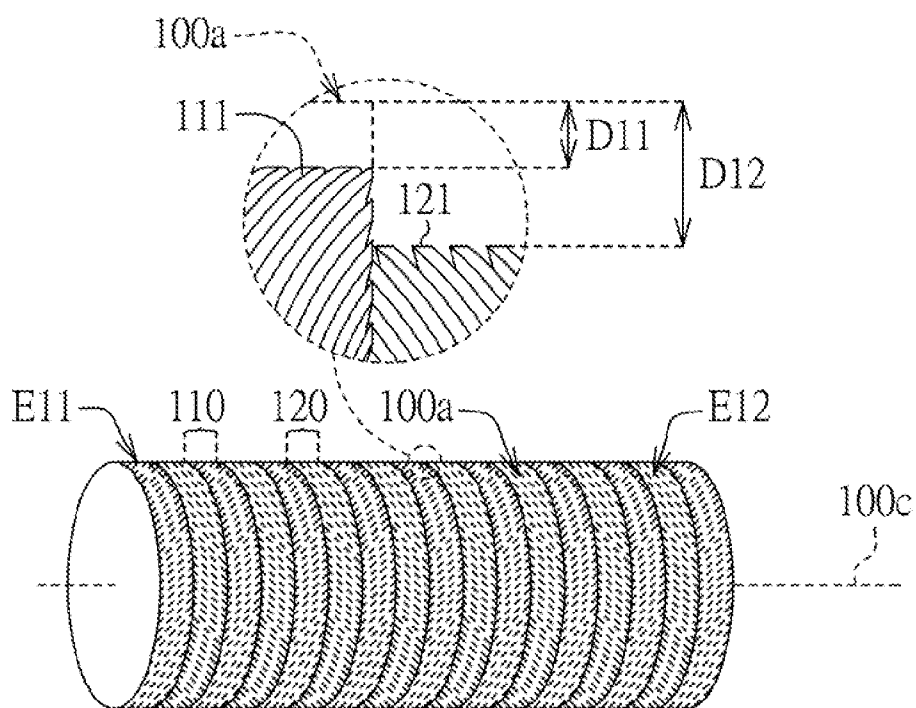


FIG. 2E

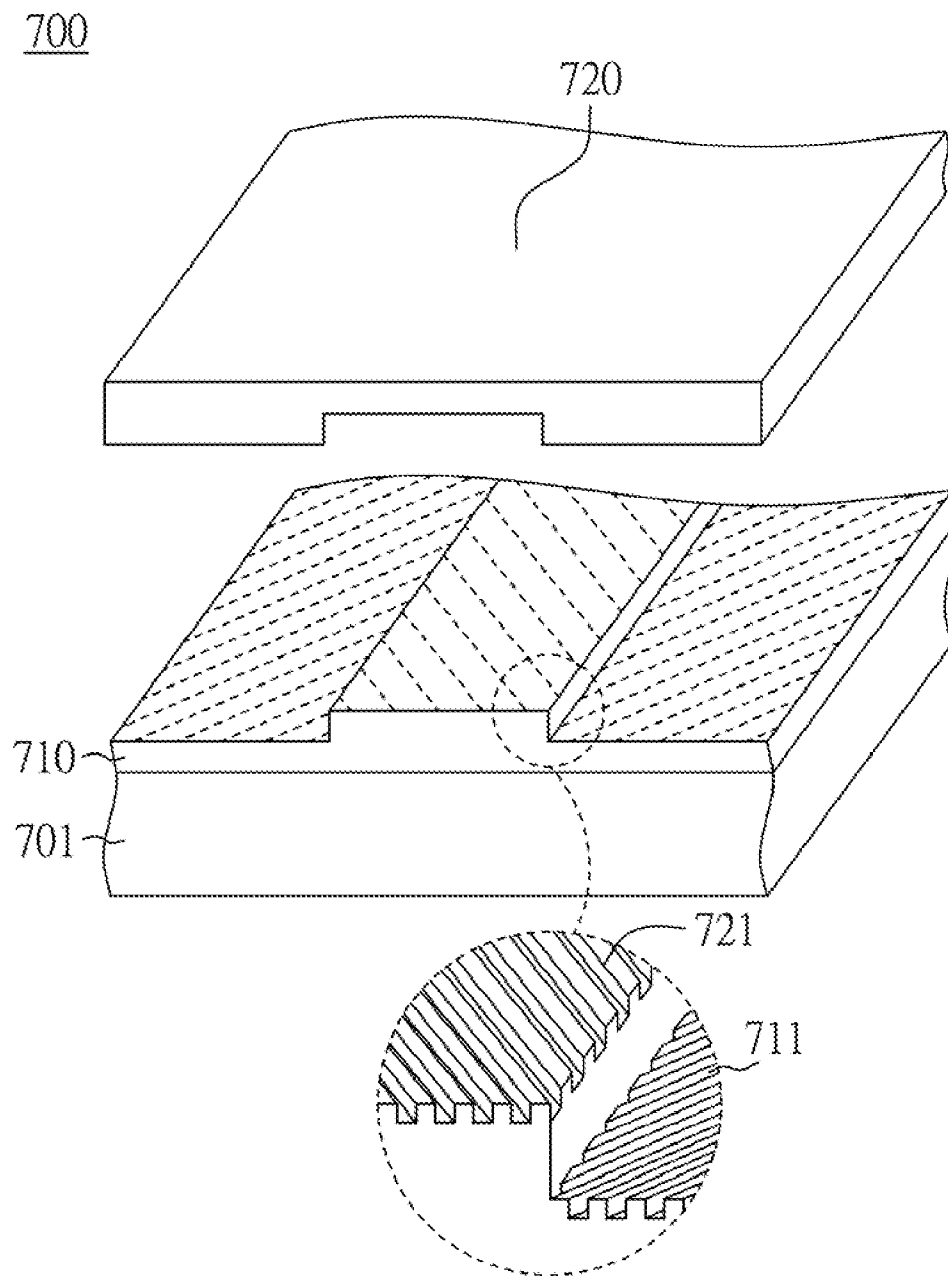


FIG. 3

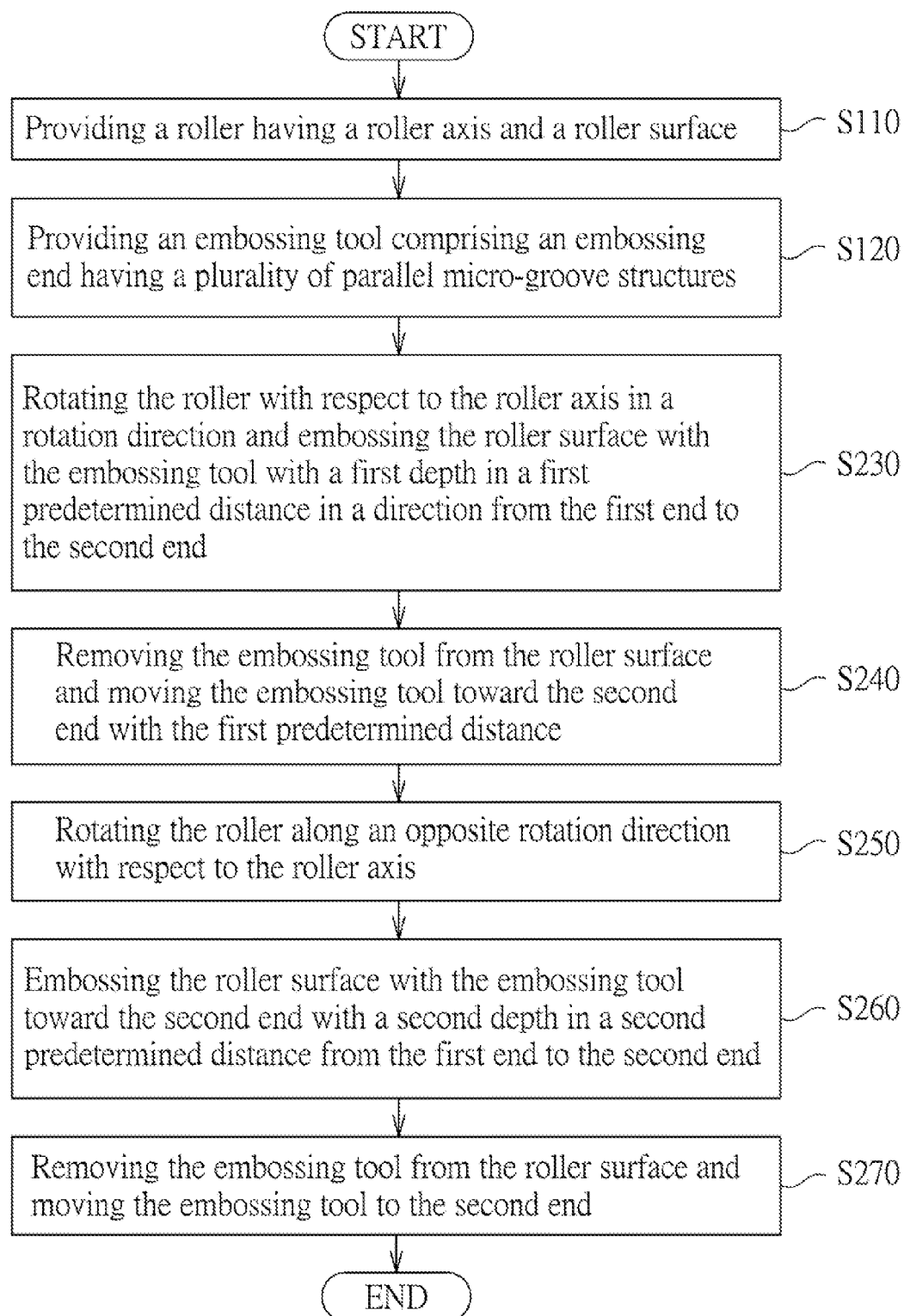


FIG. 4

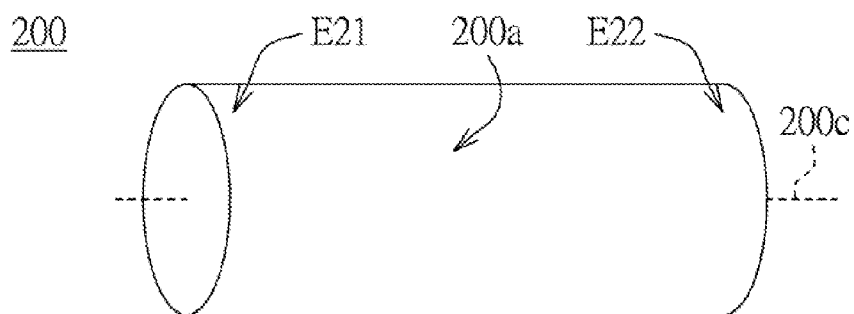


FIG. 5A

