

**March 7, 1944.**

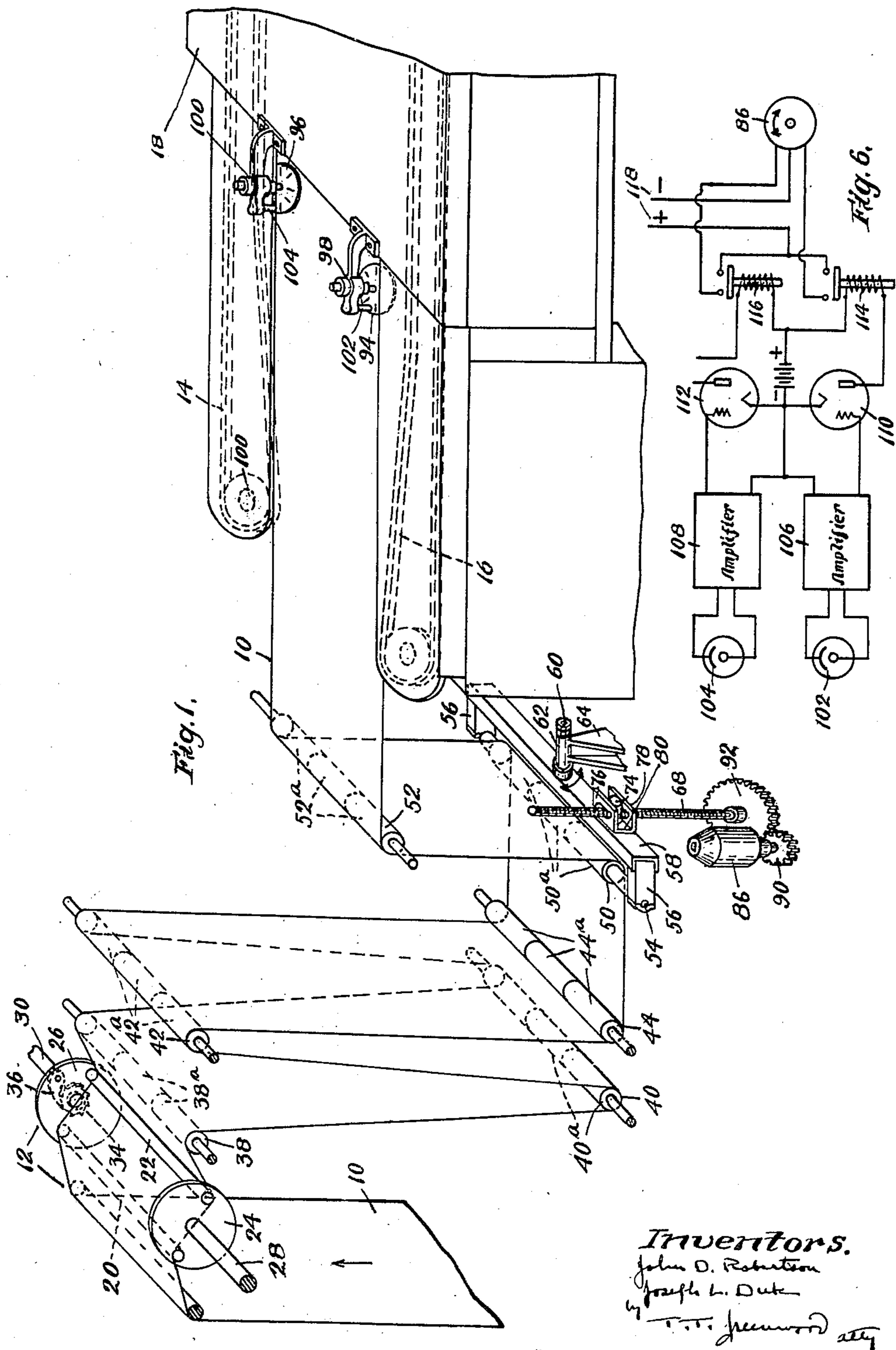
J. D. ROBERTSON ET AL

**2,343,328**

# WEFT STRAIGHTENING METHOD AND APPARATUS

Filed Dec. 14, 1940

2 Sheets-Sheet 1



March 7, 1944.

