Nov. 26, 1940. S. COHN ET AL 2,222,794

APPARATUS FOR TENSIONING TUBULAR FABRIC

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Fig. 1.

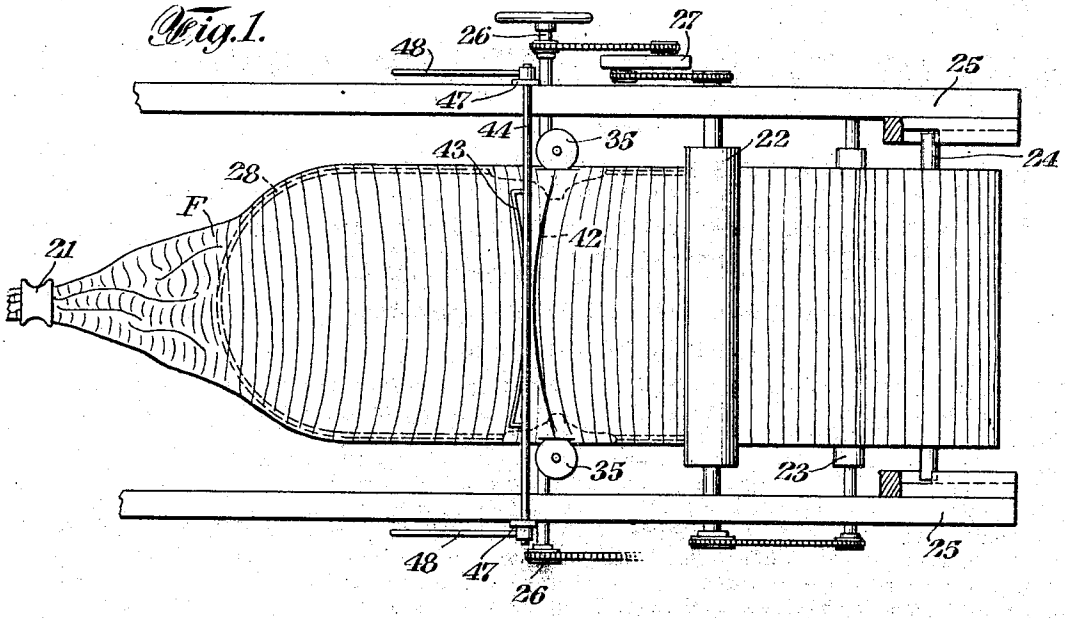
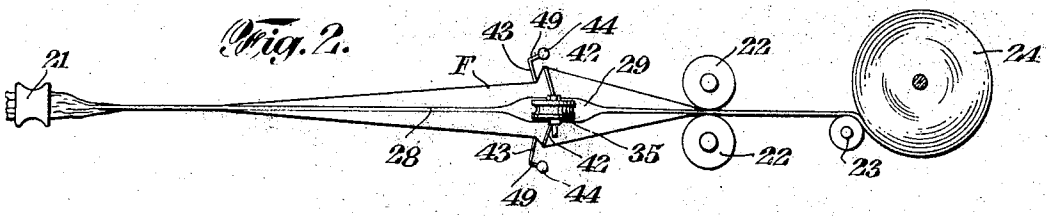



Fig. 2.



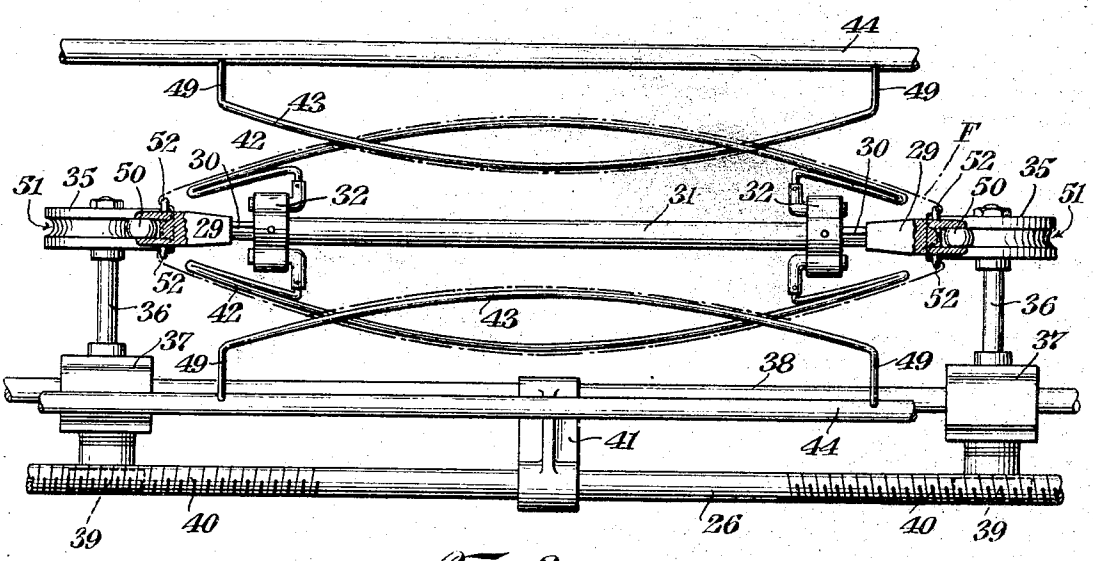




Fig. 3

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Fig. 4.

