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(54) **WEB CONVEYANCE SYSTEM FOR PROTECTING WEB PATTERNS**

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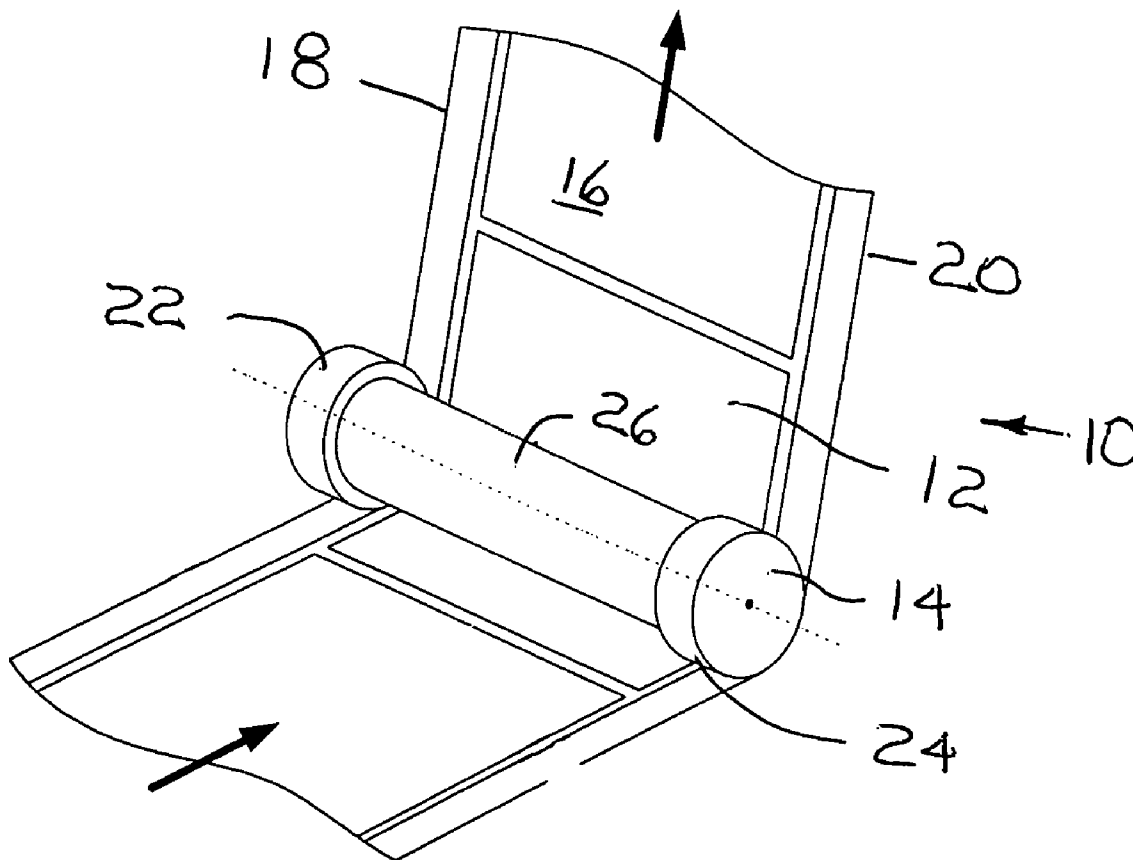
(57) **ABSTRACT**

A web conveyance system is provided for conveying a web that has first and second edge portions and a central portion disposed between the first and second edge portions. The web conveyance system has means for engaging the first and second edge portions of the web and maintaining the central portion of the web free of contact with the means. Preferably, the means comprises a roller with left and right end portions and an undercut middle portion. The end portions of the roller engage side edge portions of the web for conveyance while the middle portion of the web and roller remain free of contact with the roller.