J. D. ROBERTSON ET AL

2,343,328

WEFT STRAIGHTENING METHOD AND APPARATUS

Filed Dec. 14, 1940

2 Sheets-Sheet 2

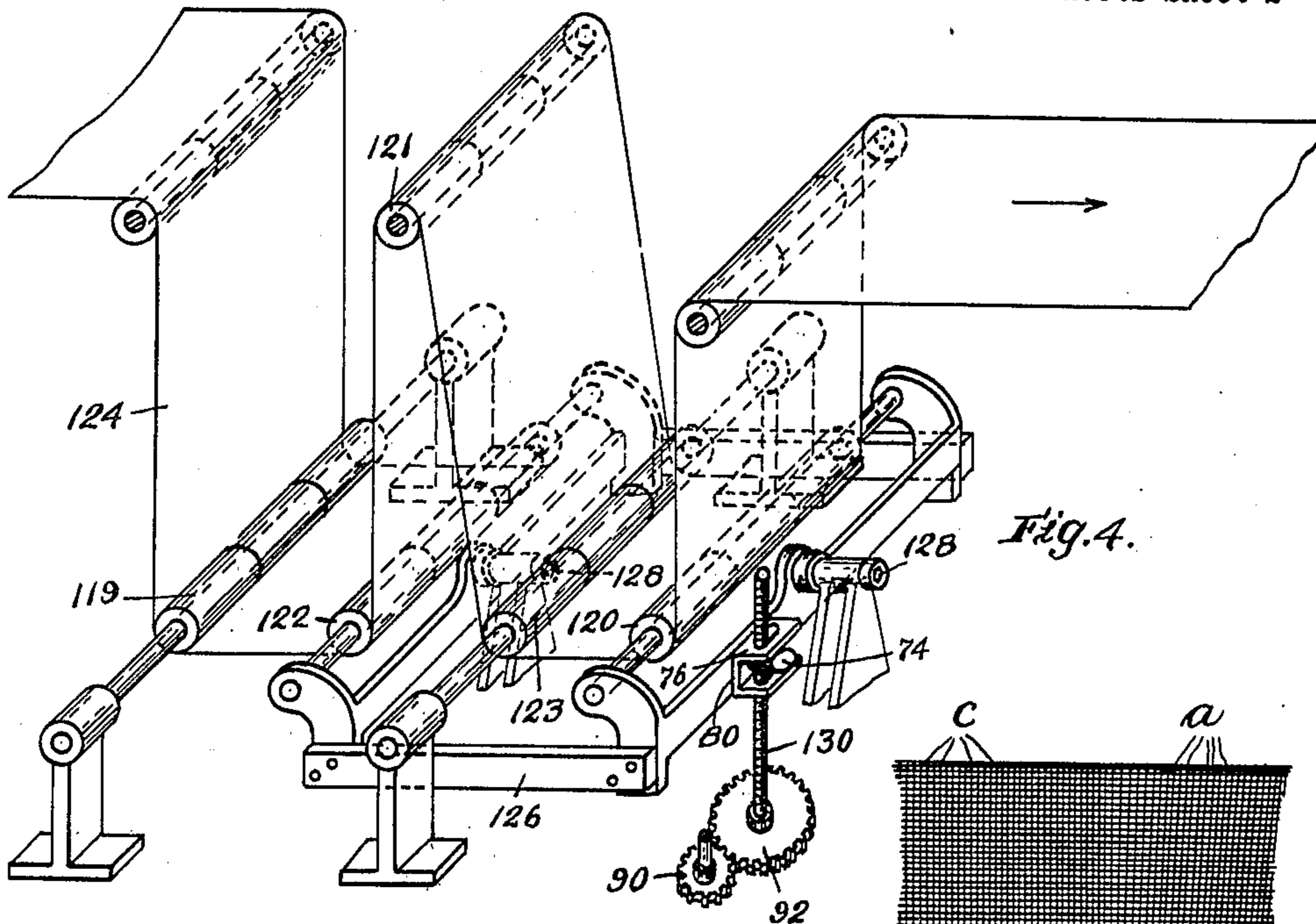


Fig. 4.

Fig. 5.

