Dec. 23, 1969 E. I. ARONOFF 3,484,949

STABILIZING KNITTED TUBULAR FABRICS

Filed May 22, 1967 6 Sheets-Sheet 1

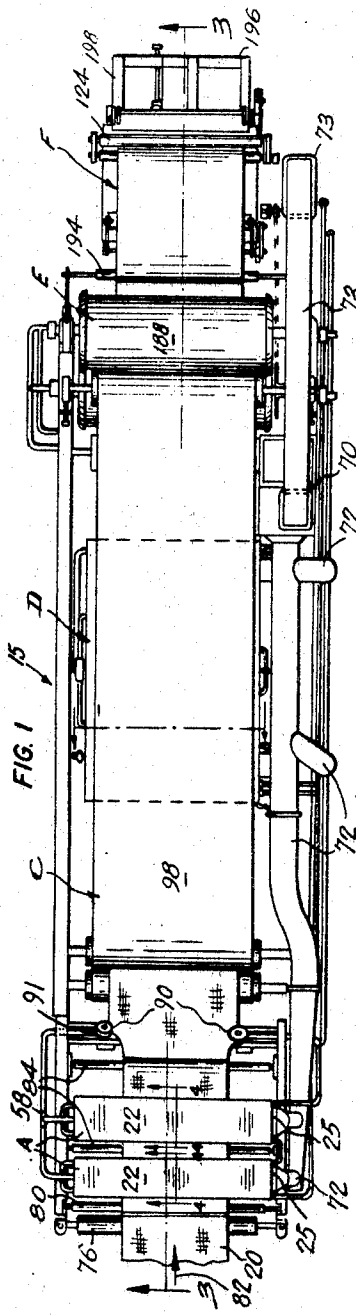


FIG. 1

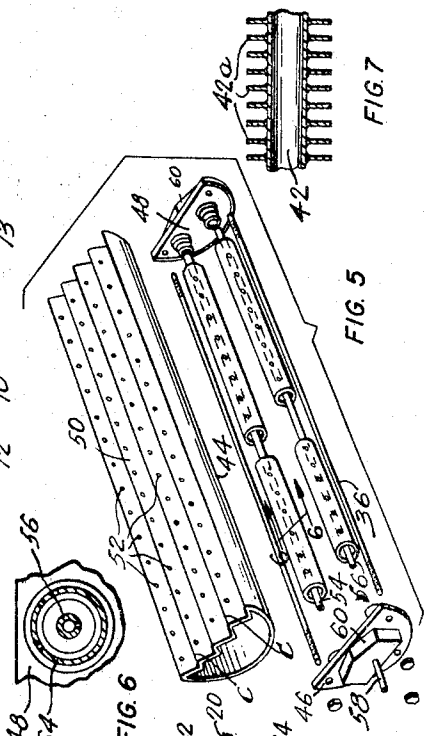


FIG. 5

FIG. 7

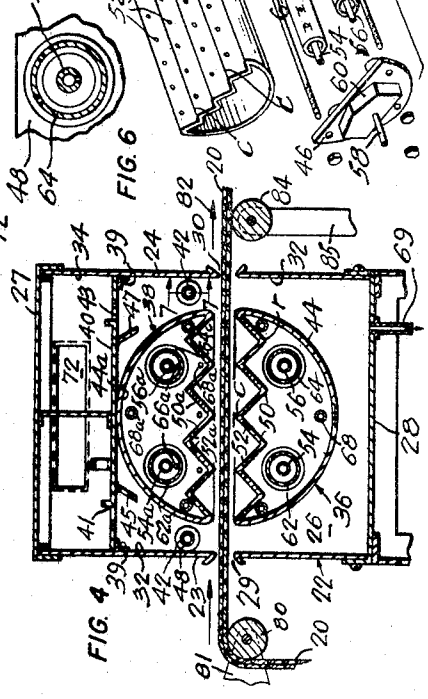


FIG. 4

FIG. 6

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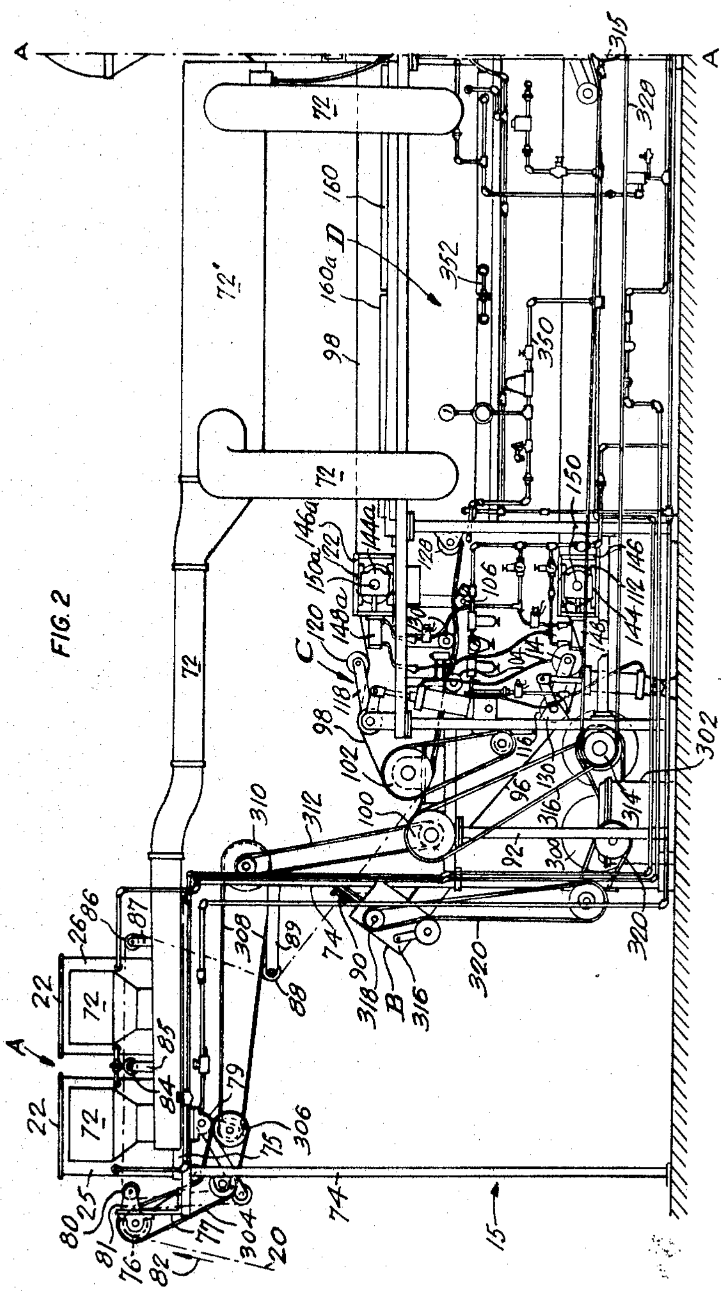


