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APPARATUS FOR STRAIGHTENING WOVEN MATERIAL

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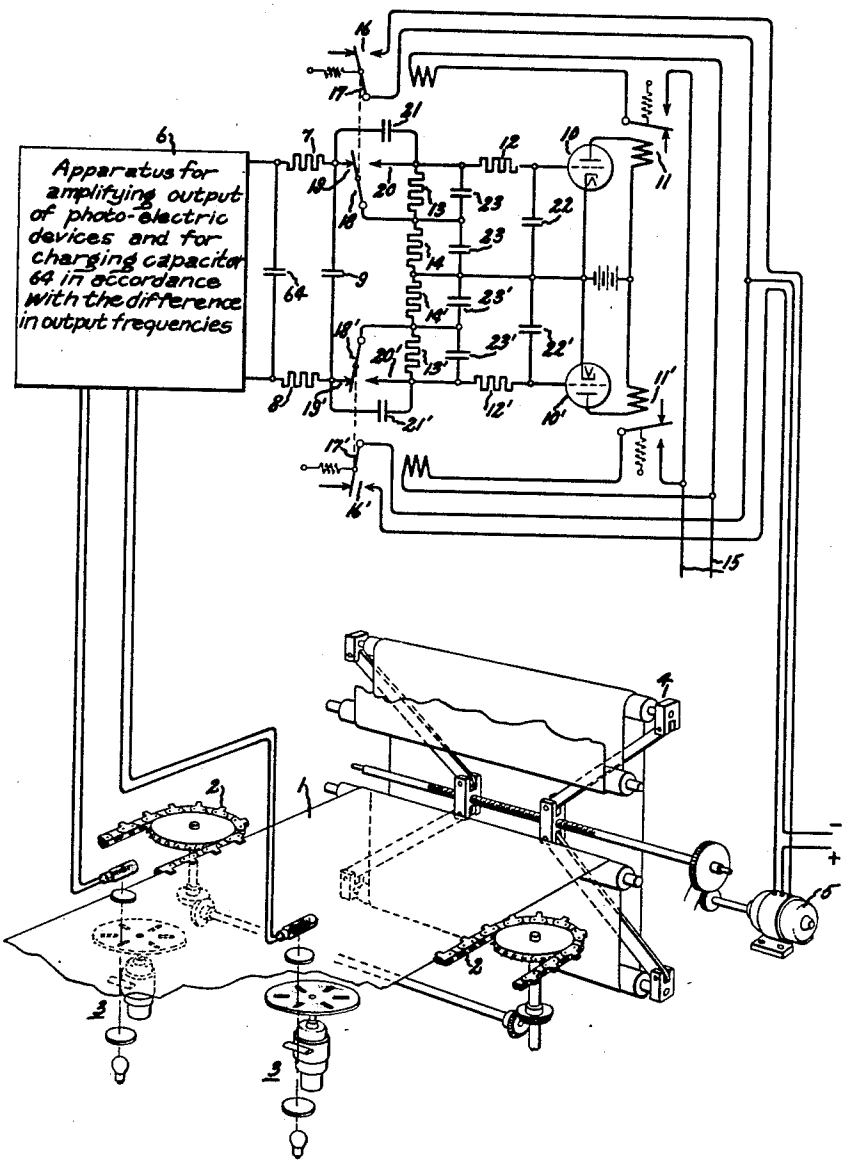

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APPARATUS FOR STRAIGHTENING WOVEN MATERIAL

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7 Claims. (Cl. 26—51)

My invention relates to apparatus for straightening woven material. In the La Pierre et al. Patent 2,106,612 and in the La Pierre Patent 2,106,611 means are disclosed and claimed for detecting and correcting any skew that may be present in a moving strip of woven material thus straightening it. With apparatus such as that disclosed in those patents, it has been found that under certain conditions the correcting mechanism sometimes had a tendency to oscillate or hunt to an objectionable extent before coming to a final position at which the skew was corrected.