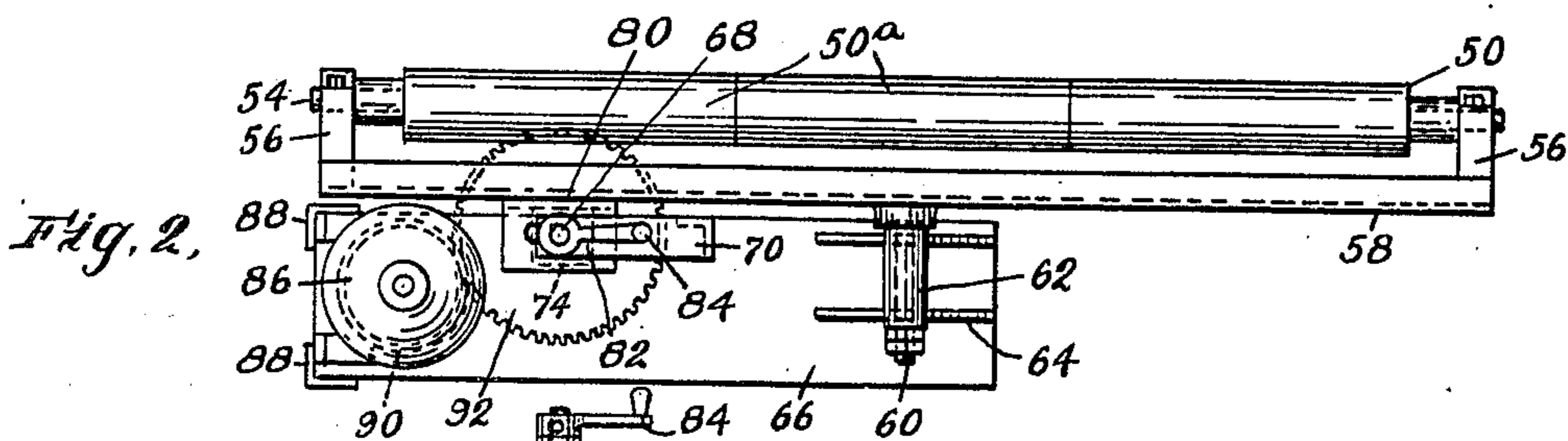
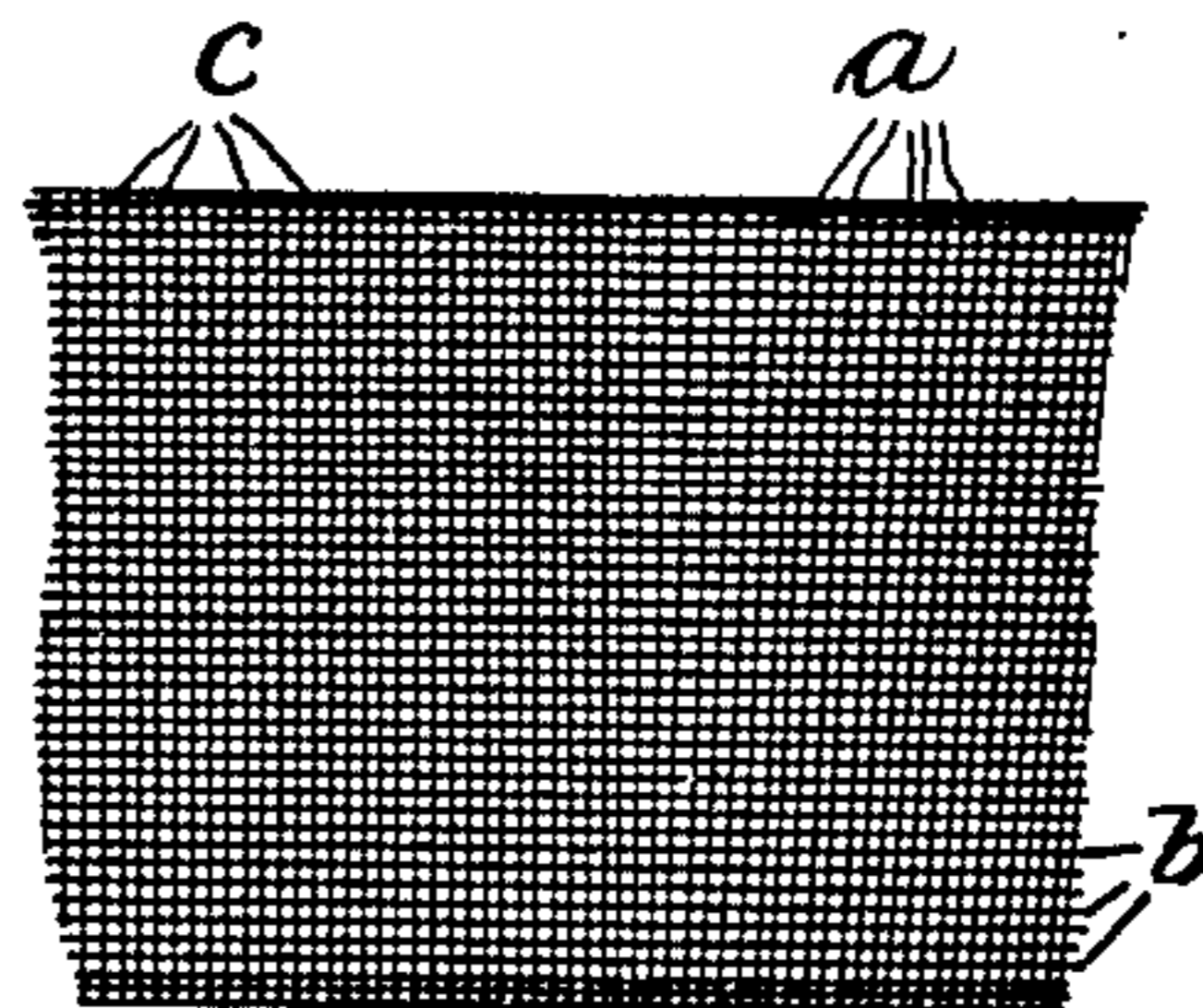


Fig. 2.