FIG. 2

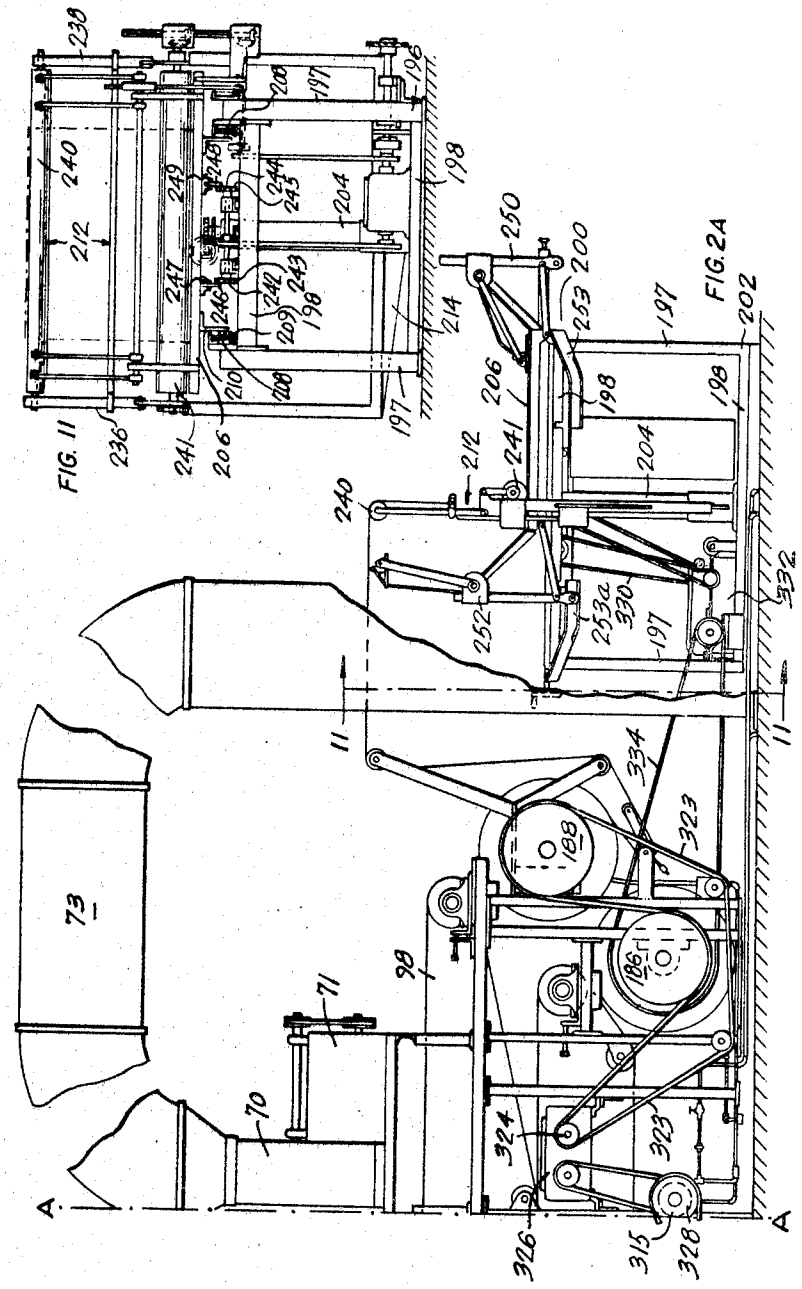
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STABILIZING KNITTED TUBULAR FABRICS

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STABILIZING KNITTED TUBULAR FABRICS

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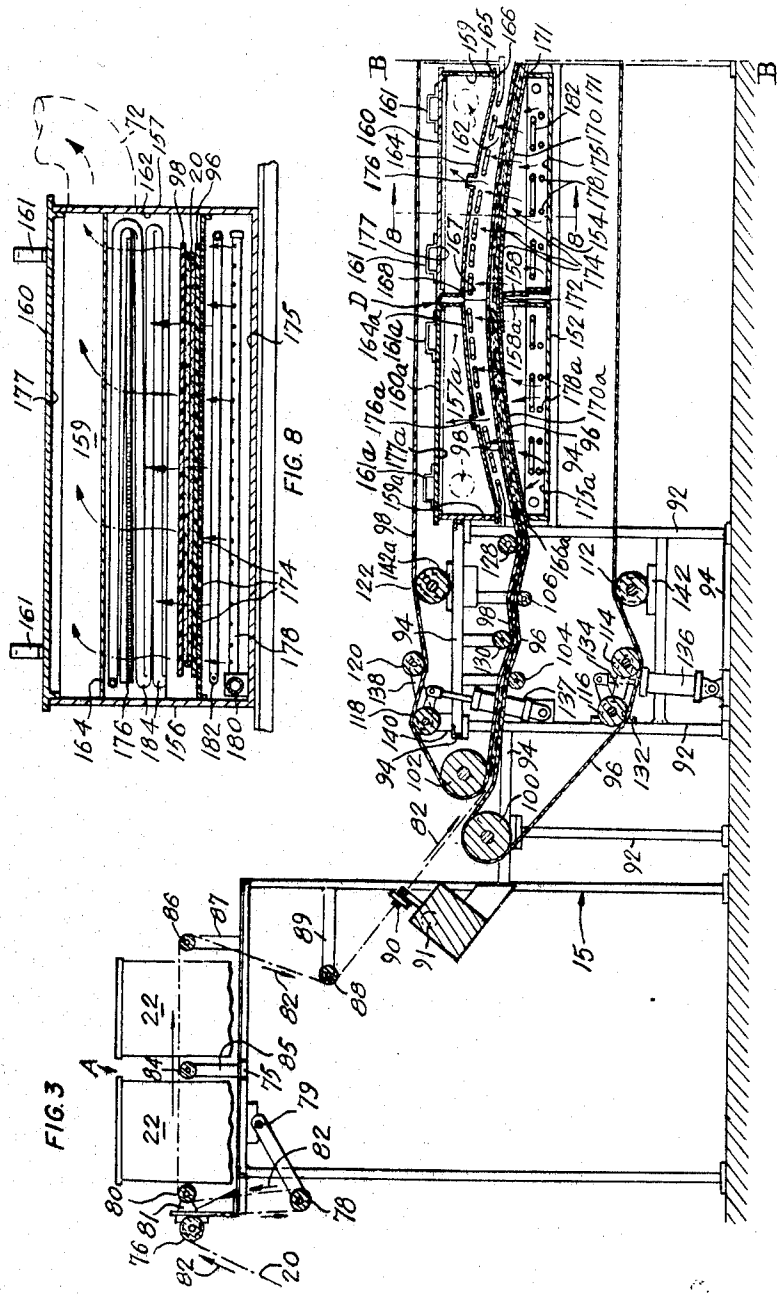


