United States Patent [19]

Kuroda

[11] **3,838,481**

[45] **Oct. 1, 1974**

[54] **APPARATUS FOR LATERALLY STRETCHING TEXTILE FABRIC AND THE LIKE**

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[22] Filed: **July 17, 1972**

[21] Appl. No.: **272,177**

[30] **Foreign Application Priority Data**

July 21, 1971 Japan 46-54865
Feb. 5, 1972 Japan 47-13107

[52] **U.S. Cl.** **26/67,** 226/17
[51] **Int. Cl.** **D06c 3/06**
[58] **Field of Search** 26/65, 66, 67; 226/17

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Primary Examiner—Robert R. Mackey
Attorney, Agent, or Firm—Fidelman, Wolffe, Leitner & Hiney

[57] **ABSTRACT**

Apparatus for laterally stretching a web of textile fabric comprising a pair of web stretching devices disposed at opposite sides of the web, each stretching device comprising a pair of rollers arranged so as to nip the side portion of the web. The torque of the rollers at either or both sides of the web is changed to correct any lateral displacement of the web in the course of the stretching operation, and if mere change of the torque is insufficient for the correction, the angular position of the rollers at either side relative to the web feeding direction is suddenly changed to further control the lateral pulling force produced by the nip rollers thereby correcting the lateral position of the web in a moment.

12 Claims, 10 Drawing Figures

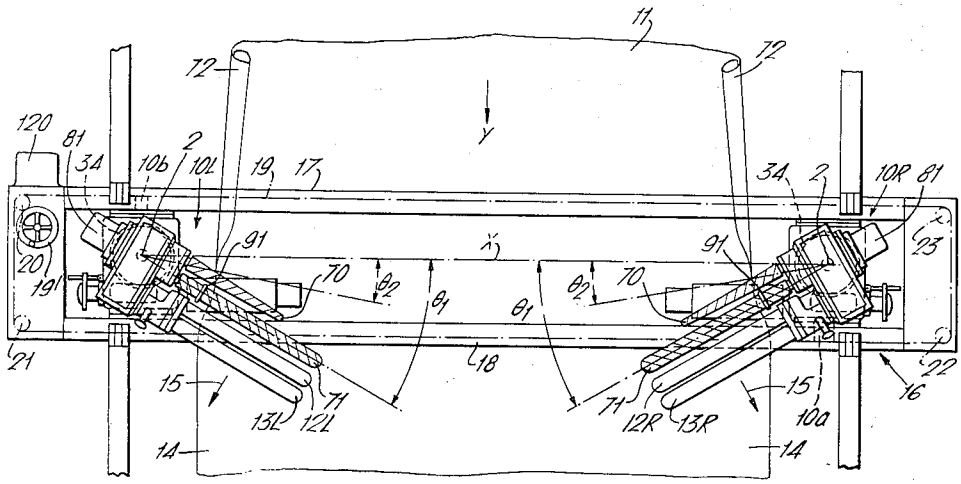


FIG. 1.

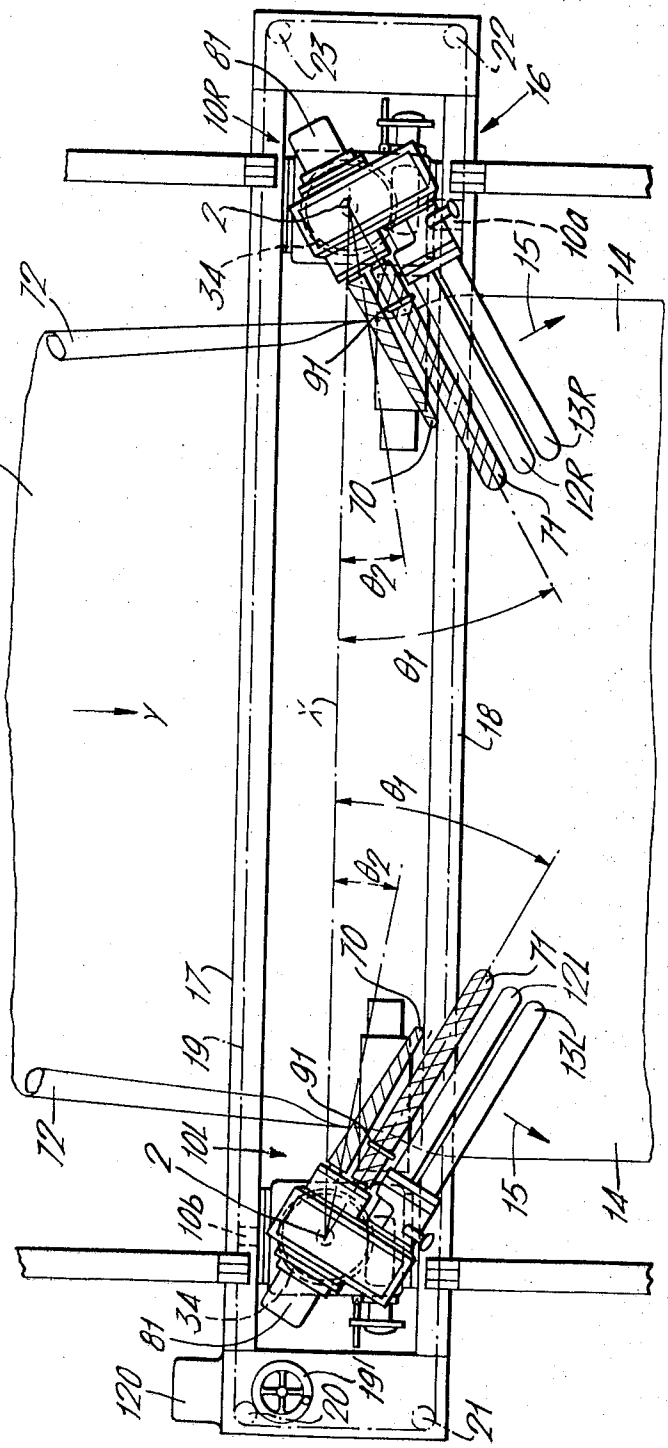

10R
81
23
22
16
2
34
15
10a
14
12
91
13R
12R
11
70
71
θ1
θ1
Y
X
18
θ4
θ2
70
71
17
19
121
131
91
12
2
102
106
15
14
34
81
120
20
19
21