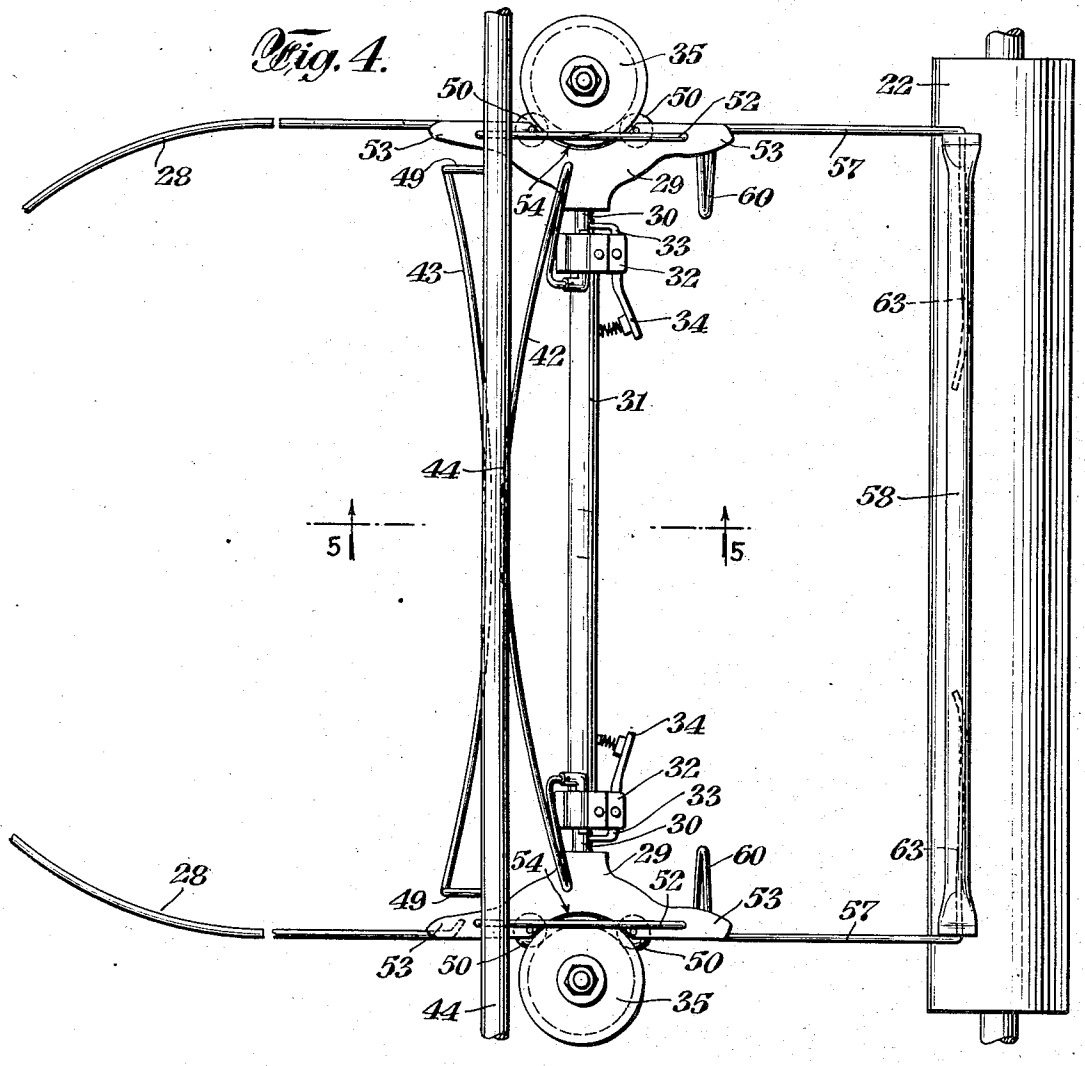
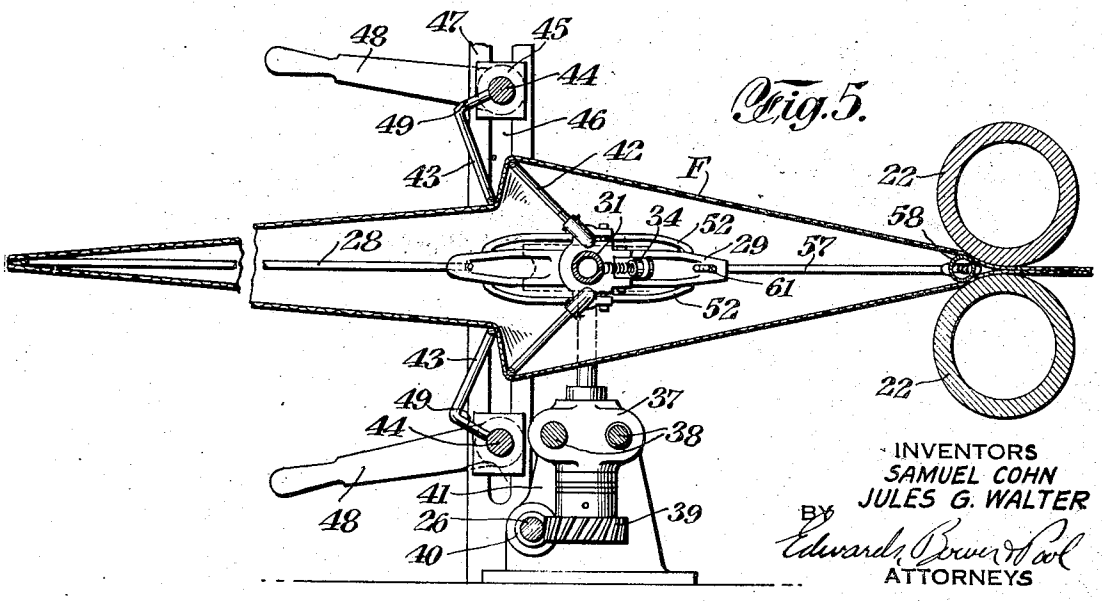



Fig. 5.




