

Feb. 15, 1938.

N. A. BATCHELDER

2,108,188

PROCESS OF YARN DYEING, DRESSING, AND LOOM BEAMING

Filed June 5, 1936

17 Sheets-Sheet 1

Fig. 1a.

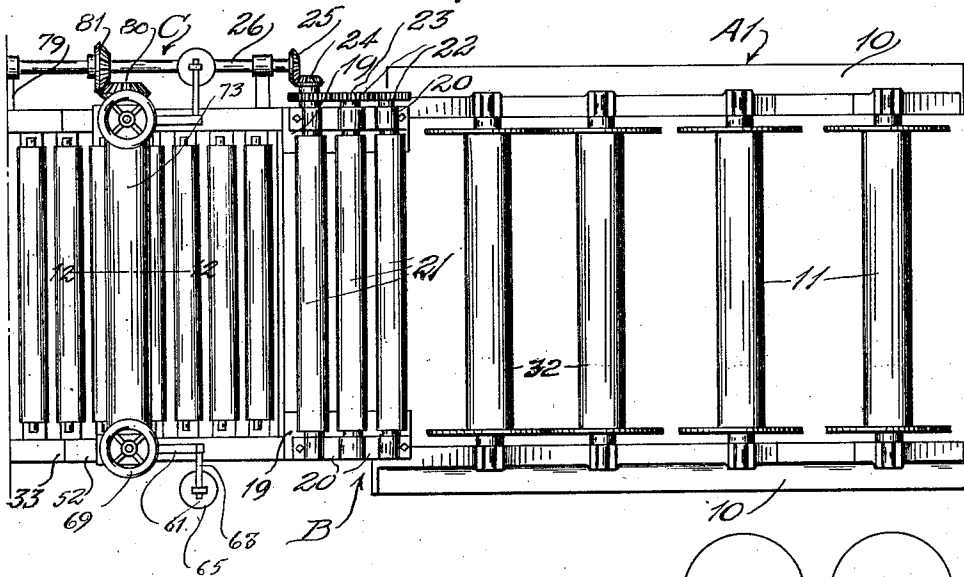
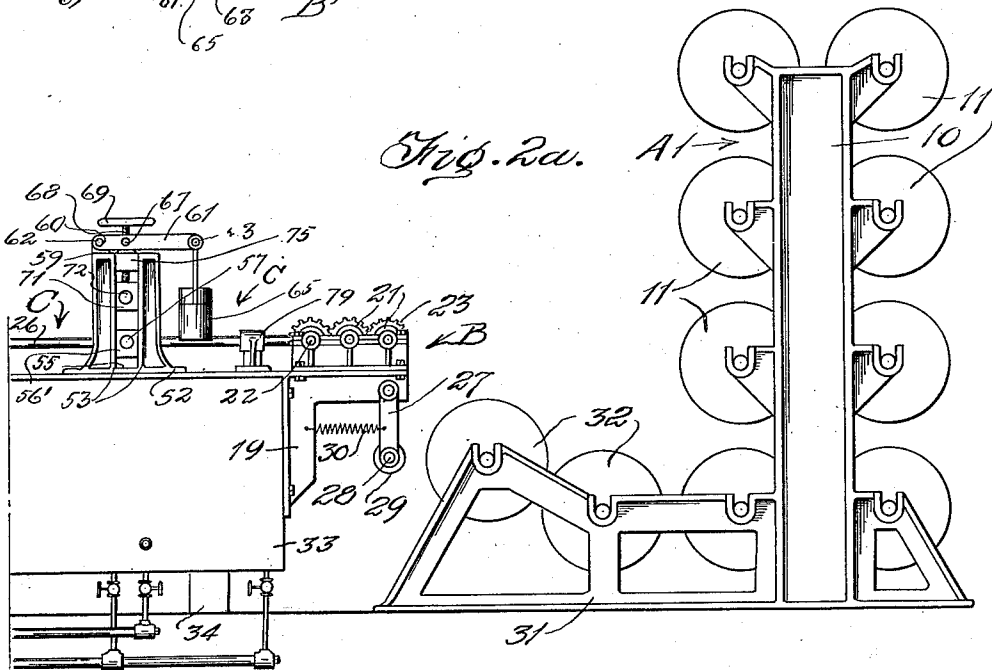


Fig. 2a.