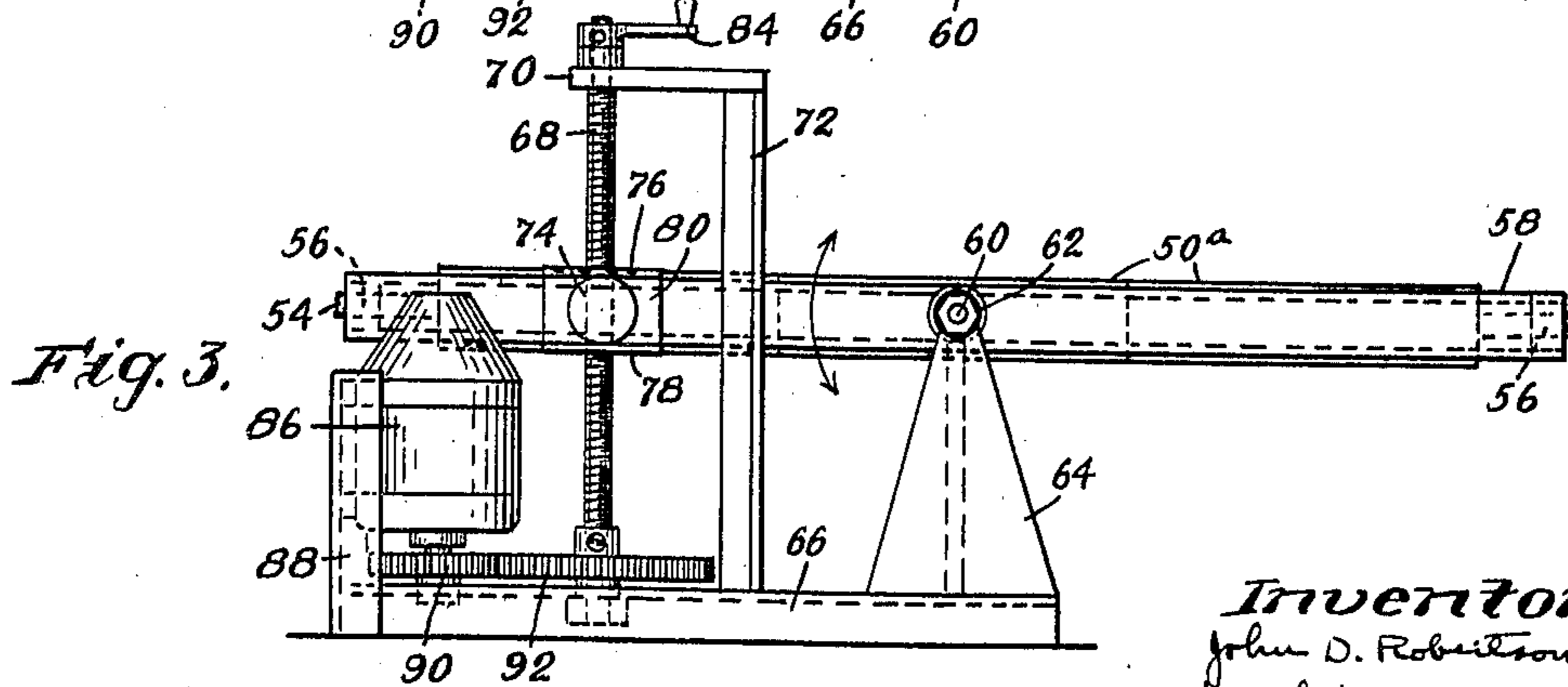


Fig. 3.

Inventors.  
John D. Robertson  
Joseph L. Duke  
by J. J. Greenwood atty

## UNITED STATES PATENT OFFICE

2,343,328

## WEFT STRAIGHTENING METHOD AND APPARATUS

John D. Robertson and Joseph L. Dube, Taunton, Mass., assignors, by mesne assignments, to said Robertson

Application December 14, 1940, Serial No. 370,168

14 Claims. (Cl. 26—51)

This invention relates to a process and apparatus for straightening the wefts of woven fabrics.

When a cloth is initially woven, the weft threads are arranged at right angles with the warp threads. Due, however, to the processing of the cloth following its weaving and the variety of devices that are caused to act upon the web, the weft threads are frequently caused to be displaced from their initial positions and to assume a variety of positions with respect to the warp threads. A common condition is a "skew" where the weft threads are generally straight but are at some other angle than a right angle with respect to the warp threads. This condition of the fabric is undesirable and it is an object of the present invention to provide an improved method of and mechanism for correcting this condition and restoring the initial right angular relation to the warp and weft threads.