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Fig. 6.

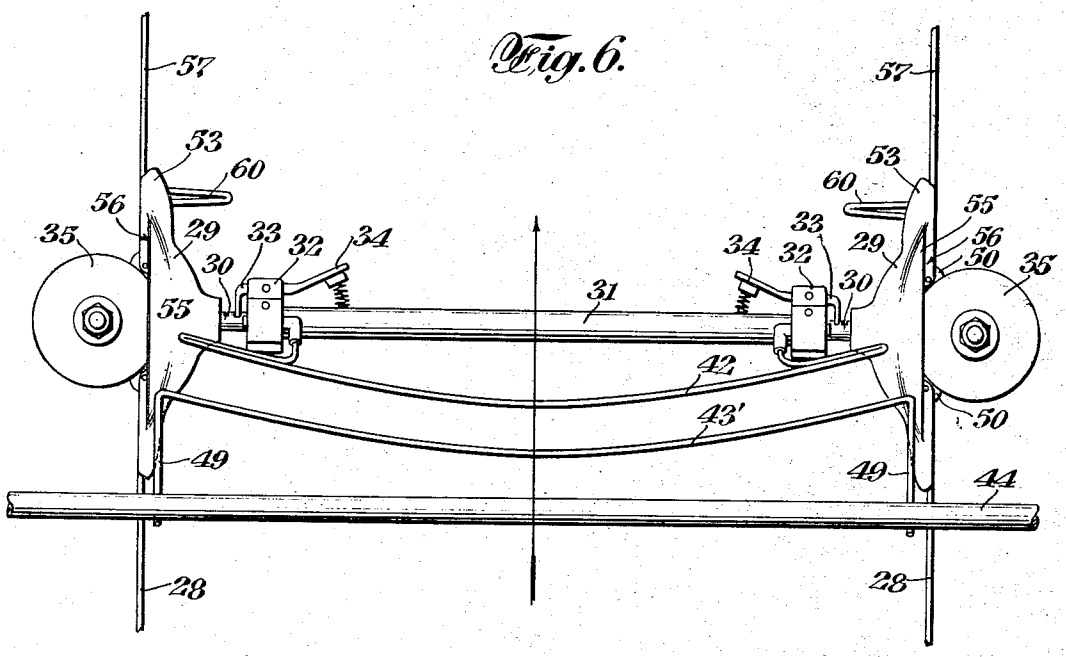



Fig. 7.

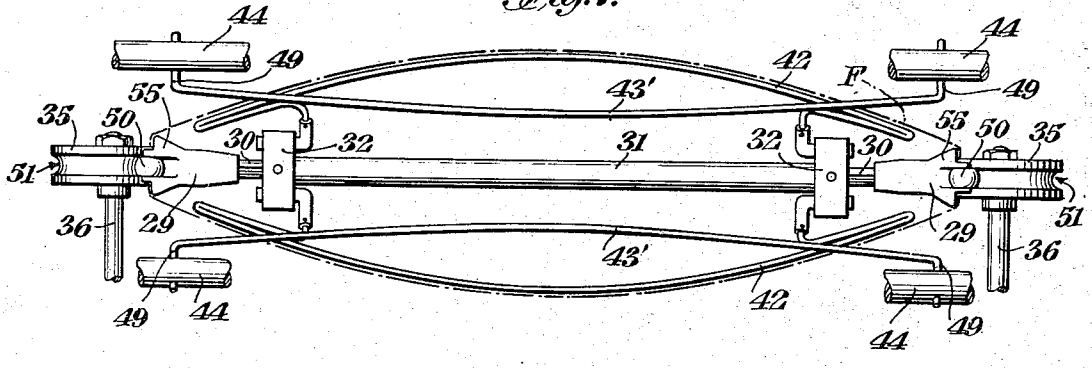
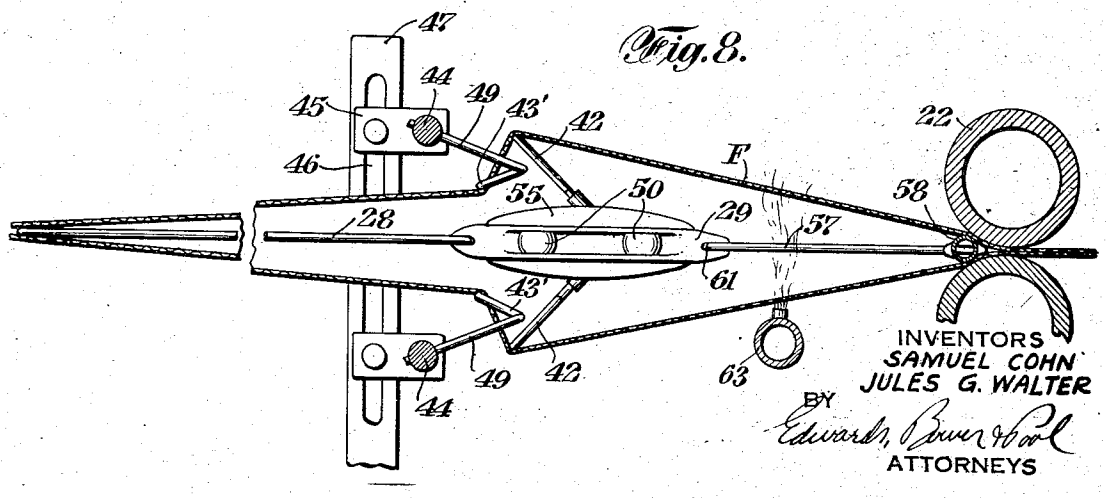



Fig. 8.