FIG. 3

FIG. 8

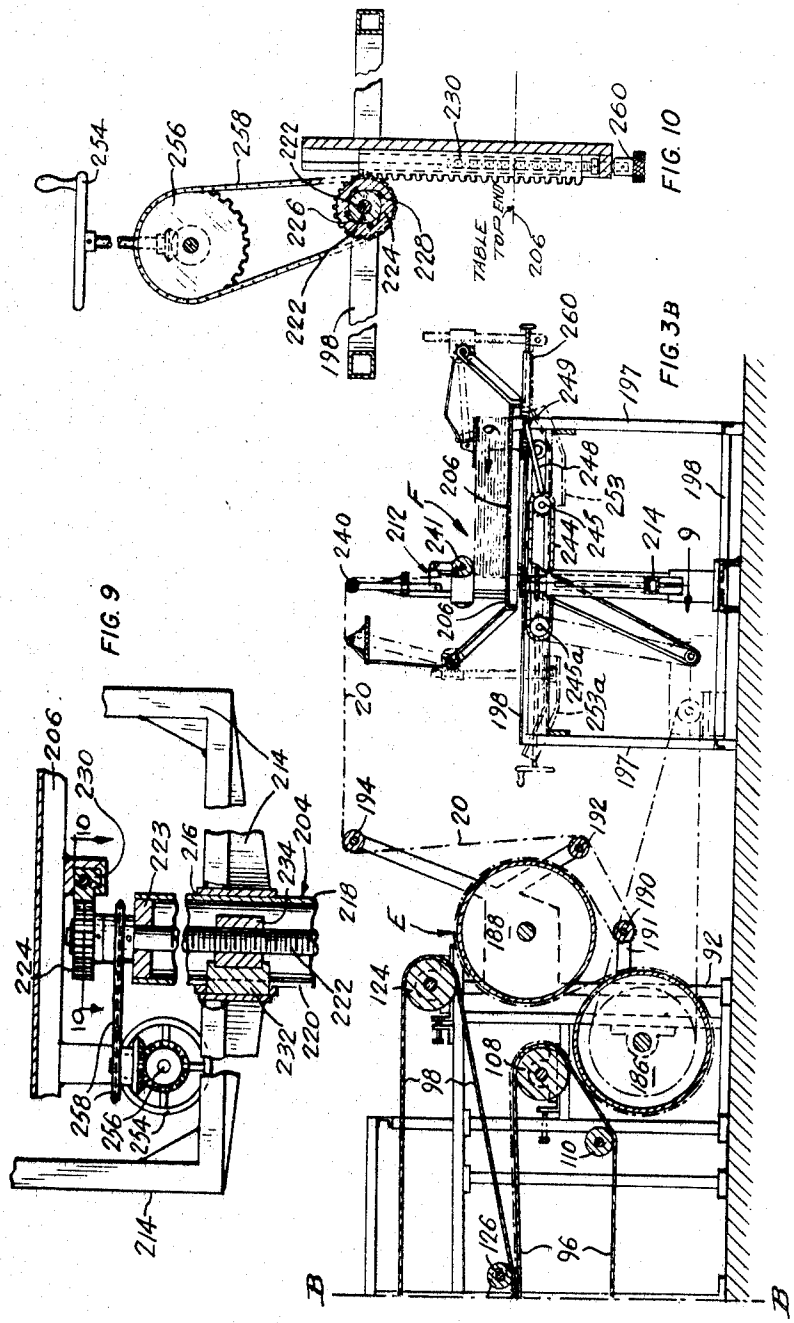
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STABILIZING KNITTED TUBULAR FABRICS

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STABILIZING KNITTED TUBULAR FABRICS

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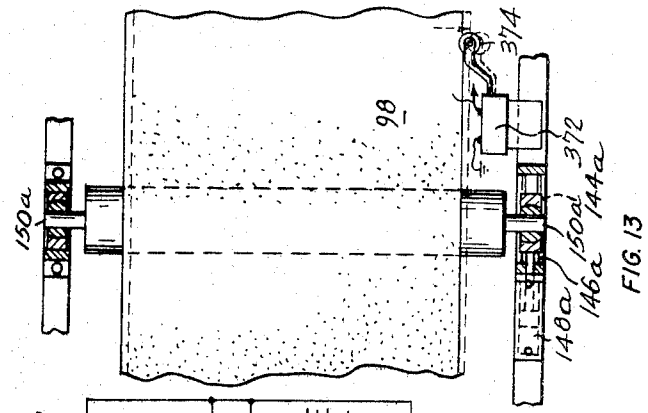