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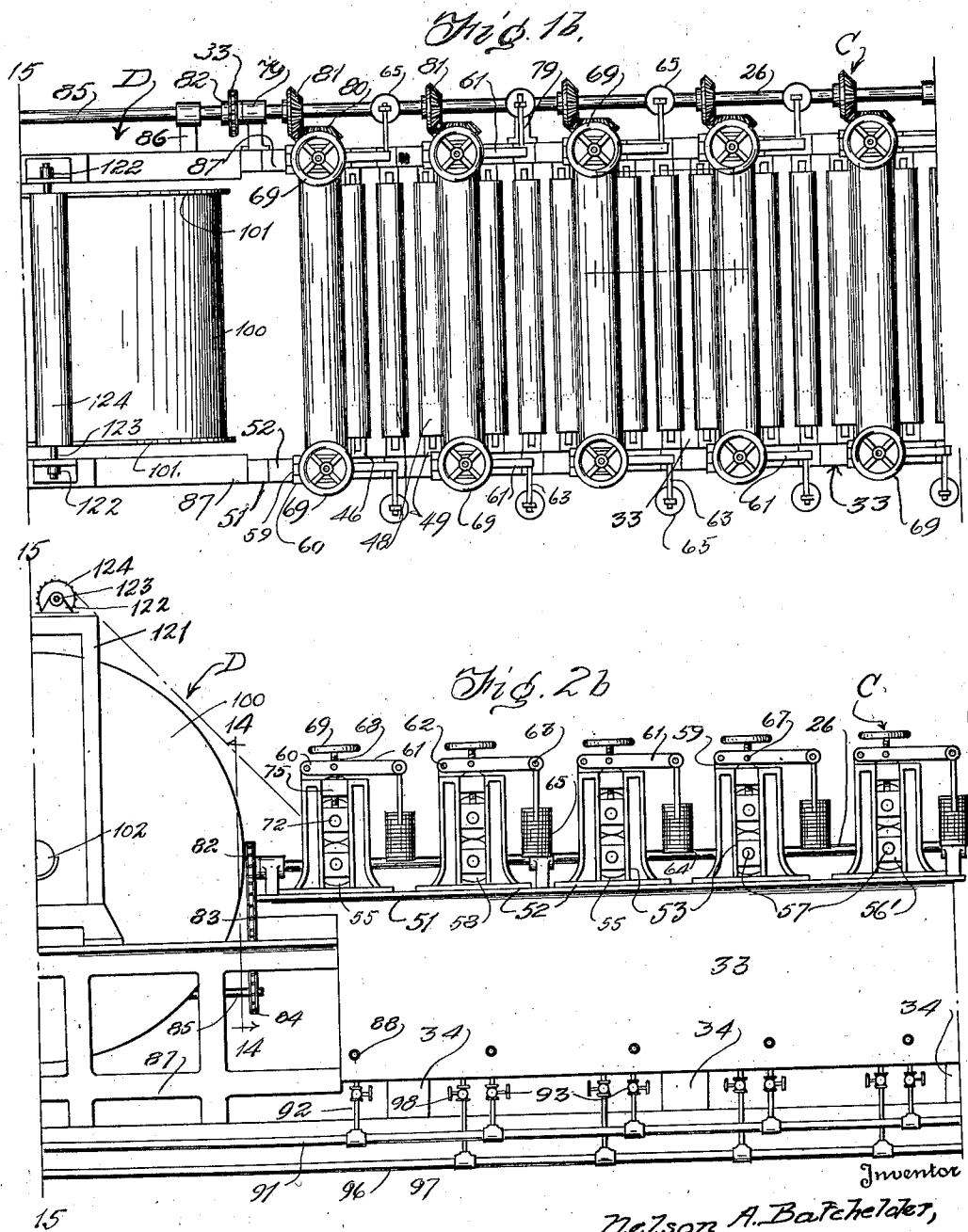
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PROCESS OF YARN DYEING, DRESSING, AND LOOM BEAMING.

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Fig. 1c.

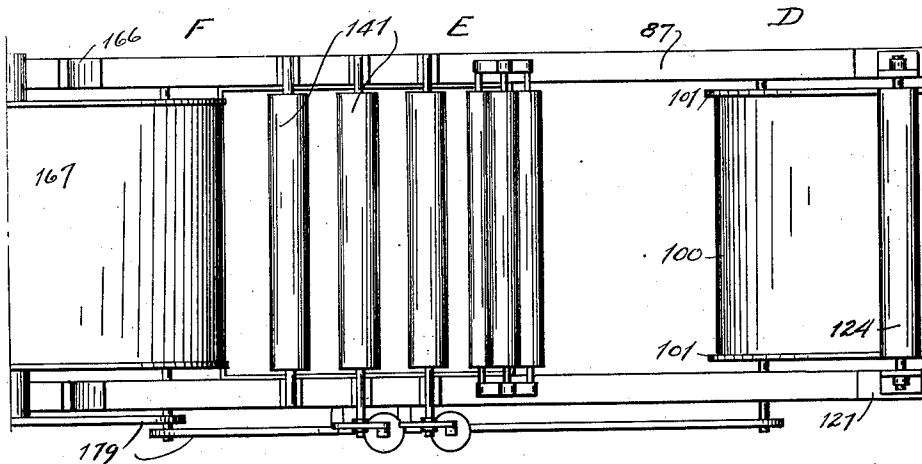
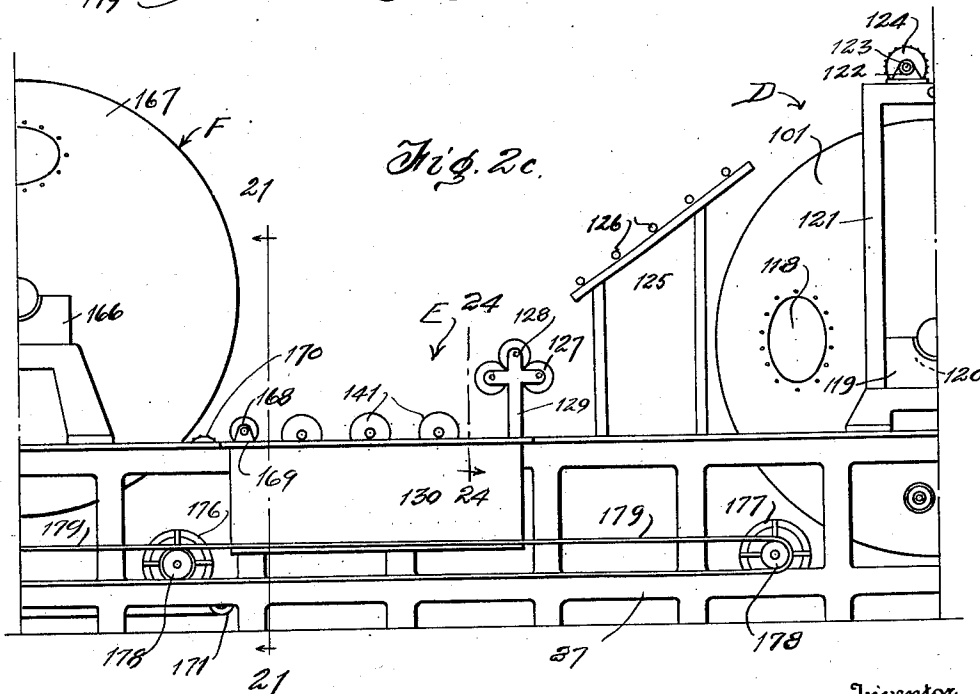


Fig. 2c.



