

March 4, 1941.

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2,233,644

WEFT STRAIGHTENING DEVICE

Filed June 10, 1939

3 Sheets-Sheet 1

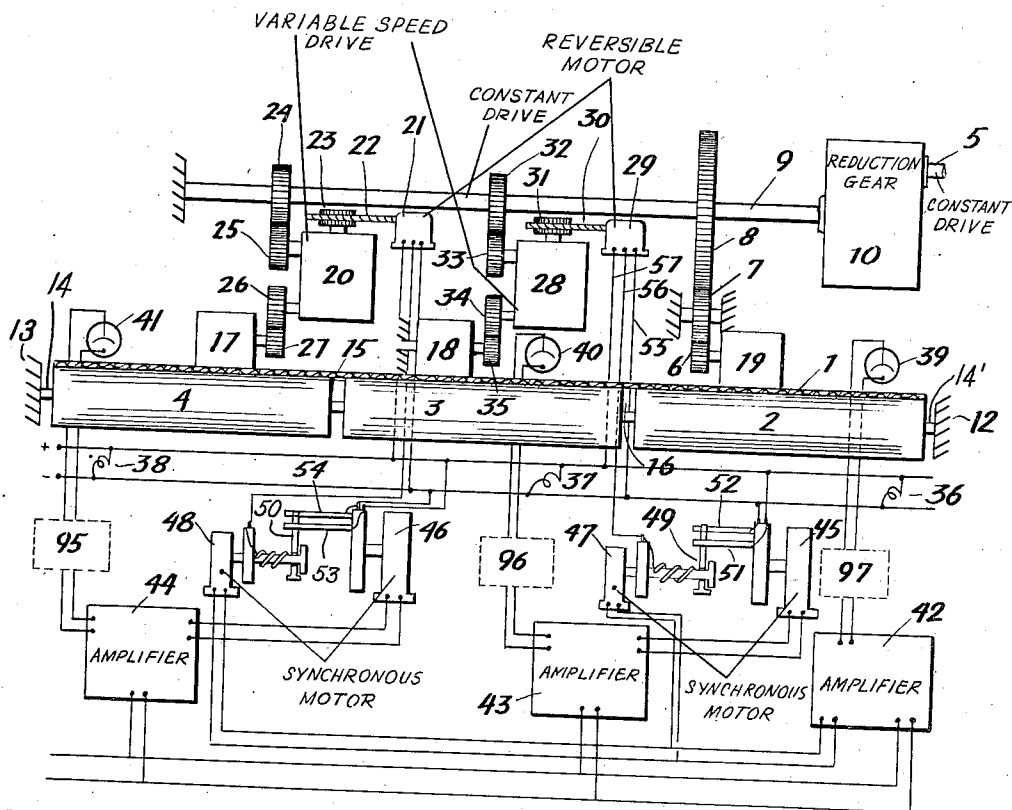


Fig. 1

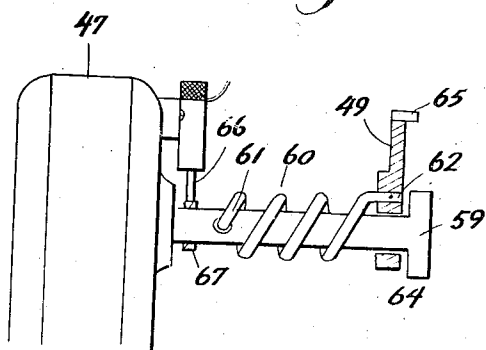


Fig. 2

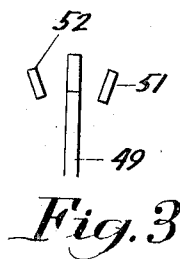


Fig. 3

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3 Sheets-Sheet 2

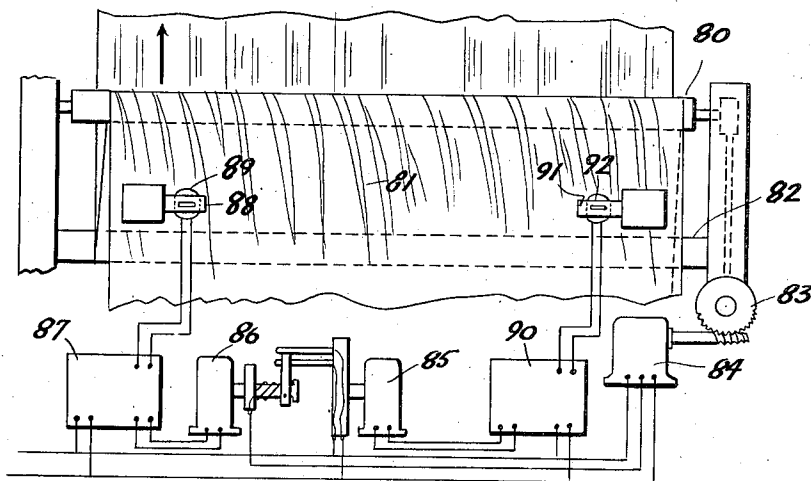


Fig. 4

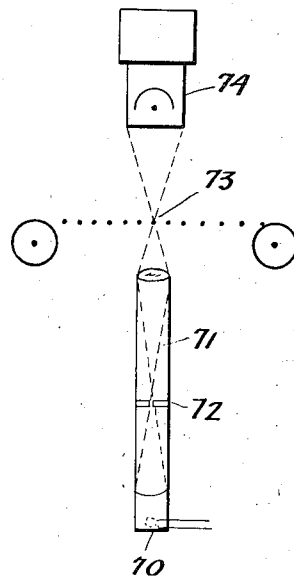


Fig. 5

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3 Sheets-Sheet 3

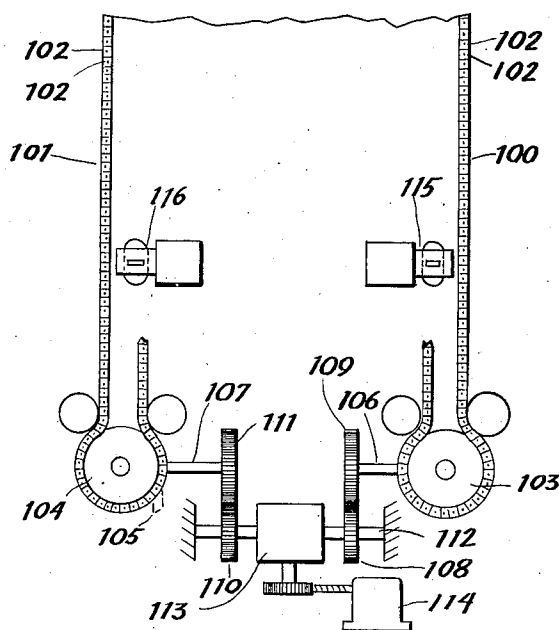


Fig. 6

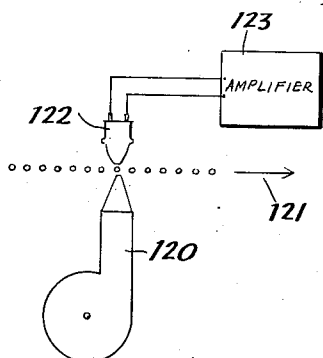


Fig. 7

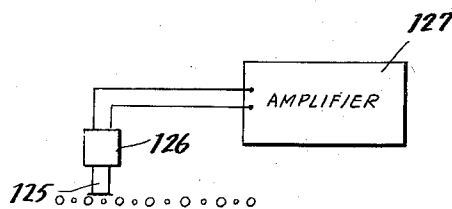


Fig. 8

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UNITED STATES PATENT OFFICE

2,233,644

WEFT STRAIGHTENING DEVICE

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3 Claims. (Cl. 26—51)

The present invention relates to the straightening of the weft in the handling of woven goods and particularly in the finishing of such goods. More particularly in the present invention the first weft threads of the feed are initially established in a straight position with respect to their feed, as for instance in a tenter frame or other frame feeding device, and maintained in such a position by means of the feed control according to the present invention.

Straightening of the weft after bleaching, dyeing, printing and finishing is usually needed because frequently the weft which is straight when it comes from the loom becomes twisted or deformed in being put through some of the processes mentioned above. Distortion may be of various types. The weft may be skewed, bowed, hooked at the edge, or it may have any combination of these faults and it may also have an irregular wave shape or any other shape, depending upon how the material was handled after it came off the looms.

In accordance with the present invention, the weft in any of these peculiar forms may be straightened manually initially and maintained in this straightened form until it is fully processed, printed, cut and rolled, or put through any other handling that may be necessary.

Weft straightening devices have largely been operated by hand, but this is not wholly successful since at the speed that the cloth is usually travelling it is difficult to control the device quickly and accurately enough to do a good job of straightening the weft. A common type of weft straightening device employs a group of rollers over which the cloth travels, and which are provided with means to tilt the rollers with respect to one another to make the travel of the cloth faster at one side than the other.

