United States Patent

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[54] **WEB FEED ADVANCE AND RETARD CONTROL MEANS**
5 Claims, 5 Drawing Figs.

[52] **U.S. Cl.** **26/51.3,** 26/52
[51] **Int. Cl.** **D06c 3/02,** D06h 3/12
[50] **Field of Search** 26/51.3, 51.4, 51.5, 52

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ABSTRACT: New and improved web feed advance and retard control means are provided and comprise means to retard or advance the feed rate of said web to correct for distortion of the latter, and means to indicate and adjust the extent of said feed rate increase or decrease.

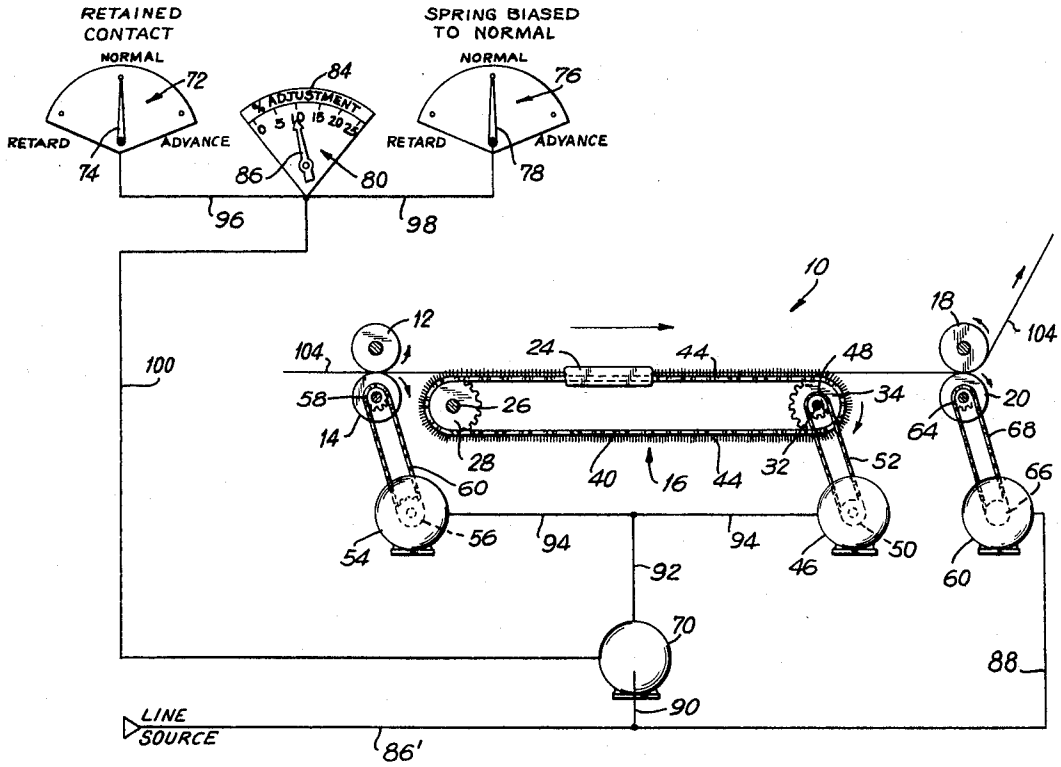
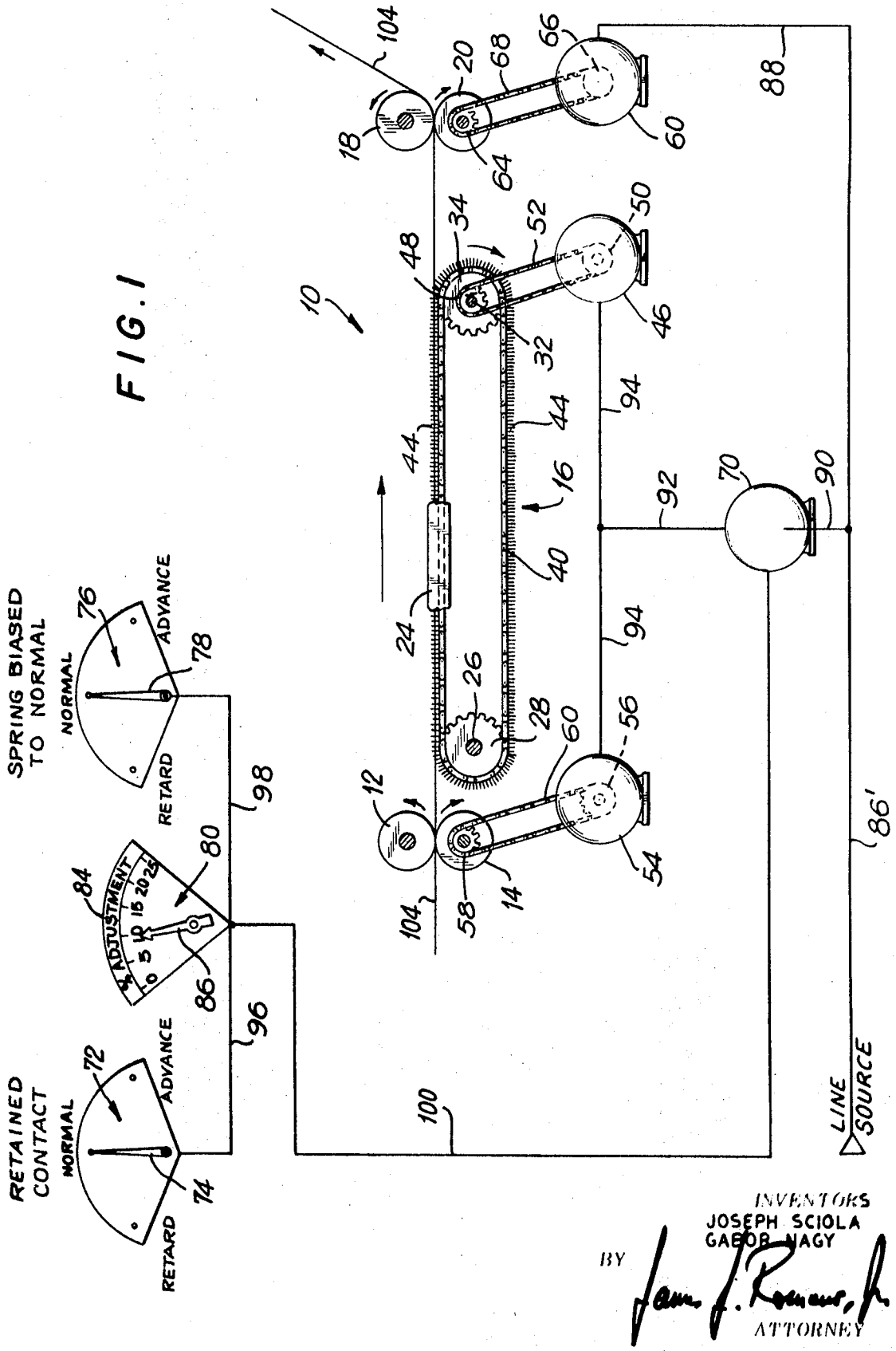