One of the objects of the present invention comprises an apparatus for and a method of acting on the moving web in such a way as to increase the length of travel of one edge of the web and to decrease the length of travel of the other edge of the web, whereby to displace the ends of the weft in one edge over the ends in the other edge, the direction and amount of displacement being such as to restore the displaced weft threads to their original right angular relation with the warp threads, the amount of change of travel of the edge or selvage portions of the web being adjusted to the displacement of the weft threads and the change of travel decreasing from the edge portion to the median line of the web. If the web acted on as above stated is free from substantial tension the action is to advance one edge of the web more than the other. If the web is under substantial tension the action is to stretch the warp in one edge more than in the other edge.

A further object of the invention consists in apparatus for and a method of straightening a tensioned web by modifying the tension on the web in transverse parts thereof to displace the weft in the proper direction and amount while gripping the advancing web between two gripping parts or zones on opposite sides of the application of the straightening action, which zones are so distant, measured lengthwise of the web, that a relatively large angular displacement of the weft threads can be corrected without imposing a harmful tension on the warp threads in the most tensioned edge portion of the web.

Another object of the invention is the provision of weft straightening mechanism including a roll

or bar extended crosswise of the web and about which the tensioned web bends and so supporting the roll or bar that one end of the roll or bar can be tilted in one direction and the other end in the opposite direction, thereby to increase the tension on one edge and reduce the tension on the other edge of the web for the purpose of straightening the weft.

A yet further object of the invention is a weft straightening mechanism including a tilting roll as above described, combined with means for adjusting the tilt of the roll in proportion to the angular displacement of the weft threads.

A yet further object of the invention is the provision of a plural number of tilting rolls arranged for tilting about an axis parallel with the median line of the web and arranged for tilting movement in the same direction about the median line of the web and with the tensioned web bending about and passing in succession between the rolls.

A further object is generally to improve weft straightening processes and mechanisms.

Fig. 1 is a diagrammatic view of weft straightening mechanism embodying the present invention.

Fig. 2 is a plan view of the weft straightening roll of Fig. 1.

Fig. 3 is a side elevation of the mechanism of Fig. 2.

Fig. 4 is a diagrammatic view of the weft straightening mechanism embodying a pair of tilting rolls of the type illustrated in Figs. 1, 2 and 3.

Fig. 5 is a plan view of a skewed fabric.

Fig. 6 is a diagrammatic view of the control circuits between the weft detecting mechanism and the straightening motor of Fig. 1.

The present invention is particularly intended to operate upon skewed fabrics, as illustrated in Fig. 5, wherein the weft threads *a* are shown as displaced from their normal right angular relation with the warp threads *b*, the initially woven right angular relation being indicated by the weft threads *c*.

The straightening of the fabric, in accordance with the present invention, is effected as the fabric advances, as to a drying chamber, cans or other apparatus.

The fabric web 10, as illustrated in Fig. 1, is drawn through a suitable form of tensioning mechanism 12 by suitable means as tenter chains 14 and 16 or other web moving mechanism which grip the selvage edges of the fabric and stretch it, if desired, to the desired width and convey

it into a drying chamber 18. The tenter frame with its chains can be of any desired or usual construction. The tensioning mechanism 12 can be of any type that places the fabric between the mechanism and the gripping point of the tenter chains or other web moving mechanism under uniform tension, which tension can be substantial or only sufficient to permit the fabric to pass to the tenter chains properly. In the form herein illustrated, the tensioning mechanism comprises a pair of bars 20 and 22, the end parts of which are fixed in discs 24 and 26 journaled on shafts 28 and 30. The fabric passes over one bar 20 and under the other bar 22. The shaft 30 has a ratchet wheel 34 fixed thereto engaged by a pawl 36 carried by the disc 26 so that the discs and bars can be held in any desired angular position to impart different degrees of tension to the web from practically no tension to a substantial tension.

The distance between the tensioning device and the initial gripping point of the tenter chains or other web moving mechanism, for a web under substantial tension, is relatively long, measured lengthwise of the web, and to this end the web passes over a plurality of fixedly-positioned guide rollers 38, 40, 42, and 44 which provide a long path of travel for the web for a shorter straight line distance between the tensioning device and the tenter chains. For a web under little or substantially no tension, the length of the path can be shortened by the elimination of the rolls 40 and 42.

The weft straightening mechanism includes a tiltable web engaging member 50, preferably a roll, extended crosswise of the web and which when horizontal is in approximately the horizontal plane of the roll 44 so that the web passes normally horizontally between the rolls 44 and 50. The web makes approximately a right angle bend around the tiltable roll 50 and passes upwardly over another horizontal roll 52 about which it bends and passes horizontally to the grip of the tenter chains. The tiltable roll is rotatable upon a fixed shaft 54, the ends of which are removably located in blocks 56 fixed to the end parts of a normally horizontal roll supporting bar 58, which bar is approximately parallel with the roll shaft 54 and is spaced from the roll sufficiently to admit the ready passage of the web between the bar and the roll. The middle part of the bar 58 has fixed thereto a horizontal rearwardly-extending stud shaft 60 which lies approximately in the median line of the web and is journaled in the bearing boss 62 of a supporting bracket 64 fixed to and rising from a base 66. The bar 58 and the roll thus can tilt endwise in both directions from a horizontal about the axis of the stud shaft 60.

