Aug. 12, 1952 F. R. PIPER ET AL 2,606,614

CLOTH SPLITTING MACHINE

Filed Feb. 14, 1950 4 Sheets-Sheet 1

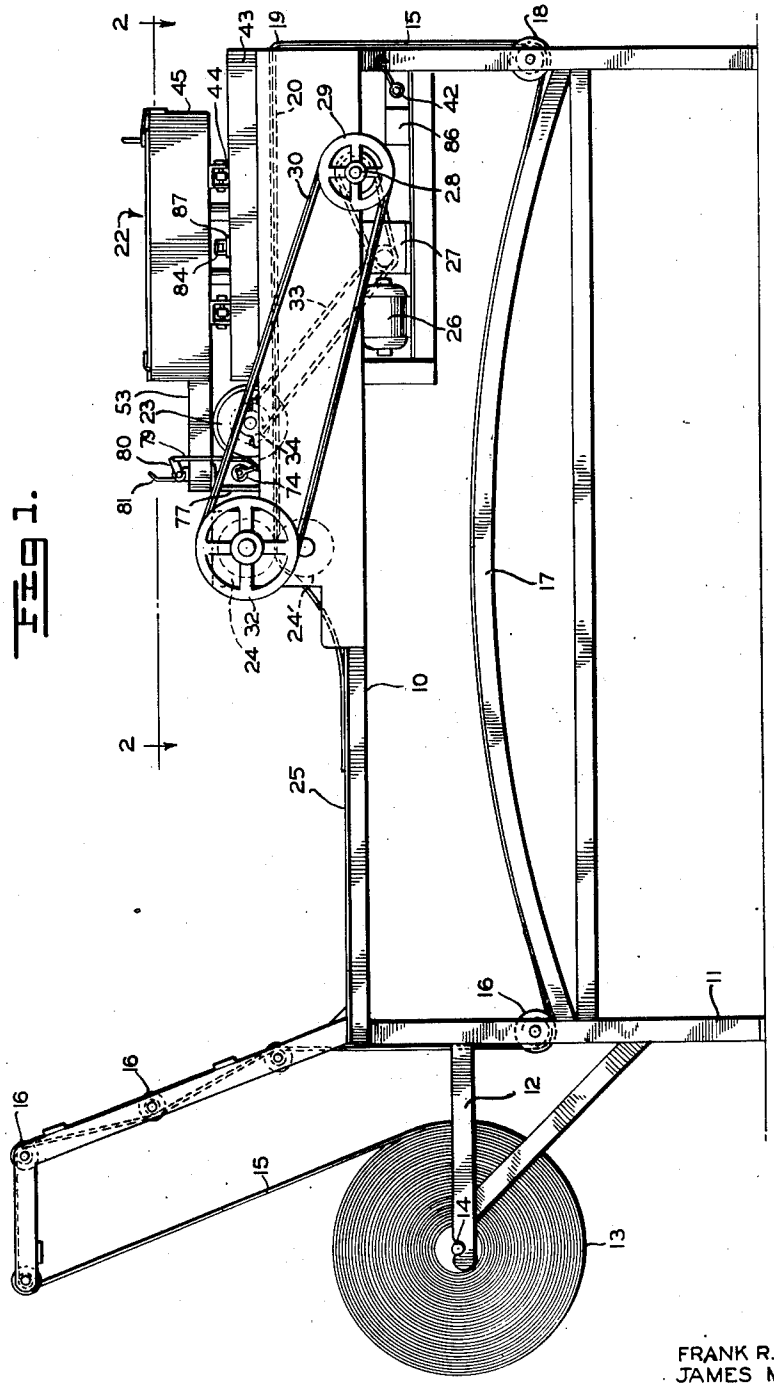


Fig 1.

