June 3, 1947. L. C. NIELD 2,421,575

METHOD AND APPARATUS FOR THE STRAIGHTENING OF THE WEFTS OF WOVEN TEXTILE FABRICS

Filed April 27, 1944 2 Sheets-Sheet 1

Fig. 1.

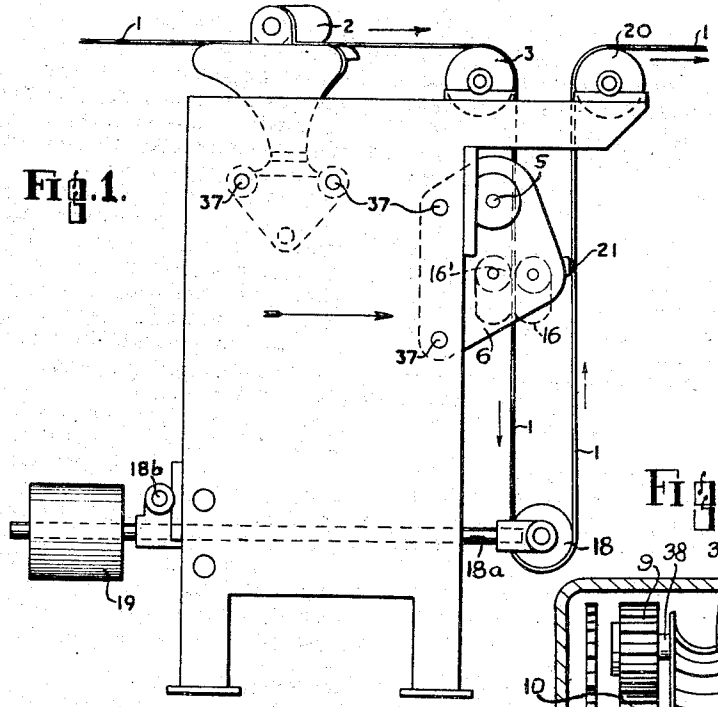
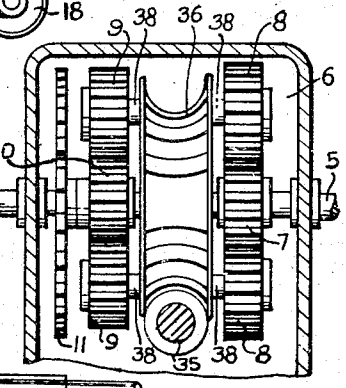


Fig. 5.



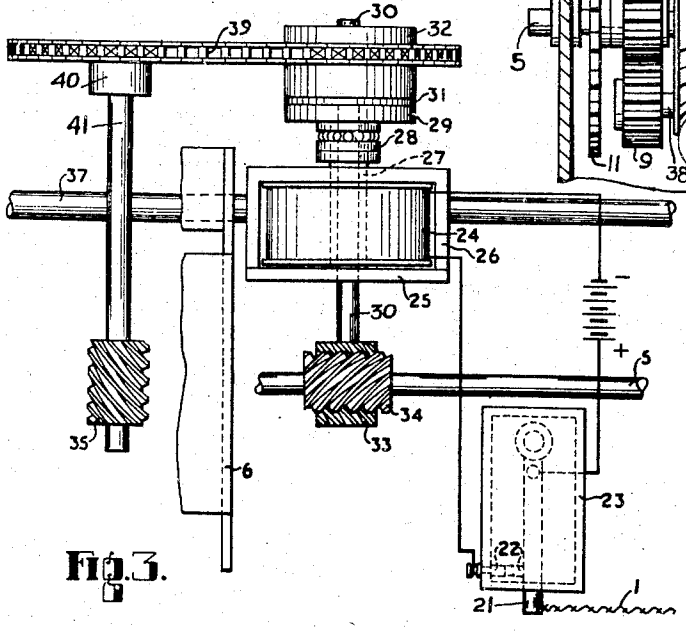


Fig. 3.