My invention is designed to correct this objection by means of apparatus which is adapted to be substituted for certain parts of the apparatus disclosed in the above mentioned La Pierre Patent 2,106,611. With the apparatus involving my invention when skew appears in the advancing strip of woven material the correcting means is operated intermittently, that is, it alternately operates and remains at rest for brief periods, the periods of rest serving to delay further correction until the need theeof is found necessary. Moreover, the length of the operating periods depends upon the amount of skew present. If, for example, there is but a small amount of skew in the material the operating periods will be short and the intervening rest periods will be long; conversely, if there is a large amount of skew present the operating periods will be long and the rest periods short. Should the amount of skew detected in the advancing strip increase for any reason notwithstanding the operation of the correcting apparatus the length of the operating periods automatically increases and the length of the rest periods decreases. Likewise, if the amount of skew detected decreases as a result of the operation of the correcting apparatus or otherwise, the length of the operating periods decreases or reduces to zero depending upon the particular conditions present and the length of the rest periods increases. If, however, the detected skew decreases suddenly to substantially zero the straightening means will be operated briefly in the reverse manner, thus in effect anticipating the probable arrival of a reverse skew in the material.

In the above brief description I have used the term "skew" and shall use it hereinafter in a broad sense covering both that condition of the weft members of the material commonly spoken of as "skew" and as illustrateed by Fig. 4 of the aforesaid Patent 2,106,611 and that condition of the weft members commonly spoken of as "bow" and as illustrated by Fig. 5 of that patent. Since the skew may occur in either direction, the apparatus which I have devised is constructed to make the necessary correction for either as in the aforesaid patent.

My invention will be better understood from the following description taken in connection with the accompanying drawing, and its scope will be pointed out in the appended claims.

Referring to the drawing which is a combined circuit diagram and fragmentary perspective view of apparatus illustrating an embodiment of my invention, the capacitor **64** is arranged to be given a charge of one polarity or of the opposite polarity in accordance with the presence of skew in one direction or the other in an advancing strip of woven material, the amount of the charge of either polarity being dependent upon the amount of skew being detected in the material. For giving the capacitor **64** a charge in accordance with the character and the amount of skew in the material, I may employ any known apparatus but preferably I employ the apparatus disclosed in the above-mentioned La Pierre Patent 2,106,611 in which the capacitor **64** corresponds with the capacitor **64** of the present application. For correcting skew in the material to thereby straighten it I may employ any known means such, for example, as that shown in the aforesaid La Pierre et al. Patent 2,106,612 where the relative speeds of the two edges of the strip of woven material is varied by the use of the reversible motor **47** acting through the differential connection with the tenter chains. Instead of the above mentioned apparatus I may employ the straightening means disclosed in the aforesaid Patent 2,106,611 where the reversible motor **22** operates through mechanism of a different type to effect the correction of the skew. In the present application the relays **16** and **16'** take the place of the relays **69** and **70** of the patent. The skew detecting apparatus and the skew correcting apparatus disclosed in the aforesaid Patent 2,106,611 may be briefly described as comprising the tenter chains **2** for moving the strip of woven material **1**, the optical and photo-electric equipment **3**, the skew correcting apparatus **4**, and the reversible motor **5** for operating the same. The electrical apparatus for amplifying the output of the photo-electric devices and for charging the capacitor **64** in accordance with the difference in the output frequencies of those devices is represented by the rectangle **6**.

The charge given to the capacitor 64 and hence the average potential difference across it is proportional to the amount of skew in that part of the material passing the point at which the skew is being detected. Connected across the capacitor 64, whose capacitance, for example, may be .02 m. f., through the resistors 7 and 8, whose resistance may be one-quarter of a megohm each, is the capacitor 9 whose capacitance, for example, may be 1.0 m. f., this circuit constituting a filter circuit which smooths out the rapid variations in the potential difference across the capacitor 64.

When there is no charge on the capacitor 9, the electron discharge devices 10 and 10' each pass current through their anode circuits sufficient to operate the relays 11 and 11' therein. Device 10 passes current because its grid is connected with its cathode through the resistors 12, 13 and 14 whose respective resistances, for example, may be 2 megohms, 5 megohms and 2 megohms. Likewise the device 10' passes current because its grid is connected with the cathode thereof through the resistors 12', 13' and 14' whose resistances also may be 2 megohms, 5 megohms and 2 megohms respectively. The relays 11 and 11' being energized, the windings of the relays 16 and 16' are deenergized since they are arranged to be supplied from the source of current 15 through the back contacts of the relays 11 and 11'. The relay 16 is provided with the two armatures 17 and 18 which are arranged to act simultaneously and for this reason are shown tied together by a dotted line. The armature 17 controls one circuit of the reversible motor 5 by which it is caused to rotate in one direction. The other armature 18 operates between the back contact 19 which connects with one side of the capacitor 9 and the front contact 20 which connects with the upper end of the resistor 13. Connected between these two contacts is the capacitor 21 whose capacitance, for example, may be 0.5 m. f.