When the roll 50 is horizontal and thus is parallel with the rolls 44 and 52 and with the web, the length of the path of travel of the opposite edges of the web is the same and hence no weft straightening action occurs. When, however, the roll 50 is tilted so that, say the nearer end, as viewed in Fig. 1, of the roll 50 is below the horizontal and the more remote end is above the horizontal, the nearer depressed edge of the web has to travel throughout a longer distance than the more remote elevated edge between the tensioning mechanism and the tenter chains. This change of length of path causes the ends of the weft threads in the nearer edge of the web to move rearwardly of the direction of travel of the web with respect to the ends of the same

weft threads in the more remote edge of the fabric and hence, when the angle of tilt is properly adjusted, causes the weft threads to return to their right angular relation with respect to the warp threads. The reduction of length of travel of the more remote edge of the fabric permits the more remote ends of the weft threads to shift forwardly in the direction of travel of the web. Since the roll 50 tilts about the median line of the web, the change in the path of travel of the web for any transverse point on the web is proportional to the distance the selected point is from the median line of the web. Thus the correction is greatest at the extreme edge of the web and is zero in the median line of the web. Hence the device corrects the skew of the weft threads by shifting the opposite ends of the same weft thread in opposite directions while maintaining the weft threads straight and parallel with each other.

When the tension device 12 is set to create little or no tension in the web, the tilting of the weft straightening roll 50 can draw fabric through the tensioning device without increasing the tension on the web. When, however, the tensioning device 12 is adjusted to place the web under substantial tension, the device has sufficient grip on the web so that the web is pulled therethrough under greater tension as a result of the tilting of the straightening roll. The tilted roll, under such condition, acts to increase the tension on the web in one edge and to decrease the tension in the opposite edge, and thereby to straighten the weft threads.

The amount that a unit length of warp thread can stretch without harm and also the amount that such length of tensioned warp thread can contract is limited. Hence the distance between the fixed gripping points of the web, that is to say, between the tensioning device 12 and the tenter chains 14 and 16, is made sufficiently great, measured lengthwise of the web, so that the unit stretch and contraction of the web warpwise is held within reasonable limits while permitting restoration of the weft threads from a relatively great departure thereof from their normal right angular relation with the warp thread.

With the arrangement herein shown, the fabric, when under substantial tension, passes in skewed form from the tensioning device and the angle of skew decreases progressively from the tensioning device to the initial gripping point of the fabric with the tenter chains, at which point the weft threads, with the proper angle of tilt of the straightening roll 50, are restored to their right angular relation with the warp threads. When the fabric is free from tension, however, the fabric advances, with skewed weft up to the straightening roll and is straight as it leaves the roll.

Since the path of travel and hence speed of the edge portions of the web at the tiltable roll 52 is different from the path of travel and speed of the median portion of the web, the roll 50 is made sectional or is composed of a plurality of axially-short independently-rotatable rolls 50a disposed in end to end confronting relation so that each short roll can rotate at the speed of that part of the web in contact therewith without slipping on the web.

Since the weft straightening action, in a web under substantial tension, takes place throughout the length of the web between the tensioning device 12 and the tenter chains 14 and 16 or other web driving device, all rollers in contact with the

web between these points are also preferably made sectional in a manner similar to the tiltable roll 50. Thus the rolls 38, 40, 42, 44, and 52 are composed of a series of independently rotatable short roll-sections 38a, 40a, 42a, 44a, and 52a.

The mechanism for tilting the tiltable roll includes a vertical, externally screw-threaded shaft 68 journaled at its lower end in the base 66 and at its upper end in a bearing projection 70 of a standard 72 which upstands from and is fixed to the base. The shaft is screw-threaded into a cylindrical nut 74 located closely between and slidably bearing on the horizontal upper and lower webs 76 and 78 of a channelled block 80 fixed to and projecting forwardly from the vertical face of the roll supporting bar 58, the webs having registering slots 82 extended parallel with the bar 58 and through which the screw-threaded shaft 68 is loosely extended to allow for the tilting of the bar. The nut 74 has a flat face engaged with the vertical face of the channelled block 80 so that the nut is prevented from rotating as the shaft is rotated.

The shaft can be rotated both manually and under automatic control to tilt the weft straightening roll a suitable amount in the proper direction to effect the straightening of the fabric at the time it is gripped by the tenter chains.

For manual tilting of the roll the shaft 68 can have a hand crank 84 fixed to the upper end thereof and the machine attendant can observe the character of the web as it enters the grip of the tenter chains and manipulates the shaft 68 so that the weft threads are at right angles to the warp threads at the position where the web is gripped by the tenter chains.