FIG. 1

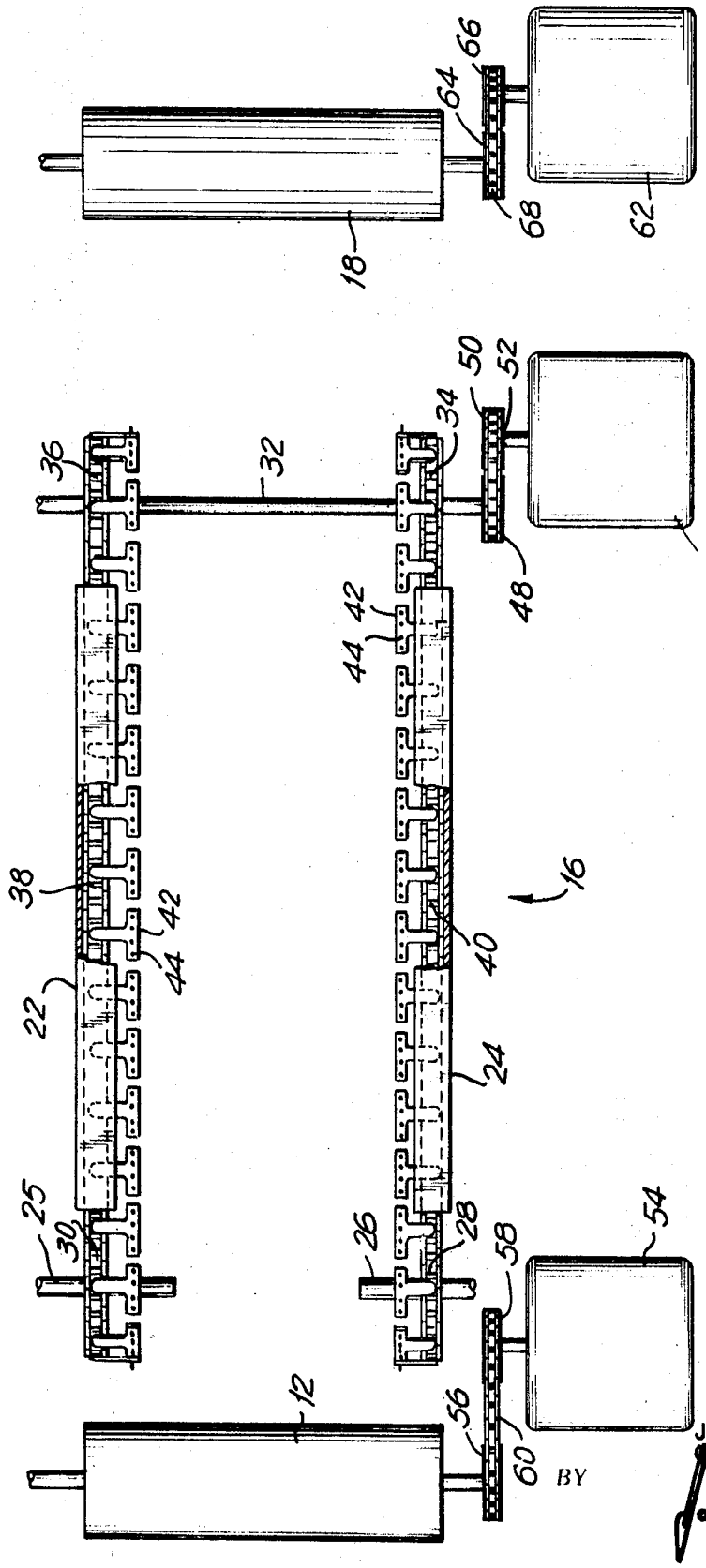


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FIG. 2



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FIG. 5

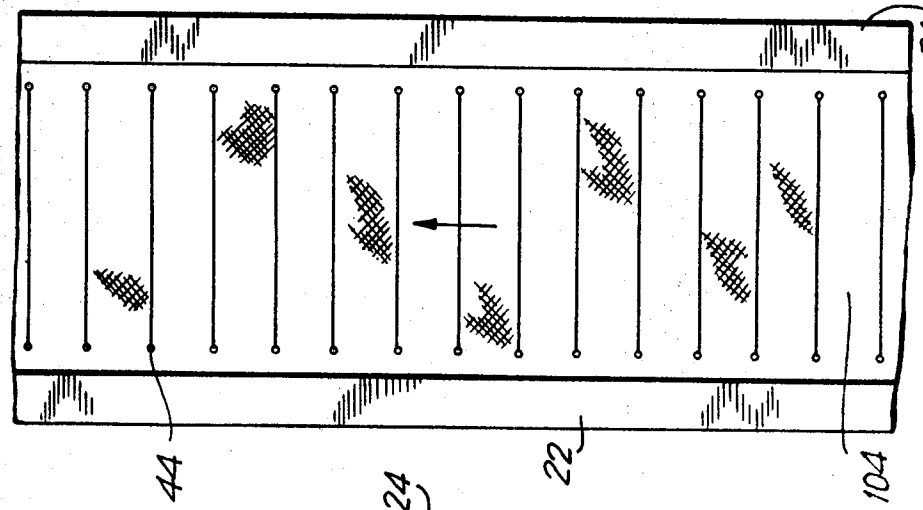


FIG. 4

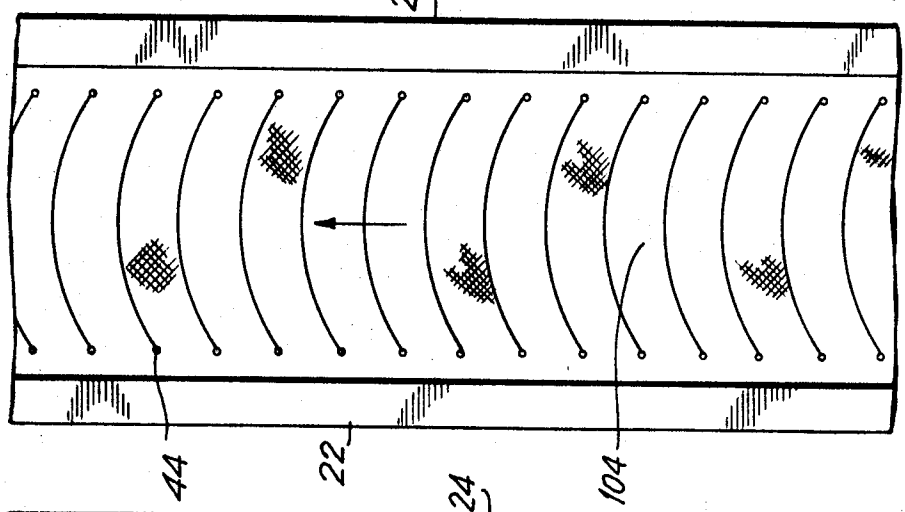
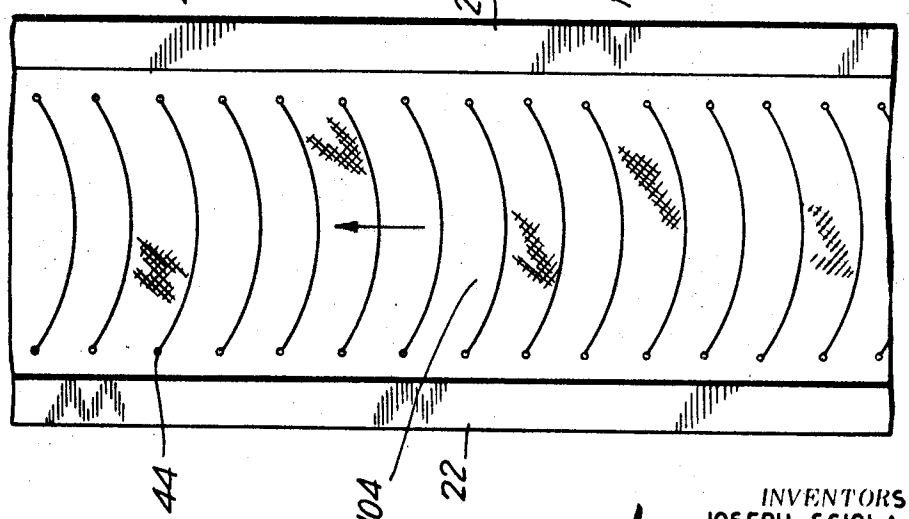


FIG. 3



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WEB FEED ADVANCE AND RETARD CONTROL MEANS

BACKGROUND OF THE INVENTION

1. Field of the Invention

This invention relates to new and improved web advance and retard control means as are particularly, though by no means exclusively, adapted to the control of the feed of fabric webs to flame bonding machinery.

2. Background of the Invention

Although control means are known for the control of the feed of fabric webs to fabric processing machinery in the nature of flame bonding machines to prevent distortion of such fabric webs, it may be understood that the same have not proven particularly satisfactory for a variety of reasons. More specifically, such prior art web feed control means are either not adaptable for use with all kinds of fabrics, do not include means which clearly indicate, and provide for convenient adjustment of, the extent of web feed advancement or retardation being provided thereby, are overly complex and require frequent adjustment and maintenance, and/or require substantially constant attention on the part of a machine operator to thereby render the latter unavailable for the performance of other useful tasks with attendant increase in the overall cost of machine operation.

OBJECTS OF THE INVENTION

It is, accordingly, an object of this invention to provide new and improved web feed advance and retard control means which are applicable for use with all kinds of fabric webs to accurately prevent distortion thereof during fabric web feed.

Another object of this invention is the provision of web feed advance and retard control means as above including means which clearly indicate, and provide for convenient adjustment of, the extent of web feed advancement of retardation being provided thereby.