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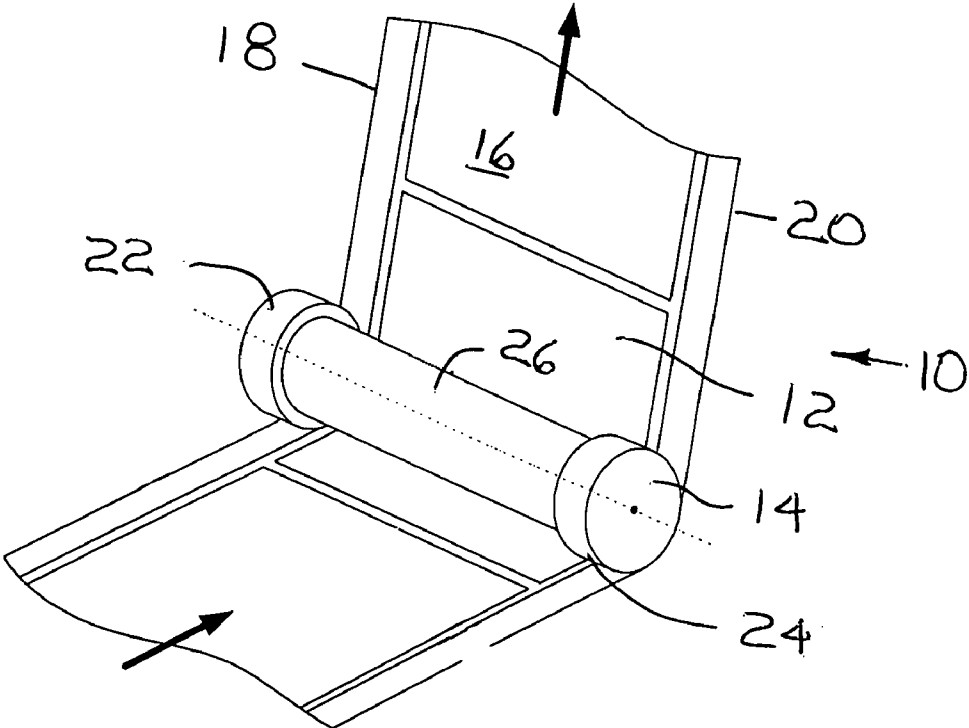


