

Nov. 1, 1966

E. E. BOASE
WEB ALIGNING DEVICE

3,282,487

Filed July 27, 1964

2 Sheets-Sheet 1

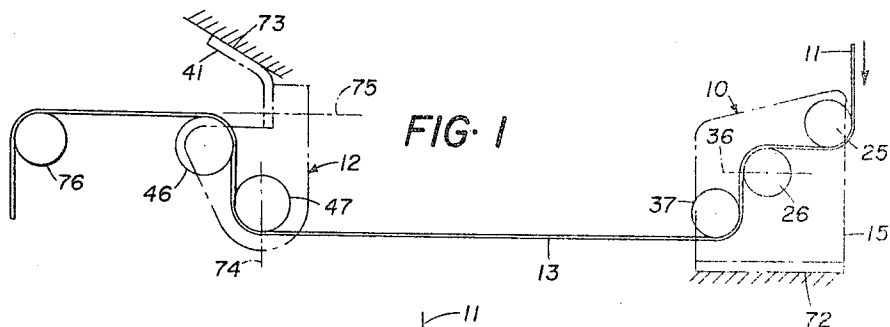


FIG. 1

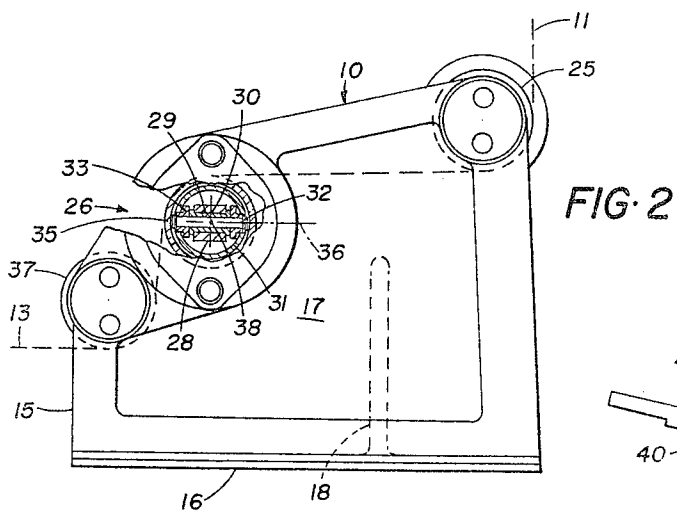


FIG. 2

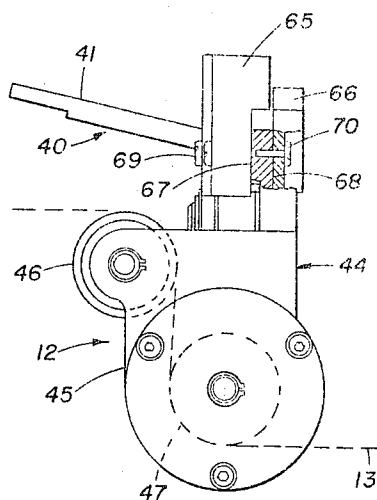


FIG. 4

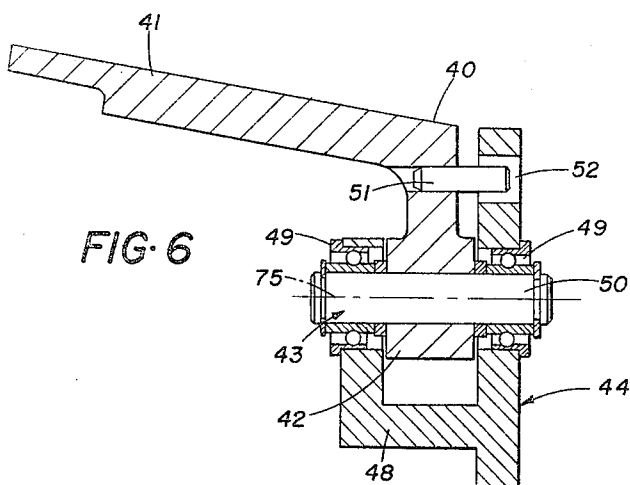


FIG. 6

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FIG. 3

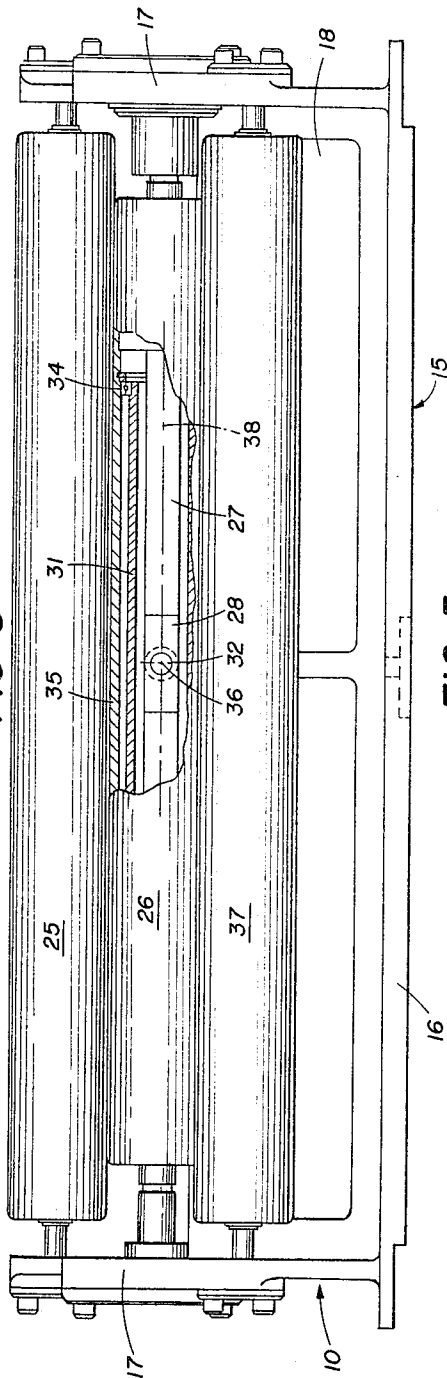
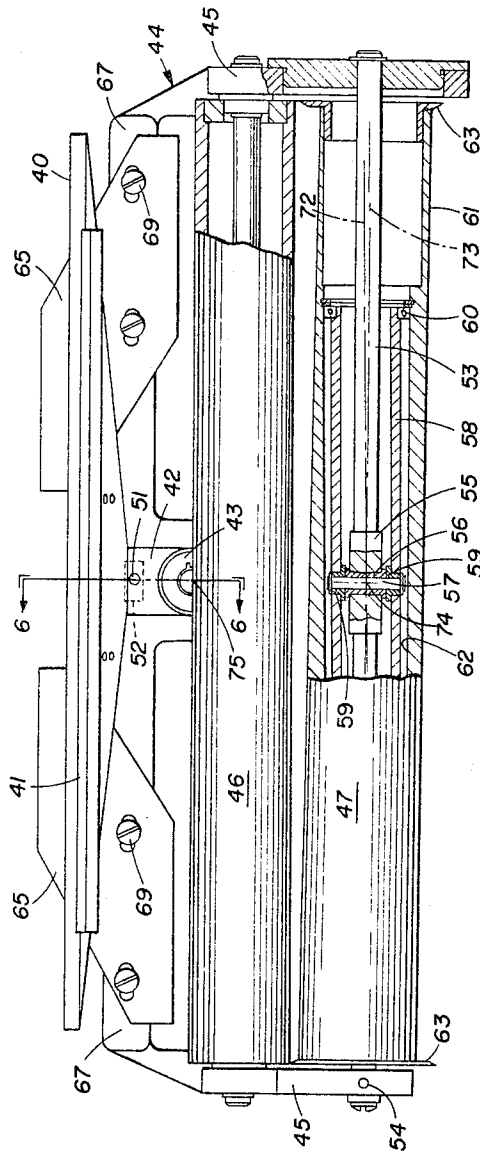


FIG. 5



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3,282,487

WEB ALIGNING DEVICE

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Filed July 27, 1964, Ser. No. 385,170

17 Claims. (Cl. 226-190)

The present invention relates to web guiding apparatus and more particularly to apparatus for automatically correcting angular displacement of a moving web, such as paper, fabric or similar materials.

In guiding a moving web through a predetermined path, it is customary to provide at least one control roller that can be oriented by any angular displacement of the web to compensate for such displacement. Such a control roller can be located in any portion of the web path and is usually located in a position where the web path changes direction. Complex electrical, hydraulic and pneumatic control devices have been devised to automatically correct for such displacement of a moving web. In most of these devices, an independent drive means is used to properly orient the control roller in response to any detected displacement of the web.