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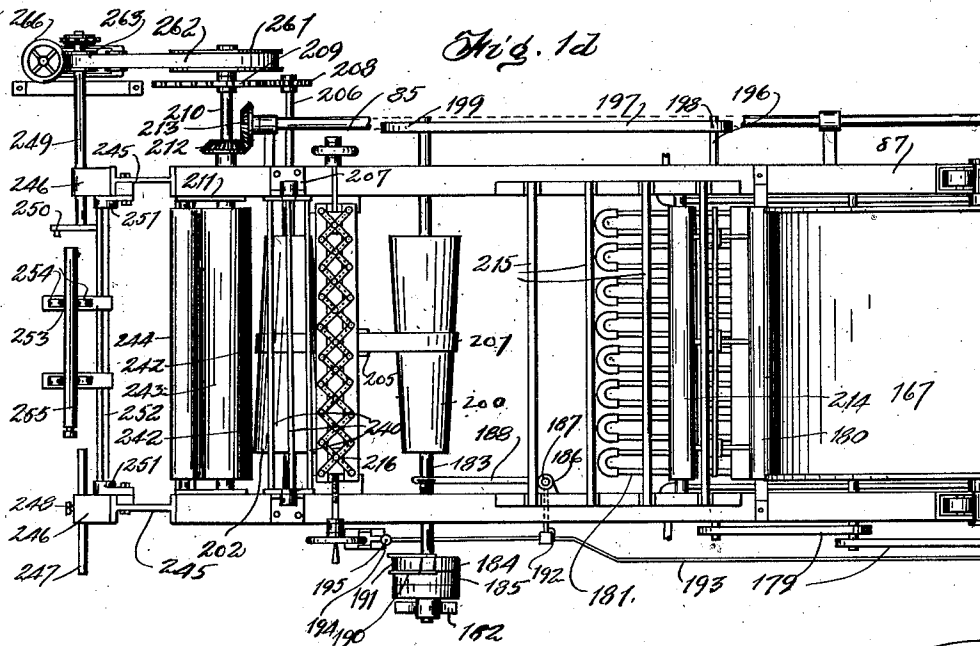
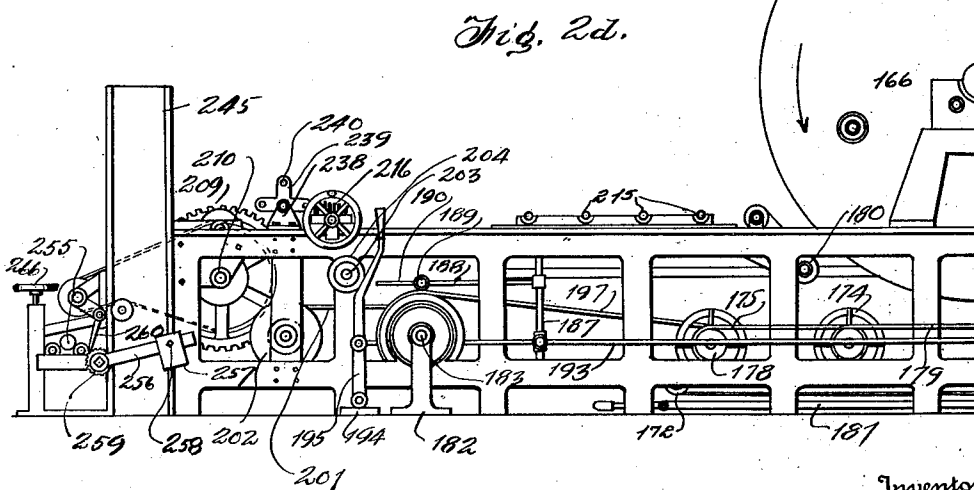
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PROCESS OF YARN DYEING, DRESSING, AND LOOM BEAMING

Filed June 5, 1936

17 Sheets-Sheet 4



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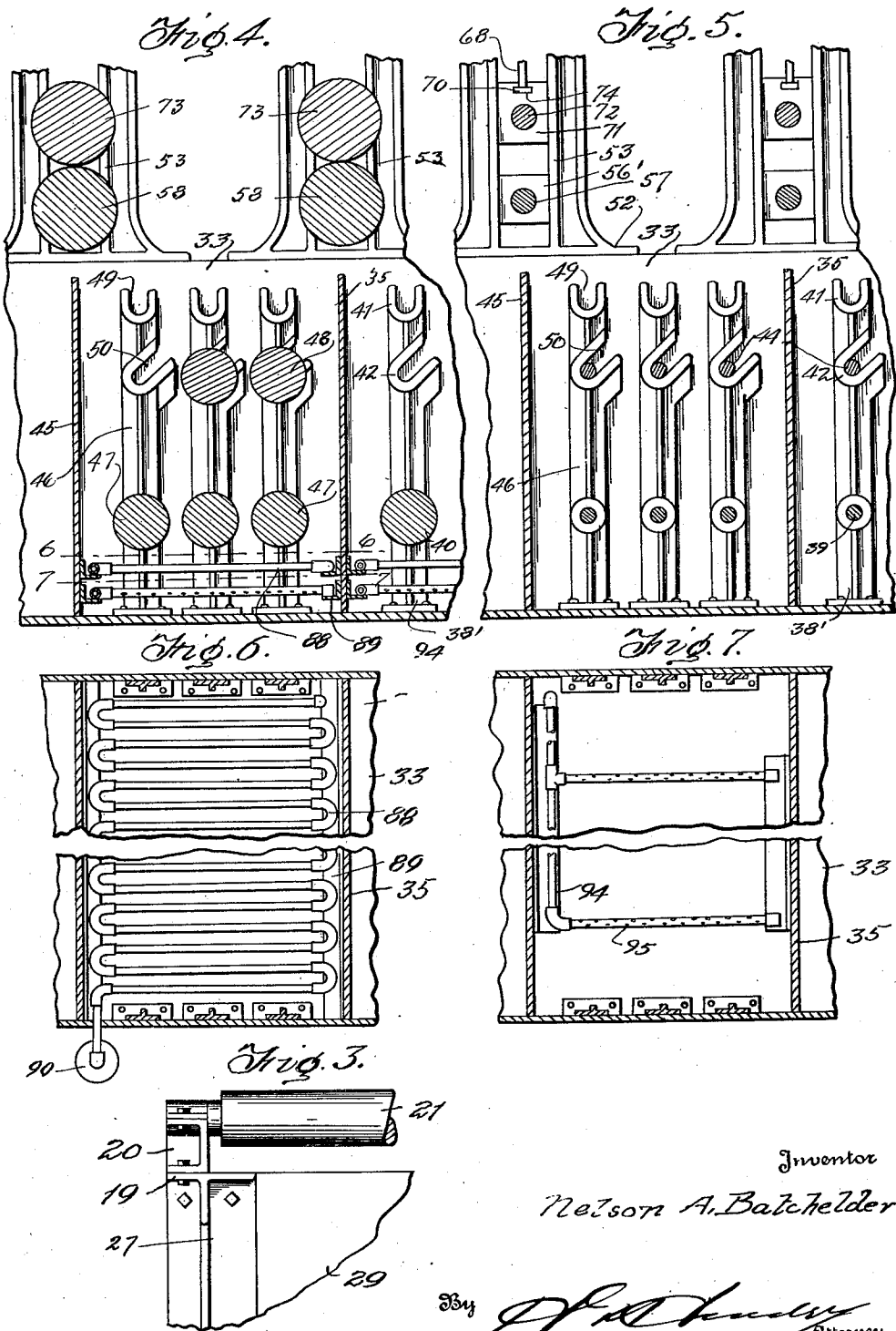
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PROCESS OF YARN DYEING, DRESSING, AND LOOM BEAMING