The relay 16' like the relay 16 has the two armatures 17' and 18', the armature 17' serving to control the other circuit of the reversible motor by which the motor is caused to operate in the opposite direction and the armature 18' operating between the back contact 19' and the front contact 20' connected respectively with the opposite side of the capacitor 9 and the lower end of the resistor 13'. Across these contacts is the capacitor 21' whose capacitance is the same as capacitor 21. Other capacitors 22, 23, 22' and 23' are employed to filter out or absorb voltage impulses arising from the operation of relays 16 and 16'.

With no charge on the capacitor 9 the several relays will be in the position illustrated and the reversible motor 5 will be stationary. If an appreciable amount of skew is present in that part of the woven material passing the detecting means, the capacitor 9 will receive a charge which will be maintained substantially uniform by the apparatus 1 as long as the amount of skew remains the same. Assuming that this charge makes the upper plate of the capacitor positive, there will be a current flow through the armature 18, the resistances 14 and 14', and the armature 18'. The resulting potential drop through the resistor 14 will make the grid of the device 10 positive whereby the relay 11 is more strongly energized. The potential drop through the resistor 14', however, will make the grid of the device 10' sufficiently negative to so reduce the current flow therethrough that the relay 11' will open. This release of the relay 11' will cause the energization of relay 16'. The resulting actuation of the armature 17' will close one circuit of the reversible motor whereby the motor will rotate in the proper direction to cause the straightening means driven thereby to correct the skew in the material. By the actuation of the armature 18' the capacitor 21' is placed in a circuit including the resistors 14 and 14' across the capacitor 9 whereby it receives a charge from that capacitor. The charging of the capacitor 21' requires a certain time interval depending upon its capacitance, the charge on capacitor 9 and the resistance of the resistors 14 and 14'. It is during this time interval that the motor 5 is operative. When the potential difference across the capacitor 21' becomes nearly equal to that across the capacitor 9, the potential drop across resistor 14' is insufficient to prevent the device 10' from passing enough current to operate the relay 11'. This relay therefore picks up its armature thereby de-energizing relay 16'. Upon the release of this relay the motor circuit 4 is opened whereby the straightening means ceases to function and the armature 18' by reengaging contact 19' allows the capacitor 21' to discharge through it and the resistor 13'. The potential drop across the resistor 13' of the discharge current holds the grid of the device 10' positive hence the relay 11' is maintained energized. When the capacitor 21' has discharged to a certain extent and the discharge current thereof accordingly has become reduced to such a value that the potential difference across the resistor 13' can no longer hold the grid of device 10' positive over the effect of the potential drop across resistor 14' due to the discharge current from capacitor 9, the grid of device 10' again becomes negative and the above mentioned procedure is repeated.

As long as any skew is detected, the apparatus undergoes successive cycles of operation like that described above. The length of each cycle comprises an interval during which the capacitor 21' is receiving a certain amount of charge from the capacitor 9 and an interval during which the capacitor 21' discharges to a certain extent through the resistor 13'. When the amount of skew detected is small and the charge maintained on the capacitor 9 accordingly is small the charging intervals of the capacitor 21' are short in comparison with the discharging intervals thereof, hence the periods of operation of the straightening means are short in comparison with the intervals between those periods.

If a greater amount of skew is detected, a greater charge is given to the capacitor 9 and the charging intervals of the capacitor 21' are longer than before but the discharge intervals thereof are shorter. Hence, with a greater amount of skew the periods of operation of the straightening means are longer and the intervals between those periods are shorter. Likewise, if the amount of skew increases in spite of the effort of the apparatus to reduce it, the periods of operation of the straightening means increase in length and the intervals between those periods decrease in length or entirely disappear.

Conversely, if the amount of skew decreases, the amount of charge given to the capacitor 9 accordingly decreases and the charging intervals of the capacitor 21' decrease while the discharge intervals thereof increase. Hence, with a decrease in the amount of skew the periods of operation of the straightening means decrease in

length and the intervals between those periods increase in length. When there is no longer any skew detected the apparatus remains at rest with the relays in the positions illustrated.