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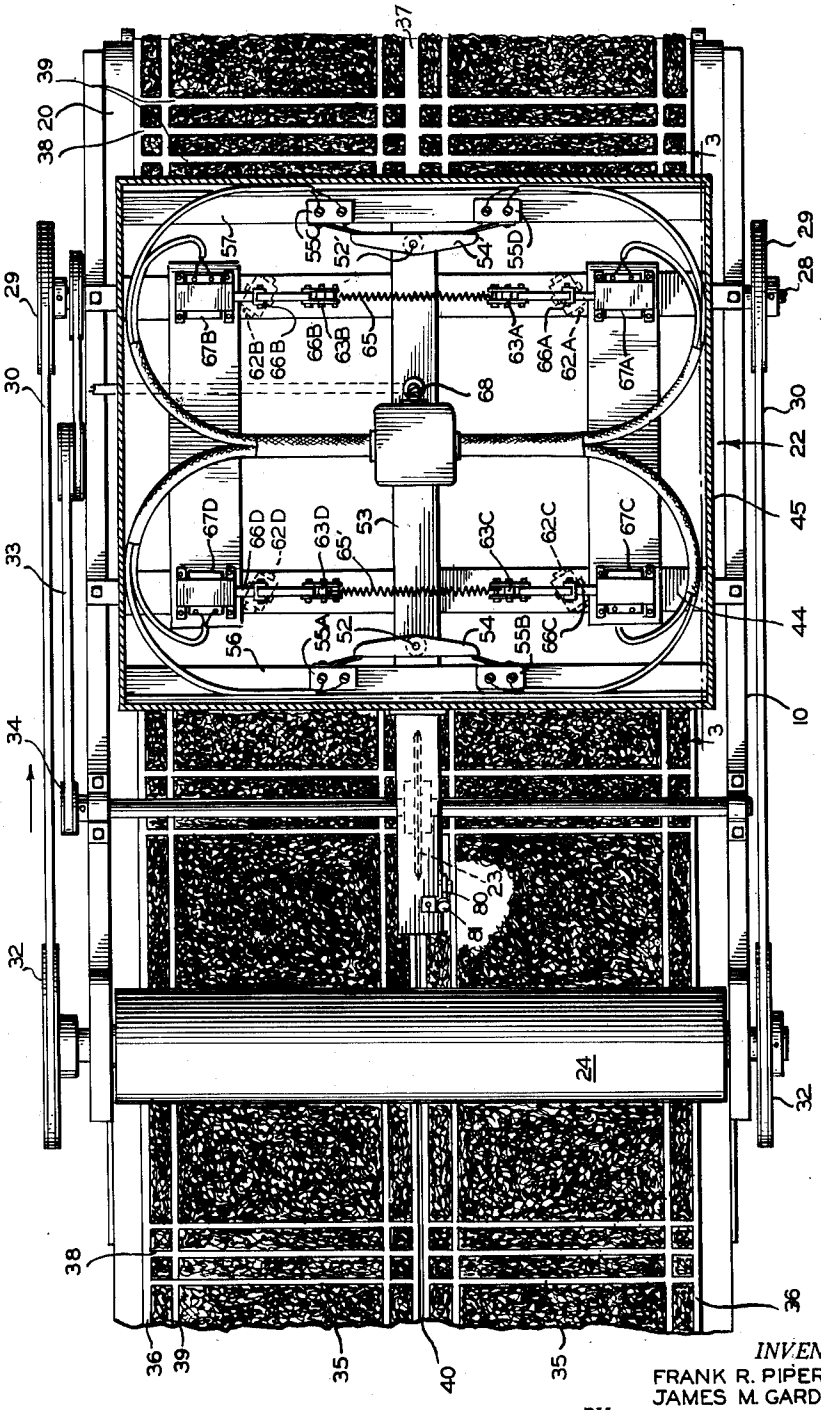
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Fig 2.