In such devices the speed of the cloth varies proportionately over the roll from one end to the other, so that only a simple skew could be perfectly corrected but not the other types of distortions mentioned above. Another type of straightening device uses cone rollers over which the cloth travels faster on the larger end than on the smaller end, but this type of device can also only take care of a simple skew.

Various means have also been used for automatically controlling the straightening devices described above, but these devices have principally depended upon the angle of a light beam shining through the cloth on a photo cell or the intensity of such a light beam on a photo cell.

In the present invention the means of control which automatically maintains it in a straight position, operates to an accuracy of a single weft thread and controls the position of the weft at a number of critically spaced points over the width of the cloth. Further, the feeding or drive rolls are divided in as many parts as there are controls and each control acts upon its own drive roll to control the speed as desired to maintain the weft straight or in its initial position. While three controls have been found to be sufficient, any other number may be used dependent upon the width of the cloth and condition of the goods which is being processed, and other factors.

Without further enumerating the advantages and merits of the present invention over the devices of the prior art, the invention will be described in connection with an embodiment of the same set forth in the specification below and illustrated by the drawings in which:

Figure 1 shows diagrammatically a layout of the present system.

Figure 2 shows a detail of a part of the system.

Figure 3 shows a further detail.

Figure 4 shows a modification of the layout shown in Figure 1.

Figure 5 shows a detail of the optical system.

Figure 6 shows a modification of the layout of Figure 1 as applied to a tenter frame, and

Figures 7 and 8 show modifications of the detail for observing and counting the threads.

In the diagram of Figure 1, the blocked elements with legends calls for known apparatus which may be commonly and readily obtained either as standard equipment on the open market or in any event as well known elements.

The cloth is shown in section at 1 passing over the rollers 2, 3 and 4, which may be idler rollers as shown, or they may be driven by gearing in conjunction with the rollers 19, 18 and 17, respectively, at the same speed as their respective rollers. The shafts 14, 14', 15 and 16, supporting the rollers 2, 3 and 4 may be a single continuous shaft or the shafts may be independently supported. If a single continuous shaft is used this may be supported by side supports 12 and 13 in any of the usual ways commonly employed in the art. The rolls may be supported in a tenter frame or in any general type of weft straightening machine. Where it is desired to control and direct the feed of the weft at more than three places across a tenter frame, a greater number of independent feed rollers may be employed, each associated with means for control-

ling the roller speed with respect to a particular chosen spot across the weft where the feed is maintained constant.

In the system illustrated in Figure 1, the independent feed rollers 17, 18 and 19 are driven through the drive shaft 5 which may be maintained constant in any usual manner as for instance by a governor control. The feed roller 19 is driven by means of a gear 6 which meshes with the idler gear 7 driven by the drive gear 8 mounted on the constant drive shaft 9 operated through the reduction gear 10 by means of the drive shaft 5. It should be noted that since the feed roller 19 is coupled through a fixed gear system to the drive shaft 5, that the speed of the roller 19 is constant at all times because the speed of the shaft 5 is constant. On the other hand the feed rollers 17 and 18 are driven indirectly by the constant drive shaft 9 through the variable speed drive 20, which variable speed drive is controlled by the operation of the reversible motor 21 driving the worm 22 which in turn controls the speed shaft crank 23. The variable speed drive 20 may be of any suitable type in which small speed changes can be readily and quickly established. The gear 24 on the constant speed shaft drives the gear 25 on the variable speed drive which transmits the motion through its variable control through the driving gear 26 which meshes with the gear 27 driving the feed roll 17. The feed roll 18 is controlled in a manner similar to the feed roll 17 by means of the variable speed drive 28, the reversible motor 29 and the worm 30 and shaft 31. In this case the constant speed shaft 9 drives the gear 32 which in turn provides the drive for the shaft 33 of the variable speed device transmitting the rotational power to the gear 34 and drives the gear 35 meshing with it.

In the present system the variable speed drives 20 and 28 are controlled through optical systems which in effect count the weft threads that are passing by the optical system. Each thread as it passes by produces a current impulse which is impressed upon an amplifier and which in turn after amplification operates by its pulses a synchronous motor. The synchronous motors controlled by the various points of observation are compared by means as will be described later with the standard synchronous motor controlled and operated by an optical system positioned at the point where the weft feed is constant.