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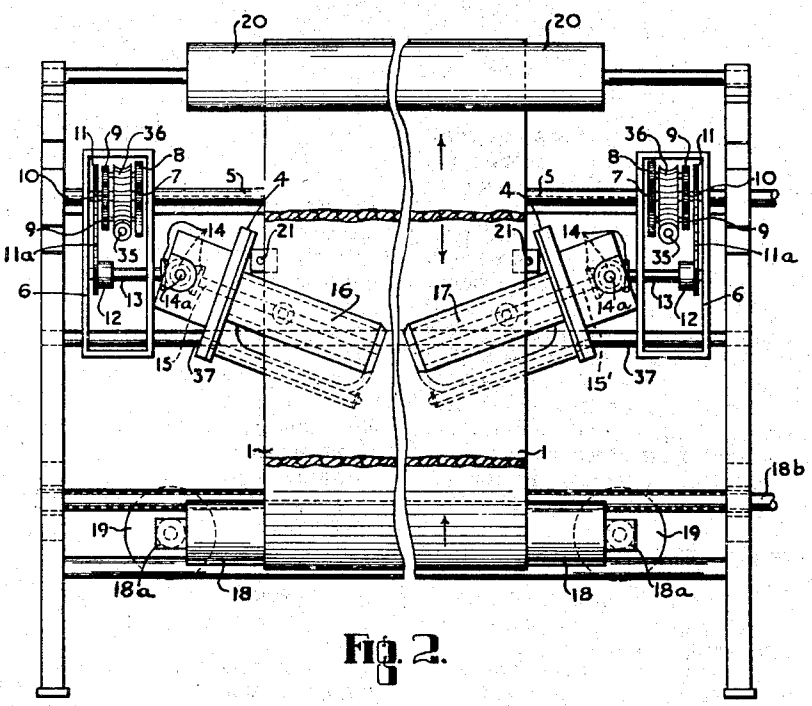


Fig. 2.

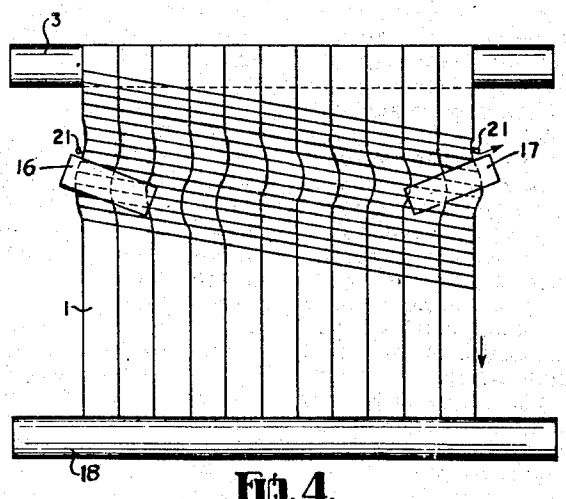


Fig. 4.

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METHOD AND APPARATUS FOR THE STRAIGHTENING OF THE WEFTS OF WOVEN TEXTILE FABRICS

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5 Claims. (Cl. 26—65)

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The weft threads of a woven fabric should be at right angles to the warp threads but in the processing of such fabrics the relative positions of such threads may be distorted and it is often necessary to provide means of correcting this distortion. Various means are known for doing this but these methods are usually manually operated. In many types of fabric it is difficult or impossible to see by visual inspection whether the weft threads are in the correct relative position. It is therefore very advantageous to have a mechanical means of detecting when the weft threads of a fabric are not at right-angles to the warp threads, which mechanical means may be made to operate apparatus for correcting the fault.

The present invention relates to an improved method and apparatus for determining when the weft threads are not truly at right-angles to the warp threads and for straightening them.

According to the present invention the selvedges of a web which is being continuously displaced are engaged obliquely to the line of run of the web, the consequent lateral deflection of the web caused by said oblique engagement whenever the weft threads lie other than at right angles to the run of the web operating a weft straightening device.