FIG. 2

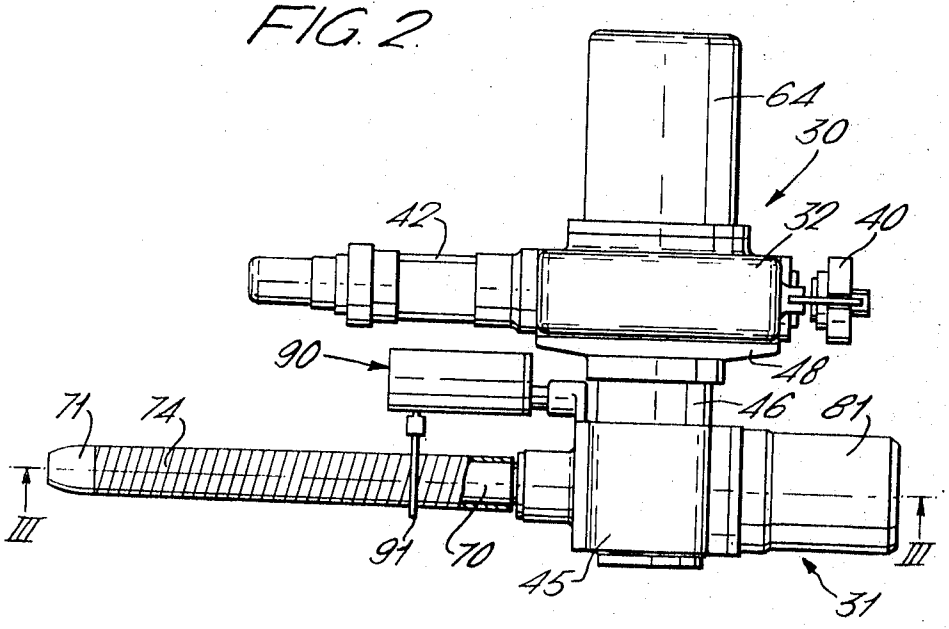

64
30
42
32
40
90
48
46
81
71
74
III
91
70
45
31
III

FIG. 4

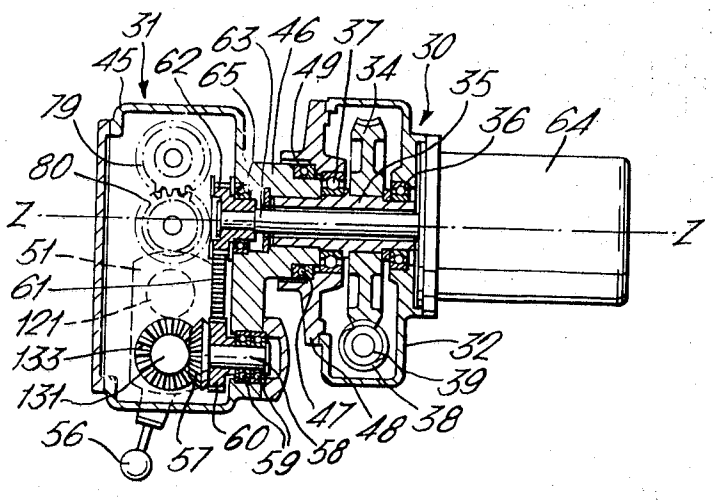

31
45
62
63
65
46
49
37
34
30
35
36
64
79
80
Z
Z
51
61
121
133
131
56
57
60
59
58
47
48
38
39
32

FIG. 3.

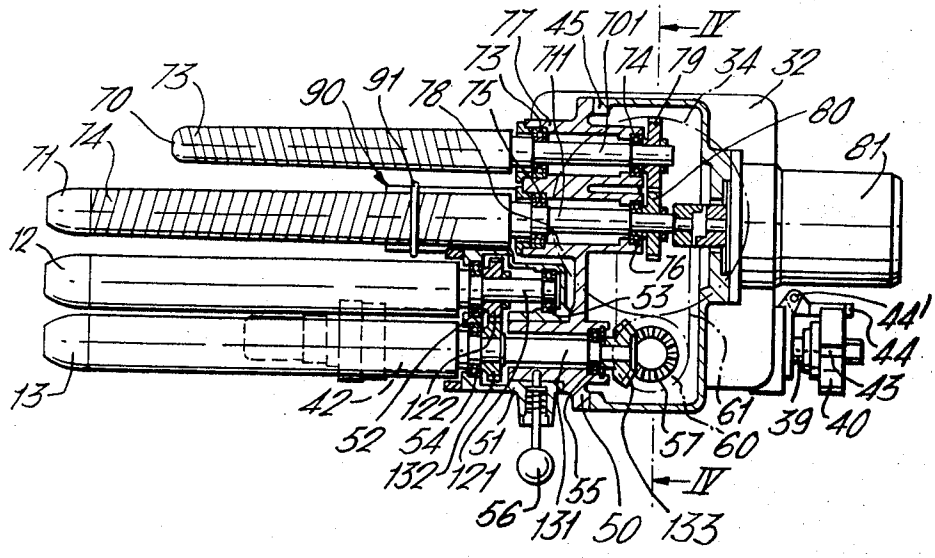

77
45
701
IV
73
711
74
79
34
32
70
73
90
91
78
75
80
74
81
71
16
12
53
44'
44
43
13
42
122
61
39
40
52
54
51
57
60
132
121
IV
55
56
131
50
133

FIG. 5.