FIG. 13

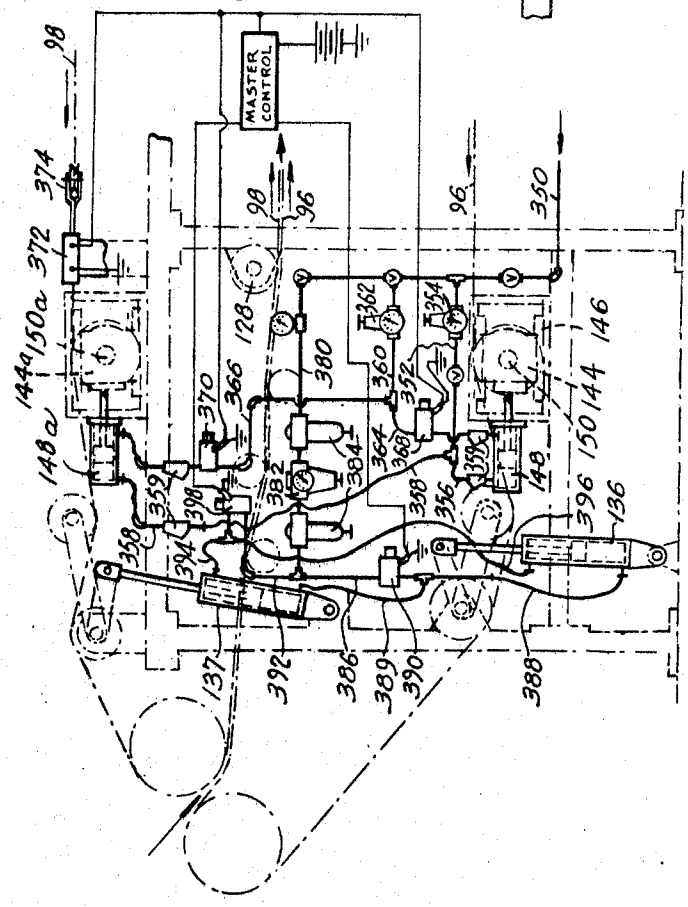


FIG. 12

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3,484,949

STABILIZING KNITTED TUBULAR FABRICS

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Filed May 22, 1967, Ser. No. 640,317
Int. Cl. F26b 13/12
U.S. Cl. 34—155 9 Claims

ABSTRACT OF THE DISCLOSURE

Apparatus for stabilizing knitted tubular fabrics against shrinkage including, in series, a steam box for preliminary moistening, a frame for laterally overstretching the tube, cooperating travelling blankets for gradually releasing the tube from its lateral stretched condition and for advancing it under reduced longitudinal tension, an applicator for applying steam through the blankets to fix the loops of the fabric, heating rolls for drying the fabric, and a folding table for stacking the stabilized tube.

The present invention relates to the treatment of fabrics and more particularly to apparatus for providing a finished tubular knitted fabric with predetermined dimensions.

The present application relates to and is an improvement on the apparatus shown in U.S. Patent 3,098,279 Brunner, which includes a suitable stretching form located in the tube of knitted fabric and along which the fabric is moved by a suitable moving means, the tube of fabric being expanded transversely by the form. The loops of the knitted fabric are therefore caused to contract longitudinally, and immediately following the stretching form are located a pair of bands which cooperate with each other to receive the tube of fabric from the form, the pair of bands holding the fabric so that the loops thereof cannot change their longitudinal dimensions. A gap of predetermined thickness is provided through which the tube of fabric moves. In this gap the tube of fabric is capable of transversely contracting in a manner controlled by the adjusted thickness of the gap, and the control of the size of this gap is such that the tube contracts due to its own resiliency until the width of the loops of the knitted fabric is of a predetermined size. Thereafter the fabric is fixed and finished.

The present invention aims to provide an improved apparatus for so stretching the fabric and laterally controlling the dimensions thereof while the fabric is under minimum longitudinal tension, whereby the speed and efficiency of the fabric travelling through the apparatus can be increased considerably yet maintenance of the apparatus is reduced, thereby reducing the cost of treating the fabric.

Generally, a construction in accordance with the present invention comprises the combination of a frame, a saturated steam conditioning box mounted at one end of the frame, a driven stretching form mounted longitudinally adjacent the conditioning box and within the tubular fabric coming from the conditioning box, a pair of cooperating continuous bands adapted to receive the fabric as it leaves the stretching form, a saturated steam box for fixing the fabric as it is held between the continuous belts, a pair of heating rolls for drying the fabric and finally means for collecting the dried stabilized fabric as it comes from the heated rolls.

Having thus generally described the nature of the invention particular reference will be made to the accompanying drawings, showing by way of illustration preferred embodiments thereof and in which:

FIGURE 1 is a top plan view of the apparatus in accordance with the present invention;

FIGURE 2 is a vertical side view illustrating one end of the apparatus shown in FIGURE 1;

FIGURE 2*a* is a vertical side view showing the other end of the apparatus shown in FIGURE 1 and is the continuation of FIGURE 2 from line A—A;

FIGURE 3 is a vertical cross section taken along lines **3—3** of FIGURE 1 showing one end of the apparatus;

FIGURE 3*a* is a vertical cross section taken along line **3—3** of FIGURE 1 and showing the other end of the apparatus continued from line B—B;

FIGURE 4, which is on the same sheet as FIGURE 1, is a vertical cross section taken along either of lines **4—4** of FIGURE 1;

FIGURE 5, which is on the same sheet as FIGURE 1, is an exploded view showing an element of the conditioning box shown in FIGURE 4;

FIGURE 6 is an enlarged fragmentary view of one of the elements shown in the conditioning box of FIGURE 4;

FIGURE 7 is a fragmentary vertical cross section taken along line **7—7** in FIGURE 4;

FIGURE 8, which is on the same sheet of drawings as FIGURE 3, is a vertical cross section taken along line **8—8** of FIGURE 3;

FIGURE 9, which is on the same sheet as FIGURE 3*b*, is a fragmentary cross section taken along line **9—9** of FIGURE 3*b*;

FIGURE 10 is a horizontal cross section taken along line **10—10** of FIGURE 9;

FIGURE 11, which is on the same sheet as FIGURE 2*a*, is a vertical cross section taken along line **11—11** of FIGURE 2*a*;

FIGURE 12 is a schematic diagram of the pneumatic system of the apparatus;

FIGURE 13 is a top plan view partly in cross section of a detail of the apparatus showing the positional roller.

Referring now to the drawings, and more specifically to FIGURES 1, 3 and 3*a*, the tubular fabric **20** passes through the pair of conditioning boxes A in a flat form in the direction of the arrow **82**. The fabric is then driven over the stretching frame B where it is stretched laterally and contracted longitudinally. The fabric is received from the stretching frame B by the continuous belt assembly C which carries the tubular fabric **20** through the fixing steam box assembly D. The tubular fabric **20** is then carried over the heated drum rollers E and is finally deposited on the folding table F. The complete apparatus is driven by a single electric motor and gear train assembly.

Referring now to FIGURES 4, 5, 6 and 7, a typical conditioning box A is shown including a rectangular enclosed housing **22** having side walls **23** and **24**, end walls **25** and **26**, top cover **27** and bottom wall **28**, respectively.

Opposed side walls **23** and **24** are provided with longitudinal slots **29** and **30**, respectively. Tubular fabric **20** enters the housing **22** through slot **29** of side wall **23** and exits through the opposite slot **30** of side wall **24**.