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Fig. 9.

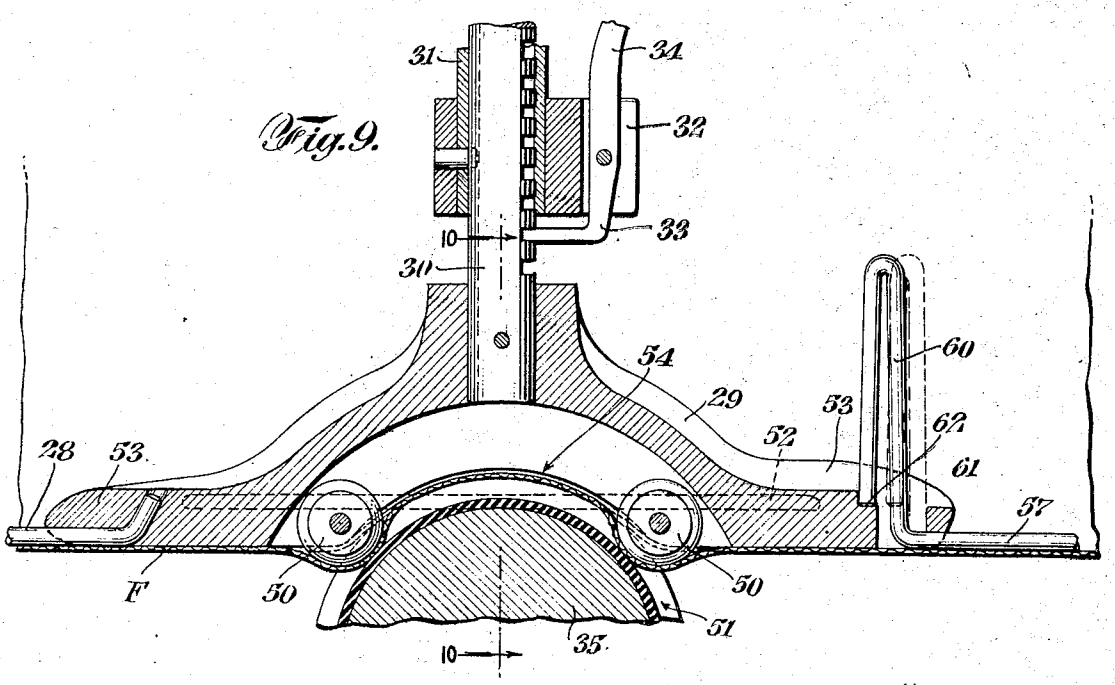
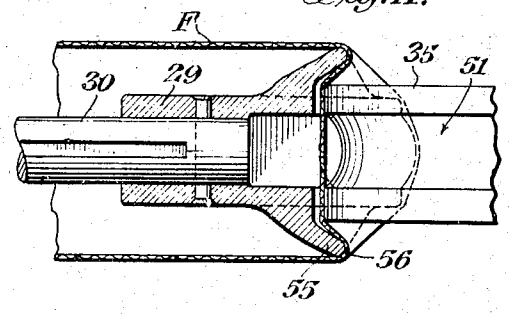



Fig. 11.



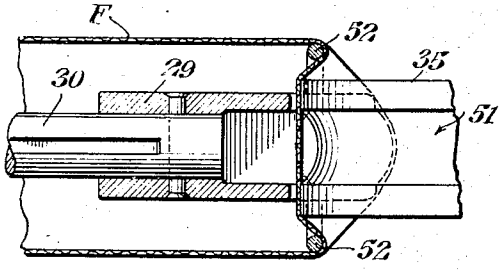




Fig. 10.

Fig. 12.

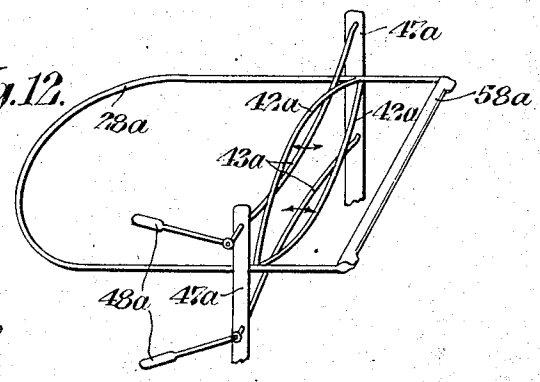
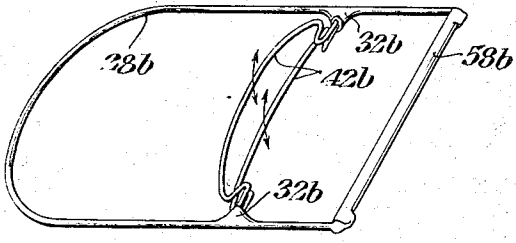



Fig. 13.




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Patented Nov. 26, 1940 2,222,794

# UNITED STATES PATENT OFFICE

2,222,794

## APPARATUS FOR TENSIONING TUBULAR FABRIC

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Application October 11, 1937, Serial No. 168,364

20 Claims. (Cl. 26—55)

This invention relates to an apparatus and a method for flattening traveling tubular fabric and particularly for establishing and maintaining the fabric in transverse alignment. It is applicable to systems employing an internal spreader engaging the fabric tube at opposite sides under conditions in which there is a tendency to shift fabric longitudinally in the zones of engagement relative to the intermediate central portion of the fabric producing misalignment of the courses, stripes, pattern elements and the like. This condition is particularly serious in knitted fabric tubes, especially the larger sizes, due to the ease with which fabric of this type is distorted especially when manipulated in moist condition, and the present system is particularly useful in manipulating fabric subjected to steaming.