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CLOTH SPLITTING MACHINE

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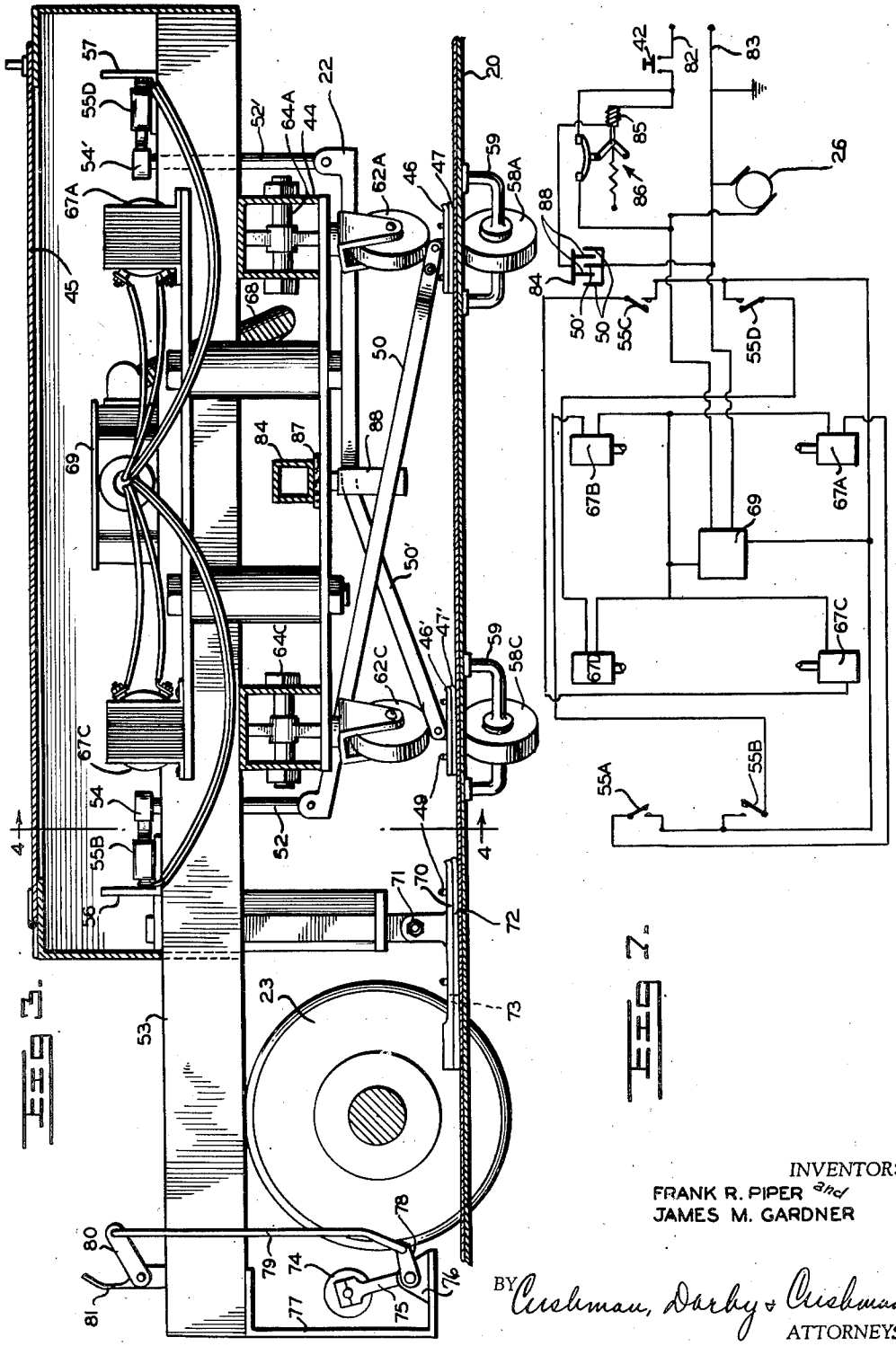


Fig. 1.

Fig. 2.

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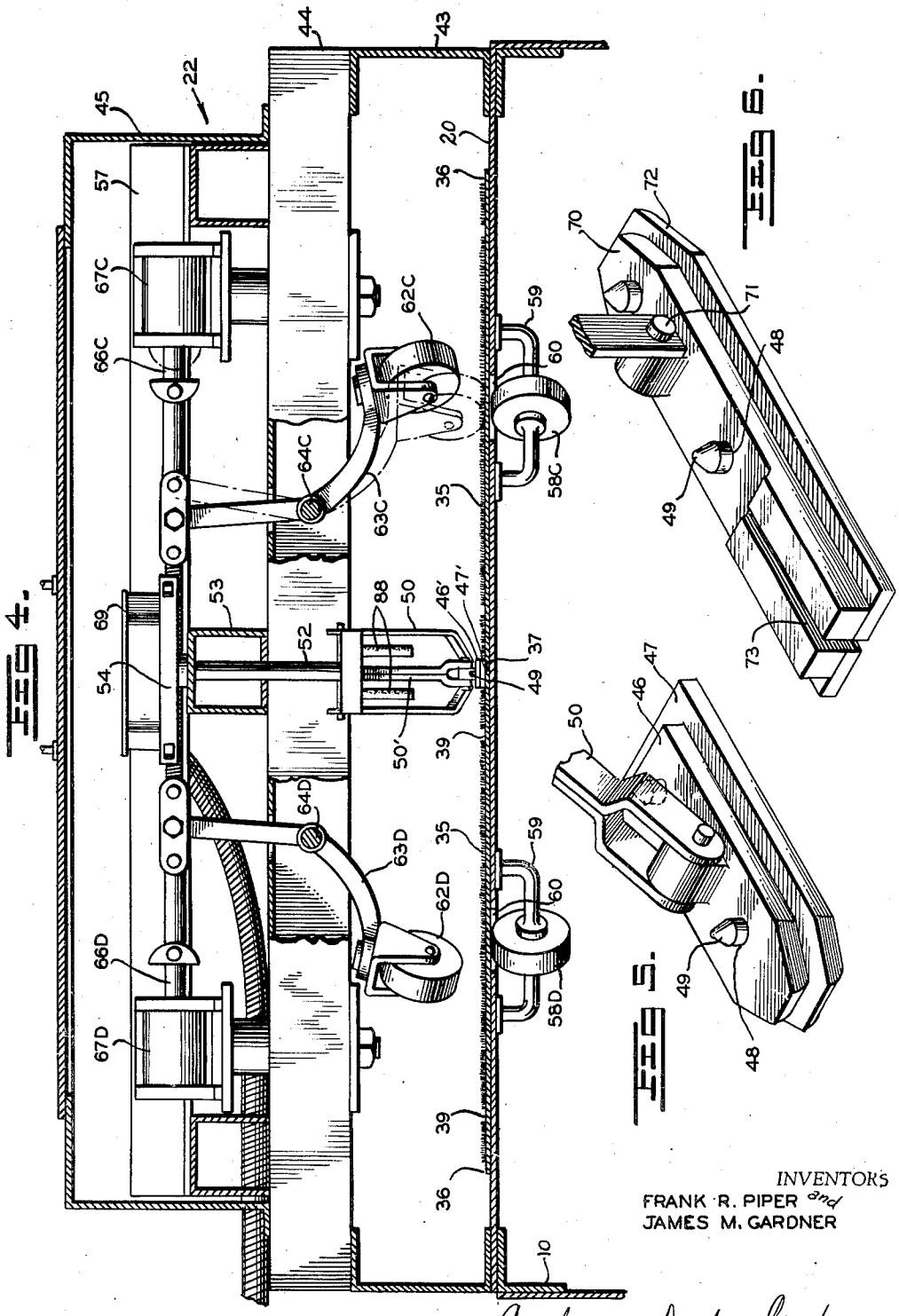