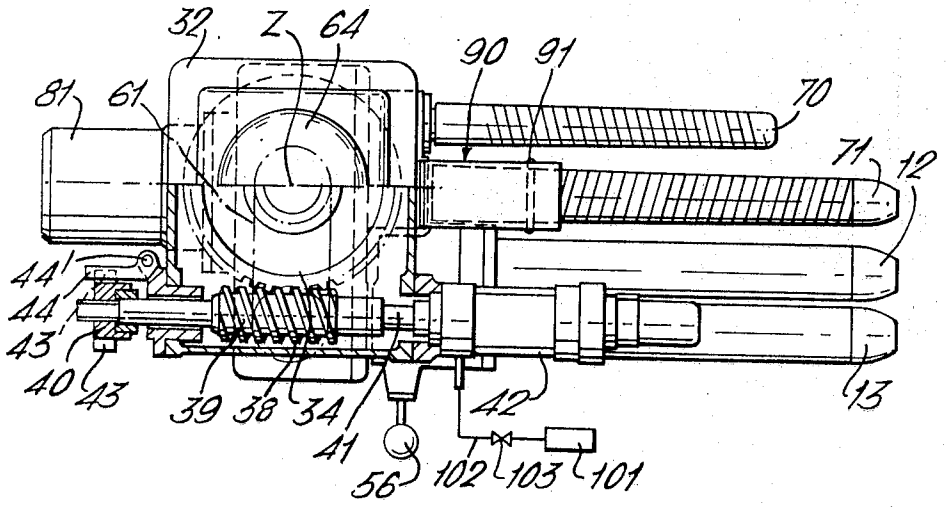

32
Z
64
90
91
81
61
70
71
12
44'
44
43'
40
43
39
38
34
42
41
56
102
103
101
13

FIG. 6

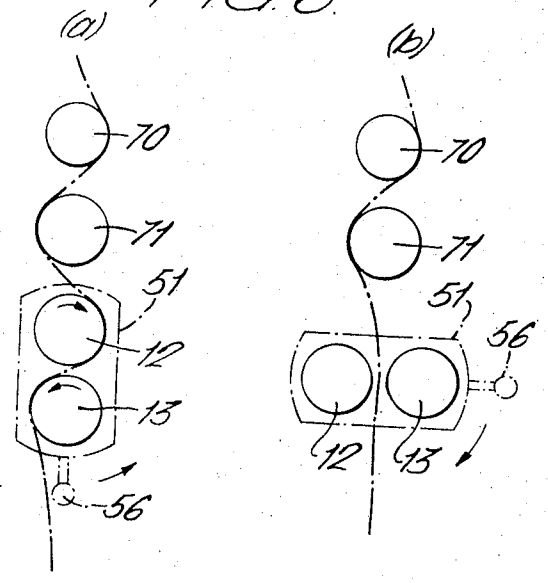

(a)
(b)
70
71
51
12
13
56
70
71
51
56
12
13

FIG. 7

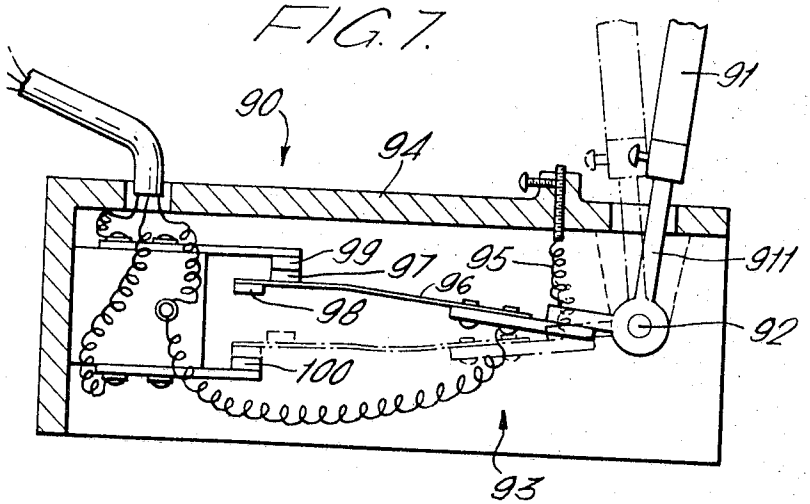

90
91
94
99
97
95
911
96
98
92
100
93

FIG. 8(a)

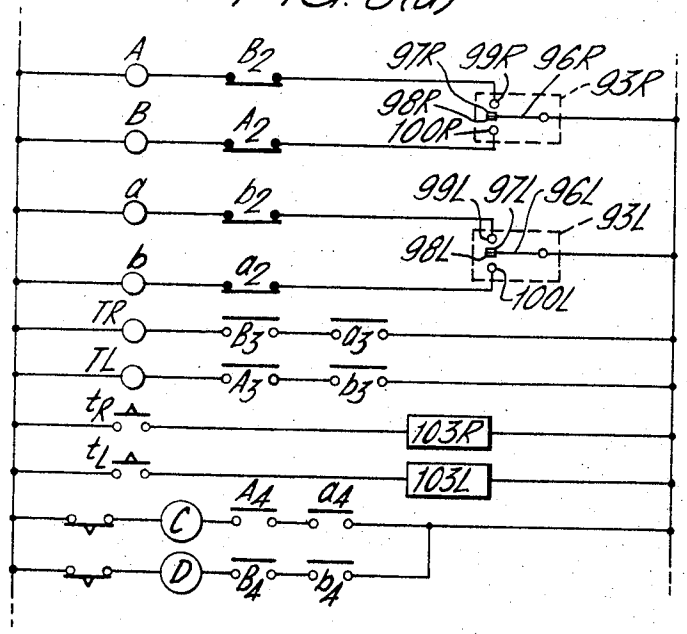

A
B
a
b
TR
TL
tR
tL
C
D
B2
A2
b2
a2
B3
a3
A3
b3
A4
a4
B4
b4
97R
99R
96R
93R
98R
100R
99L
97L
96L
93L
98L
100L
103R
103L

FIG. 8(b)