In the system as shown in Figure 1 as each thread passes between the beams produced by the lights 36, 37, 38 and the photo cells 39, 40 and 41, respectively, impulses are transmitted to the amplifiers 42, 43 and 44 respectively. The beam thrown by the light 36 upon the photo-cell 39 is the beam of constant control and operates the standard comparison synchronous motors 47 and 48 at the speed corresponding to the speed of the weft threads beneath the photo cell 39. The motors 47 and 48 are shown more in detail in Figure 2, and will be described later. For the present it will be sufficient to notice that the motors 47 and 48 carry contact poles 49 and 50 respectively, which poles are positioned between a set of contact poles 51 and 52 for the synchronous motor 45, and 53 and 54 for the motor 46. The motors 45 and 46 are also synchronous motors which are operated by speeds corresponding respectively to the passage of the weft threads under the photo-cells 40 and 41 respectively. If both synchronous motors 45 and 47 for instance are run at the same speed,

the contact pole 49 will remain between the two contact poles 51 and 52. If the speed changes in one direction the contact pole 49 will travel towards one of the poles 51 or 52, and if the speed changes in the other direction, the contact pole 49 will of course travel towards the reverse contact pole. In one case the making of the contact in one direction will drive the reversible motor 29 in a corresponding direction and the making of the contact in the other direction will reverse the drive of the synchronous motor and thereby increase or reduce the drive of the feed roller 18 through the control of the variable speed drive 28. The reversible motor 29 may be an ordinary direct current motor with a reversing shunt field so that the three wire connections 55, 56 and 57 will send the current in a forward or reverse direction in the field to control the drive of the reversible motor in a corresponding forward or reverse direction.

The same description given with regard to the operation of the synchronous motors 45 and 47 applies to the operation of the synchronous motors 46 and 48. While the speed of the weft under the photo cell 41 is the same as that under the photo cell 39 the motors 46 and 48 will retain a constant speed. If however more threads pass under the photo cell 41, the synchronous motor 46 associated with it will go faster than the synchronous motor 48 and causes a contact to be made between the contact pole 50 and one of the poles 53 or 54. The direction of this control will be such that the reversible motor 21 will control the variable speed drive 20 to reduce the drive of the feed roll 17 until the contact pole 50 leaves the contact to one of the poles 53 or 54 on the disc 58 driven by the drive shaft of the synchronous motor 46. At that moment then the feed through the drive of the roller 17 will have slowed down sufficiently so as to bring the weft back to its straight position transverse of the travel of the cloth. The motors 47 and 48 are driven at the same speed through the amplifier 42, which as previously stated, is controlled by the photo cell 39. If more points of feed drive control were desired, additional synchronous motors in parallel with the motors 47 and 48 would be used and these would be compared as described above with the synchronous motors operated by the photo cells at the desired points of control. Each of the synchronous motors in effect operates a single pole switch between the doubled pole contacts so as to make in effect a single pole double throw switch as plainly seen in Figure 3. When the contacts 49 and 51 are in engagement, the current through the field of the reversible motor is in reverse from that when the contacts 49 and 52 are in engagement with each other.

A special type of contact may be used as indicated in Figure 2. Here the synchronous motor 47 drives the shaft 59 which has surrounding it a helical spring 60 with one end 61 fixed to the shaft 59 and the other end 62 fixed to the contact pole 49 which is freely journaled by means of the journal 64 to the shaft 59. Electrical current is applied to the pole 65 by means of the brush 66 bearing upon the slip ring 67 which is electrically connected by means of the helical spring 61 or otherwise with the contact pole 65. The pole 49 is rotated by the shaft 59 through the helical spring 60 thereby providing a flexible connection between the shaft 59 and the pole 49 so that when the pole 49 meets one of the poles 51 and 52, the position of the pole 75

49 will yield with respect to the shaft 59 tensioning the helical spring or compressing it as the case may be. The yielding will be of a magnitude corresponding to the normal variation of the speeds of the synchronous motors which are being compared, so that the poles 49 and 50 and 51 may be made of unyielding material and hold their respective positions one with the other. The leeway may be made in angular degrees, either less or greater than a single revolution depending upon the accuracy of control and adjustment of synchronism that is desired and necessary.