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17 Sheets-Sheet 5



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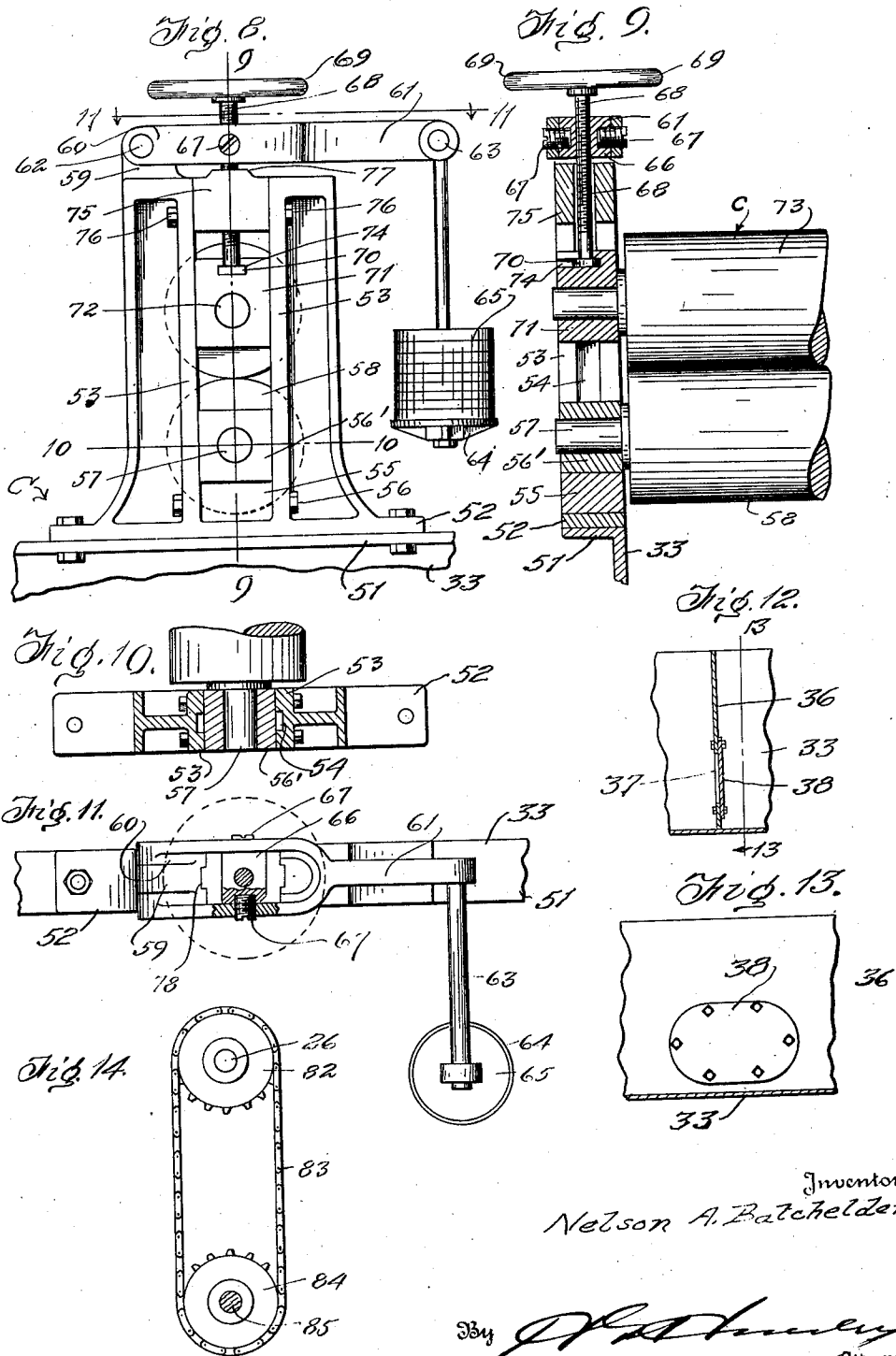
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PROCESS OF YARN DYEING, DRESSING, AND LOOM BEAMING