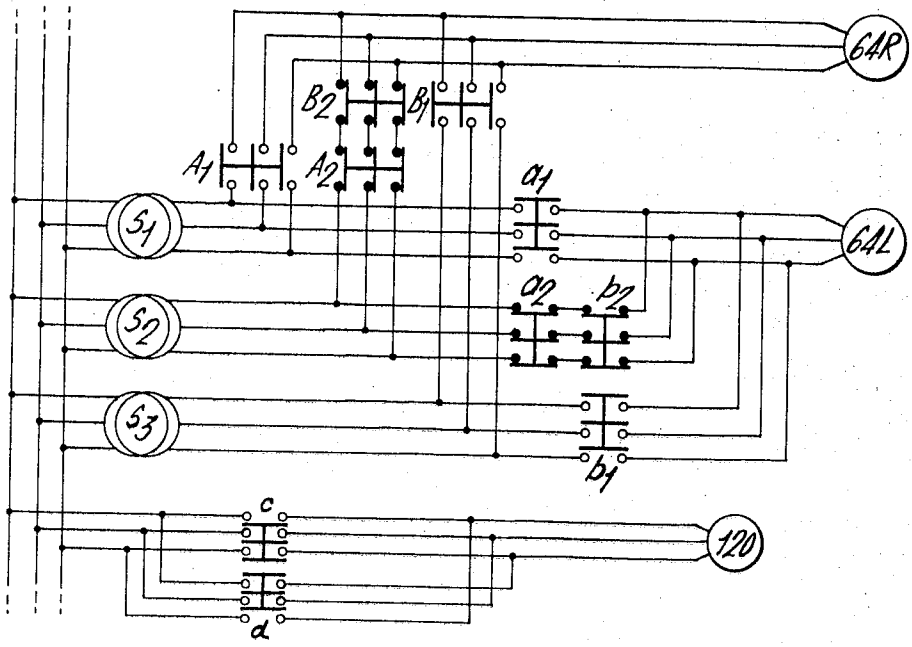
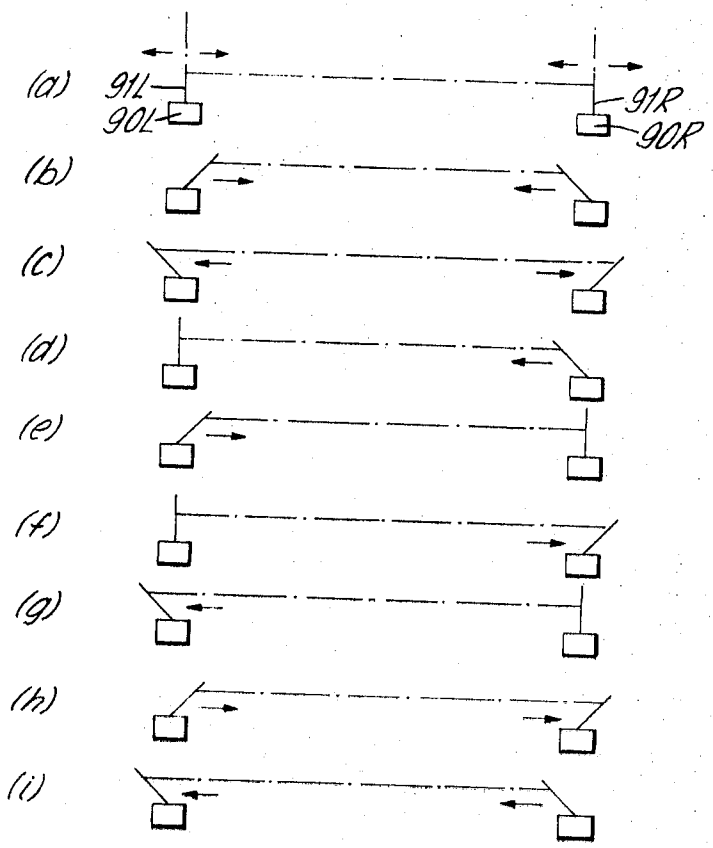

64R
64L
120
B2
B1
A1
A2
a1
a2
b2
b1
S1
S2
S3
c
d

FIG. 9.



APPARATUS FOR LATERALLY STRETCHING TEXTILE FABRIC AND THE LIKE

This invention relates to an apparatus for laterally stretching a longitudinally travelling web of textile fabric or the like flexible material, and more particularly to such an apparatus which is capable of efficiently correcting or compensating for any lateral displacement of the web being fed and/or variations in the width thereof.

There is known a web stretching machine which is provided with a pair of parallel rollers disposed angularly relative to the feeding direction of a web of cloth to be treated so as to engage or nip the edge portion at each side of the web. As is well known, as the web is longitudinally fed, the rollers exercise on the web a pulling force such as to effect lateral stretching of the web. In such web stretching operation, however, abnormal changes often occur such as lateral displacement or meandering of the running web or sudden changes in the width thereof, which must be instantly corrected or compensated for in order to assure proper web-stretching operation.

When such abnormal conditions occur, it has hitherto been customary to change the angular position of the nipping rollers or fingers of the machine thereby to take up any slack in the web at one side thereof while releasing tension at the other. However, if such abnormal changes are abrupt and/or great, or the web being treated is a knit work having a great degree of flexibility, the machine often cannot instantly operate to make a sufficient and effective compensation.

Accordingly, it is one object of the invention to provide a new and improved apparatus for laterally stretching a longitudinally fed web of textile fabric or similar flexible material.

Another object of the invention is to provide a web stretching apparatus which is capable of automatically correcting any lateral displacement of the web as it is being fed the instant such displacement occurs.

A further object of the invention is to provide a web-stretching apparatus which is capable of automatically compensating for any change in the width of the web being treated the moment such change takes place.

Still another object of the invention is to provide a web-stretching apparatus which is quick in response and reliable in operation.

The web-stretching apparatus of the invention comprises a pair of parallel rollers or fingers disposed angularly relative to the direction of travel of a web of textile to be stretched so as to nip each side portion of the web. Before the stretching operation is started, the angle the axes of the rollers make with a transverse line across the web is selectively set to a value suitable for the characteristics of the web to be treated. As the web is longitudinally fed, the rollers nipping the opposite sides of the web are rotated to exercise thereon a pulling a force acting in a direction oblique, that is, forwardly and outwardly relative to the feeding direction of the web, so that the web is laterally outwardly tensioned or stretched. If the running web is displaced toward one side, the torque of the rollers nipping the edge portion at that side of the web is decreased, and simultaneously the torque of the rollers nipping the edge portion at the opposite side is increased so as to correct the lateral position of the web. If the force causing such lateral displacement of the web is very great

and/or abrupt, mere change of the torque of the nip rollers cannot provide a sufficient counter force to effect timely and efficient correction of the lateral position of the web. In accordance with the invention, if such a great and abrupt lateral displacement of the running web occurs, the angle of the axes of the nipping rollers at either side of the web relative to the transverse line across the web is abruptly changed so as to perform the required correction of the lateral position of the web.