FIG. 1

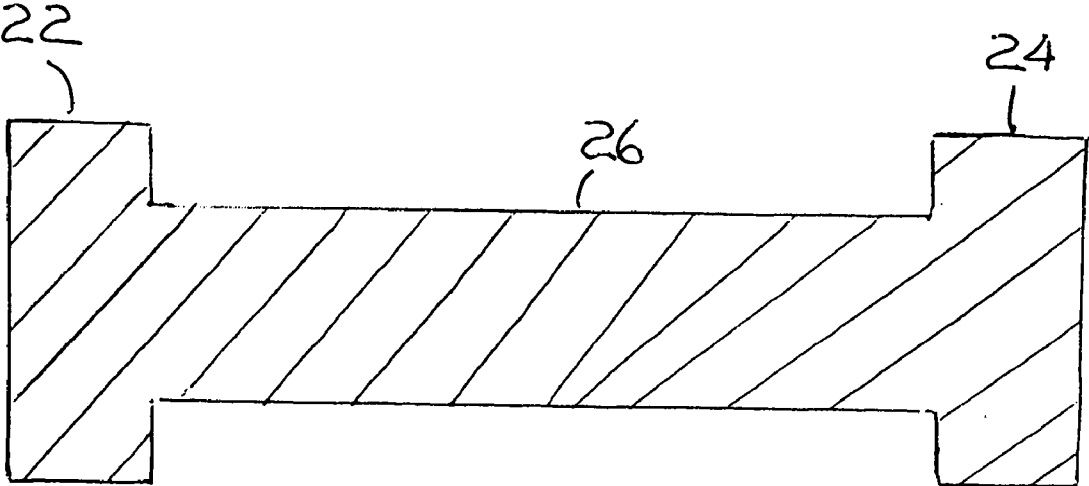


FIG. 2

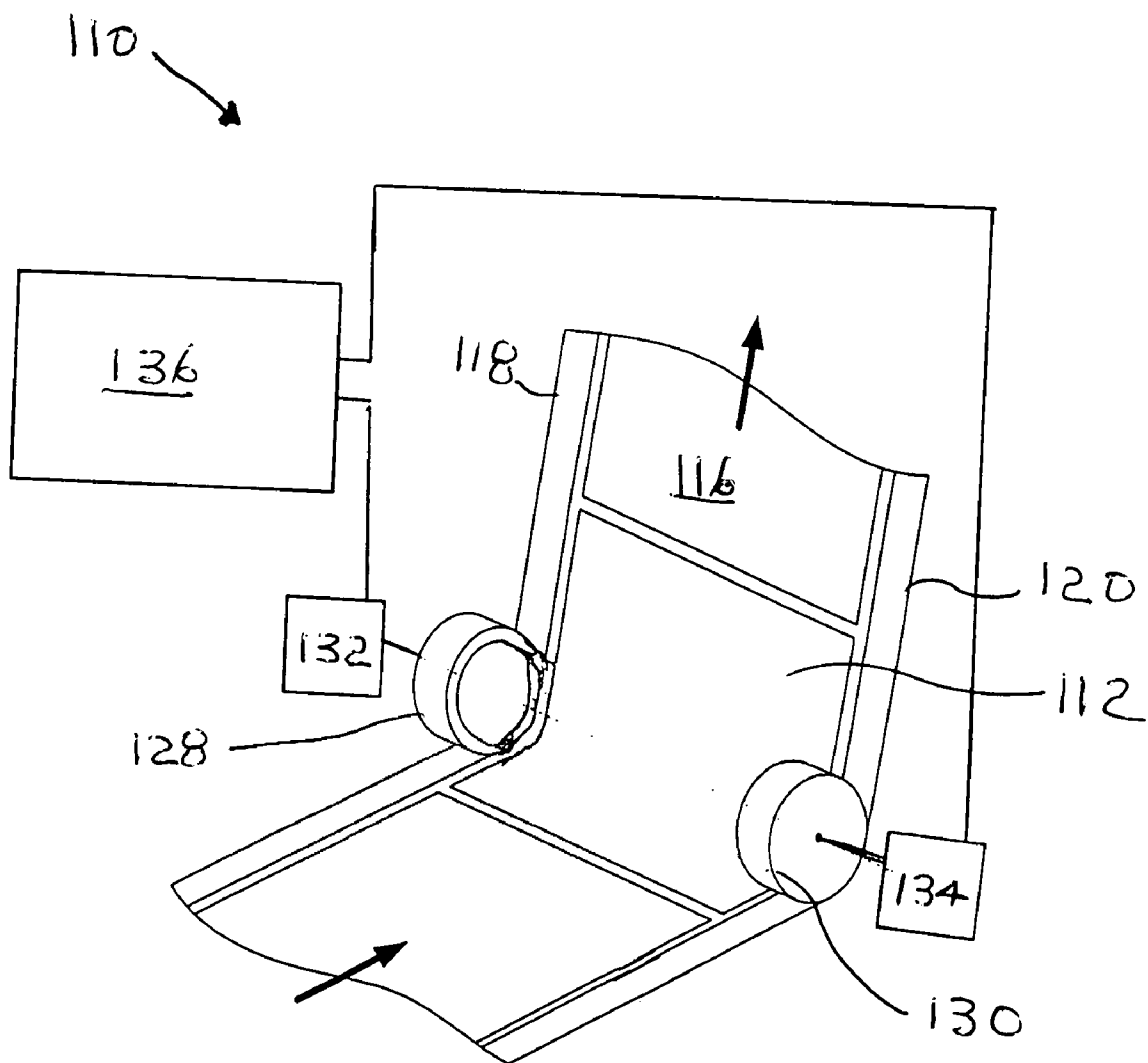


FIG. 3

**WEB CONVEYANCE SYSTEM FOR PROTECTING WEB PATTERNS**

**FIELD OF THE INVENTION**

[0001] The invention relates to an apparatus and method for manufacturing displays and other electronic components on flexible webs, and, more particularly to conveying the web so that the conveyance roller does not harm the electronic components.

**BACKGROUND OF THE INVENTION**

[0002] It is a desirable to produce displays and other electronic components in a roll-to-roll fashion on flexible web materials to achieve higher throughput and decreased manufacturing cost. In such a process, displays and other electronic components are disposed on one surface of the web material. Difficulty arises, however, because web conveyance fundamentally requires web routing that causes the web to wrap around rollers in both directions exposing the surface with displays or electronic components thereon to the rollers. This can cause defects when the rollers contact the thin films employed in displays or other electronics. A means of conveying a web through a machine is required that does not require that the rollers touch these sensitive surfaces. Air conveyance methods are one well-known means of solving this problem. However, some electronics fabricating processes must be performed in vacuum, where air conveyance methods cannot be employed. A solution is needed for vacuum processes or other situations where air conveyance is not appropriate.

[0003] U.S. Pat. No. 2,226,187 discloses an apparatus for handling strips of material passing it through a path consisting of a plurality of loops so that the material may be coated on one or both sides and may be dried or subjected to other treatments. The material is driven by a large number of driving spools with each spool having comparatively small surface contact with the material. Each spool is driven by a tendency drive; that is, a drive which resiliently tends to turn the spool but which permits the spool to be readily held back or pulled ahead by the sheet material through its small surface contact therewith. The speed of all the spools vary to take care of irregularities in the edges of the sheet. While such apparatus is suitable for certain coatings or treatments, it is unsuitable for electronic assemblies where registration is critical. A solution is needed for processes where registration of components is required.

[0004] A need exists for a method of web conveyance that is suitable for vacuum processes or other situations where air conveyance is not appropriate, and also suitable for processes where registration of components is required.