FIG. 4.

FIG. 6.

FIG. 5.

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Patented Aug. 12, 1952 2,606,614

UNITED STATES PATENT OFFICE

2,606,614

CLOTH SPLITTING MACHINE

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Application February 14, 1950, Serial No. 144,114

7 Claims. (Cl. 164—61)

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This invention relates to a cloth splitting machine, particularly to mechanism adapted to split continuously moving cloth lengths with automatically controlled accuracy of alignment. Towels, for example, rarely exceed two feet in width, and for the sake of loom efficiency are commonly woven in double widths. In the case of terry cloth toweling, the cloth is usually woven with the pile loops extending therefrom over substantially the entire towel area, with the exception of smooth border strips. When woven in double widths, the toweling must be split longitudinally centrally of the center double width border strip, and then transversely along the centers of the transverse border strips. It is to perform the former operation in a continuous and automatically controlled manner that the machine of the present invention is particularly adapted.

It is an object of the present invention, therefore, to provide a machine for splitting continuously moving cloth lengths in automatically controlled alignment with a variation in the weave thereof.

It is a further object of the invention to provide a cloth splitting machine comprising means for automatically and instantaneously correcting sidewise deviations of a longitudinally moving cloth length.

A further object of the invention is to provide a cloth splitting machine including a rotary knife, and multiple means spaced forward of the knife to insure proper alignment of cloth lengths continuously moving with respect thereto.

Still another object is to provide a cloth splitting machine capable of accurately maintaining cut alignment with reference to a central longitudinal groove in a cloth length continuously moving with respect thereto.

Further objects will be in part obvious and in part pointed out hereinafter.

The invention and the novel features thereof may best be made clear from the following description and the accompanying drawings, in which:

Figure 1 is a side elevational view of a preferred embodiment of the present invention;

Figure 2 is an enlarged partial plan view, taken on the line 2—2 of Figure 1;

Figure 3 is an enlarged sectional elevational view taken on the line 3—3 of Figure 2, showing details of the cloth guiding mechanism;

Figure 4 is a view taken on the line 4—4 of Figure 3, further showing details of the cloth guiding mechanism;

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Figure 5 is an enlarged perspective view of a groove follower, showing the replaceable shoe employed therewith;

Figure 6 is an enlarged perspective view of the machine knife guide, and

Figure 7 is a simplified diagram of the machine electrical system.

Referring to the drawings, in Figure 1 is shown an exemplary embodiment of the invention, comprising a frame 10 supported by legs 11, and aligned supports 12 extending from an end of the frame and suitably braced thereto. The supports 12 carry between them a stock roll 13 wound on spindle 14, from which an elongated length of cloth 15 extends over guide rollers 16 to a curved stretching table 17. From stretching table 17, the cloth extends about roller 18, and thence upwardly to and over the rounded edge 19 of table member 20. In passage over the table member 20, the cloth passes under the aligning mechanism designated generally as 22 and past the rotary knife 23 to drive rolls 24 and 24', through which the longitudinally split cloth length is discharged to receiving table 25.