The invention with its above-mentioned and other objects, features and advantages will become more apparent from the following description with reference to the accompanying drawings wherein:

FIG. **1** is a front elevation of a web-stretching apparatus of the invention;

FIG. **2** is a top plan view of one of the web-stretching devices shown in FIG. **1**;

FIG. **3** is a front view, partly in vertical section along line III—III, of the device of FIG. **2**;

FIG. **4** is a right-hand side view, sectioned along line IV—IV, of FIG. **3**;

FIG. **5** is a rear view, partly in vertical section, of FIG. **2.**

FIGS. **6** (*a*) and **6** (*b*) are schematic left-hand side views of FIG. **3** to show how the web is passed between the nip rollers;

FIG. **7** is a sectional view of the feeler used in the device of FIGS. **2 – 5** for detecting lateral displacement of the web;

FIGS. **8** (*a*) and **8** (*b*) diagramatically show an electrical control circuit of the invention; and

FIGS. **9** (*a*) through **9** (*i*) are diagrams to explain the operation of the invention.

Now referring in detail to the drawings, first to FIG. **1,** there are shown a pair of web-stretching devices generally designated at **10R** and **10L** and disposed at opposite sides of a web **11** of cloth being fed by a suitable device not shown in a vertically downward direction as viewed in the figure. This direction will be referred to as the feeding direction Y hereinafter of the web. The two devices are of the same construction and therefore only one of them will be described in detail. When the two devices are commonly referred to, they will be designated by the numeral **10** without the suffix R or L. Each device **10** is provided with a pair of rollers **12** and **13** nipping one side edge portion or selvage **14** of the web to exercise on the selvage a pulling force acting in a direction as shown by an arrow **15** so that the web is stretched or expanded laterally outwardly as it is longitudinally fed. The two devices **10R** and **10L** are mounted on a frame **16** disposed transversely of the feeding direction Y of the web in such a manner that the distance or space between the two devices can be adjusted. To this end the devices are slidably supported between a pair of horizontally extending and vertically spaced rails **17** and **18** of the frame **16** and connected by means of an endless belt or chain **19** passing about four sprocket wheels or pulleys **20, 21, 22** and **23** provided in the four corners of the frame. The chain is connected as at **10***a* to the lower side of the device **10R** disposed, say, at the right-hand side as viewed in FIG. **1** and as at **10***b* to the upper side of the device **10L** disposed at the opposite side. It will be easily seen that when the chain is driven manually by a handle **19′** or by a motor **120** in the clockwise direction, the two devices **10R** and **10L** are moved toward each other to

shorten the distance therebetween while when the chain is moved in the counter-clockwise direction, the two devices are moved away from each other.

The detailed construction of the device **10** will now be described with reference to FIGS. **2 – 5.** The device consists of two sections, that is, a support section **30** and a movable section **31** adapted to be rotated about an axis Z relative to the support section **30** from the original position as shown in FIG. **3** through an angle θ_1 to the inclined position shown in FIG. **1.** The support section **30** comprises a casing **32** provided with two pairs of rollers, not shown, on the upper and lower sides thereof for slidable engagement in the horizontal rails **17** and **18** of the frame. The casing **32** encloses a worn wheel **34** having a tubular shaft **35** journaled on the casing by means of radial bearings **36** and **37,** and a worm gear **38** engaged with the wheel **34** and rigidly mounted on a shaft **39.** One end of the shaft **39** projects outside the casing **32** and is provided with an operating disk **40,** while the opposite end of the shaft **39** is connected to a piston rod **41** of an air cylinder **42** (FIG. **5**). The function of the combination of the worm wheel, the gear and the air cylinder is to control the angular position of the nip rollers as will be described later in detail.

On the peripheral edge of the disk **40** there are formed a plurality of notches **43** in which a stop lever **44** pivoted at **44'** to the casing **32** selectively engages as best shown in FIG. **5.** It will be easily seen that rotation of the operating disk **40** in either direction will cause corresponding rotation of the worm gear **38** and consequently the worm wheel **34.** The rotation of the worm wheel **34** causes the movable section **31** and the nip rollers carried thereon to change its angular position relative to the support section **30.**

When the movable section **31** has been rotated to a desired angular position relative to the support section **30,** the stop lever **44** is put into one of the notches **43** in the operating disk **40** thereby to prevent further rotation of the worm gear **38** and consequently to securely hold the angular position of the section **31** and the rollers **12** and **13.**

To enable the rotation of the movable section **31** relative to the support section **30,** the section **31** comprises a casing **45** having a boss **46** which is fitted in a corresponding opening **47** formed at the front end wall **48** of the casing **32** of the support section **30** and journaled in a bearing **49** provided in the opening **47.** The tubular shaft **35** of the worm wheel **34** is securely fitted in the boss **46** of the casing **45** for simultaneous rotation therewith. As will be easily understood, rotation of the worm wheel **34** results in a corresponding rotation of the shaft **35** and boss **46** and the casing **45** of the movable section **31** and finally a change in the angular position of the nip rollers **12** and **13.**

The casing **45** has another boss **50** (FIG. **3**) on which a collar member **51** is rotatably mounted. The rollers **12** and **13** have their respective shafts **121** and **131** journaled on bearings **52, 53** and **54,** respectively, in the collar member **51.** The shaft **131** of the lower nip roller **13** pierces through the boss **50** of the casing **45** so as to be journaled on a bearing **55.**

In the operative condition, the two nip rollers **12** and **13** are positioned in vertical alignment with each other as shown in FIG. **6** (*a*), with a web **11** meandering about the rollers. For easy insertion of the selvage of the web between the nip rollers, the collar **51** can be rotated by a lever **56** attached thereto through 90° into a horizontally aligned position as shown in FIG. **6** (*b*).