Filed June 5, 1936

17 Sheets-Sheet 6



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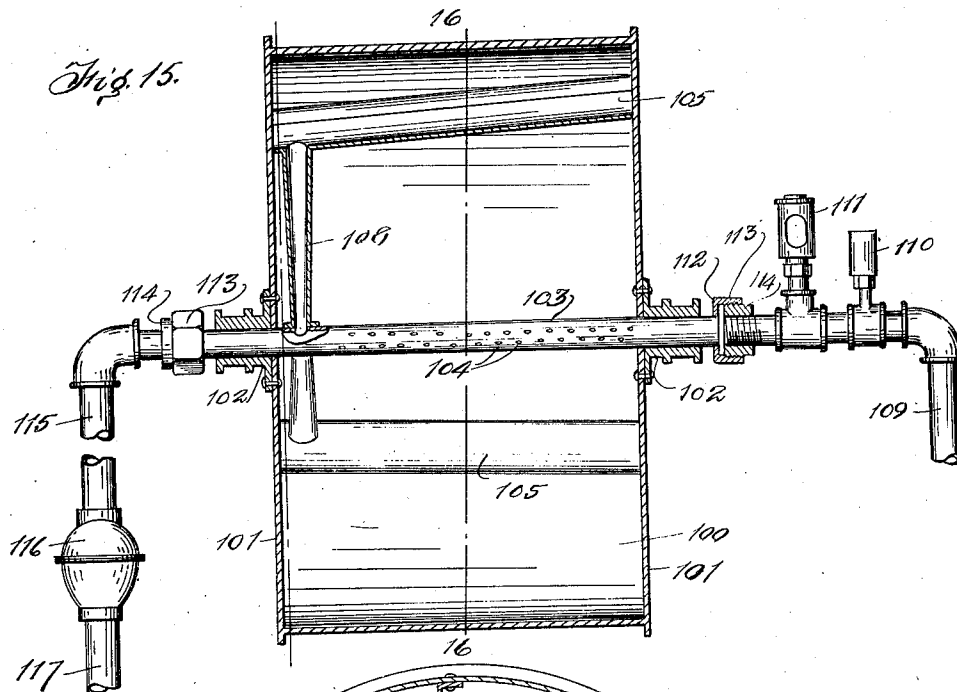
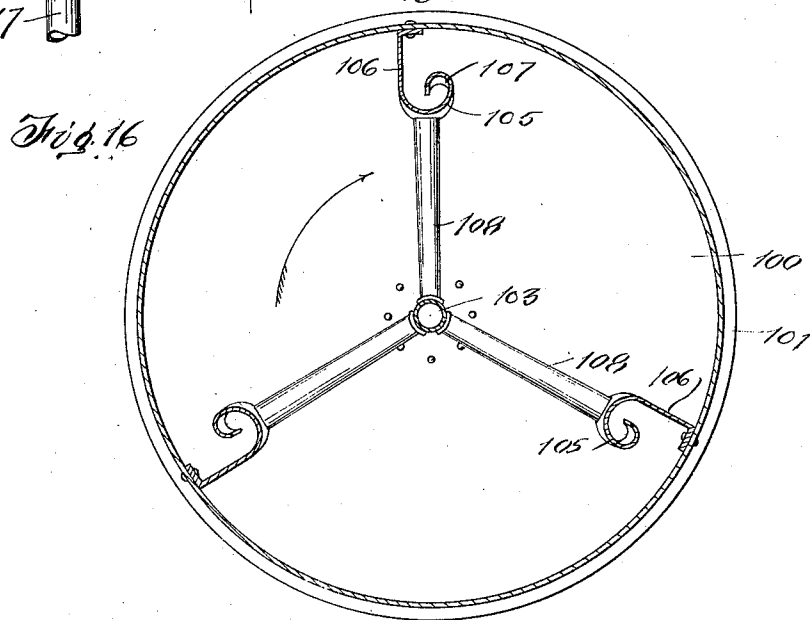
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PROCESS OF YARN DYEING, DRESSING, AND LOOM BEAMING

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17 Sheets-Sheet 7



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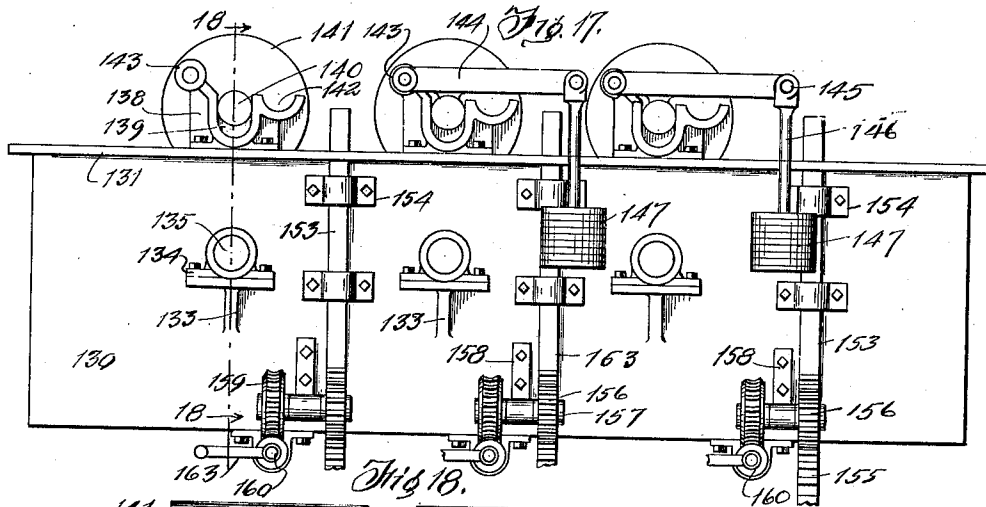
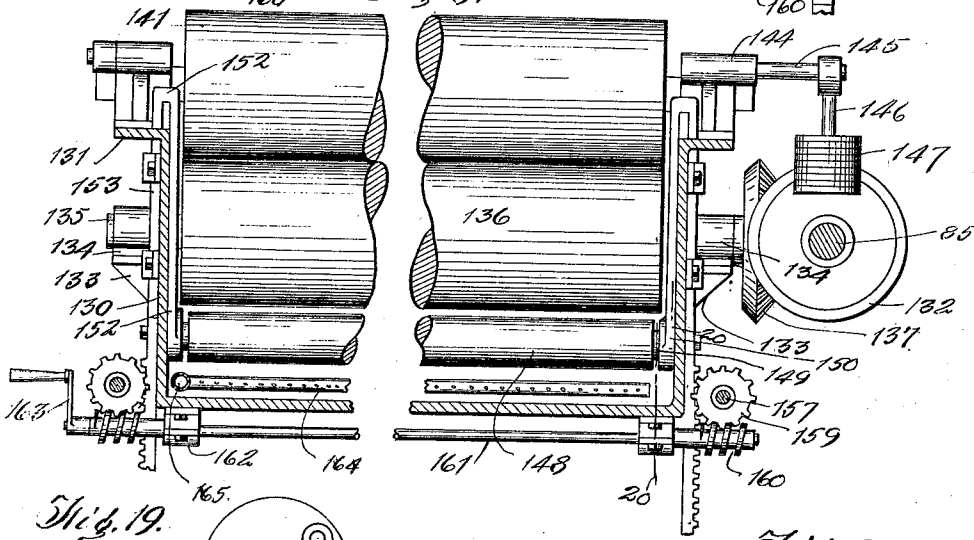
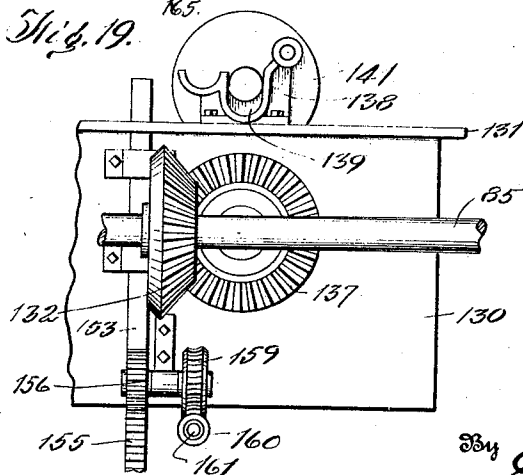
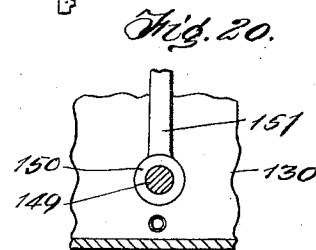
N. A. BATCHELDER