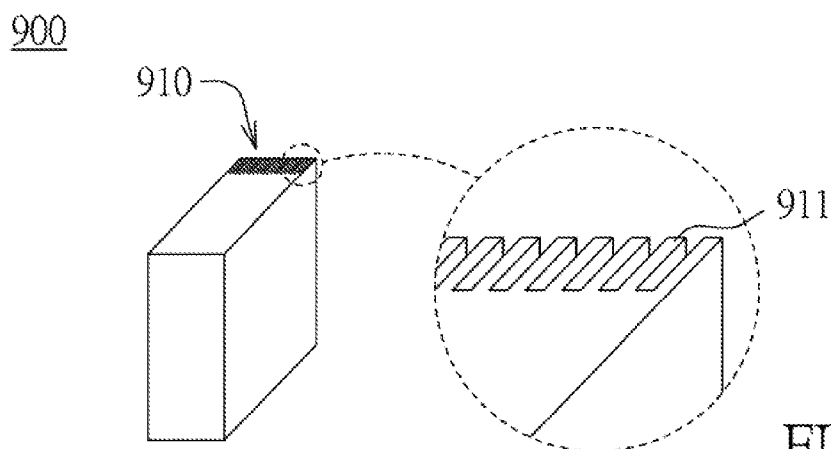


FIG. 5B

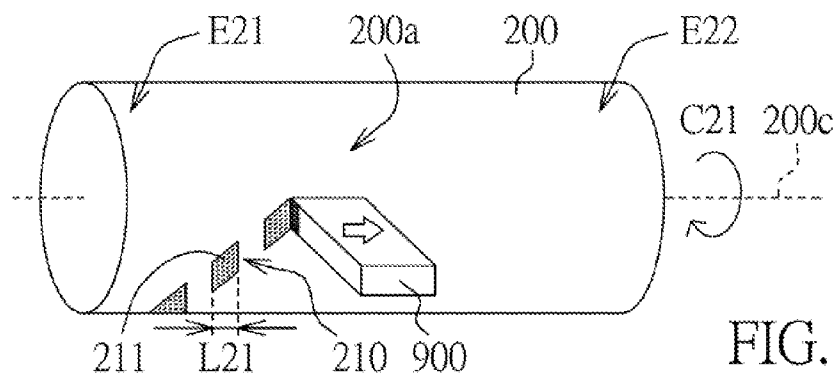


FIG. 5C

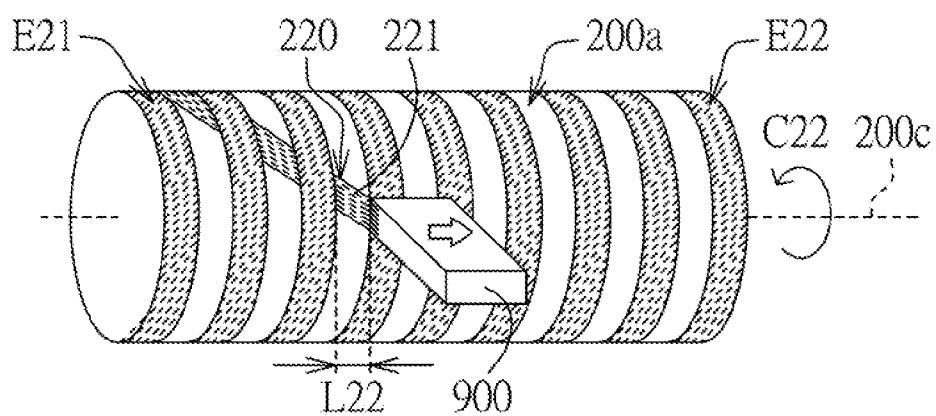


FIG. 5D

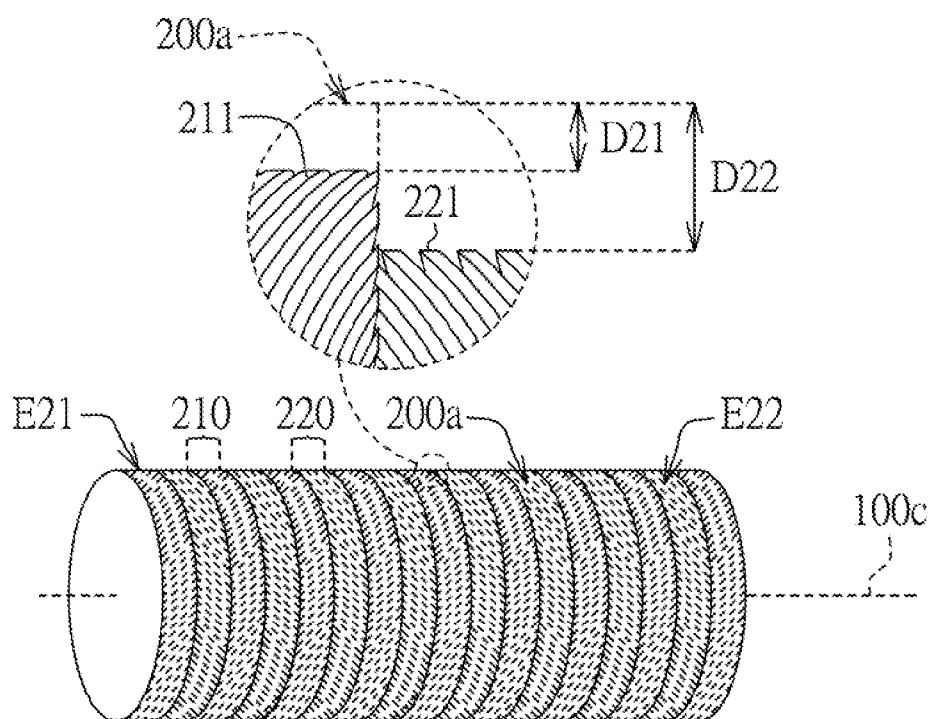


FIG. 5E

MANUFACTURING METHOD OF ROLLER FOR MANUFACTURING PATTERNED RETARDER FILM

RELATED APPLICATIONS

[0001] This application claims priority to Taiwan Application Serial Number 100126474, filed Jul. 26, 2011, which is herein incorporated by reference.

BACKGROUND

[0002] 1. Technical Field

[0003] The present disclosure relates to a method of making rollers, and more particularly to a method of making rollers for manufacturing retarder films.