Drive roll 24 is driven by a motor 26 suitably mounted on the frame, through reduction gear box 27, power being transmitted therefrom to a shaft 28, and thence through pulleys 29, belts 30 and pulleys 32 to the drive roll. By means of belt 33 and pulley 34, rotary knife 23 may be driven directly from the gear box, desirably at a substantially greater rotational speed than that of the drive rolls. Drive rolls 24 and 24' may be engaged for contra-rotation by suitable gearing, or may be merely frictionally engaged.

In Figure 2 is shown an exemplary cloth length 15, comprising a double width of terry cloth toweling having extensive pile areas 35, edge borders 36, and a central longitudinal border strip 37, desirably of twice the width of borders 36. In the example shown, the cloth length is divided into washcloth sections by the transverse border strips 38, and may also comprise the purely decorative flat strips 39. The cloth length is conducted to rotary knife 23, and severed thereby exactly midway of the central border strip 37, whereby the cut 40 is effected.

In operation, a stock roll 13 of cloth to be split is positioned on supports 12, and the cloth 15 led therefrom through rollers 16 and over stretching table 17, and thence about roller 18 to table member 20, and under the aligning mechanism 22. The cloth may be longitudinally split a short distance in from the end thereof, and the split lengths positioned on either side of knife 23 and

thereafter introduced between drive rolls 24 and 24'. If desired, threading of the cloth through the drive rolls may be facilitated by provision for separating the rolls, or the cloth may be threaded therethrough merely by turning roll 24 manually. In initially threading a cloth length, of course, the cloth is centrally aligned as nearly as possible relative to the various guide rolls and particularly relative to the table member. The machine being now ready for operation, main switch 42 may be thrown to on position, whereby motor 26 is energized and the drive rolls and rotary knife are driven thereby. It will be apparent that the drive rolls function to draw the cloth through the machine, the cloth being longitudinally split by the rotary knife after passage through the aligning mechanism and immediately prior to passage through the drive rolls. The cloth, being moved by drive rolls at the discharge end of the machine, will be tensioned by the friction of table member 20 and stretching table 27, as well as by the friction of the various guide rollers and spindle 14. Additionally, if required, a friction brake may be applied to spindle 14 and adjusted to give the desired tension in the cloth.

As the operation proceeds, cloth coming onto table member 20 will not always maintain the desired alignment relative to the rotary knife, but due to irregularities in the stock roll and other factors may tend to weave from side to side. If these lateral deviations were permitted to persist to the position of the knife, the cut 40 effected thereby would obviously be irregular, and considerable spoiled goods would result. The lateral weaving of the cloth length is corrected and compensated for, and the moving cloth automatically and exactly aligned with the knife immediately prior to its approach thereto by aligning mechanism 22, which constitutes an outstanding feature of the present invention.

The aligning mechanism is partially enclosed by a lower casing 43, upon which rest transverse channels 44, supporting an upper casing 45. The operative elements of the aligning mechanism are a longitudinally spaced pair of follower members 46 and 46', each of which is provided with a readily replaceable shoe 47 adapted to ride the central border strip 37 of the cloth. As best seen in Figure 5, the followers are provided with apertures 48 and the shoes with correspondingly spaced studs 49, whereby the shoes are removably engaged to the followers, the engagement being maintained by the weight of the followers. In order to adapt the machine to accurately split cloth lengths having central border strips of different widths, follower shoes of corresponding widths must be employed, and may be substituted as required merely by lifting the followers and placing shoes of proper width thereunder, the followers, on being dropped, engaging studs 49 of the shoes and thereby effectively retaining them.

Followers 46 and 46' are restrained from longitudinal movement relative to the table member by the arms 50 and 50' respectively secured thereto. In the exemplary embodiment, arms 50 and 50' extend from their respective followers in opposite directions, an expedient adopted merely to make the aligning mechanism more compact. To facilitate this arrangement, as is evident in Figure 4, arm 50 is bifurcate and encloses arm 50' with adequate clearance so that the arms may function individually without interference.