Another object of this invention is the provision of web feed advance and retard control means as above which include means enabling the substantially unattended operation thereof under certain web distortion conditions to thus free a machine operator for the performance of other useful tasks.

A further object of this invention is the provision of web feed advance and retard control means which require the use of only readily available components of proven dependability in the fabrication thereof to thus provide for long periods of satisfactory, maintenance-free control means operation.

SUMMARY OF THE INVENTION

As currently preferred, the new and improved web feed advance and retard control means of the invention are adapted for use with web feed means which comprise a tenter frame, tenter frame entry feed means, and tenter frame exit feed means which are respectively driven by electric drive motors at substantially the same web feed rates under normal operating conditions. The control means comprise electrical differential means which are connnected to the electric drive motors which drive the tenter frame and the tenter frame entry feed means, and switch means which are connected to said electrical differential means to actuate the latter to increase or decrease the speeds of these electric drive motors relative to the speed of the electric drive motor which drives the tenter frame exit feed means to enable correction of web distortion. Means are also provided to indicate and enable adjustment in the extent of such speed increase or decrease. One of said switch means is a retained contact switch which is operable to maintain a desired speed increase or decrease.

BRIEF DESCRIPTION OF THE DRAWINGS

The above and other objects and advantages of the invention are believed made clear by the following detailed description thereof taken in conjunction with the accompanying drawings wherein:

FIG. 1 is a somewhat schematic side view of new and improved web feed advance and retard control means constructed in accordance with the teachings of this invention;

FIG. 2 is a somewhat schematic top view of the apparatus of FIG. 1;

FIG. 3 is a top view of the web depicting an improper condition thereof which requires retardation adjustment;

FIG. 4 is a top view of the web depicting an improper condition thereof which requires advancement adjustment; and

FIG. 5 is a top view of the web depicting the proper feed condition thereof.

DETAILED DESCRIPTION OF THE INVENTION

Referring now to FIGS. 1 and 2, new and improved web feed advance and retard control means constructed in accordance with the teachings of this invention are indicated generally at **10** and comprise tenter frame entry feed means which take the form of a pair of nip rollers as indicated at **12** and **14**, a tenter frame as indicated generally at **16**, and tenter frame exit feed means which takes the form of a pair of main feed rollers as indicated at **18** and **20**, respectively.

As best seen in FIG. **2**, the tenter frame **16** comprises spaced, generally U-shaped guide rails **22** and **24**. Idler shafts **25** and **26** are disposed adjacent one end of said guide rails, and idler sprockets **28** and **30** are rotatably disposed thereon as shown in general alignment with said guide rails. A drive shaft **32** is disposed adjacent the other end of said guide rails, and drive sprockets **34** and **36** are fixedly disposed thereon so as to be rotatable therewith, again in general alignment with said guide rails.

An endless, tenter drive chain **38** extends as shown around sprockets **30** and **36** in operative relationship therewith, while an endless, tenter drive chain **40** extends as shown around sprockets **28** and **34** in operative relationship therewith, whereby is believed made clear that driven rotation of the respective drive sprockets **34** and **36** in the clockwise direction as seen in FIG. **1** will result in generally longitudinally movement of the respective upper lengths of the said tenter drive chains from left to right as seen in FIG. **1**.

Tenter pin mounting members are indicated at **42** and are supported as shown at spaced points on each of the tenter drive chains **38** and **40**, in any convenient manner, to respectively extend inwardly therefrom beyond the respective inner edges of the guide rails **22** and **24**. A plurality of tenter pins **44**, for example four, extend as shown upwardly from each of the tenter pin mounting members **42** inwardly of the said guide rails, whereby may be understood that the said tenter pins will be movable generally longitudinally of the tenter frame **16** from left to right as seen in FIG. **2** upon driven movement of the tenter drive chains **38** and **40**.

A tenter frame drive motor which may, for example, take the form of the variable speed electric motor manufactured and marketed by U.S. Electric Motors Company of Bloomfield, N.J. at the "Varidyne Syncrogear Motor, Model HVGD2," is indicated at **46** and may be understood to be effective to drive the drive sprocket shaft **32** in the indicated direction through the medium of sprocket **48** and **50** and connected chain **52** to in turn operate the tenter frame **16** as described. In like manner, a nip roller, or tenter entry feed drive motor which may, for example, take the same form as the variable speed tenter frame drive motor **46**, is indicated at **54** and may be understood to be effective to drive the lower nip roller **14** (FIG. **1**) in the indicated direction through the medium of sprocket **56** and **58** and connected chain **60**.