The shafts **121** and **131** of the rollers **12** and **13** are provided with gears **122** and **132** meshing with each other, and the shaft **131** of the lower roller **13** is further provided at its inner end with a bevel gear **133,** which meshes with a corresponding bevel gear **57** rigidly mounted on a shaft **58** journaled in a pair of bearings **59** provided in the rear wall of the casing **45** (FIGS. **3** and **4**). The shaft **58** is further provided with a sprocket wheel **60** which is connected by a chain **61** to a sprocket wheel **62** secured to the output shaft **63** of a torque motor **64** provided at the rear side of the casing **32** of the support section **30.** The output shaft **63** pierces loosely through the tubular shaft **35** of the worm wheel **34** and is journaled in a bearing **65** in the rear wall of the casing **45** of the movable section **31.** It will be easily seen that when the torque motor **64** is energized, the nip rollers **12** and **13** are rotated in opposite directions as shown in the arrows in FIG. **6** (*a*) through the drive connection of **62, 61, 60, 57, 133, 132** and **122,** thereby exercizing a required stretching force on the web selvage as will be described later.

The movable section **31** is further provided above the nip rollers **12** and **13** with a pair of substantially parallel rods **70** and **71** for smoothing out the selvage **14** of the web if it is curled or folded as shown at **72** in FIG. **1.** Each of the rods **70** and **71** is formed on its outer circumferential surface with a helical groove **73, 74** for engagement with the curled or folded selvage. The helical grooves are formed in such winding directions as to smooth out the selvage laterally outwardly. The winding direction of the helical groove in one of the rods is opposite to that of the helical groove in the other rod since the two rods are rotated in opposite directions by means of a gear connection to be described presently. The rods **70** and **71** have their respective shafts **701** and **711** journaled on pairs of bearings **73, 74** and **75, 76** provided in bearing sleeves **77** and **78** formed on the casing **45.** The shafts **711** are provided with gears **79** and **80** meshing with each other, while the shaft **711** is connected to the output shaft of a motor **81.** When the motor **81** is energized, the two rods **70** and **71** are rotated in opposite directions so as to contact and smooth out the curled selvage **72** of the web.

On the movable section **31** there is further provided a selvage detector **90** which has a feeler ring **91** encircling the lower rod **71** and arranged to be in contact with the outer edge of the web as it is being smoothed out. As the running web is displaced right and left, the feeler **91** in contact therewith is made to swing right and left so as to operate a switch **93** (FIG. **7**) enclosed in casing **94** of the detector **90,** thereby performing a switching operation on a control circuit to change the amount of energizing voltage being applied to the torque motor **64** and consequently the amount of torque of the rollers **12** and **13** as will be described hereinafter again.

The feeler ring **91** has its support lever **911** pivoted as at **92** to the casing **94** and biased by a spring **95** clockwise in FIG. **9** or toward the left in FIG. **3** so that the feeler ring **91** is brought into contact with and lightly presses against the edge of the web. The support lever **911** is provided with a movable contact arm **96** having a pair of contacts **97** and **98.** A pair of fixed contacts **99** and **100** are provided to be alternatively

contacted by the movable contacts **97** and **98**, respectively. The contacts **97** – **100** are included in the control circuit as will be described later.

As previously mentioned, characteristic of the invention is that when the web is laterally displaced as it is being fed, the torque of the nip rollers **12, 13** of either one of the devices **10** is changed so as to correct the lateral displacement, and that when such displacement becomes too great to be corrected by the maximum change of the torque of the nip rollers, the angular position of the nip rollers **12, 13** is suddenly changed so as to instantaneously effect the required correction of the lateral position of the web.

To effect such a sudden change of the angular position of the nip rollers, the air cylinder **42** (FIG. **5**) is operated so as to move the worm gear **38** axially, thereby suddenly rotating the worm wheel **34** through a predetermined angle to bring the nip rollers to a new angular position required to effect the necessary correction of the lateral displacement of the web. In this case, the worm and the worm wheel function as if they constituted a rack-and-pinion connection so that the rotation of the worm wheel through the predetermined angle is accomplished in a moment.

With particular reference to the device **10R** at the right-hand side in FIG. **1**, if the web is being displaced rightward by such a great pulling force that the maximum increased torque of the nip rollers of the device **10L** at the left-hand side cannot provide a counter force sufficient to correct the rightward displacement, then the angle θ_1 which the axes of the nip rollers of the device **10R** at the right-hand side make with the transverse line X across the web will be suddenly decreased to, say, θ_2 thereby decreasing the rightward pull on the web and consequently relatively increasing the leftward pulling force by the nip rollers of the device **10L** at the left-hand side enough to effect the necessary correction of the lateral position of the web. This will be explained again later.

For actuation of the air cylinder **42**, a source of pressurized air **101** is connected to the cylinder **42** through a supply line **102** with an electromagnetic control valve **103** inserted therein. The arrangement is such that when the electromagnetic valve is actuated by the control circuit to be presently described, pressurized air is introduced into the cylinder so that the cylinder rod **41** is axially moved thereby effecting a required change in the angular position of the nip rollers in the previously mentioned manner. The angle through which the nip rollers are turned, that is, the angle $(\theta_1 - \theta_2)$ can be selectively determined by presetting the stroke of the cylinder rod **41** to a suitable distance.

Now is the time to explain the operation of the apparatus of the invention with particular reference to FIGS. **7** – **9**, wherein and in the following description the letters R and L suffixed to the reference numerals, when necessary for discrimination, means that the component parts designated by the numerals belong to the web stretching devices disposed at the right-hand and left-hand sides in FIG. **1**, respectively.

When the web is being properly fed with no appreciable lateral displacement in either direction (FIG. **9** (*a*)), the feeler **91** of each detector **90R**, **90L** is positioned at the center of its swing range with the movable contacts **97** and **98** contacting neither of the fixed contacts **99** and **100**, so that the torque motors **64R** and **64L** of the devices **10R** and **10L** are energized by a standard voltage supplier **S2** through normally closed switches **A2**, **B2** and *a***2**, *b***2**, respectively (FIG. **8**). This means that the nip rollers of the two devices **10R** and **10L** have the same standard magnitude of torque, so that the running web is kept at its proper central position as it is properly laterally stretched.