The invention is applicable to a system for producing the desired transverse alignment by imposing an appropriate tension on the central portion of the flattened tube, and correlating such tension in novel manner with the marginal retardation of the fabric to bring the appropriate fabric elements into accurate alignment at a selected point, such as the nip of the finishing rollers.

The purpose of the invention is to provide a system adapted for efficient operation under widely varying conditions. It is arranged for ready variation of the tension in a selected zone or zones without interrupting the travel of the fabric tube. It may be constructed and operated to apply graduated tension from the center of the flattened tube toward the margins, and may be arranged to vary the rate of such graduation and the width of the tension zone. It may likewise be arranged to apply comparatively uniform tension across a predetermined central zone and to vary such tension while maintaining comparative uniformity thereof throughout the zone of engagement.

A purpose of the invention is to provide a simple and practical construction capable of convenient mounting and operation on machines of known type.

The invention is especially adapted to tube flattening arrangements employing marginal propulsion means for the fabric. In this arrangement the central tensioning means is advantageously located in approximate transverse alignment with such propulsion means and cooperates therewith to establish an accurate control of the rate of travel of all portions of the fabric throughout a single transverse zone, avoiding the tendency of the fabric to become distorted in the gaps between longitudinally spaced central and marginal fabric engaging structures.

A feature of the invention is the provision of improved means on the internal spreader for engaging external margin propulsion rollers or the like, such means being constructed and arranged to hold the fabric against the periphery of such rollers throughout the engagement zone rather than at the points of direct pressure between the rollers and the corresponding portions of the spreader. This arrangement distributes the engagement between the fabric and the rollers over a relatively large area, reducing the tendency to mark or otherwise distort the fabric and increasing the propulsive effect of the rollers.

Another feature of the invention comprises an improved construction of the nip bar at the end of the spreader normally located adjacent the nip of the rolls.

Other objects and advantages of the invention will appear from the following description considered in connection with the accompanying drawings in which:

Fig. 1 is a plan view of apparatus embodying the invention showing the tubular fabric in process;

Fig. 2 is a diagrammatic side elevation of the fabric manipulating structure of Fig. 1;

Fig. 3 is an enlarged fragmentary view of the central tensioning arrangement;

Fig. 4 is a plan view thereof;

Fig. 5 is a vertical longitudinal section on line 5—5 of Fig. 4;

Fig. 6 is a fragmentary plan view of a modified form of tensioning apparatus;

Fig. 7 is an endwise elevation of such modification;

Fig. 8 is a side elevation thereof with parts broken away;

Fig. 9 is a detail plan view of a propelling device with the parts shown in central horizontal section;

Fig. 10 is a fragmentary vertical section on line 10—10 of Fig. 9;

Fig. 11 is a similar section showing a modified form;

Fig. 12 is a perspective view of a simplified spreader and central tensioning construction; and

Fig. 13 is a perspective view of a simplified spreader carrying an adjustable central tensioning arrangement.

Referring particularly to Figs. 1–5, the invention is applied to a conventional type of apparatus in which the tubular fabric F is fed through

a pot eye 21 over the spreading device and thence between finishing rollers 22 and over wind-up roller 23 to a suitable winding spindle 24. These parts are mounted on a frame 25, and are driven from shaft 26 connected through a variable speed mechanism 27 with the finishing rollers 22 which in turn drive roller 23. This general arrangement is well known.

The spreader comprises an initial spreading bow 28 mounted at its ends on propeller heads 29 arranged to form a smooth continuation of the ends of bow 28. Propeller heads 29 are interconnected in suitable manner to maintain a predetermined spacing corresponding to the desired width of the flattened fabric; and means preferably is provided for adjusting such spacing, operable without removing the fabric. A suitable arrangement is illustrated, and comprises notched rods 30 mounted in heads 29 and fitting within a connecting sleeve 31 provided at its ends with frames 32 carrying latches 33 engaging the notches in rods 30 and provided with spring-pressed finger pieces 34 operable by pressure through the fabric to release the latches 33 and permit a change in the spacing of propeller heads 29.

The propeller heads 29 are arranged to maintain the fabric F in engagement with the propeller rolls 35 and for the support of the spreader structure by means of rolls 35 during operation. Said rolls may be mounted on vertical shafts 36 journaled in carriages 37 slidably mounted on rods 38. The lower ends of shafts 36 carry worm gears 39 engaging worms 40 on drive shaft 26 held in alignment with rods 38 by bracket 41. Said carriages may be transversely adjusted to vary the spacing of propeller rolls 35 in accordance with various spaced positions of propeller heads 29, a suitable arrangement comprising a threaded engagement with a rod 38, the threads for the two carriages 37 being in opposite directions, so that suitable rotation of said threaded rod will adjust the propeller rolls without disturbing the drive thereof.

An arrangement is provided for applying tension to the fabric intermediate the propeller rolls 35. This includes upper and lower internal transverse spreader bows 42 adjustably mounted on the spreader structure, as by pivoting the ends of the bows in frames 32 by a clamping engagement permitting adjustment about a horizontal axis. Bows 42 preferably have a convex curvature toward the plies of the fabric following a smooth curve between the lines of marginal engagement with the spreader, as shown in Fig. 3. The zone of fabric engagement by bows 42 preferably terminates adjacent to but substantially spaced from the area of such marginal engagement for purposes hereinafter set forth. Bows 42 preferably have likewise a curvature in a horizontal plane to present a convex surface in the direction from which the cloth is fed. In referring to the curvatures of the various fabric engaging bows herein, reference to inward or outward curvature indicates convexity toward or from the plane of flattening of the tube; forward curvature indicates convexity toward the direction from which the cloth is fed and rearward convexity indicates curvature in the opposite direction.