The optical system is indicated diagrammatically in Figure 5 and comprises a bright filament light 70, a projector 71 with a slit 72 whereby the filament image may focus at a point 73 where the weft is passing by. The photo cell 74 may be placed at a point in the dispersion of the focus of the filament so that when the threads pass by the focal point of the projector 71, a shadow will be caused on the photo cell 74 and cause a response in the input of the amplifier circuit. The slit 72 may be similar to that used for the reproduction of sound tracks of picture films and the image of the slit will be of the order of the dimensions of the thread. By controlling the width of the slit and the type of filament and sharpness of focus, the system may be applied to a great variety of woven material. It may be applied to the very finest type of cloth, as for instance fine cambric handkerchiefs which have threads 120 to the inch and it may also be applied to very coarsely woven and thick thread material. The device described in connection with Figure 1 provides for automatic adjustment speeds of the feed rolls 17 and 18 to maintain constant weft speed. In place of the automatic adjustment shown in Figure 1, the control may be made through visual adjustment by an observer standing at a position beside the moving cloth. In this case the impulse obtained through the photo cells operating the amplifiers may be impressed upon a high powered stroboscope which may be made to reflect a beam transversely across the direction of feed of the cloth. If the weft in this case is straight it will appear to stand still and can be visually seen as though the cloth were not moving. When however the portions of the weft become skew or otherwise distorted, the weft will change its position from the desired straight line. The operator may thereupon adjust the variable speed drives to correct for such distortions. While this system may be employed for some type of work, it is not preferable to the general automatic adjustment described in connection with the system indicated in Figure 1.

In Figure 4 there is illustrated an automatic adjustment of a weft drive in which the position of the axis of one roll 30 may be changed with respect to its associated roll 32. In this type of device when the weft is running straight, the rolls are parallel and when the weft is running skew as indicated by the lines 31, the roll 30 may be adjusted with respect to the roll 32. This may be accomplished through the spur gear drive 33 operated by a reversible motor 34 whose direction is controlled between the action of the synchronous motors 35 and 36 similar to the motors 45 and 47 of Figure 1.

The motor 36 as shown in Figure 4 is driven through the amplifier 37 controlled by means of the light beam passing from the light source 38 to the photo cell 39. The drive of the syn-

chronous motor 35 is through the amplifier 90 controlled in the same manner as the amplifier 87 through the light source 91 and the photo cell 92.

When the weft under the light source 88 speeds up over the weft under the light source 92, the motor 84 is operated to control the axis of the roll 80 to reduce the speed under the light source 88 to that under the light source 91. In this respect the control is similar to that described in Figure 1. The arrangement shown in Figure 4 illustrates how the present invention may be applied to a weft straightening machine in which a plurality of weft straightening rollers may be used the axis of which may be adjusted with respect to one another. In a similar manner the present invention may be applied to a cone type weft straightening device where the variation in speed is obtained by means of a conical roll.

In the present invention where high speed feed is desired, the impulse transmitted through the photo cells to the amplifier may be proportionately reduced in frequency by any of the well known frequency reduction means as indicated by the blocked elements 95, 96 and 97. The construction of this particular means it will be appreciated does not form a part of the present invention. Where however very high speeds of weft travel is desired, the impulses per second established by the travel of the threads over the photo-cells will be such that reduction of frequency is desired to operate the synchronous motors under normal speed range.

In Figure 6 there is shown a modification whereby the system of the present invention may be applied to a tenter frame drive. In the tenter frame drive the cloth is fed or driven by means of a pair of chains operating at the edges of the cloth. These chains are provided with clips or pins which grip and hold the cloth and carry it along as the chain moves. In Figure 6 two chains are provided, 100 and 101, each of these chains carrying pins 102, 102 to which the cloth is fastened. These chains 100, 101 are driven by means of the gears 103, 104, respectively which in turn are driven through a pair of bevelled gears, one of which is indicated at 105, driven by the shafts 106 and 107, on the right and left side of the frame respectively. As indicated in Figure 6 the shaft 106 on the right is driven by the main drive 108 through the gear 109, while the shaft 107 on the left is driven by the gear 110 through the gear 111. The gear 110 is connected to the main drive shaft 112 through the variable speed device 113, which is controlled by the reversible motor 114 in the same manner as described in connection with the reversible motors 21 and 29 of Figure 1. The light beams provided by the lights 115 and 116 operate in the same way as those described in connection with Figure 4 and control the reversible motor 114 through two synchronous motors operated in the same manner as described in connection with Figure 4. If it is desired to have a control intermediate between the position of the light source 115 and 116, a third light source may be provided somewhere across the cloth and in such a case this third control will be operated similarly as the middle drive roll 18 of Figure 1 in connection with the photo cell 40.