If the width of the web decreases, the feelers **91R** and **91L** are moved inwardly as shown in FIG. **9** (*b*) so that the movable contacts **97R** and **97L** on the arms **96R** and **96L** both contact the upper fixed contacts **99R** and **99L**, respectively, whereupon relays A and a are energized to close normally open switches **A1** and *a***1** and at the same time open normally closed switches **A2** and *a***2**, respectively. This switches the torque motors **64R** and **64L** from the standard voltage supplier **S2** over to a high voltage supplier **S1**, so that the torque of the nip rollers at the opposite sides of the web is increased tending to expand the web toward the normal width. At the same time the relays A and a also close normally open switches **A4** and *a***4**, whereupon a relay C is energized to close a normally open switch *c* in the three-phase supply line to the motor **120** so as to rotate the motor clockwise in FIG. **1**. This moves the web stretching devices **10R** and **10L** toward each other thereby decreasing the distance therebetween until the feelers and consequently the movable contacts are returned to their original position of FIG. **9** (*a*).

Contrary to the above, if the width of the web tends to increase, the feelers **91R** and **91L** are moved away from each other as shown in FIG. **9** (*c*), so that the movable contacts **98R** and **98L** on the arms **96R** and **96L** contact the lower fixed contacts **100R** and **100L**, respectively, whereupon relays B and *b* are energized to close normally open switches **B1** and *b***1** and simultaneously open normally closed switches **B2** and *b***2**. As a result, the torque motors **64R** and **64L** are disconnected from the standard voltage supplier **S2** and connected to a low voltage supplier **S3**, so that the torque of the nip rollers at the opposite sides of the web is decreased tending to reduce the pulling force on the web.

At the same time the relays B and *b* also close normally open switches **B4** and *b***4**, whereupon a relay D is energized to close a normally open switch *d* in the supply line to the motor **120**, with two of the three phases being connected in the opposite manner to the previous connection through the switch *c*. This rotates the motor **120** oppositely, that is, counter-clockwise in FIG. **1**, so that the two devices **10R** and **10L** are moved apart from each other thereby increasing the distance therebetween as far as the feelers and consequently the movable contacts are returned to their original position of FIG. **9** (*a*). In this manner, as the width of the web varies, the two web-stretching devices at the opposite sides of the web move toward or apart from each other to compensate for the variation of the width of the web thereby performing proper stretching operation on the web at all times.

If the width of the web decreases only at the right-hand side as shown in FIG. **9** (*d*), the feeler **91R** alone responds to the change and the movable contact **97R** contacts the upper fixed contact **99R** so that the torque motor **64R** alone is supplied from the high voltage supplier **S1** to increase the torque of the nip rollers **12R** and **13R** thereby pulling the right-hand side of the web rightward to the proper width of the web.

If the width of the web decreases only at the left-hand side as shown in FIG. **9** (*e*), the torque motor **64L** alone increases its torque in a manner similar to that mentioned just above, so that the web is pulled leftward to the proper width.

If the width of the web increases at the right-hand side alone as shown in FIG. **9** (*f*) or at the left-hand side alone as shown in FIG. **9** (*g*), the feeler **91R** alone or **91L** alone feels the change so that the torque motor **64R** alone or **64L** alone is supplied from the low voltage supplier **S3** to decrease the torque of the associated nip rollers thereby decreasing the lateral pull on the right-hand or left-hand side of the web for restoration of the proper width of the web.

If the web is displaced rightward as shown in FIG. **9** (*h*), the feeler **91R** is pushed rightward (leftward in FIG. **7**) so that the movable contact **98R** touches the lower fixed contact **100R**, whereupon the relay B is energized to close the normally open switch **B1** and simultaneously open normally closed switch **B2** so that the torque motor **64R** is connected to the low voltage supplier **S3** thereby decreasing the torque of the nip rollers **12R** and **13R**. At the same time, the feeler **91L** at the opposite side of the web also moves rightward so that the movable contact **97L** touches the upper fixed contact **99L**, whereupon the relay *a* is energized to close the normally open switch *a***1** and open the normally closed switch *a***2**, so that the torque motor **64L** is disconnected from the standard voltage supplier **S2** and connected to the high voltage supplier **S1** thereby increasing the torque of the nip rollers **12L** and **13L**. The increase in the torque of the nip rollers at the left side combined with the decrease in the torque of the nip rollers at the right side causes the web to be moved leftward to the normal lateral position.

If the web is displaced leftward as shown in FIG. **9** (*i*), the feelers **91R** and **91L** are moved leftward so that the torque motor **64R** increases the torque of the nip rollers at the right-hand side of the web while the motor **64L** decreases the torque of the nip rollers at the left-hand side in the manner just opposite to the above mentioned manner in the case of FIG. **9** (*h*), so that the web is pulled rightward to the proper lateral position.

In the case of FIG. **9** (*h*) or FIG. **9** (*i*), if the force causing the rightward or leftward displacement of the web cannot be overcome within a required period of time by the combined effect of the increase and decrease of the torque of the nip rollers at both sides of the web, the angular position of the nip rollers at the side toward which the web is being displaced is suddenly decreased so that the lateral pulling force by the nip rollers on the selvage of the web at that side is suddenly decreased thereby relatively increasing the pulling force by the nip rollers at the opposite side of the web.

As previously mentioned, in the case of FIG. **9** (*h*) the movable contact **98R** contacts the lower fixed contact **100R** to energize the relay B, and the movable contact **97L** contacts the upper fixed contact **99L** to energize the relay *a*. The relays B and *a* also close normally open switches **B3** and *a***3**, respectively, thereby actuating a timer TR. If the condition continues longer than the time set in the timer TR, a normally open switch *t*R is closed to actuate the electromagnetic valve **103R**, whereupon pressurized air is introduced into the cylinder **42R** (FIG. **5**) so that the nip rollers **12R** and **13R** are suddenly rotated clockwise in FIG. **1** to the angular position of $\theta 2$. At this time the angular position of the rollers **12L** and **13L** of the device **10L** at the opposite side is kept unchanged at $\theta 1$. Due to the difference ($\theta 1$–$\theta 2$) between the angular positions of the two devices the lateral pulling force by the nip rollers **12L** and **13L** is relatively increased enough to accomplish the required correction of the lateral position of the web in a moment.