Sometimes the skew detecting means shows by its operation that a material amount of skew present suddenly decreases to substantially zero and is immediately followed by a skew in the opposite direction. Such a condition has been found to exist when a seam is passed by which two lengths of the material are joined end to end and particularly when care has not been taken in making the seam to have the weft elements on one side thereof parallel to those on the other. When the straightening apparatus which I have devised encounters such a condition of reverse skew it appears to anticipate the demand for a quick readjustment of the straightening mechanism and does it in a manner now to be described.

The sudden reduction of the first skew to a very small or zero value not only releases the relay 16' in the manner already described thereby stopping the motor 5 but also starts the motor rotating in the opposite direction in anticipation of a probable opposite skew to follow. The capacitor 21 although substantially inactive during the sequence of operations just described has, nevertheless, acquired a small charge by reason of the previous potential difference across the capacitor 9 and the grid current of the device 10. This charge it will be noted is such that the plate of the capacitor 21 connected with the grid is negative. When, therefore, the charge on the capacitor 9 suddenly reduces to zero or approximately so the grid of 10 is made sufficiently negative by the charge on the capacitor 21 to cause it to release the relay 11 and thus, acting through the relay 16, to cause the motor 5 to operate in the reverse direction. The capacitor 21 soon becomes discharged, however, so the relay 11 is actuated, the relay 16 is released and the motor stops unless the reverse skew condition of the following portion of the material causes the continued operation thereof.

In the above description, it has been assumed that the charge given to the capacitor 9 was of a certain polarity. Should this capacitor be given, instead, a charge of the opposite polarity in response to a skew in the opposite direction the apparatus obviously will operate in a manner to cause the motor driving the straightening means to operate in the reverse manner to correct the opposite skew. In that case the grid of the device 10 is made negative, the relay 11 is released, the relay 16 is energized and the other motor circuit is energized all in the same manner as has been described above in the case of the corresponding elements 10', 11' and 16' respectively.

In my divisional application Serial No. 311,537, I have claimed broadly the apparatus by which the motor 5 is operated intermittently in response to a charge on the capacitor 64.

What I claim as new and desire to secure by Letters Patent of the United States is:

1. Apparatus for straightening a moving strip of woven material comprising means for detecting skew in said material, means operative to correct skew therein and means responsive to said detecting means for producing increments of skew correction by a series of intermittent operations of said correcting means.

2. Apparatus for straightening a moving strip of woven material comprising means for detecting skew in said material, means operative to correct skew therein and means responsive to said detecting means for causing said correcting means to have intervals of action separated by intervals of inaction, the length of the intervals of action being dependent upon the amount of skew detected.

3. Apparatus for straightening a moving strip of woven material comprising means for detecting skew in said material, means operative to correct skew therein and means responsive to said detecting means for causing said correcting means to have intervals of action separated by intervals of inaction, the length of the intervals of action varying directly with the amount of skew detected and the length of the intervals of inaction varying inversely therewith.

4. Apparatus for straightening a moving strip of woven material comprising a capacitor, means responsive to a condition of skew in said material for giving said capacitor a charge, means for straightening skew in said material and means controlled by said charge for producing increments of skew correction by a series of operations of said straightening means at recurring intervals.

5. Apparatus for straightening a moving strip of woven material comprising a capacitor, means responsive to a condition of skew in said material for giving said capacitor a charge, means for straightening skew in said material and means controlled by said charge for operating said straightening means, said charge controlled means including an auxiliary capacitor arranged to receive a charge from said main capacitor, and means responsive to a predetermined small current flow from the main capacitor to the auxiliary capacitor for limiting the time during which the straightening means is in operation.

6. Apparatus for straightening a moving strip of woven material comprising means responsive to a skew in said material for producing relative movement between laterally spaced portions thereof in a direction to reduce said skew, and means responsive to a sudden predetermined decrease in said skew for producing relative movement between said spaced portions in the reverse direction.

7. Apparatus for straightening a moving strip of woven material comprising means responsive to a skew in said material for producing during successive spaced intervals relative movement between laterally spaced portions of the material in a direction to reduce said skew, said means including means responsive to an increase in the amount of the skew for increasing the length of said intervals and responsive to a decrease in the amount of the skew for decreasing the length of the intervals and means responsive to a sudden predetermined decrease in the skew for producing relative movement between said spaced portions of the material in the reverse direction.

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