The housing **22** comprises a steam chamber **32**, a suction chamber **34** and identical steam units **36** and **38** in the steam chamber **32** provided to impinge steam on both sides of the fabric **20**. A longitudinal partition **40** separates the steam chamber **32** from the suction chamber **34**.

Elongated tapered slots **41** and **43** are provided in the partition **40** separating the suction chamber **34** from the steam chamber **32** whereby the spent steam can be withdrawn equally.

Baffle plates **45** and **47** are provided on the partition **40** along slots **41** and **43** in order to prevent unwanted recirculation of the steam in the steam chamber **32**.

Heater tubes **42** containing radial fins **42***a* are provided in the proximity of slots **29** and **30** in order to

heat the incoming external air to prevent condensation of the steam so as to prevent dripping on the fabric **20**. Heater tubes **42** are heated by live steam continually passing through them.

The steam units **36** and **38** are independently mounted in the housing **22** and may be easily replaced. They are located close to, but spaced on either side of the path of the moving fabric **20**. They can be easily removed because of the access provided by removable top cover **27** and partition **40**, which rests on ledges **39**.

For descriptive purposes, only steam unit **36** will be referred to but the related parts of unit **38** will have identical reference numbers supplemented by the subscript "*a*". Steam unit **36** comprises a semi-cylindrical tube **44** closed at both ends by end plates **46** and **48**, and having corrugated face **50**. In FIGURE 5 of the drawings, the letter "*c*" represents the crest of one corrugation of face **50** and letter "*r*" designates the root. A series of perforations **52** are provided between the crest "*c*" and the root "*r*" on the slope of the corrugations of face **50**.

Longitudinal perforated steam pipes **54** and **56** are located longitudinally within the steam unit **36** for distributing steam therein. A suitable conduit **58** is connected to a steam source, not shown, and feeds steam to distributor **60** which in turn distributes the steam to the perforated pipes **54** and **56**. A pair of perforated tubes **62** and **64** which are concentric with the steam pipes **54** and **56** respectively provide a first steam trap.

The perforations in the tubes **62***a* and **64***a* of steam unit **38** are directed away from the corrugated face **50***a* so that the steam will reach it indirectly. Thus, most of the condensate formed is collected in the tubes **62***a* and **64***a* before it reaches the corrugated face **50***a*. Drain holes **66***a* are provided in end walls **46***a* and **48***a* to drain the condensate from the tubes **62***a* and **64***a*.

The condensate which escapes the first steam trap formed by the tubes **62***a* and **64***a* collects in the root *r* of the corrugations and is drained off through drain **68***a* provided in the end plates **46***a* and **48***a*. Holes **68***a* are located below the line of perforations **52***a* in each corrugation. Thus, the condensation is drained from the steam unit **38**. The bottom inverted steam unit **36** is provided with drain hole **68** in the bottom of the semi-cylindrical tube **44**. The drained condensed water is also collected in the bottom of the housing **22** whereby it is removed by a suitable drain pipe **69**.

The steam forced into the steam units **36** and **38** is released through perforations **52** and **52***a* in the slopes of the corrugations of the faces **50** and **50***a*, respectively. The dry steam from the units **36** and **38** impinges directly upon respective layers of the fabric **20**. The condensation which occurs in the upper steam unit **38** is collected in the corrugations and is prevented from dripping onto the fabric **20**.

A suitable vacuum pump, not shown, is connected to the suction chamber **34** by an exhaust duct **72**. The pump creates a negative pressure in the suction chamber thereby withdrawing the spent steam from the steam chamber **52** after it has impinged upon the fabric **20**.

In operation, the conditioning box assembly A is mounted on the frame **15** at one end thereof. The conditioning box assembly A comprises two steam boxes represented in FIGURES 2 and 3 by housings **22**. Part of the frame **15** which mounts the steam box assembly A is constituted by uprights **74** and horizontal members **75**. The housings **22** are mounted on the members **75** in a parallel spaced relation, but laterally with respect to the path of the tubular fabric **20**. In order to properly support the tubular fabric **20** as it enters and passes through the steam box assembly A, a suitable roller assembly is provided including driven roller **76**, mounted on a bracket **77** which is in turn fixed to the members **75**; a tensioning roller **78** which is freely mounted on pivoting bracket **79** on the underside of the members **75**, and a positioning roller **80** which is rotatably supported by bracket **81** mounted on bracket **77**. Briefly, the tubular fabric follows a path in the direction of arrow **82**, over the driven roller **76** down around the tensioning roller **78** and over the positioning roller **80** into the steam box assembly A. A support roller **84** is also freely mounted on a bracket **85** positioned between the spaced-apart parallel steam box housings **22**.

The tubular fabric **20** then travels over a free roller **86** freely mounted by a bracket **87** on platform **75**, and down around a positioning roller **88** freely mounted by a bracket **89** to the uprights **74**.

A stretching frame B which serves as an expansion means for transversely expanding the tubular fabric **20** includes a form (not shown) which is well known in this art. A specific example of such a form is shown in U.S. Patent 3,098,279 to Brunner. The form which is within the tubular fabric **20** is driven by cooperating driven rollers **90** which are transversely adjustable on a screw shaft **91**, as is also well known in the art.

The continuous belt assembly C is mounted on that part of the frame adjacent the steam box assembly A and includes uprights **92** and beam members **94**. The belt assembly C comprises a pair of endless belts called blankets, **96** and **98** driven by rolls **100** and **102**. The lower endless blanket **96** passes over laterally mounted freely rotating rolls **104**, **106**, **108**, **110**, **112**, **114** and **116**, while the upper blanket **98** passes over the laterally mounted, freely rotating rolls **118**, **120**, **122**, **124**, **126**, **128** and **130**. Rolls **100**, **104**, **106** and rolls **102**, **130**, **128** of the blankets **96** and **98**, respectively, are positioned in a slightly staggered fashion so as to force the upper run of blanket **96** against the lower run of blanket **98**.

Blankets **96** and **98** must be permeable to allow steam to pass through them as will be further described. In one embodiment it was found that the use of a single-ply material having multi-filament warp threads of Terylene material and monofilament nylon weft threads was most effective.

A tensioning apparatus is also provided to control the tension of the blanket **96** and/or **98**. The tensioning device for blanket **96** comprises rolls **114** and **116**, whereby roll **116** is mounted on a bracket **132**. Roll **114** is mounted to one arm of a bell crank **134** which is pivoted to bracket **132**. The other arm of bell crank **134** is connected to the piston rod of hydraulic cylinder **136**.