In the present invention two roller assemblies are used, each having at least one roller that is movable about a pivotal axis in response to any angular displacement of the web for automatically correcting for such displacement. In many instances it is desirable to convey the web from one type of apparatus to another, for example, from a printing device to a cutting device in which the continuous web spans the space between the devices. If these devices are not precisely aligned, there is some lateral displacement of the web in its movement from the one device to the other. The invention described hereinafter is particularly adapted to such an arrangement in that one of the roller assemblies can be associated with each of the devices and is capable of compensating not only for web displacement but also for any translational or rotational misalignment of the devices. Such correction is accomplished by the invention in that the movable roller in the first assembly is responsive to any change in the angular displacement in the web between the two devices and the second roller assembly is responsive to any change in the path length of the web between the devices as well as any residual angular displacement of the web.

A primary object of the invention is to automatically correct angular displacement of a moving web by means which is self-actuating and has a short response time.

Another object of the invention is to provide an apparatus for automatically correcting angular displacement of a moving web by translational and/or rotational displacement of one web support device with respect to another.

These and other objects and advantages of the invention will be apparent to those skilled in the art by the description of a preferred embodiment of the invention which follows.

Reference is now made to the accompanying drawings wherein like reference numerals and characters designate like parts and wherein:

FIG. 1 is a diagrammatic view of two roller assemblies shown in spaced relation which is indicative of different devices on which each assembly can be mounted;

FIG. 2 is a side view of the roller assembly shown at the right-hand side of FIG. 1;

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FIG. 3 is a front elevational view of the roller assembly shown in FIG. 2;

FIG. 4 is a side view of the roller assembly shown at the left-hand side of FIG. 1;

FIG. 5 is a front elevational view of the roller assembly shown in FIG. 4; and

FIG. 6 is a partial sectional view taken on the line 6-6 in FIG. 5.

With reference to FIG. 1 a first roller assembly 10 can be fixed in proper relation to a device 72 that is used to accomplish a step or process with respect to the web 11. A second roller assembly 12 is arranged on another device 73 which coacts with the web 11 and is spaced from that on which the roller assembly 10 is mounted. The web 11 can be moved through the path formed by the rollers associated with each assembly as described in more detail hereinafter in any well known manner.

The first roller assembly 10 comprises a U-shaped bracket 15 which includes a base 16 that is secured to device 72 and a pair of spaced bearing supports 17. An upright partition 18 extends from the base and between the supports 17 to make the bracket 15 more rigid. Roller 25 is mounted between the supports 17 in bearings not shown; is freely rotatable and serves to guide the incoming web 11 from a substantially vertical direction to a substantially horizontal direction.

Steering roller 26 comprises a longitudinal shaft member 27 that is fixed at its ends in the supports 17, a pivotal sleeve 31 and a web roller 35. The central portion 28 of the shaft 27 is preferably square in cross-section and is provided with a central bore 29 in which a bearing sleeve 30 is arranged. Approximately concentric with the shaft 27 is a sleeve 31 which is pivotally mounted with respect to shaft 27 by means of a pin 32 that is mounted in bearing sleeve 30 and at its ends is journaled in a pair of bearing members 33 in the sleeve 31. Each end of sleeve 31 carries a bearing 34 for rotatably supporting the web roller 35. With reference to FIG. 1, it will be noted that the axis 36 of pin 32 is substantially perpendicular to the center line of the incoming web 11. As explained in more detail hereinafter, the web roller 35 can rotate about its axis 38 and can also be moved about the pivotal axis 36 of pin 32 in a vertical plane that passes through the axis 38.

The roller assembly 10 also includes a freely rotatable roller 37 that is mounted between the supports 17 in substantially the same manner as the roller 25. The roller 37 receives the moving web from the web roller 35 and guides it into a first path or plane that is substantially perpendicular to that of the incoming web 11. The outgoing portion 13 of the web 11 spans the space between the first roller assembly 10 and the second roller assembly 12.