The other ends of arms 50 and 50' are secured, respectively, to pivot shafts 52 and 52', these pivots being rotatably supported in longitudinal beam 53 extending through upper casing 45 and rearwardly therefrom. Above beam 53, rocker arms 54 and 54' are fixedly secured to pivots 52 and 52'. As may be best seen in Figure 2, rocker arm 54 is disposed to alternatively engage and displace the leaf blades of microswitches 55A and 55B, suitably supported on an angle 56, and rocker arm 54' is similarly disposed to engage and close microswitches 55C and 55D, correspondingly mounted on angle 57. It will be understood that the rocker arms are so disposed relative to the microswitches that when the respective arms 50 and followers 46 engaged thereto are exactly centered transversely of the machine, none of the switches is closed by the rocker arms.

Laterally spaced from each follower, on each side thereof and preferably in longitudinal alignment therewith is disposed a roller pair, one roller of each pair being positioned above table member 20 and the other below. The rollers of each pair are normally maintained in inoperative spaced relationship relative to each other, but are adapted to be brought into operative adjacency, whereby the moving cloth length will be frictionally engaged therebetween. The axes of each roller pair are disposed at an acute angle to the direction of travel of the cloth, the roller pairs being positioned in outwardly directed relationship relative to the cloth path, as shown in dotted lines in Figure 2. By reason of the angular disposition of the roller pairs, frictional engagement of the moving cloth length thereby will in each case effect lateral deviation of the cloth length outwardly relative to the roller pair. As best shown in Figure 4, the lower roller designated as 58A—D in the drawing of each pair may be rotatably mounted on the underside of table member 20, as by the fixed brackets 59, and disposed in substantial tangency to the plane of the upper surface of the table member, the lower rollers extending into cut-away portions 60 of the table member provided therefor.

The upper, or movable, roller designated as 62A—D in the drawing of each pair is suitably affixed to the end of a crank designated as 63A—D in the drawing, each crank being pivotally mounted on a pin designated as 64A—D in the drawing supported and retained in one of the channels 44. As shown in Figures 2 and 4, the upper ends of cranks 63A and 63B are aligned and urged together by a spring 65, and are also suitably connected, respectively, to the plungers 66A and 66B, operatively associated with solenoids 67A and 67B. Similarly, the upper ends of cranks 63C and 63D are urged together by spring 65', and are also connected, respectively, to plunger 66C of solenoid 67C and plunger 66D of solenoid 67D. While the structure of the preferred embodiment is most simple, it will be evident that both rollers of each pair may be movable, if desired.

When the individual solenoids are not energized, the parts occupy the position shown in solid lines in Figure 4, the roller pairs being disposed in inoperative spaced position. As each solenoid is energized, the associated plunger is displaced inwardly relative thereto, displacing thereby the upper end of the connected crank against the action of the spring 65, whereby the crank is pivoted about its pin 64 and displaces the upper roller carried thereby into adjacency with the lower roller of the same pair. The position of plunger 66C, crank 63C and upper roller 62C effected by energization of solenoid 67C is indicated in dotted lines in Figure 4.

Power for operation of the solenoids is introduced into the aligning mechanism casing by means of conduit 68 leading to the junction box 69, from which suitable conductors lead to the switches and solenoids, as indicated in Figure 7.

The functioning of the aligning mechanism will now be described in detail. Referring first to the forward follower 46, the follower is provided with a shoe substantially the same width as that of the central border strip 37 of the cloth to be split. The cloth length being properly threaded through the machine, as previously described, the follower and shoe are positioned in the groove formed by the central border strip between the piled areas on both sides thereof, and the machine started. By reason of its smooth form and the lack of lateral restraint, the shoe and follower will ride the groove in the moving cloth length, being retained therein by their weight and to a partial extent by the weight of the associated arm 50.

Obviously, any sidewise deviation of the moving cloth length 37 will effect corresponding lateral deviation of the follower. Through arm 50, lateral movement of the follower causes rotation of pivot 52 and corresponding rotation of the rocker arm 54. If the follower is displaced to the right (looking in the direction of movement of the cloth), rocker arm 54 will be rotated counterclockwise as viewed in Figure 2, and will thereupon close microswitch 55A. Closing of this microswitch, as will be evident from the electrical diagram of Figure 7, is effective to energize solenoid 67A, whereby plunger 66A is displaced and the crank 63A secured thereto is rotated about pin 64A. The upper roller 62A is thereby displaced into operative adjacency with lower roller 58A, the roller pair thereupon engaging the moving cloth to the left of follower 46 and effecting a corrective sidewise movement of the cloth to the left. As the central border strip of the cloth is returned to proper alignment by the roller pair 58A—62A, the follower 46 is returned thereby to centrally aligned position and microswitch 55A is permitted to open, de-energizing solenoid 67A, whereupon the spring 65 returns crank 63A and upper roller 62A to inoperative position. Similarly, a deviation of the cloth to the left, looking in the direction of its movement, causes rocker arm 54 to close microswitch 55B, energizing solenoid 67B and causing the roller pair 58B—62B to the right of the follower to engage the cloth and displace it to the right until the cloth length has been returned to proper alignment, whereupon switch 55B opens and the upper roller 62B returns to inoperative position. It will be evident that the mechanism is effective to properly and automatically maintain cut alignment with reference to the central border strip of the cloth, irrespective of variations in the total width of the cloth length and the like, and the cut 40 is at all times straight and true.