In the case of FIG. **9** (*i*) the relays A and *b* close normaly open switches **A3** and *b***3**, so that a timer TL is actuated, and if the leftward displacement of the web cannot be corrected within the time preset in the timer TL, a switch *t*L is closed so that the nip rollers **12L** and **13L** are suddenly rotated counter-clockwise in FIG. **1** to the angular position of $\theta 2$, thereby effecting correction of the displacement of the web in a manner similar to that mentioned just above.

The time set in the timers TR and TL is the time no longer than which the lateral displacement can be left uncorrected.

Although the invention has been described and illustrated in detail, it is to be clearly understood that the same is by way of illustration and example only and not to be taken by way of limitation, the spirit and scope of this invention being limited only by the terms of the appended claims.

What I claim is:

1. A device for laterally stretching a web of textile fabric or the like flexible material, comprising: two pairs of parallel nip rollers, one pair located at each selvage of said web, and each pair adapted to nip therebetween a side portion of said web being longitudinally fed; means for rotating said nip rollers about their respective axes in opposite directions so that said rollers exercise on said web a pulling force to laterally stretch said web; means for detecting lateral displacement of said web relative to the feeding direction thereof; means operable in response to said detecting means to cause said rotating means to change the torque of said nip rollers thereby to change the magnitude of said pulling force; and means for selectively changing the angular position of said nip rollers relative to said web comprising first means for effecting a change in said angular position relatively gradually so as to determine said angular position before the web-stretching operation is commenced, and second means responsive to said detecting means for effecting a change in said angular position suddenly in the course of the web-stretching operation.

2. The device of claim **1**, further including means adapted to be brought into contact with each said side portion of said web before said side portion is nipped by said nip rollers to smooth out said side portion.

3. The device of claim **2**, wherein each said smoothing means comprises at least one rotatable rod having a helical groove on the outer surface thereof and means for rotating said rod so that said helical groove contacts and smoothes said web side portion laterally outward.

4. The device of claim **1**, wherein said first means comprises: a worm wheel; a worm gear meshing therewith; means for manually rotating said worm gear; and means supporting said nip rollers and being rotatable about an axis perpendicular to the plane of said web, said worm wheel being connected to said rotatable supporting means so that rotation of said worm gear results

in a corresponding rotation of said worm wheel and consequently said supporting means about said axis thereby effecting said gradual change in said angular position of said nip rollers relative to said web.

5. The device of claim **4,** wherein said second means comprises said worm wheel, said worm gear, said rotatable supporting means and means for axially moving said worm gear so that said worm wheel is suddenly rotated thereby effecting said sudden change in said angular position of said nip rollers relative to said web.

6. Apparatus for laterally stretching a web of textile fabric or the like flexible material, comprising: a pair of web stretching devices, each comprising a pair of nip rollers adapted to nip therebetween a selvage of said web being longitudinally fed, means for rotating said nip rollers about their respective axes in opposite directions so that said rollers exercise on said web a pulling force to laterally stretch said web, means for detecting lateral displacement of said web, means operable in response to said detecting means to cause said rotating means to change the torque of said nip rollers, thereby changing the magnitude of said pulling force; means for supporting said devices in a laterally spaced apart relation to each other so that said devices are disposed at the opposite sides of said web, with said nip rollers nipping the selvages at the opposite sides of said web; means for selectively changing the angular position of said nip rollers relative to said web; and means operable in response to said displacement detecting means of said devices for controlling said angular position changing means of said pair of devices correlatively to suddenly decrease the angular position relative to said web of said nip rollers in one of said devices while keeping the angular position relative to said web of said nip rollers unchanged in the other of said devices.

7. The apparatus of claim **6,** further including means for selectively changing the distance between said pair of web stretching devices.

8. The apparatus of claim **7,** wherein said distance changing means operates in response to said displacement detecting means.

9. The apparatus of claim **6,** wherein each of said web-stretching devices further includes means adapted to be brought into contact with each said selvage before said selvage is nipped by said nip rollers to smooth out said selvage.

10. A device for laterally stretching a web of textile fabric or the like material, comprising: a casing consisting of a support section and a movable section mounted on said support section for rotation about an axis relative to said support section, said axis being perpendicular to the plane of said support section; a pair of web stretching devices, each comprising a pair of parallel nip rollers having axes in a plane perpendicular to said first-mentioned axis and carried on said support section so as to nip therebetween a selvage of said web; a pair of parallel rods having oppositely wound helical grooves on the outer circumferential surfaces thereof and mounted on said movable section in parallel relation with said rollers so as to contact and smooth out said web selvage to be nipped by said rollers; a torque motor carried on said casing; a drive connection between said torque motor and said nip rollers; rotating means for selectively changing the angular position of said nip rollers relative to said web including a worm gear in said casing support section having a shaft, one end of which projects outside said casing support section for manual rotation thereof, and a worm wheel engaged by said worm gear and having a shaft to which said movable casing section is connected for simultaneous rotation about said first-mentioned perpendicular axis; means for supplying electric energy to said torque motor; means for detecting lateral displacement of said web nipped by said nip rollers, electrical control circuit means operable in response to said detecting means to change the amount of electric energy to be supplied to said torque motor, thereby changing the torque of said nip rollers.

11. The device of claim **10,** further including a fluid cylinder having a piston rod connected to the other end of said worm shaft, and means operable in response to said displacement detecting means to control the supply of pressurized fluid to said cylinder to suddenly move said worm shaft axially, thereby effecting a sudden rotation of said movable section about said first-mentioned perpendicular axis relative to said support section.

12. Apparatus for laterally stretching a web of textile fabric or the like flexible material, as defined in claim **11,** further comprising a frame having a pair of parallel rails for supporting said devices in a laterally spaced apart relation to each other so that said web being fed in a transverse direction to said rails has its opposite selvages nipped by the nip rollers of said devices; and means for changing the distance between said devices in said rails; and further control circuit means operable in response to said torque control means for controlling said pressurized fluid supply control means of said devices in a correlative relation so that the pressurized supply control means of one of said devices is actuated while that of the other device remains unactuated.

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