A main feed roller drive motor is indicated at **62** and may, for example, take the form of the variable speed electric motor manufactured and marketed by said U. S. Electric Motors Company as "Varidyne Motor Model WAVJFGR." The main feed roller drive motor **62** is drivingly connected as shown, through sprocket **64** and **66** and chain **68**, to the lower main feed roller **20** (FIG. **1**) so as to be effective to drive the said lower main feed roller in the indicated direction.

Electrical differential means are indicated at **70** and may, for example, take the form of the electrical differentials manufactured and marketed by said U.S. Electric Motors Company, which differentials comprise their "Varidyne Electrical Power Differential, Type D.R." as driven by their variable-speed "Varidyne Varidrive Motor, Model VAVJFGR" correcting motor.

Briefly described, although not per se forming a part of this invention, it may be understood that an electrical differential provides a means of advancing or retarding the speed of the motor controlled thereby. Since, as utilized herein, the speeds of the electric drive motors **46** and **54** are wholly dependent upon the frequency of the electrical power provided thereto from the electrical differential means **70**, it may be understood that the said speeds may be readily increased or decreased by raising or lowering the said power frequency.

Although not specifically illustrated, electrical differential means **70** comprise a stator and a rotor, with the input power to the differential means being applied to the said stator, and the output power from the differential means being applied from the said rotor. As a result, it may be understood that the output power from the differential means can be changed in frequency relative to the input power applied thereto by rotating the said rotor relative to the said stator, with the nature and extend of such frequency change being determined by the direction and extent of such rotor rotation. More specifically, and as utilized herein, clockwise rotation of the said rotor will be effective to increase said differential means output frequency relative to said differential means input frequency, while counterclockwise rotation of said rotor will be effective to decrease said differential means output frequency relative to said differential means input frequency. Alternatively, with no rotation of said rotor, said differential means input and output frequencies will be identical.

A three-position retained contact, differential means control switch is indicated at **72** and comprises a manually operable switch actuator **74** which is movable between, and retainable in, each of a "normal," "retard" and "advance" positions.

A three-position spring-biased-to-normal, differential means control switch is indicated at **76** and comprises a manually operable switch actuator **78** which is movable between each of a "normal," "retard" and "advance" positions, but is spring biased to return to said "normal" position upon release thereof.

A percent adjustment control and indication means is indicated at **80** and comprises an indicating dial **84** and manually operable percent adjustment control means **86** operatively associated therewith as shown. For purposes of illustrations, only, the indicating dial **84** is depicted as calibrated from 0 percent adjustment to 25 percent adjustment, it being understood that other and different percent adjustment ranges may, of course, be utilized.

A line source of 60-cycle power is indicated at **86'** and is connected as shown by leads **88** and **90** to drive motor **62** and the input of the electrical differential means **70**, respectively, while leads **92** and **94** connect the output of the electrical differential means **70** to the drive motors **46** and **54**.

A lead **96** connects switch **72** to the percent adjustment control and indication means **80**, and a lead **98** connects switch **76** to the said control and indication means. A control lead **100** connects the percent adjustment and control means **80** to the electrical differential means **70** to provide a control input to the latter.

OPERATION

Prior to detailed description of the operation, it is to be understood that drive motor **62** will be set to drive the main feed roller **20** at substantially constant speed, while drive motors **46** and **54** will be set to drive the respective nip roller **14** and tenter frame **16** at the same substantially constant speed under normal conditions.

In addition, with the arrangement depicted in FIG. **1**, switches **72** and **76** are respectively operative to advance or retard the speed of drive motors **46** and **54** relative to the speed of drive motor **62** to an extent determined, in each instance, by the setting of the percent adjustment and control means **80**. More specifically, and referring first to spring-biased-to-normal switch **76**, and assuming percent adjustment and control means **80** to be set as depicted to the 10 percent adjustment position, it may be understood that manual movement of switch actuator **78** to the "retard" position and manual maintenance of the same therein will be effective to provide an input on lead **100** to the electrical differential means **70** to cause the latter to rotate the rotor thereof in the counterclockwise direction to subtract cycles from the power supplied thereby on lines **92** and **94** to the drive motors **46** and **54** to retard or decrease the respective speeds to substantially 90 percent of the speed of drive motor **62**, and that this speed retardation or decrease will remain in effect only for so long as switch actuator **78** is manually maintained in said "retard" position.