This much of the mechanism, comprising a single follower and a roller pair on either side thereof, is effective in many cases to satisfactorily maintain proper alignment of the moving cloth length. It has been found, however, that even better alignment control of the moving cloth strip, especially at high speeds, is effected by duplicating the mechanism at a point longitudinally spaced therefrom. In the embodiment shown, this is accomplished by follower 46', which is effective in the manner described above to operate alternatively microswitches 55C and 55D, which are in turn effective, respectively, to energize solenoids 67C and 67D, controlling in this manner the roller pairs 58C—62C and 58D—62D. Accordingly, lateral deviations of the moving cloth length are corrected at two longitudinally spaced points immediately preceding the rotary knife, whereby an especially effective control of alignment is attained under all conditions of operation.

Supported below longitudinal beam 53, at the rear end of upper casing 45, is a knife guide 70, provided, as in the case of followers 46 and 46', with a replaceable guide shoe 72. The knife guide is fixedly mounted relative to table member 20, and its shoe 72 is effective to ride the groove formed by central border strip 37 and prevent lateral deviation thereof between the aligning mechanism and the knife. The guide shoe 72 may be replaced when required as in the case of shoes 47 and 47', by removing the bolt 71 and raising the knife guide to disengage the studs 49 of the shoe. As shown in Figures 3 and 6, the rear portion of the knife guide is provided with a slot 73 adapted to partially enclose the knife, whereby the guide extends on both sides of the leading edge of the knife and serves to flatten and hold the cloth length as it is being severed.

At its rear end longitudinal beam 53 desirably supports also a sharpener mechanism. As best seen in Figure 3, this mechanism comprises a rotary sharpener 74 mounted in the end of a swinging arm 75, pivotally supported between lugs 76 extending from the bracket 77 suspended below the beam. The swinging arm may be rotated into and out of engagement with the rotary knife by means of a linkage comprising link 78, rod 79, and link 80, the link 80 being operatively engaged to an operating handle 81 conveniently mounted above beam 53. It will be understood that the rotary knife 23 may be sharpened while the machine is in operation, merely by displacing handle 81 in the clockwise direction as shown in Figure 3, whereby the arm 75 will swing sharpener 74 into sharpening engagement with the knife. The need for sharpening may be determined from the condition of the cut 40 produced, and when required the knife may be sharpened without interrupting the splitting operation.

As the longitudinally split lengths are discharged from drive rolls 24 and 24', they are received on receiving table 25, whereat they may be transversely severed into unit lengths by manually operated means, or may be collected and removed for further operations. When a stock roll becomes exhausted and the cloth length is longitudinally split throughout its length, the machine may be turned off by means of main switch 42, the spindle 14 removed, and replaced by a spindle bearing another stock roll, which may be threaded through the machine in the manner previously described, and similarly operated upon. As previously indicated, if the new stock roll comprises a central border strip of width differing from that of the roll previously worked upon, the shoes 47 and 47' and the guide shoe 72 may be replaced by similar shoes corresponding to the width of the new stock roll central border strip.

A simplified circuit diagram of the electrical system of the machine is shown in Figure 7, wherein it will be seen that power is conducted from a suitable source by means of hot wire 82 through main switch 42 to motor 26 and junction box 69. From the junction box, as shown, individual circuits lead through switches 55A, B, C, and D to solenoids 67A, B, C, and D, respectively, and thence to the grounded return wire 83. It

will be recognized that the switches may be of any suitable type, although microswitches have been found to be especially desirable, affording particularly sensitive control.