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PROCESS OF YARN DYEING, DRESSING, AND LOOM BEAMING

Filed June 5, 1936

17 Sheets-Sheet 8



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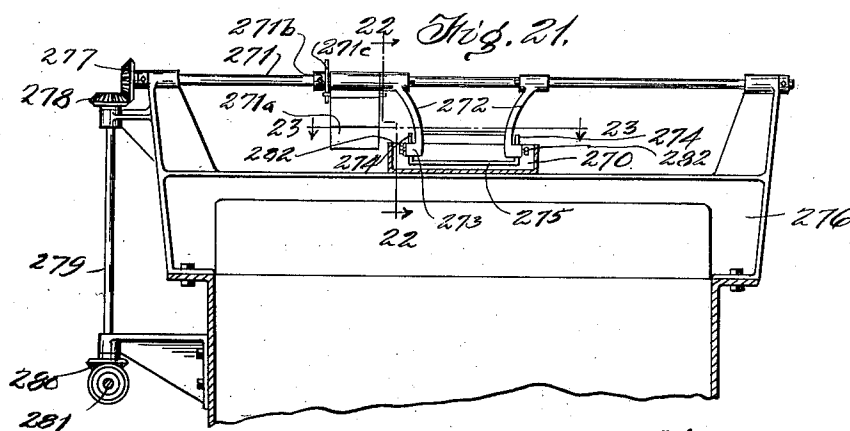
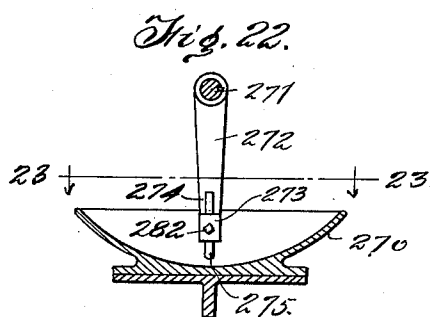
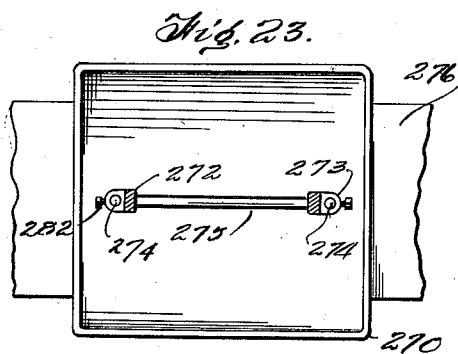
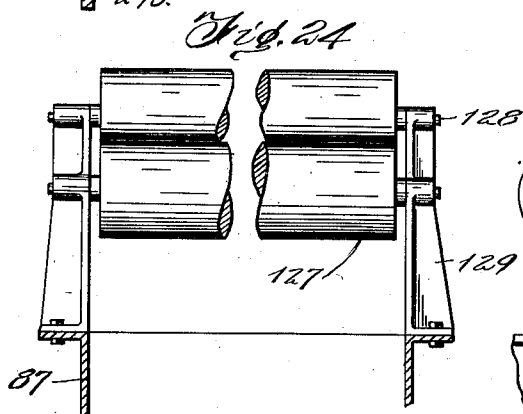
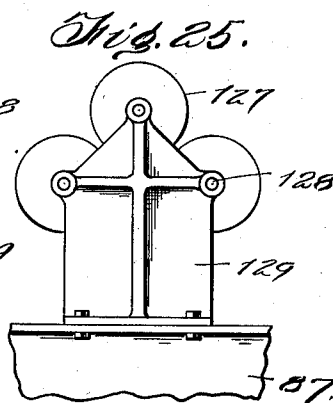
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PROCESS OF YARN DYEING, DRESSING, AND LOOM BEAMING