**SUMMARY OF THE INVENTION**

[0005] The present invention is directed to overcoming one or more of the problems set forth above. According to one aspect of the invention, a web conveyance system comprises a web having first and second edge portions and a central portion disposed between the first and second edge portions, and conveyance apparatus for engaging the first and second edge portions of the web and maintaining the central portion of the web free of contact with the conveyance apparatus. The conveyance apparatus may comprise a roller having first and second end portions and a central

portion disposed between the first and second end portions so that the edge portions of the web engage the end portions of the roller while the central portion of the web and the central portion of the roller remain free of contact with one another. Preferably, the central portion of the roller has a smaller diameter than the end portions of the roller. Alternatively, the conveyance apparatus may comprise a first wheel means associated with the first edge portion of the web for engaging and transporting the web, and a second wheel means associated with the second edge portion of the web for engaging and transporting the web. Electronic controls or the like are provided for controlling operation of the first and second wheel means for uniform transport of the web.

[0006] According to another aspect of the invention, a method for conveying a web having a display thereon so that the display is unmarred, comprises the steps of: providing a web having first and second edge portions and a central portion disposed between the first and second edge portions; providing a first wheel means for engaging the first edge portion of the web for transporting the web; providing a second wheel means for engaging the second edge portion of the web for transporting the web; and synchronizing operation of the first and second wheel means and conveying the web.

[0007] According to another aspect of the invention, a method for conveying a web having a display thereon with a roller so that the roller does not contact the display, comprises providing a web having first and second edge portions and a central portion disposed between the first and second edge portions; providing a roller having first and second end portions and a central portion disposed between the first and second end portions; and entraining the side edges of the web about the end portions of the roller so that the central portion of the web and the central portion of the roller remain free of contact with one another.

**BRIEF DESCRIPTION OF THE DRAWINGS**

[0008] The above and other objects, features, and advantages of the present invention will become more apparent when taken in conjunction with the following description and drawings wherein similar reference numerals have been used, where possible, to designate similar features that are common to the figures, and wherein:

[0009] **FIG. 1** is a perspective view of a preferred embodiment of a flexible web and roller of a web conveyance system according to the present invention;

[0010] **FIG. 2** is a longitudinal sectional view of the undercut roller; and

[0011] **FIG. 3** is a diagrammatic perspective view of a flexible web conveyed using wheels on the edges.

**DETAILED DESCRIPTION OF THE INVENTION**

[0012] Referring to **FIGS. 1 and 2**, a web conveyance system **10** includes a web **12** and a roller **14**. Web **12** has a central portion **16** bounded by left and right edge portions **18, 20**. Central portion **16** is further divided into frames or patches. When manufacturing is completed, each frame or patch contains displays and other electronic components

formed thereon by printing, chemical vapor deposition, doping or other thin film fabrication techniques.

[0013] Roller 14 has left and right end portions 22, 24 and a central portion 26 extending between the end portions. Central portion 26 has a surface that is recessed below the surface of the end portions 22, 24. End portions 22, 24 of roller 14 engage edge portions 18, 20 of web 12 while central portions 26, 16 remain free of contact with one another. The undercut roller forms means for engaging the first and second edge portions of the web while maintaining the central portion of the web free of contact with the roller.

[0014] It can now be appreciated that an apparatus and method for manufacturing displays and other electronic components on flexible webs so that the conveyance roller does not harm the electronic components features an undercut roller. The web has first and second edge portions and a central portion disposed between the first and second edge portions. The roller has first and second edge portions and a central portion disposed between the first and second edge portions. The central portion of the roller has a smaller diameter than the edge portions of the roller. The edge portions of the web engage the edge portions of the roller while the central portion of the web and the central portion of the roller remain free of contact with one another. Undercutting the central portion of the roller so that there is no contact with the web provides a method of web conveyance that is suitable for vacuum processes or other situations where air conveyance is not appropriate, and is also suitable for processes where registration of components is required.

[0015] The method for conveying a web having a display thereon with an undercut roller so that the roller does not contact the displays, comprises the steps of: providing a web having first and second edge portions and a central portion disposed between the first and second edge portions; providing a roller having first and second end portions and a central portion disposed between the first and second end portions; and entraining the side edges of the web about the end portions of the roller so that the central portion of the web and the central portion of the roller remain free of contact with one another. The method includes forming the central portion of the roller with a smaller diameter than the end portions of the roller. Undercutting the central portion of the roller so that there is no contact with the web provides a method of web conveyance that is suitable for vacuum processes or other situations where air conveyance is not appropriate, and is also suitable for processes where registration of components is required.