One form of apparatus for carrying out the invention comprises two pairs of rollers, each pair engaging one selvedge of the fabric web running freely past said rollers, means being provided to rotate said rollers at different peripheral speeds whenever a lateral deflection of a selvedge edge of the web occurs due to an unbalanced pull of said rollers, as will occur when the weft lies along a line other than parallel to the line joining the median points of said pairs of rollers.

One form of construction according to this invention is shown in the accompanying drawings, in which:

Figure 1 is a side elevation of a machine for detecting and rectifying weft unstraightness in a fabric web,

Figure 2 is a front view of the machine shown in Figure 1,

Figure 3 is a conventionalized diagram of the control and driving means for the floating element of the differential gear in the machine, with the driving means shown in plan view,

Figure 4 is a diagram showing, in exaggerated form, displacements of a fabric when the weft threads are unstraight and a lateral pull is applied to the edges, and

Figure 5 is an enlarged view of one of the differential gears shown in Figure 2.

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The moving web or band of woven textile material 1 is carried from either a roll, a pile or other such supply of fabric or from any previous apparatus to the machine in such a way that it shall pass over, through or between any suitable apparatus which shall ensure the web travelling in a predisposed path, one preferred type being known as the Foxwell fabric positioners and are marked 2 on Figure 1. Thereafter the cloth shall pass over the horizontal guide roller 3 and thence to the control and straightening heads 4.

After leaving the nip roller heads 4, the web 1 is carried vertically downward and then under roller 18, which is carried by arms 18a pivoted on shaft 18b and counterbalanced by the weights 19, as shown in Figure 1. In Figure 2, the upward draft of the web 1 is cut away to show driven rollers 16 and 17. The web then passes over roller 20 to the next piece of apparatus by which it may be required to be treated.

The control and straightening heads 4 consist of two pairs of nip rollers 16 and 17 (the free member of pair 16 being designated 16'), one pair being disposed on either selvedge of the web, the axes of one pair of said nip rollers lying at an angle to the axes of the other pair of nip rollers. This angle can be varied at will about the axis of a shaft 14a when and if required. The disposition of these nip rollers can be seen from Figures 2 and 4.

These nip rollers are driven by suitable mechanism so that either one can be driven at a different speed than the other.

The aforesaid driving mechanism can be arranged as follows. Referring to Fig. 2, the driving shaft 5 is rotated by some prime mover or from suitably driven apparatus (not shown) disposed either before the weft straightening apparatus or following it.

Disposed on either side of the machine are two differential epicyclic gear boxes 6, an enlarged view of one of which is shown in Figure 5. The prime gear wheels 7 of the two differentials are rotated from the shaft 5 through keys which can slide in a long keyway (not shown) in shaft 5. As the same general arrangement is provided at each differential gearing, only one will be described in detail.

In the normal way, the drive is transmitted through the gear wheels 8 and 9 keyed on to shaft 38 rotatable in bearings carried by a worm wheel 36 to gear wheel 10 rotatably mounted on shaft 5. The train of gear wheels 7, 8, 9, and 10 has a speed-reducing ratio of say 1.5:1. Fixed to the gear wheel 10 is a sprocket 11, which engages a

chain 11a to drive sprocket 12, which is keyed to a shaft 13 at the opposite end of which is a double mitre gear 14 to allow the change of angle of the nip roller head 4: the middle mitre gear being coaxial with the axis 14a about which the head 4 can move. The ratio of the chain drive 11, 11a, 12 is such that it has a speeding-up ratio the inverse of that in the compound train of gears, namely, 1:1.5. (This is only for ease in working out shaft speeds relative to cloth speeds.) The last wheel of the double mitre gear 14 is fixed on the shaft 15 which carries the driven member of the nip rollers 16 or 17.

The control of the speed of the nip rollers is achieved from the two fingers 21 which are disposed (Fig. 2) at opposite edges of the web, each a small distance outside the general run of the fabric. When the web 1 encounters either of these fingers 21, electrical contacts are closed to provoke a change of speed of the corresponding rollers. It will be understood that identical sets of apparatus are provided for each finger 21 and its associated parts, but only one will be described in detail.