Bows 42 as shown in Figs. 1–5 therefore are curved in both outward and forward directions, with their end portions inwardly deflected away from the cloth into position for engagement with clamps 32. Outer bows 43 are provided in position to engage the fabric adjacent bows 42, and are arranged for adjustment to vary their curvature relative to the fabric and their position relative to bows 42, thereby varying the central tension on the fabric. In the convenient arrangement illustrated, bows 43 are mounted on adjusting rods 44 frictionally pivoted in slide blocks 45 adjustably clamped in vertical slots 46 in tension frame members 47 mounted at opposite sides of the apparatus on frame 25. Handles 48 are provided on the outer ends of rods 47 for adjusting the positions of bows 43.

A suitable location and conformation of bows 43 is important to obtain various types and degrees of tension adjustment. In the form illustrated the bows 43 are convex on their fabric-engaging faces and are connected to rods 44 by relatively straight legs 49 preferably arranged substantially at right angles to rods 44 and the contiguous curved portion of bows 43, as shown in Figures 3 and 5. Bows 43 preferably have likewise a rearward convexity as shown in Fig. 5, and in operative position may be arranged so that they may move beneath as well as above bows 42 when appropriately arranged as illustrated.

Various modifications in the contour and arrangement of the fabric-engaging bows may be made within the scope of the invention. One modification is illustrated in Figs. 6–8, and relates primarily to the arrangement and contour of the outer bows 43'. In this form the curvature of bows 43' is generally similar to that of the contiguous bows 42.

An improved construction for the spreader heads 29 is also provided, and illustrated more particularly in Figs. 9–11. Each propeller head 29 is provided with convex rollers 50 extending into a corresponding groove 51 in the propeller roll 35, and heretofore serving to hold the fabric F against such roll by direct pressure. This arrangement provided a gripping effect on the fabric more or less localized at the points of engagement between rollers 50 and roll 35.

In the present embodiment applicants have provided means for maintaining the fabric in engagement with the periphery of roll 35 between rollers 50. In the form illustrated in Figs. 9 and 10 this is accomplished by means of bridge rods 52 mounted at their ends on wings 53 of head 29, and spanning a portion of the arcuate recess 54 in the outer face of head 29, recess 54 following the general contour of roll 35. Bridge rods 52 overlie said recess at an appropriate distance above the upper and lower faces of the head 29 to hold the fabric F outwardly against the periphery of roll 35 between rollers 50 as shown. A modification is illustrated in Fig. 11, in which bridge flanges 55 integral with head 29 are provided with outer cloth engaging faces 56 which extend across the bight of recess 54 and function in the same manner as bridge rods 52.

With this arrangement the fabric is pressed strongly against the periphery of each propeller roll 35 above and below groove 51 by the tension at right angles to the plane of the roll produced by bridge rods 52 and the action of rollers 50 in forcing the fabric into the groove 51 at substantially spaced points, thereby exerting a tensioning effect in the plane of rotation of the roll 35. This construction likewise increases the propelling effect of each roll 35 since the driving engagement is primarily with the periphery of the roll at the sides of groove 51, which is greater than the periphery of the central part of the groove against which the fabric is pressed by the rollers 50, and which in the absence of such ten-

sioning effect would determine the propulsion exerted by the roll 35. There is likewise a certain differential in the propulsion at the center of groove 51 and at the margins thereof which is advantageous under certain conditions, and may assist in assuring proper fabric tension and driving engagement.

A suitable arrangement is provided for maintaining the flattened tube at the desired width between heads 29 and the rolls 22. For this purpose spreader rods 57 are employed, mounted at one end on heads 29 and connected at the other end to nip bar 58 positioned in the nip of rollers 22. An arrangement is disclosed which facilitates the maintenance of the desired full width of the material until it is taken up by the rollers 22. The arrangement likewise avoids the necessity for employing a nip bar 58 for every width adjustment of the spreader. In this construction each spreader rod 57 may be detachably mounted on a wing 53 of a head 29, as by providing a return bend latch portion 60 extending through an opening 61 in wing 53 and having a spring locking engagement with a suitable socket 62 adjacent recess 61. The other end of rod 57 extends into the end of hollow bar 58 and has a curved portion 63 bearing against the bar 58 and pressing it into the nip of rolls 22.

This arrangement permits ready removal of a spreader rod 57 to permit replacement of nip bar 58, as when substituting a bar of different length. This may be accomplished simply by compressing the latch portion 60 to release it from socket 62 and permit the withdrawal of the latch portion in compressed condition through opening 61. This feature avoids the necessity for removing the spreader structure from the machine when making such adjustments.

Figure 12 shows a highly simplified embodiment of the invention in which the spreader bow 28*a* is fixed to the nip bar 58*a* and carries transverse tension bows 42*a* fixed thereto. The outer tensioning bows 43', curved toward the zone of fabric engagement, are pivotally mounted in bars 47*a* on frame 25 and manipulated by handles 48*a*. In this arrangement the spreader floats in the fabric and the central tension is adjusted through the handles 48*a* in obvious manner.

In Figure 13 a similar construction is illustrated except that the inner bows 42*b* are curved at their ends to terminate short of the side bars of spreader 28*b*, and are frictionally pivoted in frame blocks 32*b* on said side bars for adjustment toward and from the fabric.

The fabric may be steamed at an appropriate point or points during its passage over the spreading and tensioning apparatus. One arrangement is diagrammatically indicated in Fig. 8, in which a steam nozzle 63 of known type extends across the apparatus below the fabric F. Obviously the type and location of the steaming device may be varied in accordance with the various conditions encountered in practice.