Conversely, if it is desired to advance or increase the speed of drive motors **46** and **54** relative to the speed of drive motor **62**, it may be understood that manual movement of the switch actuator **78** of switch **76** to the "advance" position of the latter and manual maintenance of the same therein will be effective to provide such speed increase to an extent determined by the setting of percent adjustment control means **86**, and for the period of time for which switch actuator **78** is manually maintained in such "advance" position.

The operation of retained contact switch **72** is the same as that described for spring-biased-to-normal switch **76** with the exception that, in the former, the switch actuator **74** will remain in either of the "advance" or "retard" positions thereof once manually moved thereto, until manually released therefrom and returned to the "normal" position. Accordingly it is believed made clear that retained contact switch **72** makes possible the unattended advancement or retardation of the respective speeds of drive motors **54** and **46** relative to the speed of drive motor **62** for any desired period of machine operating time.

In operation for use in the control of the feed of a web of woven or knitted fabric as indicated at **104** in FIG. **1** to a fabric handling machine in the nature, for example, of the "Three Ply Sandwich Flame Laminating Machine For Combining Foam Between Two Layers of Fabrics" as manufactured and marketed by the Arc Machine Co., Inc. of Paterson N.J., it may be understood that the fabric web **104** would be fed from a nonillustrated source of supply thereof between the nip rollers **12** and **14** with the driven rotation of the latter functioning to advance the said fabric web therebetween as indicated and effect attendant rotation of the nip roller **12**. Therefrom the fabric would be fed over the tenter frame **16** to be pierced by the pins **44** and advanced thereby as indicated for feed between the main feed rollers **18** and **20** with the driven rotation of the latter functioning to advance the said fabric web therebetween as indicated and effect attendant rotation of the main feed roller **18**. Therefrom, the fabric web **104** would be fed to nonillustrated flame bonding means wherein the former would be bonded to one side of a foam material for use, for example, in the manufacture of carpets or the like.

As a result, it is believed clear that any significant distortion or misalignment in the fabric web **104** as bonded to the said foam material would render the finished product substantially unsuitable for commercial use. More specifically, and as seen in FIGS. **3** and **4**, if the said fabric web is fed to said flame bonding means with the fabric distorted as depicted in said Figures, as opposed to the substantially correct fabric condition as depicted in FIG. **5**, it may be understood that the finished product will have little, if any, commercial sales value.

Referring first in detail to the distorted fabric condition of FIG. **3**, it is believed clear that the same may be corrected by

slowing down or retarding the drive of the nip rollers **12** and **14**, and the tenter frame **16**, relative to the drive of the main feed rollers **18** and **20**, to in essence enable the central portion of the fabric web **104** to catch up with the respective edge portions thereof to provide the correct fabric web condition of FIG. **5**. If, in the judgment of the control means operator, such distortion is of a temporary nature as caused, for example, by a fabric web seam or a temporary misalignment in the feed of the fabric web to the nip rollers **12** and **14**, the said operator would judge the extent of such distortion, manually set percent adjustment and control means **80** to the percent setting considered appropriate to remedy such distortion, and manually move switch actuator **78** to the "retard" position thereof and manually maintain the same therein to decrease or retard the speed of drive motors **54** and **46** relative to the speed of drive motor **62** until such time as the fabric web **104** assumed the substantially undistorted condition thereof of FIG. **5**, whereupon the said operator would release switch actuator **78** and the same would return to the "normal" position thereof with the result that the respective speeds of drive motors **54**, **46** and **62** would again become substantially equal to resume normal feed of the fabric web **104**.

If, on the other hand, the fabric web distortion is of the nature depicted in FIG. **4** and again judged to be of a temporary nature, it may be understood that the above-described procedure would again be utilized with the exception that, under such conditions, the switch actuator **78** would be manually moved to the "advance" position thereof and manually maintained therein to increase or advance the speed of drive motors **54** and **46** relative to the speed of drive motor **62**, for the period of time necessary to correct for such distortion.