[0004] 2. Description of the Related Art

[0005] A retarder film has been applied to a liquid crystal display (LCD) to generate a visual three-dimensional stereo effect. As such, the retarder film can be found in some commercial products, like stereoscopic display glasses, stereoscopic display TVs and other display products.

[0006] To the display products, it is required to ensure an optical quality of the retarder film by keeping an accuracy of manufacturing process of the retarder film. However, keeping the accuracy of manufacturing process of the retarder film reduces manufacturing speed of the retarder film. In this regard, there is still a need to provide one tool to manufacture the retarder film in keeping with the accuracy and the manufacturing speed of the retarder film.

SUMMARY

[0007] The disclosure is to provide a manufacturing method of rollers for manufacturing retarder films.

[0008] According to an aspect of the present disclosure, a method for making a roller used for manufacturing a retarder film is provided. The method comprises the steps of: providing a roller having a roller axis and a roller surface; providing an embossing tool having an embossing end; rotating the roller along a rotation direction with respect to the roller axis and embossing the roller surface with a first depth in a first predetermined distance from a first end to a second end; removing the embossing tool from the roller surface and moving the embossing tool to the second end; embossing the roller surface with the embossing tool with a second depth in a second predetermined distance from the second end to the first end; and removing the embossing tool from the roller surface and moving the embossing tool to the first end. The embossing end has a plurality of parallel micro-groove structures.

[0009] Accordingly, the embossing end embosses the roller surface repeatedly to generate a plurality of first embossing patterns in the first depth and second embossing patterns in the second depth to cover all area of the roller surface.

[0010] According to another aspect of the present disclosure, a method for manufacturing a retarder film with micro-structures is provided. The method comprises the steps of: providing a roller having the roller axis and the roller surface; providing an embossing tool having an embossing end; rotating the roller along the rotation direction with respect to the roller axis and embossing the roller surface with a first depth in a first predetermined distance in a direction from the first end to the second end; removing the embossing tool from the roller surface and moving the embossing tool toward the second end with the first predetermined distance; rotating the

roller along an opposite rotation direction with respect to the roller axis; embossing the roller surface with the embossing tool toward the second end with a second depth in the second predetermined distance; and removing the embossing tool from the roller surface and moving the embossing tool to the second end.

[0011] Accordingly, the embossing end has a plurality of parallel micro-groove structures. Accordingly, the embossing end embosses the roller surface repeatedly to generate a plurality of first embossing patterns in the first depth and second embossing patterns in the second depth to cover all area of the roller surface.

[0012] The above and other embodiments of the disclosure will become better understood with regard to the following detailed description of the preferred but non-limiting embodiment(s). The following description is made with reference to the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

[0013] FIG. 1 is a flowchart of a first embodiment of a manufacturing method of a roller for manufacturing a retarder film of the present disclosure;

[0014] FIGS. 2A-2E show schematic diagrams of each step of FIG. 1;

[0015] FIG. 3 is a schematic diagram of one embodiment of a retarder film of the present disclosure;

[0016] FIG. 4 is a flowchart of a second embodiment of a manufacturing method of a roller for manufacturing a retarder film of the present disclosure; and

[0017] FIGS. 5A-5E show schematic diagrams of each step of FIG. 4.

DETAILED DESCRIPTION OF THE INVENTION

[0018] This specification discloses one or more embodiments that incorporate the features of present disclosure. The disclosed embodiment(s) merely exemplify the disclosure. The scope of the disclosure is not limited to the disclosed embodiment(s). The disclosure is defined by the claims appended hereto. As used herein, the singular forms “a,” “an” and “the” include plural referents unless the context clearly dictates otherwise.

[0019] The embodiment(s) described, and references in the specification to “one embodiment,” “an example embodiment,” etc., indicate that the embodiment(s) described can include a particular feature, structure, or characteristic, but every embodiment may not necessarily include the particular feature, structure, or characteristic. Moreover, such phrases are not necessarily referring to the same embodiment. Further, when a particular feature, structure, or characteristic is described in connection with an embodiment, it is understood that it is within the knowledge of one skilled in the art to affect such feature, structure, or characteristic in connection with other embodiments whether or not explicitly described.

First Embodiment

[0020] Referring now to FIG. 1, a flowchart of a first embodiment of a manufacturing method of a roller **100** for manufacturing a retarder film **700** (shown in FIG. 3) is shown. FIGS. 2A-2E show schematic diagrams of each step of FIG. 1.