The automatic control of the tilting of the weft straightening roll 50 is accomplished by means including a reversible electric motor 86 fixed to upstanding standards of the base 66 and having a small spur gear 90 fixed to its shaft which meshes with a larger spur gear 92 fixed to the screw-threaded shaft 68.

The amount and direction of rotation of the motor 86 is under control of scanning discs 94 and 96 rotated by suitable means, as electric motors 98 and 100, proportioned to the speed of the web and located close above the web near the opposite edges thereof and as near as practicable to the weft straightening roll and where the web is fully stretched transversely and the weave is sufficiently open to permit satisfactory operation of the scanning devices. The scanning discs control the passage of light through the web and the slots of the discs to photo-electric cells 102, 104, in a manner now well known, to detect both the direction and angle of skew of the weft threads and to effect proper control of the motor 86 in the desired manner.

Fig. 6 illustrates schematically one form of connections between the photo-electric cells 102, 104 with the motor 86. The photo-electric current from the cells passes through suitable amplifiers 106, 108 and the amplified potential is conducted to the grids of thermionic tubes 110, 112 the plate circuits of which include relays 114, 116 which control the energization of separate and oppositely acting motor windings from the power circuit 118. Energization of one relay 114 effects the rotation of the motor in one direction, while energization of the other relay 116 effects the rotation of the motor in the opposite direction. Any suitable control system between the photo-electric cells and the motor is within the

scope of the present invention, as the invention is not directed to any particular control circuit.

In the modification illustrated in Fig. 4, a plurality of weft straightening rolls, herein two rolls 120, 122 act upon the web 124. The rolls 120, 122 are parallel and are carried by a common supporting frame 126 pivoted on the shafts 128 disposed approximately in the median line of the web. A screw-threaded shaft 130 operates on the frame to tilt the similar ends of both rolls simultaneously in the same direction. The web 124 passes horizontally from a fixedly supported roll 119 to the first tiltable roll 122 and makes a right-angle bend or quarter turn about said tiltable roll and then passes vertically upward in a plane parallel with the plane of tilt of said tiltable roll 122 and over an upper fixedly supported idler roll 121. The web then passes downwardly over a lower roll 123 and horizontally about the second tiltable roll 120. The web makes a right angle bend or quarter turn about said roll 120 and passes vertically upward and to the driers or some other web moving device. The two tiltable rolls are thus arranged as is the single roll of Fig. 1. With this arrangement, the equivalent straightening effect of one roll is obtained for half the tilt. Where the web is extremely skewed the structure of this modification may be advantageously employed where large angular displacement of a single weft straightening roll is objectionable.

By having the weft straightening device in front of the tenter frame the scanning discs can be located close to the gripping points of the tenter chains of the fabric so that the proper correction can be promptly applied without the advance of any long length of skewed web beyond the zone of action of the straightening device.

One of the important features is the arrangement of the described construction whereby lateral shifting of the fabric web is prevented when it is under a weft straightening action. This is accomplished in the disclosed construction by having the axis about which the tiltable roll tilts arranged approximately in the median line of the section of the web advancing to it and also approximately in a plane containing the axis of the tiltable roll and by having the web make a quarter turn about the tiltable roll. That is to say, in the construction illustrated in Fig. 1, the web passes horizontally from the roll 44 and makes a right angle bend about the tiltable roll 50 and passes vertically to the upper roll 52. In the construction illustrated in Fig. 4, the fabric makes two successive quarter turns about the tiltable rolls 122 and 120. With the described quarter turn arrangement of the web about the tiltable rolls, the rolls can tilt in either direction throughout a relatively great useable angle without exerting any particular force on the web tending to displace it laterally. For best results, the web should travel away from the tiltable roll in a plane parallel with the plane in which the roll tilts.

We claim:

1. A method of straightening the weft threads of a cloth web, which consists in advancing the web of cloth and twisting a spread section of the web to increase the length of travel of one edge of the web over the length of travel of the other edge of the web in direction and amount to shift the weft threads into right angular relation with the warp threads while maintaining that portion of the web free from any material tendency toward lateral displacement.

2. The method of straightening the weft threads of cloth, which consists in advancing a tensioned web of the cloth, and twisting a spread section of the web to increase the tension in one edge portion of the web and decrease the tension in the other edge portion of the web between points where the web is held against relative longitudinal displacement of its edge portions, which points are spaced apart lengthwise of the web sufficiently great to effect the straightening a maximum skew of the weft threads between said two points without harmful stretch of the increased tensioned edge portion and without entire release of tension in the decreased tensioned edge portion of the web.

3. Apparatus for straightening the weft threads of cloth comprising two web guiding rolls, a straightening member bearing against the advancing web transversely thereof and between said rolls, and means for tilting said member about an axis lying between the edges of the web to increase the length of travel of one edge of the web and to decrease the length of travel of the other edge of the web, said rolls and said straightening member being relatively positioned to maintain the web thereon free from any deleterious tendency to shift laterally when said straightening member is tilted.