Filed June 5, 1936

17 Sheets-Sheet 9



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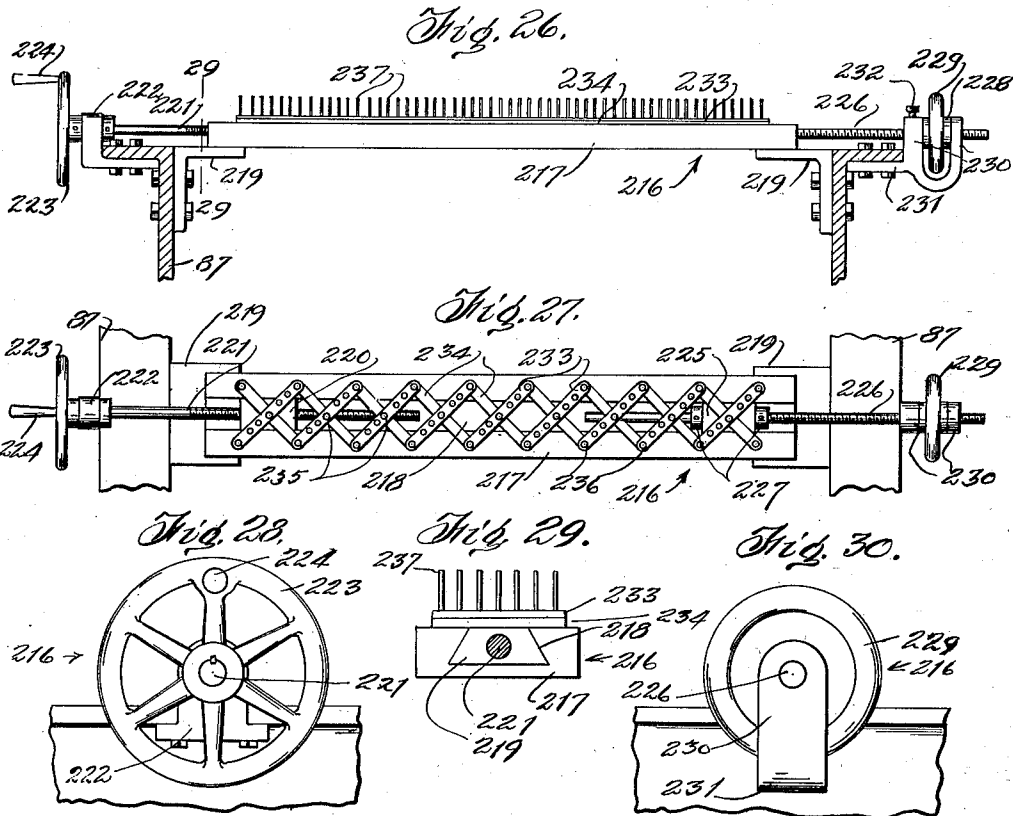
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PROCESS OF YARN DYEING, DRESSING, AND LOOM BEAMING

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17 Sheets-Sheet 10



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PROCESS OF YARN DYEING, DRESSING, AND LOOM BEAMING

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Fig. 31.

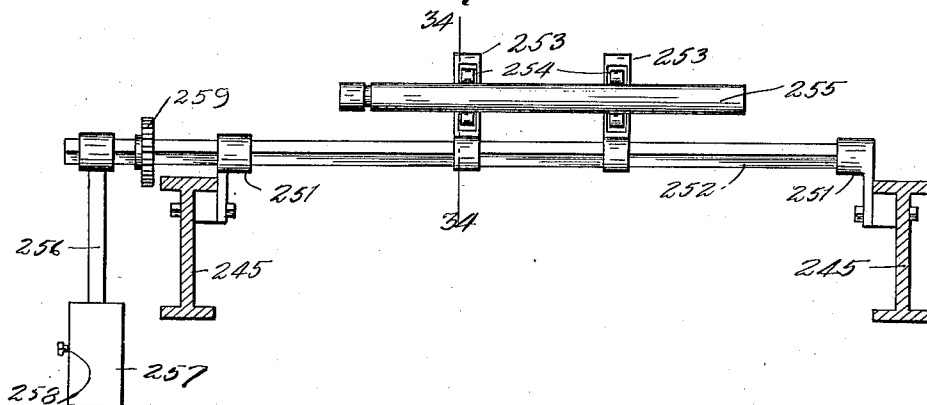


Fig. 32.

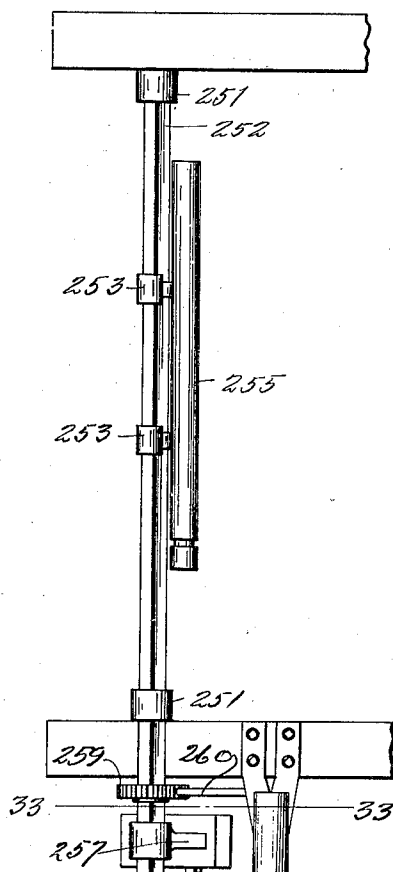


Fig. 33.

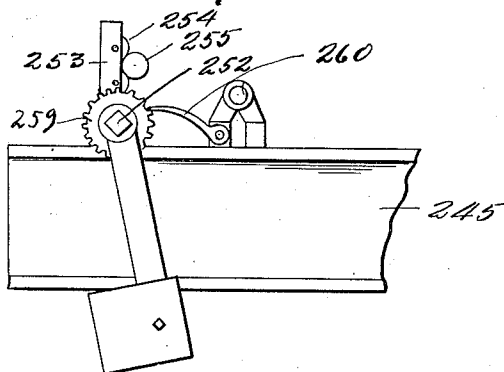
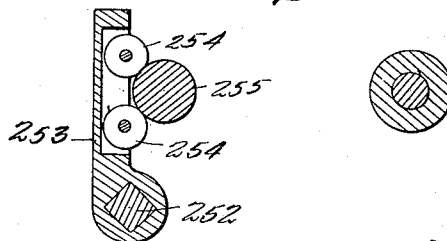


Fig. 34.