The other end of cylinder **136** is pivotally-mounted to a beam **94** on the frame **15**. Similarly a cylinder **137** is pivoted at one end to an upright **92** of the frame **15** and is operatively connected to one arm of a bell crank **138**. The bell crank is in turn pivoted to bracket **140**, supporting roll **118**, on the beam **94**, and its other arm mounts the roll **120**.

Roll **112** is pivoted at one end to a bracket **142** for movement about a vertical axis. The other end of roll **112**, as is shown in FIGURE 2, is mounted in a bearing block **144** which is adapted for relative sliding movement in the pillow block **146**. A cylinder **148** is fixedly mounted to the pillow block **146** and its piston rod is connected to the bearing block **144** for effecting the sliding movement thereof. It can be seen that by sliding the bearing block **144** one way or another the axis of the shaft **150** of roll **112** will diverge from its normal perpendicular position with respect to the blanket **96** thereby forcing the blanket to shift either to the left or right of the longitudinal axis of the path of travel.

Similarly roll **122** is provided with an identical device, to adjust blanket **98**, and for reference purposes the same numerals have been used but the subscript "a" has been added.

The blankets, under controlled tension, **96** and **98** receive the tubular fabric **20** from the stretching frame assembly B. By controlling the tension of the blankets **96** and **98** the gap formed thereby, between rolls **100** and **102**, can be controlled in order to provide controlled transverse contraction of the tubular fabric **20** as it

comes off stretching form B. The blankets **96** and **98** carry the tubular fabric **20** through the fixing steam boxes D, without exacting any longitudinal tension thereto.

The pneumatic system which operates cylinders **148** and **148***a* and tensioning cylinders **136** and **137** includes a main air feed line **350** which branches into a secondary feed line **352**. In the secondary feed line **352** a pressure regulator **354** is provided. Normally a pressure of about 30 to 50 pounds is set on the pressure regulator **354**. The air is then branched off into the feed line **356** which leads into one side of the cylinder **148**, and feed line **358** which leads into a similar side of cylinder **148***a*. Suitable flow controls **359** are provided in lines **356** and **358**. This air line **352**, communicating with air lines **356** and **358** to the cylinders **148**, **148***a*, is normally open and the pistons in the cylinders **148** and **148***a* are normally projecting outward of the cylinders at their full extent.

Another secondary line **360** which receives air from line **350** is provided, and includes a pressure regulator **362** (which is set at a pressure higher than pressure regulator **354**) and branches off into lines **364** and **366** to the other side of cylinder **148** and **148***a* respectively. This line is normally shut by solenoid valves **368** and **370** in lines **364** and **366**, respectively. A limit switch **372** which includes a wheel **374** is mounted so that the wheel **374** is in constant contact with the side edge of the blanket **98**. As the blankets **96** and **98** deviate from their longitudinal axis, the wheel **374** will actuate limit switch **372** in such a way as to activate the solenoid valve **368** and **370** so as to proportionally open the air lines **364** and **366**. When air of higher pressure than in the lines **352** is applied to the opposite side of the cylinder, the pistons will be forced to move against the air pressure provided by line **352**. The cylinder operation by means of such differential pressure provides for smooth operation of the cylinders.

Air coming in on the main air line **350** is also fed to a secondary line **380**. Line **380** is also provided with a pressure regulator **382** and oil feed valves **384**. The air is then branched into line **386** to one end of cylinder **136** by means of the line **388** which is connected to line **386** and to a similar end of cylinder **137** by means of line **389** which is also connected to the common air line **386**. A solenoid valve **390** is provided on line **386** for opening and closing this air line. Normally, when the belts are in a relaxed position, the solenoid valve is open which allows air to push the piston to its full extent. Air is also branched off from the line **380** to a line **392** which feeds air to the opposite side of cylinders **136** and **137** by means of lines **394** and **396**. A solenoid valve **398** is also provided on the line **392** to open and shut the air going into the end of the cylinders. When tension is required on the blankets **96** and **98**, the solenoid valve **390** is normally closed and the solenoid valve **398** would be open, thereby forcing the piston arms to retract within the cylinders.

The fixing steam box assembly D as shown in FIGURES 2, 3 and 8 comprises a pair of rectangular enclosures **152** and **154**. Each enclosure is a mirror image of the other and together form the steam fixing assembly. Only one of the enclosures will be described for the purposes of simplicity while related elements in the other enclosure will be characterized by a subscript "*a*" added to the reference numeral. Enclosure **154** includes end walls **156**, **157** and side walls **158** and **159**. A removable top cover **160** having handles **161** is provided for easy access.

A passage **162** is defined in the enclosure **154** by a top concave wall **164** extending in an upwardly sloping direction from the upper edge **165** of opening **166** in wall **159** to the upper edge **167** of opening **168** in wall **158**. A bottom convex wall **170** forms the floor of the passage **162** and extends from the lower edge **171** of opening **166** to the lower edge **172** of opening **168**.

The bottom wall **170** is perforated extensively as at **174** communicating with the steam chamber **175**. The top concave wall **164** is provided with a longitudinal tapered slot **176** as shown best in FIGURE 8, whereby the negative pressure in suction chamber **177** is equally applied along the width of the tubular fabric **20** passing through passage **162**.

Referring to the drawings both enclosures **152** and **154** will now be referred to wherein perforated steam pipes **178**, **178***a* extending from a steam header **180** are provided in the steam chambers **175** and **175***a*. Heating pipes **182** which conduct live steam but do not discharge it, are placed near the steam pipes **178** to keep condensation to a minimum so that only dry steam reaches the tubular fabric **20** between the blankets **96** and **98**. Similar heating pipes **184** are also provided in the passage **162** just below the top concave wall **164** and **164***a* to keep the spent steam from condensing and to heat the incoming fresh air as it is forced through slots **176** and **176***a* into the suction chambers **177** and **177***a*.