The second roller assembly 12 comprises a bracket 40 having an extension 41 that is secured to the second device 73. A support arm 42 depending from extension 41 cooperates with a pivotal connection 43, as shown in FIG. 6, for supporting a U-shaped bracket 44 having spaced arms 45 between which a pair of rollers 46 and 47 are rotatably mounted. The bracket 44 is provided with a yoke 48 into which the support arm 42 extends. The yoke 48 carries a pair of bearings 49 in which a stub shaft 50 that is carried by arm 42 is journaled. In order to limit arcuate movement of bracket 44 relative to bracket 40, as described hereinafter, the bracket 40 carries a pin 51 which extends into an arcuate slot 52 in one arm of the yoke 48.

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Roller 46 is a solid roller and is rotatably mounted in bearings that are carried by the arms 45. The second steering roller 47 comprises a shaft 53, a pivotal sleeve 58 and a web roller 61, the shaft 53 being pinned to one of the arms 45, as designated by the numeral 54, so that this shaft is held against any rotation. The central portion 55 of shaft 53 carries a sleeve bearing 56 for a pintle 57. The pivotal sleeve 58 is journaled on the ends of pintle 57 by means of a pair of bearing members 59 and at each end thereof carries a bearing 60. The web roller 61 is provided with an internal diameter 62 that engages the bearing 60 so that the roller is rotatable about an axis 72 that is angularly arranged with respect to the intersection of the axis 73 of shaft 53 and the axis 74 of pintle 57. Each end of web roller 61 is provided with a flange 63 which is formed as a separate member insertable into the end of the roller or formed integral with the roller. The roller 47 can therefore rotate freely about its axis 72 and can also pivot in a horizontal plane about the axis 74 of the pintle 57 which is substantially perpendicular to the pivotal axis of the brackets 40 and 44 which is designated by the numeral 75.

Since the second roller assembly permits movement of the roller 47 about the axis 74 of the pintle 57 and also is rotatable about the axis 75 as a complete unit, it is necessary that the assembly be well balanced in order to make the device independent of any gravity effect. In order to accomplish this, counterweights 65 and 66 are secured to the surfaces 67 and 68 of the bracket 44 by means of screws 69 and 70. By means of such counterweights, the second roller assembly 12 can be balanced in assembly and before it is mounted on the second device 73.

As described above, bracket 15 of the first roller assembly 10 can be secured to the first device, generally designated by the numeral 72 in FIG. 1, and the bracket 40 of the second roller assembly 12 can be secured to the second device generally designated by the numeral 73. While the devices 72 and 73 are shown and described as being separate devices, the aligning function of the system is the same even if the two roller assemblies were mounted in spaced relation on the same device. In either case, it can be readily appreciated that one assembly could be mounted with respect to the other such that the rollers 26 and 37 are not aligned with their axes exactly parallel to those of rollers 46 and 47. In addition, the assemblies 10 and 12 could be mounted so that they are transversely misaligned or even with one assembly rotated slightly with respect to the other. This means that the intermediate portion 13 of the web can be angularly displaced due to any lateral misalignment of the assemblies as well as twisted where there is rotation of one assembly with respect to the other. It is for conditions such as these that the roller assemblies 10 and 12 described hereinabove provide for maintaining the outgoing length of the web in a position that is automatically corrected for any such misalignment.

The intermediate portion 13 of the web on leaving roller 37 is forced to run between the flanges 63 on the roller 47. If there is any angular displacement of the web between these two rollers, the side force exerted against the flange corresponding to the direction in which the displacement takes place causes the bracket 44 to pivot about the axis 75 of stub shaft 50 until this force is negated by the position that the roller assembly 12 then assumes. It will be noted from FIGS. 1 and 5 that the axis 75 of stub shaft 50 is on the neutral axis of the web between the roller 46 and a fixed idler roller 76. As a result, the outgoing web leaving roller 46 is always maintained in the same relation to this pivotal axis. When the intermediate portion 13 of the web 11 is angularly displaced, an increase in path length of the web between the rollers 37 and 47 actually occurs. The increase in path length then effects the force required to rotate or

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pivot the assembly 12 about the axis 75 of stub shaft 50 to minimize the path length.