When an edge of the cloth web 1 is deflected laterally and moved outward into contact with a finger 21, this finger (Fig. 3) moves and closes the contacts 22 in the switch box 23, and current is caused to flow in the solenoid 24, which pulls the pole piece 25 against the solenoid core frame 26 and into the position shown in Fig. 3. This movement of the pole piece 25 pushes the sliding tube 27 against the thrust race 28 which in turn acts to push the clutch disc 29, engaged by a sliding key in shaft 30, into contact with the clutch lining 31 attached to the chain sprocket 32. The shaft 5 has a spiral gear 33 engaged with a spiral gear 34 on the shaft 30 so that the latter is continuously rotated and acts, when the clutch 29—31 is engaged, to drive the chain sprocket 32 so that the chain 39 turns the chain sprocket 40 and therewith the shaft 41 carrying the worm 35. This worm 35 (Fig. 5) then rotates the worm wheel 36 which carries the shafts 38 of the differential gears, and thereby introduces a further component of motion so that, for example, the speed of the associated nip rollers is reduced, and the movement of the corresponding edge of the web is retarded and thereby the weft threads are straightened, that is, brought to lie along lines normal to the direction of feeding of the web. Since this is produced by the relative speeds of the nip rollers at the two edges, it is obvious that a like result is attained by causing the worm wheel 36 of the other differential to rotate and cause the speed of the associated nip rollers to be increased.

When the weft threads passing the nip rollers are again at right angles to the direction of movement of the web, the lateral deflection or outward movement ceases, and the web now runs within the parallel limits established by the fingers 21, and between these fingers without touching either. Hence the contacts 22 are broken at each side, the solenoids 24 are deenergized, the clutches 29—31 are open, and shafts 41 are at a standstill. The worm wheels 36 are at a standstill, and the nip rollers are again driven at the same speed.

The cloth positioner 2 and the straightening heads 4 together with the mechanism for driving them are arranged to slide on the guide bars 37 to accommodate various widths of fabric. The keyed engagements with shafts 5 permits such adjustment while assuring continuous drive.

The diagram of Figure 4 shows the displacement of the warp and weft threads as the cloth

is moving through the apparatus with the weft threads diagonal when viewed from the direction of the arrow in Figure 1. It will be seen that as long as the weft lies truly at right angles to the warp, the pull of the pairs of rollers 16 and 17 engaging the web obliquely to its line of travel is balanced, but whenever the weft comes to lie along lines other than parallel to the line joining the median points of the obliquely disposed rollers 16 and 17, then the pull of these rollers becomes unbalanced, the nip rollers 17 pulling the fabric outwards more than the nip rollers 16 because the former are pulling more nearly parallel to the weft threads than the latter. Therefore it can be seen that the selvedge on the right hand side of the web will move outwards more than the left-hand side and as a result there is more width of cloth in that nip, so it follows that nip rollers 17 will exert a still greater pull in their direction than nip rollers 16; hence the contact finger 21 adjacent to the rollers 17 will be the one which will be operated to effect directly or indirectly the displacement of the floating element of the differential gear in the particular arrangement described with reference to Figures 1 to 3, thus causing either a speeding up of the rollers 16 or a retardation of the rollers 17, when rollers 16 will exert a greater pull in the opposite direction which will restore the position of the finger to normal, when the sequence will repeat itself until the weft threads are very nearly at right-angles to the warp threads.

The operation of the differential gears may be carried out by other means than the electrical method previously described such as air or other fluid operating a diaphragm or piston to apply pressure to the friction clutch, or again a magnetic clutch may be used. In certain cases it may be desirable to use a small prime mover which may be started and stopped by operation of the selvedge contact fingers through relays or other servo mechanism.

It may also be desirable to dispense with differential gears and use a double chain drive alongside sprockets 11 and 12 with a different ratio to give the speed change of the nip rollers in which case a double clutch of a sensitive type could be used, again operated by the fingers 21 through suitable servo mechanism.