In the operation of the device, when fabric is passed over the spreader as shown in Fig. 1 the engagement of the spreader bars 28 therewith tends to retard the marginal portions. Propeller rolls 35 are driven at a speed appropriate to correct such deflection and to advance the margins of the fabric ahead of corresponding portions therebetween to an extent sufficient to compensate for the retarding effect of the spreader rods 57, so that the fabric when engaged by the rolls 22 will be in accurate transverse alignment. This fact however is dependent upon the ability to maintain a definite relationship between the margin retardation or acceleration and the rate of travel of the intermediate or central zone of the flattened fabric tube. In knit fabrics particularly, and especially when moist, it is impractical to maintain the necessary transverse tension solely through rods 28 and 57 without excessive strain at the margin portions.

In the arrangement disclosed in Figs. 1–5 the central portion of the fabric travels under bows 43 and over bows 42, thereby imparting a tension which assures uniform travel of this portion of the fabric and therefore permits accurate correlation of the marginal portion therewith by regulating the speed of rolls 35. Owing to the curvature of bows 42 and 43 the tension is greatest at the middle of the fabric where the distance from the margins makes greater tension necessary to assure accurate control, and such tension is progressively reduced by the decreasing extent of overlap of bows 42 and 43 toward the sides of the fabric tube.

The differential between the overlap, and consequently the tension, at the center and at the ends of the overlapping portions can be varied by changing the angular positions of the bows about their axes, thereby changing their effective curvature as viewed from the position of Figure 3. The amount of tension at any particular point may be varied by moving bows 43; and the arrangement illustrated is especially effective since it provides movement of such bows primarily in a horizontal direction, which maintains the relative curvature of the bows and provides a gradual change in the degree of tension. The width of the zone of central tension may be varied by vertical adjustment of slide block 45. The construction is such that the internal bows 42 may be adjusted without removing the cloth, and the external bows 43 may be separately adjusted with the greatest accuracy while the cloth is traveling through the machine.

In some instances, the substantially greater tension at the center may be excessive; and the curvature of the bows may be appropriately varied. In the variation illustrated in Figs. 6–8, the bows 43' are curved so that they follow the curvature of bows 42 sufficiently to provide similar tension throughout the zone of action of such bows. Moreover, because of the carefully designed angular mounting of the bows on rods 44 and legs 49, the deviation in curvature between bows 42 and 43' may be adjusted to give the desired amount of difference in tension between the center of the bows and their effective end portions.

While the outer bows have been shown as engaging the fabric in advance of the inner bows, an arrangement that has definite advantages, it will be understood that the invention in its broadest phase is not limited to this arrangement.

While numerous variations in the particular construction and arrangement illustrated herein may be made within the scope of the invention as defined by the claims, such arrangements have been shown accurately to scale to facilitate the accurate determination of the various locations and curvatures of the parts in such preferred embodiments.

We claim:

1. Spreading apparatus for flattening traveling tubular fabric comprising a spreading device engaging the interior of the fabric tube in restricted opposed marginal zones to flatten the

tube and retarding the travel of the fabric at the margins, fabric retarding members in transverse bow formation engaging the outer and inner faces of both plies of the tube and applying a drag on said inner and outer faces in a restricted central zone spaced from the marginal zones, and means for regulating the retarding effect of the members by adjusting at least one of said members longitudinally of the fabric.

2. Spreading apparatus for flattening traveling tubular fabric comprising a spreading device engaging the interior of the fabric tube in restricted opposed marginal zones to flatten the tube, transverse tensioning means carried by said device and internally engaging the fabric, cooperating transverse tensioning means engaging the fabric externally, and means for adjusting the spacing of the internal transverse tensioning means through the fabric.

3. Spreading apparatus for flattening traveling tubular fabric comprising a spreading device engaging the interior of the fabric tube in restricted opposed marginal zones to flatten the tube, transverse internal tensioning means carried by the device and having transversely convex faces engaging the fabric at its center portions and acting to impose a drag thereon, and cooperating external transverse tensioning means having transversely convex faces engaging the fabric adjacent the internal tensioning means.

4. Spreading apparatus for flattening traveling tubular fabric comprising a spreading device engaging the interior of the fabric tube in restricted opposed marginal zones to flatten the tube, transverse external tensioning means carried by the device and having transversely convex faces engaging the fabric, cooperating external transverse tensioning means having transversely convex faces engaging the fabric adjacent the internal tensioning means, and means for changing the effective transverse curvature of the face of the external tensioning means in contact with the fabric.

5. Spreading apparatus for flattening traveling tubular fabric comprising a spreading device engaging the interior of the fabric tube in restricted opposed marginal zones to flatten the tube, internal transverse tensioning means, cooperating external transverse tensioning means, and means for adjusting the position of the external tensioning means to vary the tension conditions, including means for shifting a fabric-engaging element of the external means about an axis, and means for adjusting the axis in a direction transverse to the plane of the flattened tube.

6. Spreading apparatus for flattening traveling tubular fabric comprising a spreading device engaging the interior of the fabric tube to flatten the tube, internal transverse tensioning means carried by the device and having an outwardly convex transverse curvature, and cooperating transverse external tensioning means engaging the fabric adjacent the internal tensioning means and having a similar outwardly convex transverse curvature.

7. Spreading apparatus for flattening traveling tubular fabric comprising a spreading device engaging the interior of the fabric tube to flatten the tube, internal transverse tensioning means carried by the device and having an outwardly convex transverse curvature, cooperating transverse external tensioning means engaging the fabric adjacent the internal tensioning means and having a similar outwardly convex transverse curvature under selected conditions, and means for varying the relative transverse curvature of the external and internal tensioning means along the faces thereof in engagement with the fabric.