For use in instances wherein the distortion of web **104** is judged by the machine operator to be of a nature as will occur throughout the entire feed thereof as might be caused, for example, by generally uneven initial fabrication of the web, shrinkage of stretching thereof due to web dry cleaning or steaming, improper handling thereof and/or improper alignment thereof with the nip rollers **12** and **14** resulting in improper web entry to the tenter frame **16** and, as is the case with woven fabric webs, a natural tendency thereof to bow upon entry to the tenter frame despite the initially undistorted condition of such woven fabric web, it may be understood that operation of the web feed advance and retard control means of the invention would preferably and advantageously be carried out through use of the retained contact switch **72** rather than the spring-biased-to-normal switch **76**. More specifically, and in an instance wherein the web distortion is as depicted in FIG. **3** and is judged by the relevant machine operator to be of a nature as will occur throughout the entire feed of web **104**, the said operator would manually set the percent adjustment and control means **80** to the percent setting considered appropriate to remedy such distortion, and manually move switch actuator **74** to the "retard" position thereof and leave the same in such position to correct the distortion by decreasing or retarding the speed of drive motors **46** and **54** relative to the speed of drive motor **62**. This having been done, the said operator need only observe the web to insure that the distortion has been removed therefrom—it being understood that some adjustment in the setting of percent adjustment and control means **80** may be required after such manipulation of switch actuator **74** to bring the web being fed to the substantially undistorted condition thereof of FIG. **5**—whereupon the said operator can leave the retained contact switch **72** unattended and be free for the performance of other useful tasks during machine operation, to obviously significant advantage.

If, on the other hand, the web distortion is as depicted in FIG. **4** and again judged by the machine operator to be of a nature as will occur throughout the entire feed thereof, it is believed clear that the above-described procedure would be repeated with the switch actuator **74** of the retained contact switch **72** being of course moved to the left in the "advance" rather than "retard" position thereof.

Although disclosed for purposes of example as applicable to the control of the feed of fabric webs to laminating machinery it is believed clear that the web feed advance and retard control means of the invention are by no means limited thereto, but rather, would be applicable to the control of the feed of webs of many other and different materials to many other and different types of machinery in correcting for material distortion.

While we have shown and described the preferred embodiment of our invention, it will be understood that the invention may be embodied otherwise than as herein specifically illustrated or described, and that certain changes in the form and arrangement of parts and in the specific manner of practicing the invention may be made without departing from the underlying idea or principles of this invention within the scope of the appended claims.

What is claimed is:

1. In web feed advance and retard control means for removing distortion from a web being fed by controlling the feed rate of tenter frame means and tenter frame entry feed means relative to the feed rate of tenter frame exit feed means, the improvement comprising, means to vary the feed rate of said tenter frame means and said tenter frame entry feed means relative to the feed rate of said tenter frame exit feed means, manually operable means to adjust the extent of such feed rate variation, and means to indicate the extent of such feed rate variation, said feed rate varying means comprising means to increase or decrease the feed rates of said tenter frame entry feed means and said tenter frame means relative to the rate of said tenter frame exit feed means, and indicating and adjusting means being operable in each instance to indicate and adjust the extent of such increase or decrease, said feed rate adjusting means being manually operable and comprising feed rate adjusting means which will remain in either of a feed rate increase or a feed rate decrease condition once manually placed therein, and feed rate adjusting means which must be manually maintained in each of said feed rate increase and feed rate decrease conditions.

2. In web feed advance and retard control means as in claim **1** wherein, said tenter frame means, said tenter frame entry feed means and said tenter frame exit feed means are respectively driven by electric drive motors, and wherein said feed rate varying means comprise means to increase or decrease the speeds of said electric drive motors which drive said tenter frame means and said tenter frame entry feed means, respectively, relative to the speed of said electric drive motor which drives said tenter frame exit feed means.

3. In web feed advance and retard control means as in claim **2** wherein, said means to increase or decrease said electric drive motor speeds comprise electric differential means operatively connected thereto.

4. In web feed advance and retard control means as in claim **3** wherein, said adjusting means comprise switch means which are operable to actuate said electrical differential means.

5. In web feed advance and retard control means as in claim **4** wherein, said switch means comprise a retained contact switch which is movable between "advance" and "retard" positions to respectively increase and decrease the speeds of said electric drive motors.