It may also be desirable to use other forms of stretching heads in place of the nip roller heads 4, such as a short chain passing round a pair of chain wheels with either pins or some other apparatus to hold the web, these chains to be pivoted at one end so that a spring could be used to pull the chains out and so operate the fingers.

The counterbalanced roller pivot shaft 18 can be used to operate a control for automatic speed synchronisation of the weft straightening apparatus or other apparatus to some other following or preceding apparatus.

Instead of varying the peripheral speeds of the two sets of nip rollers relatively to one another, either by speeding one set up or by slowing one set down, or by both, the contact finger may operate any auxiliary known form of weft straightening device such as a pair of rollers over which the fabric web is passed, the angle of which relatively to the warp direction being varied by the control.

Instead of a mechanical control by spades or weft fingers 21, any other known control arrangement operated by a displacement of the selvedge edge from a predetermined path may

be used, such as a photo-electric cell arrangement.

I declare that what I claim is:

1. A method of straightening the weft threads of a cloth web consisting in constraining the web of cloth to move with its edges within predetermined parallel limits and at equal speeds, applying a pull to the web by forces acting equally and oppositely to one another and applied along a line normal to the direction of displacement of the web, and using the movement outwards of either one or other edge of this web outside one of said limits which will occur whenever the said pull on the web no longer coincides with the direction of the weft threads to operate weft straightening means to effect movement of said edges at differential speeds while maintaining applied the aforesaid pulling forces.

2. A device for straightening the weft threads of a textile web comprising means to constrain the edges of the web to move within predetermined parallel limits, two pairs of nip rollers on axes oblique to the movement of the cloth and continuously engaging the edges of the web, individual driving means for said nip rollers, and means controlled by the movement outward of part of either edge of the web outside said predetermined limits when the weft lies along a line other than parallel to the line joining the median points of said pairs of rollers and effective to operate the drives for the pairs of rollers whereby to produce faster rotation of the pair of rollers at the side opposite to that on which the movement outwards occurs than at the other pair.

3. A device for straightening the weft threads of a textile web, comprising means to constrain the edges of the web to move witthin predetermined parallel limits, two pairs of nip rollers continuously engaging the edges of the web and mounted on axes oblique to the movement of the cloth, a pair of feelers disposed on opposite sides of said web and spaced apart a slightly greater distance than the said parallel limits and disposed adjacent to said nip rollers, driving means for said rollers which include a differential gear coupling said pairs of nip rollers, each differential gear having a floating element effective by its rotational displacement to control the rate of rotation of the associated pair of nip rollers, and means selectively operated by either one of said feelers to displace the floating element of a corresponding differential gear whenever the web contacts with one or other of said feelers.

4. A method of straightening the weft threads of a cloth web, consisting in moving the web with its edges travelling at equal speeds in the warp direction, applying a pull to the web by equal and opposite forces acting along a line normal to the direction of movement of the web whereby to produce an outward deflection of one or the other edge of the web wherever the said pull no longer coincides with the direction of said weft threads, and using said outward deflection for selectively causing one edge of the web to move at a different rate than the other while the pulling forces are maintained applied and thereby effect straightening of the weft threads into parallelism with said line.

5. Apparatus for straightening the weft threads of a cloth web, comprising a frame past which the cloth may be advanced in the general direction of the warp threads, two oppositely and obliquely positioned pairs of nip rollers rotatively mounted on the frame and individual variable speed means for driving the same, said rollers and driving means being positioned and arranged to act continuously upon the cloth at edge portions thereof spaced at right angles to the said direction of advancement and to establish forces at each said portion for advancing the cloth and for causing said portions to move away from one another whereby a weft thread which lies other than parallel to the line joining the median points of the pairs of nip rollers is engaged by one pair of nip rollers before it is engaged by the other pair of nip rollers and thereby an outward movement of one edge of the cloth is produced, and detector means selectively responsive to the said outward movement and effective for controlling the action of said variable speed driving means whereby to cause the advanced end of the obliquely-positioned weft thread to be relatively retarded.

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