In addition to the pivotal movement of the roller assembly 12, the roller 47 pivots about the axis 74 of pintle 57 until the rotational axis 72 of the web roller 61 is perpendicular to the direction of web movement. Once this has been accomplished, the web is in a position of equilibrium on roller 47 and does not exert any side force on either of the flanges 63 except that amount of force necessary to move the assembly 12 to maintain the portion 13 of web 11 in a twisted helical shape. The force that causes roller 47 to move into a position of equilibrium with respect to the incoming web is proportional to the number of degrees that the web is angularly displaced. In order to supplement the restoring force necessary to overcome the static friction as the point of perpendicularity is approached, the roller 47 has its geometric axis 72 arranged at an angle with respect to its rotational axis 73 in order to cause a roller surface wobble. As described above, the geometric axis 72 passes through the point of intersection of the axis 73 of shaft 53 and the axis 74 of pintle 57. The wobble effect obtained with this structure causes the roller 47 to oscillate about the perpendicular position it assumes relative to the web and thereby nullifies the effective friction between the roller and the web.

With any angular displacement of the portion 13 of the web, the roller 26 acts as a tension equalizing or steering roller. With any such displacement, roller 26 tilts at an angle about the axis 36 of pin 32 to allow the web to turn in the same direction as the roller 47 and at the same time maintains the level of tension in each edge of the web at a constant value.

From the foregoing description it should be readily appreciated that the system is a passive device requiring no external power and is capable of correcting angular and/or translational displacement of a moving web. Further, the system has proven to be especially useful with wide, thin webs that resist other methods of alignment correction and normally require very close angular tolerances between the rollers forming the web path in order to prevent mistracking of the web. It should be apparent to those skilled in the art that the system described hereinabove can be used to advantage in many applications for controlling displacement of a moving web and while a preferred embodiment of the invention has been described, the invention is not to be limited to such embodiment but is of a scope as defined by the appended claims.

I claim:

1. Apparatus for maintaining lateral alignment of a moving web, comprising in combination:

- a first roller assembly for engaging the web and guiding it from a first path into a second path substantially perpendicular to that of said first path, said first assembly including at least one web engaging roller mounted for rotation about its longitudinal axis and for pivotal movement about an axis that is substantially perpendicular to the center line of said web in said first path in response to any angular displacement of said web in said second path for equalizing the tension in the edges of said web; and
- a second roller assembly for engaging said web in said second path and guiding it into an outgoing path that is substantially parallel to said second path, said second assembly including at least one steering roller unit comprising a member including a pivotal bearing having a pivot axis which is substantially perpendicular to said second path, a cylindrical sleeve mounted on said pivotal bearing for pivotal movement in response to any angular displacement of said web in said second path, and a web guiding roller mounted for rotation on said sleeve about a rotational axis and for pivotal movement as a unit with said sleeve about said pivot axis, the

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rotational axis of said web guiding roller being angularly disposed with respect to the axis of said sleeve and substantially perpendicular to the axis of said pivotal bearing;

said second assembly being movable about an axis, substantially perpendicular to the rotational axis of said web guiding roller and substantially coincident with the extended center line of said web in said outgoing path, to compensate for any change in path length between said first and second roller assemblies; whereby changes in the lateral alignment of the moving web are corrected.

2. Apparatus in accordance with claim 1 wherein said member has an axis substantially perpendicular to the center line of said web in said second path and the rotational axis of said web guiding roller is angularly disposed relative to the point of intersection of the axis of said member and the pivot axis of said pivotal bearing.

3. Apparatus in accordance with claim 1 wherein the pivot axis of said pivotal bearing is substantially perpendicular to the axis of said second roller assembly.

4. Apparatus in accordance with claim 1 wherein said web guiding roller is provided with end flanges against which a force is exerted by any lateral translation of the portion of said web between said first and second roller assemblies for moving said second roller assembly in a direction to maintain said portion of said web in a twisted helical shape.

5. Apparatus in accordance with claim 1 wherein the angular disposition of the rotational axis of said web guiding roller causes the latter to oscillate about the axis of said member for nullifying the effect of friction when said web guiding roller is in a position of equilibrium.