4. Weft straightening mechanism comprising a weft straightening roll to which the web advances in a normal plane and about which the web is adapted to be passed, means for holding the web against lateral displacement on both sides of said roll, a supporting frame for the roll, and means for tilting the frame and roll about an axis located crosswise of the roll in the middle thereof and thereby tilting the advancing web out of its said normal plane.

5. Weft straightening mechanism comprising a pair of parallel guide rolls and an intervening weft straightening roll about which the cloth is adapted to pass at substantially a right angle from one to the other guide roll, a supporting frame for the roll, means for pivotally supporting the frame intermediate the ends of the roll, and means for tilting the frame on its pivotal support about an axis approximately parallel to one of the passes of a cloth.

6. Weft straightening mechanism comprising a pair of parallel guide rolls and an intervening weft straightening roll about which the cloth is adapted to pass at substantially right angles from one to the other guide roll, a supporting frame for the roll, means for pivotally supporting the frame intermediate the ends of the roll to turn on an axis approximately parallel to one of the passes of the cloth, means for tilting the frame on its pivotal support, said means comprising a screw-threaded shaft, a nut on said shaft carried by said frame, and means for rotating said shaft.

7. Weft straightening mechanism comprising a pair of parallel guide rolls and an intervening weft straightening roll about which the cloth is adapted to pass at substantially a right angle from one to the other guide roll, a supporting frame for the roll, means for pivotally supporting the frame intermediate the ends of the roll to turn on an axis positioned with respect to the cloth passes to maintain the cloth free from any deleterious lateral shifting when the frame is tilted, means for tilting the frame on its pivotal support, said means comprising a screw-threaded shaft, a nut on said shaft carried by said frame, and means

for rotating said shaft comprising an electric motor.

8. Weft straightening mechanism comprising a base having an upstanding standard, a supporting bar having in the middle thereof a horizontal shaft journaled in said standard, a weft straightening roll carried by and arranged generally parallel with said bar, a vertical externally screw-threaded shaft carried by said base, a nut on said shaft connected with said bar, and means for rotating said shaft.

9. Weft straightening mechanism comprising a base having an upstanding standard, a supporting bar having in the middle thereof a horizontal shaft journaled in said standard, a weft straightening roll carried by and arranged generally parallel with said bar, a vertical externally screw-threaded shaft carried by said base, a nut on said shaft connected with said bar, and means for rotating said shaft, said means comprising an electric motor carried by said base and having a power transmitting connection with said shaft.

10. Weft straightening mechanism comprising a pair of parallel guide rolls and an interposed straightening roll about which a web of cloth is adapted to be passed at approximately right angles between said guide rolls, and means for tilting said roll endwise in engagement with the web about the median line of one of the right angled passes of the web, said roll being comprised of a plurality of axially-short independently-rotatable roll sections disposed in endwise confronting relation and each freely rotatable by the section of the web in contact therewith.

11. Weft straightening apparatus comprising mechanism for advancing a cloth web, a plurality of rollers about which the web is passed including a pair of parallel guide rolls and an intervening weft straightening roll disposed in engagement with and transversely of the web, the web passing over said straightening roll at approximately right angles between said guide rolls, and means for supporting said straightening roll for endwise tilting movement thereof about an axis lying within the edges of one of the right angled passes of the web, said rollers including said straightening roll being composed of a plurality of axially-short independently-rotatable roller sections disposed in end to end confronting order and each freely rotatable by the section of the web in contact therewith.

12. Weft straightening apparatus comprising a weft straightening roll over which the web is adapted to pass, means including a fixed pivot the axis of which is parallel to one of the passes of the web and is in the median line of the web for supporting said roll for tilting it crosswise of the web, and means for guiding the web into and out of engagement with said tiltable roll in directions to prevent lateral displacement of the web throughout wide displacements of said tiltable roll.

13. Weft straightening apparatus including a roll for engaging a travelling web, means for passing the web in a quarter turn about said roll to provide approximately right-angularly disposed passes of the web, one approaching and one leaving said roll, and means tiltable supporting the roll including means for tilting it transversely of one of said passes of the web for displacing said pass of the web out of its normal plane with simultaneous movement of the two ends of the roll in opposite directions.

14. Weft straightening apparatus including a roll for engaging a travelling web, means for

passing the web in a quarter turn about said roll to provide approximately right-angularly disposed passes of the web, one approaching and one leaving said roll, and means tiltably supporting the roll including means for tilting it transversely of the approaching pass of the web and parallel to the leaving pass of the web and about an

axis parallel to the approaching pass with simultaneous movement of the two ends of the roll in opposite directions, the tilting of said roll displacing the approaching pass of the web out of its normal plane.

JOHN D. ROBERTSON.  
JOSEPH L. DUBE.