Figures 1 and 4 indicate optical means for picking up the count of the number of threads. This may be done in other ways. It may be done

pneumatically as indicated in Figure 7 where a light blast of air from a source 120 is blown across the travel of the thread indicated by the arrow 121. As the threads pass over the air blast, a sound of a definite frequency will be picked up by the microphone 122 which will be passed on to the amplifier 123 and which will give a definite frequency for the control of the synchronous motor. Another method of obtaining the count is by means of a direct contact device 125 which operates an electro responsive device 126 which may be impressed upon an amplifier 127 to control a synchronous motor similarly as described in connection with Figure 1.

Having now described my invention, I claim:

1. A system for maintaining the weft yarns straight in the feeding of textile fabrics, comprising a plurality of feeding means spaced transversely across the textile fabric, means for counting the weft threads of said fabric passing by chosen fixed points, synchronous motors operated in synchronism with said counting means and means operated by said synchronous motors to control said plurality of feeding means for differentially feeding said textile fabric near the points of observation.

2. A system for maintaining the weft yarns straight in the feeding of textile fabrics, comprising a plurality of feeding means spaced transversely across the textile fabric, means for counting the weft threads of said fabric passing by chosen fixed points, synchronous motors operated in synchronism with said counting means and having a relative phase difference established thereby between said motors, and means operated in conjunction with the relative phase positions of said synchronous motors for operating said plurality of feeding means adjusting the speed of feed near the points of the counting.

3. A system for maintaining the weft yarns straight in the feeding of textile fabrics, comprising a plurality of feeding means spaced transversely across the textile fabric, means for counting the weft threads of said fabric passing by chosen fixed points, one of which is set as standard, a synchronous motor operated in synchronism with each point of counting and establishing a relative phase difference thereby between said motors, and means operated in conjunction with said relative phase for operating said plurality of feeding means for adjusting the speed of feed near the points of counting.

4. A system for maintaining the weft yarns straight in the feeding of textile fabrics, comprising means for feeding the textile fabric, means spaced at fixed points across the fabric for counting the weft threads of said fabric passing by said chosen fixed points, one of which is set as standard, a synchronous motor operated in synchronism by the impulses of the counting means at each point of counting, and switch means rotated with each of said synchronous motors and positioned each with respect to said standard synchronous motor for operation in accordance with the relative phase position of each of said synchronous and the standard mo-

tors, a plurality of reversible motors each operated by said switch means and means operated by said reversible motors for adjusting the speed of said feed near each point of counting.

5. A system for maintaining the weft yarns straight in the feeding of textile fabrics, comprising means for feeding the textile fabric, means spaced at fixed points across the fabric for counting the weft threads of said fabric passing by said chosen fixed points, one of which is set as standard, a synchronous motor operated in synchronism by the impulses of the counting means at each point of counting, and switch means rotated with each of said synchronous motors and positioned each with respect to said standard synchronous motor for operating in accordance with the relative phase position of each of said synchronous and the standard synchronous motors, a plurality of reversible motors each operated by said switch means, variable speed control means operated by said reversible motors for adjusting the speed of said feed near each point of counting to maintain the weft speed constant.

6. A system for maintaining the weft yarn straight in the feeding of textile fabrics, comprising a plurality of feeding means spaced transversely across the textile fabric, electric means fixedly spaced transversely across said fabric, responsive to acoustic waves for producing electric impulses with the passage of each thread by said electric means, synchronous motors operated by said impulses in synchronism therewith and means operated by said synchronous motors for varying the speed of said feeds to maintain the weft straight.

7. A system for maintaining weft yarn straight in the feeding of textile fabrics in a tenter frame which comprises means fixedly positioned at opposite sides of the tenter frame for counting the number of threads passing by said fixed means, a pair of synchronous motors operated differentially with respect to said counting means and means controlled by the operation of said synchronous motors for differentially varying the speed of the chain drive on either side of said tenter frame.

8. A system for maintaining the weft yarns straight in the feeding of textile fabrics, comprising means for feeding the textile fabric, means spaced at fixed points across the fabric for counting the weft threads of said fabric passing by said chosen fixed points, one of which is set as standard, a synchronous motor operated in synchronism by the impulses of said counting means at each point of counting, and switch means rotated with each of said synchronous motors and positioned each with respect to said standard synchronous motor for operation in accordance with the relative speed of each of said synchronous and the standard motors, a plurality of reversible motors each operated by said switch means and means operated by said reversible motors for adjusting the speed of said feed near each point of counting.

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