In operation, blankets **96** and **98** carry the tubular fabric **20** through the passage **162** and over the convex wall **170** and **170***a*. Steam is fed through the header of **180** and is distributed in the steam chambers by means of the perforated pipes **178**, **178***a* and is drawn upwardly through the perforations **174** and **174***a* in convex plate **170** and **170***a*. The heating pipes **182** keep the temperature within the steam chamber **175** and **175***a* from lowering thus keeping the steam dry. The steam after it passes through the perforations **174** and **174***a* seeps through the permeable blanket **96** and fixes the loops of the tubular fabric **20**. A zone of negative pressure is built in the suction chambers **177** and **177***a* by means of the vacuum pump **70** which communicates with the suction chambers **177** and **177***a* by vacuum duct **72**. This suction causes outside air to enter through the openings **166** and **166***a* which is in turn heated as it comes near the heating pipes **184**. The spent steam which finds itself trapped within the passage **162** exhausts into suction chamber **177**, **177***a* through the tapered slots **176**, **176***a*. The steam is then drawn through the exhaust duct **72**.

A suitable drainage is provided both in the steam chambers and the suction chambers to drain any unwanted condensation which is formed.

The combination of the blankets **96** and **98** and the sandwich tubular fabric **20** comes out of opening **166**. Blanket **98** diverges from blanket **96** as it passes roll **126**, thus relieving the pressure on the tubular fabric **20**. As the blanket **96** proceeds about the roll **108**, the tubular fabric **20** diverges from the blanket **96** and travels about driven heater roll **186**, which is part of the heater roll assembly E. The tubular fabric **20** is taken off the heater roll **186** and passes over a similar driven heating roll **188** and then passes through the rotating roll **190** which is mounted on bracket **191** to an upright **92**. The tubular fabric then proceeds about roll **192** and positioning roll **194** to the folding table F. Heating rolls **186** and **188** are of similar diameter and are driven at exactly the same speed in order to prevent any unnecessary longitudinal tension thereto.

The folding table F is similar to conventional tables already developed and it is obvious that these other folding tables can be substituted in place of the embodiment which will now be described.

Folding table F comprises a frame **196** including uprights **197** and horizontal beams **198** arranged to form an upper level **200** and a lower level **202**. Fixed to the horizontal beams **198** of the lower level **202** is an upstanding cylindrical lift member **204**. At the upper level **200**, a sliding table **206** is adapted for horizontal sliding movement by means of wheels **208** freely mounted to angle beams **210** fixed in parallel relation to the underside of sliding table **206**. The wheels **208** travel in guideways **209** mounted at level **200** to the horizontal beams **198**. A vertically extending feeding arrangement **212** is provided centrally of the folding table F, over the sliding table **206** and transverse to the direction of movement of the sliding table **206**.

Feeding arrangement **212** is adapted for up and down movement towards and away from the plane of said sliding table **206** by a yoke bracket **214** which is journalled to lift member **204** at **216**.

Lift member **204** includes a cylindrical casing **218** having a longitudinal slot **220** extending in an axial direction. A rotatable screw **222** is journalled in bushing **223** concentrically within the casing **220**. A gear wheel **224** is attached in a ratchet engagement at the top end of the screw as shown in FIGURES 9 and 10. When wheel **224** is turned in a clockwise direction, the cam surfaces **226** engage the balls **228** tightening them against the end of screw **222** forcing it to rotate in a similar direction. However, when the wheel **224** is turned in a counterclockwise direction the balls **228** are disengaged and the wheel **224** rotates freely about the end of screw **222**. A rack gear **230** is provided on the underside of sliding table **206** and engages the gear wheel **224** with every pass, forcing the screw **222** to rotate clockwise intermittently.

Yoke bracket **214** includes a key portion **232** which protrudes within the casing **218** through slot **220** and subtends an internally threaded bushing **234** engaged on the screw **222**. As the screw **222** rotates clockwise, the bushing **234** moves upwardly forcing the yoke **214** and the feeding arrangement **212** to move upwardly.

The feeding arrangement **212** includes a pair of upstanding bracket members **236** and **238** subtending a lead roll **240** which receives the tubular fabric **20** from positioning roll **194**. A pair of cooperating, freely rotating, rolls **241** deliver the tubular fabric **20** to the sliding table **206** as it passes below them.

The sliding table **206** as was previously described is adapted for sliding movement by means of wheels **208** riding in guideways **209**. A pair of parallel endless chains **242** and **244** are engaged on driven sprocket components **243**, **243***a* (not shown), **245** and **245***a* respectively. (This arrangement is shown in FIGURES 3*b* and 11.) A connecting rod **246** is pivoted at one end to chain **242** and at the other end to a bracket **247** on the underside of sliding table **206**. Similarly a connecting rod **248** is attached to chain **244** and bracket **249**. As the connecting rods **246** and **248** follow the endless chains **242** and **244** along one run between sprockets **243**, **243***a*, **245** and **245***a* respectively the sliding table **206** is pulled in one direction and as it follows the chains **242** and **244** in the other run, is pulled in the opposite direction. Conventional cam operated lever gripping arms **250** and **252** are also provided at opposite ends of the table **206** and are operated by cam ways **253** and **253***a*.

In operation, the tubular fabric **20** is received from the heating rolls assembly E by the intermediary of freely rotating rolls **190**, **192**, **194**. The tubular fabric **20** passes over the lead roll **240** and down through the pair of feeding rolls **241** and **241***a*. The sliding table **206**, which reciprocates below the feeding rolls **241**, receive the tubular fabric and the reciprocation of the sliding table **206** causes the fabric to be piled in a folded orderly fashion as shown in FIGURE 3*b*.

Any time the sliding table **206** moves towards the left (in FIGURE 3*b*) the rack gear **230** engages the ratchet gear **224** and causes it to rotate counterclockwise. As was described previously, when the gear wheel **224** rotates counterclockwise, the balls **228** are loose and no force is exerted on the screw **222**. However, once the sliding table **206** reaches the end of its path, and returns towards the right of the frame in FIGURE 3*b*, the rack gear **230** causes the gear wheel **224** to rotate in a clockwise direction whereby the balls **228** will be tightened against the screw **222** and forces the screw **222** to rotate clockwise slightly. Each time the screw turns clockwise, the threaded bushing **234** creeps slightly up the screw forcing the yoke **214** and the feeding arrangement **212**, which it carries to move upwardly, a small distance. This small distance corresponds to approximately the thickness of one layer, that is each time the sliding table **206** completes a circuit, the feeding apparatus has moved upwardly to compensate for the increased thickness of the resulting folded pile of tubular fabric **20**. As the complete pile is formed, and it is cleared away from the sliding table, the feeding apparatus **212** can be returned to a starting position by rotating the screw counterclockwise. This is done manually by rotating the handle **254** which activates gear train **256** connected to the screw **222** by chain **258**. Incidentally the gear rack **230** can also be adjusted by means of an adjustment screw **260**.