6. Apparatus for maintaining lateral alignment of a moving web, comprising in combination:

a first roller assembly for engaging the web and guiding it from a first path into a second path substantially perpendicular to that of said first path, said first assembly including at least one web engaging roller mounted for rotation about its longitudinal axis and for pivotal movement about an axis that is substantially perpendicular to the center line of said web in said first path in response to any angular displacement of said web in said second path for equalizing the tension in the edges of said web;

a rotatable steering roller for engaging said web in said second path and guiding it into a third path substantially perpendicular to said second path, said steering roller having a rotational axis and being movable about an axis, substantially perpendicular to said rotational axis, in response to any angular displacement of said web in said second path;

a rotatable idler roller for engaging said web leaving said steering roller and guiding it into an outgoing path substantially perpendicular to that of said third path; and

means for mounting said steering roller and said idler roller for movement as a unit about an axis substantially perpendicular to the rotational axis of said steering roller in response to any change in path length of said web between said first roller assembly and said steering rollers, whereby changes in the lateral alignment of the web are corrected.

7. Apparatus in accordance with claim 6 wherein said one roller comprises a fixed member having a central pivotal bearing whose axis is substantially perpendicular to the center line of said incoming web, a cylindrical sleeve mounted on said pivotal bearing and a web engaging roller rotatably mounted on said sleeve.

8. Apparatus in accordance with claim 6 wherein said steering roller comprises an axial, fixed member having a central pivotal bearing whose axis is substantially perpendicular to the axis of said second roller assembly, a cylindrical sleeve mounted on said pivotal bearing and a web guiding roller rotatably mounted on said sleeve.

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9. Apparatus in accordance with claim 8 wherein said web guiding roller is rotatable about an axis that is angularly disposed relative to the axial center line of said sleeve at the point of intersection of the axial center line of said fixed member and the center line of said pivotal bearing.

10. Apparatus in accordance with claim 9 wherein said web guiding roller is provided with end flanges against which a force is exerted by any lateral translation of the portion of said web between said first roller assembly and said steering roller for moving said mounting means in a corresponding direction to maintain said portion of said web in a twisted helical shape.

11. Apparatus in accordance with claim 9 wherein the angular disposition of said web guiding roller causes the latter to oscillate about the axis of said fixed member for nullifying the effect of friction when said eccentric roller is in a position of equilibrium.

12. Apparatus for maintaining lateral alignment of a moving web, comprising in combination:

a first rotatable steering roller for engaging the web and guiding it from a first path into a second path substantially perpendicular to that of said first path and mounted for rotation about its longitudinal axis and for pivotal movement about an axis that is substantially perpendicular to the center line of said web in said second path, in response to any angular displacement of said web in said second path for equalizing the tension in the edges of said web;

a first rotatable idler roller for engaging the web in said second path and guiding it into a third path substantially perpendicular to that of said second path; a second rotatable steering roller for engaging said web in said third path and guiding it into a fourth path substantially perpendicular to said third path, said second steering roller having a rotational axis and being movable about an axis substantially perpendicular to said rotational axis in response to any angular displacement of said web in said third path; a second rotatable idler roller for engaging said web in said fourth path and guiding it into an outgoing path substantially perpendicular to that of said fourth path; and

means for mounting said second steering roller and said second idler roller for movement as a unit about an axis substantially perpendicular to that of said second steering roller, said unit being movable in response to any change in path length of said web between said first idler roller and said second steering roller; whereby changes in the lateral alignment of the moving web are corrected.

13. Apparatus in accordance with claim 12 wherein said first steering roller comprises an axial, fixed member having a central pivotal bearing whose axis is substantially perpendicular to the center line of said incoming web, a cylindrical sleeve mounted on said pivotal bearing and a web engaging roller rotatably mounted on said sleeve.

14. Apparatus in accordance with claim 12 wherein said second steering roller comprises an axial, fixed member having a central pivotal bearing whose axis is substantially perpendicular to the axis of said mounting means, a cylindrical sleeve mounted on said pivotal bearing and a web guiding roller rotatably mounted on said sleeve.

15. Apparatus in accordance with claim 14 wherein said web guiding roller is rotatable about an axis that is angularly disposed relative to the axial center line of said sleeve at the point of intersection of the axial center line of said fixed member and the center line of said pivotal bearing.

16. Apparatus in accordance with claim 14 wherein said web guiding roller is provided with end flanges against which a force is exerted by any lateral translation of the portion of said web between said first idler roller

and said second steering roller for moving said mounting means in a corresponding direction to maintain said portion of said web in a twisted helical shape.

17. Apparatus in accordance with claim 14 wherein said mounting means includes means for balancing said mounting means to make the latter independent of any gravity effect.

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