[0016] Referring to FIG. 3, a web conveyance system 110 includes a web 112 that has a central portion 116 bounded by left and right edge portions 118, 120. Central portion 116 is further divided into frames or patches. When manufacturing is completed, each frame or patch contains displays and other electronic components formed thereon by printing, chemical vapor deposition, doping or other thin film fabrication techniques. Web conveyance system 110 also includes a first wheel means 128 associated with left edge portion 118 of web 112 and second wheel means 130 associated with right edge portion 120 of web 112 for engaging and transporting the web. By wheel means it is meant not only a wheel in the conventional sense but other mechanisms and devices that can engage and move the web. In its simplest form, wheel means 128, 130 are circular

members mounted, preferably ganged, for rotation to convey the web. More preferably, wheel means 128, 130 are circular members or track members that can be driven or controlled by an electronic device 132, 134. A master electronic control 136 coordinates operation of electronic control devices 132, 134 and wheel means 128, 130 so that the web is conveyed uniformly.

[0017] A method for manufacturing displays and other electronic components on flexible webs so that the display is unmarred comprises providing a web having first and second edge portions and a central portion disposed between the first and second edge portions; providing a first wheel means for engaging the first edge portion of the web for transporting the web; providing a second wheel means for engaging the second edge portion of the web for transporting the web; and synchronizing operation of the first and second wheel means and conveying the web. Because the wheel means only engage the edge portions of the web, the central portion containing the components remains untouched and therefore unspoiled.

[0018] It can now be appreciated that an apparatus and method for manufacturing displays and other electronic components on flexible webs so that the display is unmarred features wheel means that do not cross the area of the web where the display or components are located. Each wheel means operates under the control of a master control unit that can synchronize wheel movement so that both edges of the web travel at the same rate, or different rates as may be desired from time to time, for uniform distribution of the displays or components.

[0019] The present invention has been described with reference to the preferred embodiments. However, it will be appreciated that variations and modifications can be effected by a person of ordinary skill in the art without departing from the scope of the invention.

PARTS LIST

- [0020] 10 web conveyance system
- [0021] 12 web
- [0022] 14 roller
- [0023] 16 central portion of web
- [0024] 18 left edge portion of web
- [0025] 20 right edge portion of web
- [0026] 22 left end portion of roller
- [0027] 24 right end portion of roller
- [0028] 26 central portion of roller
- [0029] 110 web conveyance system
- [0030] 112 web
- [0031] 116 central portion of web
- [0032] 118 left edge portion of web
- [0033] 120 right edge portion of web
- [0034] 128 first wheel means
- [0035] 130 second wheel means
- [0036] 132 electronic control device

[0037] 134 electronic control device

[0038] 136 master electronic control

1. A web conveyance system, comprising:

a web having first and second edge portions and a central portion disposed between said first and second edge portions; and

means for engaging said first and second edge portions of said web and maintaining said central portion of said web free of contact with said means.

2. A web conveyance system, as set forth in claim 1, wherein said means comprises a roller having first and second end portions and a central portion disposed between said first and second end portions, said edge portions of said web engaging said end portions of said roller while said central portion of said web and said central portion of said roller remain free of contact with one another.

3. A web conveyance system, as set forth in claim 2, wherein said central portion of said roller has a smaller diameter than said end portions of said roller.

4. A web conveyance system, as set forth in claim 1, wherein said means comprises:

a first wheel means associated with said first edge portion of said web for engaging and transporting said web; and

a second wheel means associated with said second edge portion of said web for engaging and transporting said web.

5. A web conveyance system, as set forth in claim 4, including means for controlling operation said first and second wheel means.

6. A method for conveying a web having a display thereon so that the display is unmarred, comprising the steps of:

providing a web having first and second edge portions and a central portion disposed between said first and second edge portions;

providing a first wheel means for engaging said first edge portion of said web for transporting said web;

providing a second wheel means for engaging said second edge portion of said web for transporting said web; and

synchronizing operation of said first and second wheel means and conveying said web.

7. A method for conveying a web having a display thereon with a roller so that the roller does not contact the displays, comprising the steps of:

providing a web having first and second edge portions and a central portion disposed between said first and second edge portions;

providing a roller having first and second end portions and a central portion disposed between said first and second end portions; and

entraining the side edges of the web about the end portions of the roller so that the said central portion of the web and the central portion of the roller remain free of contact with one another.

8. The method of claim 7 including the step of forming the central portion of the roller with a smaller diameter than the end portions of the roller.

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