[0021] In step S110, the roller 100 (shown in FIG. 2A) having a roller surface 100a and a roller axis 100c is provided. The roller surface 100a includes a first end E11 and a second end E12. The second end E12 is opposite to the first end E11.

[0022] The roller surface 100a is a smooth and cylindrical outer surface. The smooth and cylindrical outer surface means the roller surface 100a has a uniform diameter 100d along the rotation axis 100c. That is, a distance from each point of the roller surface 100a to the rotation axis 100c is substantially the same. In one embodiment, the roller 100 is made of easily embossing and antioxidant materials, such as copper (Cu).

[0023] In step S120, an embossing tool 900 (shown in FIG. 2B) having an embossing end 910 is provided. The embossing end 910 includes a plurality of parallel micro-groove structures 911. Each one of the micro-groove structures 911 includes a width W911. Each two of the micro-groove structures 911 form a gap D911 positioned. The width W911 and the gap D911 is substantially the same in length. Furthermore, a material hardness of the embossing tool 900 is greater than that of the roller 100. In one embodiment, the material of the embossing tool 900 is made of diamond.

[0024] In step S130, the roller 100 rotates along a rotation direction C11 with respect to the roller axis 100c in a rotation speed (shown in FIG. 2C). Then, the embossing end 910 embosses the roller surface 100a of the roller 100 with a first depth D11 (shown in FIG. 2E, the dotted line is the roller surface 100a before embossing) in a first predetermined distance L11 from the first end E11 to the second end E12. After embossing, the embossing end 910 embosses a plurality of first embossing patterns 111. The plurality of first embossing patterns 111 generate a first embossing area 110. In step S130, the first depth D11 is between 5 μ m and 10 μ m in depth. The rotation speed is between 1 rpm and 300 rpm. The embossing tool 900 moves in a moving speed in a range of 10 mm/min and 20000 mm/min.

[0025] In step S140, after embossing the plurality of first embossing patterns 111 in the first predetermined distance L11, the embossing tool 900 removes from the roller surface 100a and moves to the second end E12 of the roller surface 100a.

[0026] As shown in FIG. 2D, the embossing tool 900 embosses the roller surface 100a repeatedly to generate the plurality of first embossing areas 110. Accordingly, the plurality of first embossing areas 110 are assembled in ring structures.

[0027] In step S150, the roller 100 rotates along the rotation direction C11 with respect to the roller axis 100c in the same rotation speed (shown in FIG. 2D). Then, the embossing end 910 embosses the roller surface 100a of the roller 100 with a second depth D12 (shown in FIG. 2E, the dotted line is the roller surface 100a before embossing) in a second predetermined distance L12 from the second end E12 to the first end E11. After embossing, the embossing end 910 embosses a plurality of second embossing patterns 121. The plurality of second embossing patterns 121 generate a second embossing area 120. In step S150, the first depth D12 is between 0.1 μ m and 10.0 μ m in depth. The rotation speed is between 1 rpm and 300 rpm. The embossing tool 900 moves in the moving speed in the range of 10 mm/min and 20000 mm/min. In one embodiment, the embossing tool 900 is controlled by a Fast-tool-servo system in step S130 and S150. The plurality of first and second embossing areas 110 and 120 are between 100 μ m and 1000 μ m in width.

[0028] As shown in FIG. 2E, the embossing tool 900 embosses the roller surface 100a repeatedly to generate the plurality of second embossing areas 120. Accordingly, the plurality of second embossing areas 120 are assembled in ring structures. Furthermore, the plurality of first embossing areas 110 are parallel and staggered linking to the plurality of second embossing areas 120. In addition, the plurality of first embossing areas 110 and second embossing areas 120 cover all area of the roller surface 100a.

[0029] FIG. 3 shows a schematic diagram of one embodiment of a retarder film 700 manufactured with the roller 100. After the embossing process, the roller 100 embosses a plurality of phase retardation structures 710 on a base substrate 701. The plurality of first stripe structures 711 are embossed with the plurality of first embossing patterns 111 of the roller 100. And the plurality of second stripe structures 721 are embossed with the plurality of second embossing patterns 121 of the roller 100. Wherein, the plurality of second stripe structures 721 are at a higher position than the plurality of first stripe structures 711.