The driven components of the complete assembly are all driven by a single electric motor **300**. Electric motor **300** drives an electrically-controlled automatic gear box **302**. Driven roll **76** is driven by a V belt **304** which passes about pulley **306** which is in turn connected to pulley **310** by the V belt **308**. Strap **312** drives pulley **310** and is in turn connected to the shaft of roll **100**. Roll **100** is in turn connected to a pulley **314** by means of V belt **317** which is in turn connected to gear box **302**. Similarly, the driven roll **90** is connected to a pulley **318** through gear box **316**. The pulley **318** is connected to the gear box **302** by means of V belt train **320**.

The heater rolls **186** and **188** are driven by means of V belts **323** which is driven by pulley **324** of gear reducing box **326**. Gear reducing box **326** is operated by the belts **328** which passes around rolls **314** and **315**. Driven sprocket wheels **242** and **244** on the folding table apparatus are driven by V belts **330** from a gear reducing box **322** which is in turn driven by V belts **334** which passes over roll **186**.

The evacuation system is operated mainly by a vacuum pump **70** which is driven by a separate electric motor **71**. Various ducts **72** lead from the steam chambers as previously explained, which are all connected to a main duct **72** leading to the vacuum pump **70**. The discharge duct **73** from the vacuum pump **70** leads to a central exhaust system which in this case is shown as being underground.

Suitable dry steam pipes **350** conducting steam from a steam source to the heating pipes within the various steam boxes are provided. Steam conduits **352** are also provided for furnishing dry steam to the distributors **60** and **180** of the various steam boxes.

I claim:

1. An apparatus for steaming tubular fabrics, comprising a house enclosing a steam chamber and a suction chamber separated therefrom by a wall, said housing having opposed vertical walls each provided with a slot to permit passage of the tubular fabric in a path through the steam chamber, a steam unit at each surface of the fabric adapted to apply steam to said fabric in said steam chamber, condensation trapping means for trapping condensation formed by said steam as it is being applied to said fabric, means for draining said trapped condensate, and said suction chamber adapted to exhaust said steam chamber.

2. A steaming apparatus as defined in claim **1** wherein said steam unit is hooded in said chamber, said hooded steam unit including said condensation trapping means comprising a corrugated wall adapted to be adjacent to said fabric, a source of steam provided between said hood and said corrugated wall, a corrugation of said corrugated wall having a crest portion and a root portion adjacent thereto, perforations spaced between said crest portion and said root portion for diffusing said steam onto said fabric.

3. In an apparatus for finishing tubular fabrics, comprising a housing enclosing a steam chamber and a suction chamber connected thereto, said housing having opposed vertical walls each provided with a horizontal slot to permit passage of the tubular fabric in a horizontal path through the housing, a hooded steam unit to one side of the fabric adapted to apply steam to said fabric having a hood substantially covering said path of said fabric, said hooded steam unit including condensation trapping means for collecting any condensate formed by said steam as it

is being applied, and said suction chamber adapted to apply suction to the steam chamber for exhausting said steam after it has been applied.

4. In an apparatus for finishing tubular fabrics comprising a housing enclosing a steam chamber and a suction chamber connected thereto, as defined in claim 1, wherein heating units are located near the respective slots in the housing for minimizing the amount of steam condensing in the housing, wherein said housing is of a rectangular elongated configuration including a pair of opposed vertical side walls each provided with said horizontal slots for permitting passage of the fabric in a horizontal path through the housing, means in said steam chamber for applying steam to said fabric, a horizontal partition at a distance above said horizontal slot for dividing said housing into said steam chamber and said suction chamber, said partition being provided with slots whereby said excess steam in said steam chamber is sucked through to said suction chamber by a negative pressure.

5. A steam box comprising an enclosed steam chamber having a perforated convexly curved wall, an enclosed suction chamber having a concavely curved wall spaced from said convex wall, the concave and convex walls defining a passage adapted to pass a flattened tubular fabric, wherein heating means are provided within the steam chamber and within the passage to minimize the condensation of said steam, steam distribution means in said steam chamber for forcing steam into said chamber and through the perforated convex wall, slots provided in said concave wall and evacuation means in said suction chamber adapted to remove excess steam from said passage.

6. A steaming apparatus as defined in claim 5 wherein the concave wall has smaller radius of curvature than that of the convex wall thereby providing the middle of the passage with a greater height than the ends of said passage.

7. An apparatus for treating fabrics comprising a pair of continuous belts engaging each other along a first run of said belts, the second run of each of said belts being spaced from said first run and parallel thereto, a housing having opposed side walls one at each lateral edge of belts along said first run, a perforated wall convexly curved about a transverse axis, subteneded transversely between said side walls and located below but in contact with a belt in said first run, a second wall, having slots, curved concavely about a transverse axis and subtended transversely between said side walls above said belts in said first run, means for providing dry steam through said perforated wall below said first run and means provided above said first run for exhausting excess steam through said slots in said concave wall, wherein said means for providing dry steam is located in an enclosure provided on said concave or convex perforated wall between said first and second run of said belt, wherein heating means are provided within the enclosure to minimize the condensation of said steam, and means for exhausting excess steam including an enclosure common with said concave wall between the first and second run of said belt and evacuation means for providing negative pressure within said enclosure.

8. An apparatus as defined in claim 1 wherein said steam-applying means includes an enclosed chamber having a corrugated face adjacent the path of the tubular fabric, perforations provided between the crest and root of the corrugations for emitting steam, whereby the steam which condenses within the steam-applying means is trapped in the root of the corrugations, and draining means are provided for draining the condensate from the roots of said corrugations.

9. An apparatus as defined in claim 2, wherein the hooded steam units include elongated steam distribution members within the hooded unit and said condensation trapping means also includes elongated tubular members concentric with the elongated steam distribution members, having steam outlet apertures located on the upper portion of the tube, so that any condensate forming as it is leaving the elongated steam distribution members is collected in the bottom portion of the concentric tube member and means are provided for collecting the so-formed condensate from the tube members.

References Cited

UNITED STATES PATENTS

1,967,130	7/1934	Nuernberg	68—5
2,008,230	7/1935	Spooner	68—5
2,300,982	11/1942	Slagboom et al.	68—5
2,590,849	4/1952	Dungler	34—37 XR
3,015,893	1/1962	McCreary	34—158
3,125,424	3/1964	Peck	34—155
3,181,250	5/1965	Vits	34—160 XR

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