The machine desirably also comprises a circuit breaker operative to stop the machine in the event of excessive lateral movement of the cloth length entering upon table member 20, of a magnitude greater than the aligning mechanism 22 is capable of correcting, to preclude spoilage of goods in such event. To attain this end, in the exemplary embodiment a transverse bar 84 is provided in the aligning mechanism, suitably connected to hot wire 82 through the solenoid 85 of a circuit breaker indicated generally as 86, the bar 84 being insulated from the machine, as by the insulating blocks 87, see Figure 3. Spaced stop members 88 extend downwardly from bar 84, the stop members being disposed on either side of follower arm 50' and inside the bifurcate portions of follower arm 50, as clearly shown in Figures 3 and 4. The machine being grounded, it will be evident that in the event either follower 46 or 46' is caused to deviate laterally more than a predetermined maximum in accordance with sidewise movement of the cloth length, one of the stop members 88 will be contacted by the corresponding follower arm, thereby completing a circuit through the circuit breaker and breaking the power circuit to motor 26 and junction box 69. It will be apparent that the circuit breaker 86 may be of any conventional type, either electromagnetic, as shown, electronic, or otherwise.

It will thus be seen that there has been provided by this invention a structure in which the various objects hereinbefore set forth, together with many practical advantages, are successfully achieved. As various possible embodiments may be made of the mechanical features of the above invention, all without departing from the scope thereof, it is to be understood that all matter hereinbefore set forth or shown in the accompanying drawings is to be interpreted as illustrative, and not in a limiting sense.

We claim:

1. In a machine of the class described, a table member, means for continuously moving an elongated cloth length over said table member, longitudinally spaced followers disposed above said table member and adapted to ride a groove in said cloth length, a roller pair disposed on each side of each of said followers with axes at an acute angle to the direction of travel of said cloth length, the rollers of each pair being normally spaced but adapted to be moved into operative engagement with the cloth length passing therebetween, and means responsive to lateral deviation of each of said followers in each direction to actuate the opposite roller pair and thereby laterally displace the moving cloth length in compensation of such deviation, including a knife guide disposed above said table member and adapted to ride a groove in said cloth length, said guide being spaced from said followers in the direction of movement of said cloth length, and a splitting knife associated with said guide.

2. In a machine of the class described, a table member, means for continuously moving an elongated cloth length over said table member, an arm longitudinally disposed above said table member, one end of said arm being pivoted and the other bearing a follower adapted to ride a groove in said cloth length, a roller pair disposed on each side of said follower with axes at an acute angle to the direction of travel of said cloth length, the rollers of each pair being normally spaced but adapted to be moved into operative engagement with the cloth length passing therebetween, and electrical means responsive to lateral pivotal movement of said arm in each direction to actuate the opposite roller pair and thereby laterally displace the moving cloth length in compensation of such movement.

3. In a machine of the class described, a table member, means for continuously moving an elongated cloth length over said table member, an arm longitudinally disposed above said table member, one end of said arm being pivoted and the other end bearing a follower adapted to ride a groove in said cloth length, a roller pair disposed on each side of said follower with axes at an acute angle to the direction of travel of said cloth length, the rollers of each pair being normally spaced, a solenoid associated with each roller pair and operative to move the associated pair into frictional engagement with the cloth passing therebetween, and switch means responsive to lateral pivotal movement of said arm in each direction to actuate the opposite solenoid and thereby laterally displace the moving cloth length in compensation of such movement.

4. In a machine of the class described, a table member, means for continuously moving an elongated cloth length over said table member, a plurality of arms longitudinally disposed above said table member, one end of each arm being pivoted and the other bearing a follower adapted to ride a groove in said cloth length, said followers being longitudinally spaced relative to each other, a roller pair disposed on each side of each of said followers with axes at an acute angle to the direction of travel of said cloth length, the rollers of each pair being normally spaced but adapted to be moved into operative engagement with the cloth length passing therebetween, and electrical means responsive to lateral pivotal movement of each of said arms in each direction to actuate the opposite roller pair and thereby laterally displace the moving cloth length in compensation of such movement.

5. A machine as defined in claim 4, including a knife guide disposed above said table member and adapted to ride a groove in said cloth length, said guide being spaced from said followers in the direction of movement of the cloth length, and a rotary splitting knife associated with said guide and disposed to sever the cloth length centrally of the groove in which said guide rides.

6. A machine as defined in claim 5, wherein said knife guide and said followers comprise replaceable shoes, whereby said guide and followers may be readily altered to ride grooves of various widths.

7. In a machine of the class described, a table member, means for continuously moving an elongated cloth length over said table member, a follower disposed above said table member and adapted to ride a groove in said cloth length, a roller pair disposed on each side of said follower with axes at an acute angle to the direction of travel of said cloth length, the rollers of each pair being normally spaced but adapted to be moved into operative engagement with the cloth length passing therebetween, means responsive to lateral deviation of said follower in each direction to actuate the opposite roller pair and thereby laterally displace the moving cloth length in compensation of such deviation, and means responsive to excessive lateral deviation of said fol-

lower in each direction to deactivate said cloth length moving means.

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