[0030] After the embossing process finished, a liquid crystal layer 720 is disposed on the phase retardation structures 710 to form the retardation film 700. The liquid crystal layer 720 disposed on the phase retardation structures 710 can generate different phase retardation effects in different areas of the retardation film 700.

Second Embodiment

[0031] Referring now to drawings, FIG. 4 and FIGS. 5A-5E. FIG. 4 shows a flowchart of a second embodiment of a manufacturing method of a roller 200 for manufacturing the retarder film 700. FIGS. 5A-5E show schematic diagrams of each step of FIG. 4.

[0032] In step S210, the roller 200 (shown in FIG. 5A) having a roller surface 200a and a roller axis 200c is provided. The roller surface 200a includes a first end E21 and a second end E22. The second end E22 is opposite to the first end E21.

[0033] The roller surface 200a is a smooth and cylindrical outer surface. The smooth and cylindrical outer surface means the roller surface 200a has a uniform diameter 200d along the rotation axis 200c. That is, a distance from each point of the roller surface 200a to the rotation axis 200c is substantially the same. In one embodiment, the roller 200 is made of easily embossing and antioxidant materials, such as copper (Cu).

[0034] In step S220, the embossing tool 900 (shown in FIG. 5B) having the embossing end 910 is provided. The embossing tool 900 disclosed in the first embodiment is the same to the one disclosed in the second embodiment. The embossing end 910 includes the plurality of parallel micro-groove structures 911.

[0035] In step S230, the roller 200 rotates along a rotation direction C21 with respect to the roller axis 200c in a rotation speed (shown in FIG. 5C). Then, the embossing end 910 embosses the roller surface 200a of the roller 200 with a first depth D21 (shown in FIG. 5E, the dotted line is the roller surface 200a before embossing) in a first predetermined distance L21 in a direction from the first end E21 toward the second end E22. After embossing, the embossing end 910 embosses a plurality of first embossing patterns 211. The plurality of first embossing patterns 211 generate a first

embossing area **210**. Wherein, the first depth **D21** is between 5 μm and 10 μm in depth. The rotation speed is between 1 rpm and 300 rpm. The embossing tool **900** moves in a moving speed in a range of 10 mm/min and 20000 mm/min.

[0036] In step **S240**, the embossing tool **900** removes from the roller surface **200a** of the roller **200** and moves the embossing tool **900** toward the second end **E22** with the first predetermined distance **L21**.

[0037] In step **S250**, the roller **200** rotates along a rotation direction **C22** with respect to the roller axis **200c** in a same rotation speed (shown in FIG. 5D). Wherein the rotation direction **C22** is opposite to the rotation direction **C21**.

[0038] In step **S260**, the embossing tool **900** embosses the roller surface **200a** toward the second end **L22** with a second depth **D22** in a second predetermined distance **L22**. After embossing, the embossing end **910** embosses a plurality of second embossing patterns **221**. The plurality of second embossing patterns **221** generate a second embossing area **220**.

[0039] In step **S270**, the embossing tool **900** removes from the roller surface **200a** of the roller **200** and moves to the second end **E22**.

[0040] As shown in FIG. 5D, the embossing tool **900** embosses the roller surface **200a** repeatedly to generate the plurality of first embossing areas **210**. Accordingly, the plurality of first embossing areas **210** are assembled in ring structures.

[0041] As shown in FIG. 5E, the embossing tool **900** embosses the roller surface **200a** repeatedly to generate the plurality of second embossing areas **220**. Accordingly, the plurality of second embossing areas **220** are assembled in the ring structures. Furthermore, the plurality of first embossing areas **210** are parallel and staggered linking to the plurality of second embossing areas **220**. In addition, the plurality of first embossing areas **210** and second embossing areas **220** cover all area of the roller surface **200a**.

[0042] In one embodiment, the depth of the first depth **D11**, **D12** and the second depth **D21**, **D22** are substantially the same. In other embodiments, the depth of the first depth **D11**, **D12** and the second depth **D21**, **D22** are substantially different.

[0043] In some embodiments, the base substrate **701** is the Polyethylene terephthalate (PET), polycarbonate (PC), triacetyl cellulose (TAO), Polymethylmethacrylate (PMMA) or cyclo-olefin polymer (COP).

[0044] The present patterned retarder films manufactured according to embodiments of the present disclosure are utilized with at least one of functional optical films selected from a group consisting of hard-coating film, low reflective film, anti-reflective film and anti-glaring film on the surface of the base film opposed to the surface for forming the alignment layer in order to provide desired additional optical functionalities.