8. Spreading apparatus for flattening traveling tubular fabric comprising an internal spreading device engaging opposed marginal zones of the fabric tube and having transversely aligned recesses adjacent said zones, rotary propelling means extending into the recesses for engaging the fabric, and means extending across the recesses on opposite sides of the propeling means arranged to maintain the fabric in engagement with such propelling means.

9. Spreading apparatus for flattening traveling tubular fabric comprising an internal spreading device provided with heads each having portions extending along a marginal zone of the flattened fabric tube on opposite sides of a recess, rotary propeller means extending into each recess in position to engage the fabric therein, and bridging means mounted on each head and extending across the recess at opposite sides of the propeller means arranged to maintain the fabric in engagement with the propeller means.

10. Spreading apparatus for flattening traveling tubular fabric comprising a spreading device including heads engaging the interior of the tube in opposed marginal zones on opposite sides of a recess in each head, rotary propeller means extending into each recess to engage the fabric therein, rotary means carried by each head positioned to engage the fabric adjacent the propeller means, and an interlocking engagement between said rotary means and propeller means arranged to support the spreading device upon the propeller means during operation.

11. A propeller head for spreading apparatus adapted to flatten tubular fabric, comprising an elongated surface adapted to engage internally a marginal portion of the flattened tube and having a recess therein adapted to receive a rotary fabric-propelling device, and fabric-guiding means carried by the head and extending across the recess at opposite sides thereof.

12. Spreading apparatus for flattening traveling tubular fabric comprising an internal spreading device adapted to feed the flattened fabric between a pair of rollers, including side members, a nip bar adapted for location in the nip of the rollers, and resilient means carried by the side members and engaging the nip bar to press the bar yieldably into said nip.

13. Spreading apparatus for flattening traveling tubular fabric comprising an internal spreading device adapted to feed the flattened fabric between a pair of rollers, including side fabric guide members, a tubular nip bar adapted for location in the nip of the rollers, and resilient means extending from the side members into the ends of the tubular bar to press the bar yieldably into said nip.

14. Spreading apparatus for flattening traveling tubular fabric comprising an internal spreading device adapted to feed the flattened fabric between a pair of rollers, including a tubular nip bar adapted for location in the nip of the rollers, and guide rods for opposite edges of the fabric extending into the ends of the nip bar and resiliently engaging the bar to press it yieldably into the nip of the rollers.

15. Spreading apparatus for flattening travel-

ing tubular fabric comprising a tubular nip bar adapted for location in the nip of a pair of fabric-engaging rollers, said bar having flattened end portions extending into said nip beyond the intermediate portion of the bar and forming elongated openings, and guide rods for the opposite margins of the fabric extending into the openings arranged to maintain the bar in the nip.

16. Spreading apparatus for flattening traveling tubular fabric comprising a spreading device engaging the interior of the fabric tube in restricted opposed marginal zones to flatten the tube, transverse tensioning means carried by said device and internally engaging the fabric, cooperating transverse external tensioning means, at least one of said tensioning means including a transversely curved member in engagement with the fabric, and means for altering the angular position of the member relative to the fabric and thereby altering the effective transverse curvature of such margin in engagement with the fabric.

17. Spreading apparatus for flattening traveling fabric comprising a spreading device engaging the interior of the fabric tube in restricted opposed marginal zones to flatten the tube and retard the travel of the fabric at the margins, fabric retarding means in bow formation engaging within the fabric tube in a restricted central zone spaced from the marginal zones, and means for regulating the retarding effect of said bow means by adjustment thereof through the traveling fabric.

18. Spreading apparatus for flattening traveling tubular fabric comprising a spreading means engaging the interior of the fabric tube in restricted opposed marginal zones, flattening the tube into laterally distended form and retarding the travel of the fabric for a substantial distance at the margins, fabric retarding means in transverse bow formation following said spreading means and engaging the fabric tube in a restricted central area to cause a progressive distention of the center portions of the fabric away from the plane of the initial spreading and flattening, means for regulating the retarding and distending effect of said bow means by adjustment thereof, and subsequent feeding and flattening means reducing said distention and re-drawing said fabric into spread and flattened form.

19. Spreading apparatus for flattening traveling tubular fabric comprising a spreading means engaging the interior of the fabric tube in restricted opposed marginal zones, flattening the tube into laterally distended form and retarding the travel of the fabric for a substantial distance at the margins, propelling means engaging opposite edges of the fabric in said zones, fabric retarding means in transverse bow formation following said spreading means and located adjacent said propelling means and engaging the fabric tube in a restricted central area to cause a progressive distention of the center portions of the fabric away from the plane of the initial spreading and flattening, means for regulating the retarding and distending effect of said bow means by adjustment thereof through the traveling fabric, and subsequent feeding and flattening means reducing said distention and re-drawing said fabric into spread and flattened form.

20. Spreading apparatus for flattening traveling tubular fabric comprising means spreading said fabric into flat laterally distended form with the upper and lower portions in substantially parallel planes and moving said fabric along parallel marginal guides, and means engaging the marginal edges of the fabric while so distended to drive said fabric at a point on each side at a rate advancing the fabric over the spreading means and maintaining a relative lag of the edge portions with respect to the corresponding center portions, a plurality of transverse bows between said spreading means and said marginal drive means and located at the center portions of said fabric inside and outside thereof and subjecting each ply thereof to outward internal pressure and inward external pressure at longitudinally successive and adjacent points so that the center portions of the fabric are retarded and brought into transverse alinement with the marginal portions, and subsequent feeding and flattening means drawing the said fabric onward from said center means.

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