[0045] While the disclosure has been described by way of example and in terms of the preferred embodiment(s), it is to be understood that the disclosure is not limited thereto. On the contrary, it is intended to cover various modifications and similar arrangements and procedures, and the scope of the appended claims therefore should be accorded the broadest interpretation so as to encompass all such modifications and similar arrangements and procedures.

What is claimed is:

1. A method for making a roller used for manufacturing a retarder film, comprising:

providing the roller having a roller axis and a roller surface, said roller surface having a first end and a second end;

providing an embossing tool comprising an embossing end having a plurality of parallel micro-groove structures;

rotating the roller along a rotation direction with respect to the roller axis in a rotation speed and embossing the roller surface with the embossing tool with a first depth in a first predetermined distance from the first end to the second end to generate a first embossing area having a plurality of first embossing patterns;

removing the embossing tool from the roller surface and moving the embossing tool to the second end;

embossing the roller surface with the embossing tool with a second depth in a second predetermined distance from the second end to the first end to generate a second embossing area having a plurality of second embossing patterns; and

removing the embossing tool from the roller surface and moving the embossing tool to the first end.

2. The method of claim 1, further comprising:

embossing the roller surface repeatedly to generate the plurality of first and second embossing areas to cover all area of the roller surface,

wherein the plurality of first and second embossing areas are assembled in ring structures, and the first embossing areas are parallel and staggered linking to the second embossing areas.

3. The method of claim 1, wherein the depth of the first depth and the second depth are substantially the same.

4. The method of claim 1, wherein the depth of the first depth and the second depth are substantially different.

5. The method of claim 1, wherein the first depth and the second depth are in a range of 0.1 μm and 10.0 μm in depth.

6. The method of claim 1, wherein the plurality of first and second embossing areas are in a range of 100 μm and 1000 μm in width.

7. The method of claim 1, wherein the rotation speed is in a range of 1 rpm and 300 rpm.

8. The method of claim 1, wherein the embossing tool moves in a moving speed in a range of 10 mm/min and 20000 mm/min.

9. The method of claim 1, wherein the embossing tool is controlled by a Fast-tool-servo system.

10. The method of claim 1, wherein the roller is made of copper and the embossing tool is made of diamond.

11. A method for making a roller used for manufacturing a retarder film, comprising:

providing the roller having a roller axis and a roller surface, said roller surface having a first end and a second end;

providing an embossing tool comprising an embossing end having a plurality of parallel micro-groove structures;

rotating the roller along a rotation direction with respect to the roller axis in a rotation speed and embossing the roller surface with the embossing tool with a first depth in a first predetermined distance in a direction from the first end to the second end to generate a first embossing area having a plurality of first embossing patterns;

removing the embossing tool from the roller surface and moving the embossing tool toward the second end with the first predetermined distance;

rotating the roller along an opposite rotation direction with respect to the roller axis in the rotation speed; and embossing the roller surface with the embossing tool toward the second end with a second depth in a second predetermined distance to generate a second embossing area having a plurality of second embossing patterns; removing the embossing tool from the roller surface and moving the embossing tool to the second end.

12. The method of claim **11**, further comprising:

embossing the roller surface repeatedly to generate the plurality of first and second embossing areas to cover all area of the roller surface,

wherein the plurality of first and second embossing areas are assembled in ring structures, and the first embossing areas are parallel and staggered linking to the second embossing areas.

13. The method of claim **11**, wherein the depth of the first depth and the second depth are substantially the same.

14. The method of claim **11**, wherein the depth of the first depth and the second depth are substantially different.

15. The method of claim **11**, wherein the first depth and the second depth are in a range of 0.1 μm and 10.0 μm in depth.

16. The method of claim **11**, wherein the plurality of first and second embossing areas are in a range of 100 μm and 1000 μm in width.

17. The method of claim **11**, wherein the rotation speed is in a range of 1 rpm and 300 rpm.

18. The method of claim **11**, wherein the embossing tool moves in a moving speed in a range of 10 mm/min and 20000 mm/min.

19. The method of claim **11**, wherein the embossing tool is controlled by a Fast-tool-servo system.

20. The method of claim **11**, wherein the roller is made of copper and the embossing tool is made of diamond.

* * * * *