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Fig. 35.

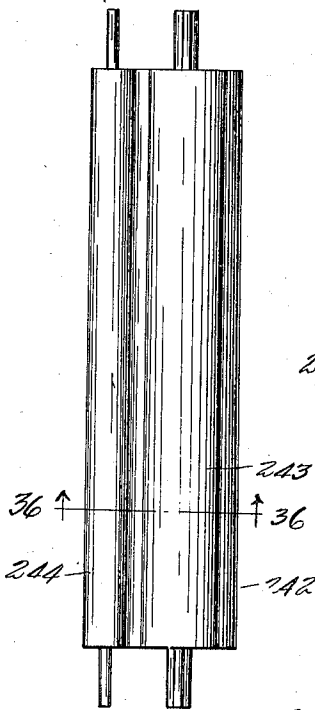


Fig. 38.



Fig. 39.

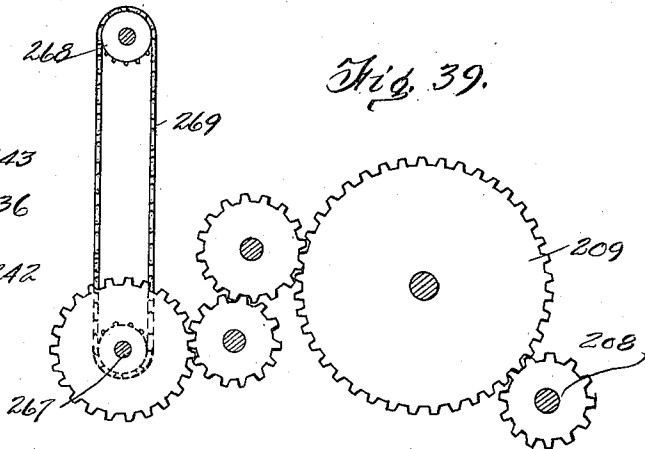


Fig. 36.

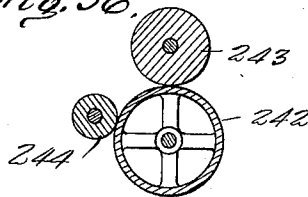
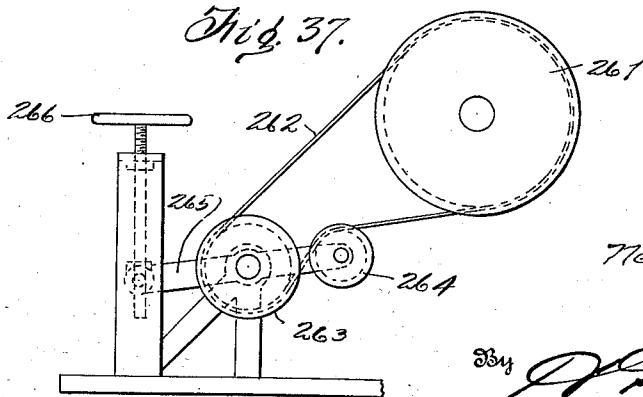


Fig. 37.



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PROCESS OF YARN DYEING, DRESSING, AND LOOM BEAMING

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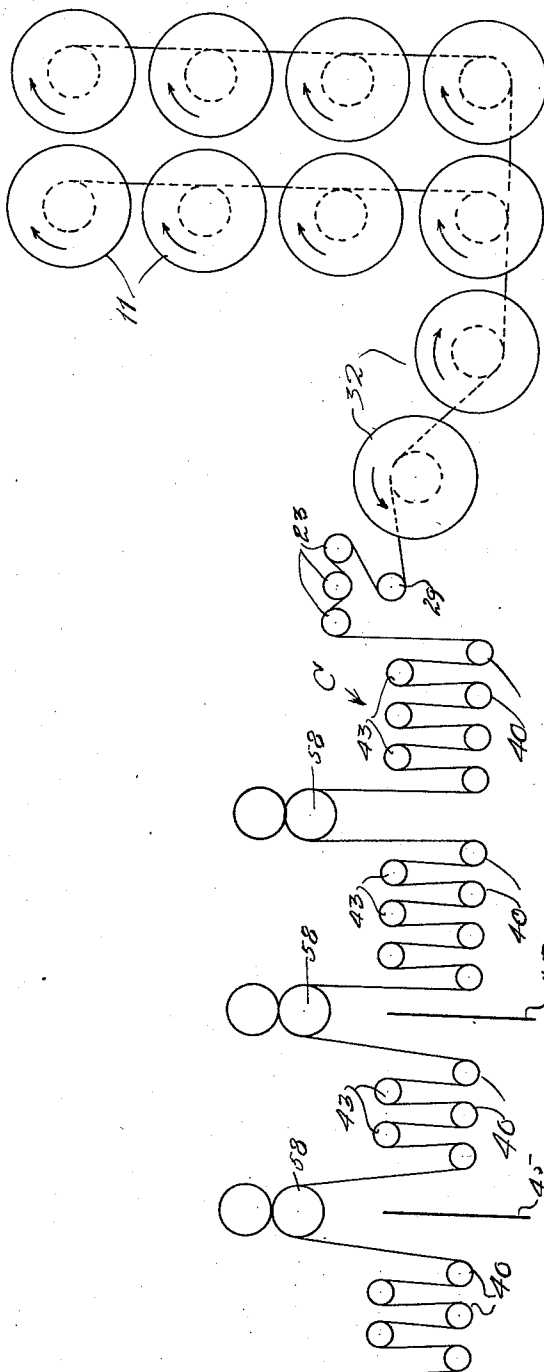


Fig. 39a.

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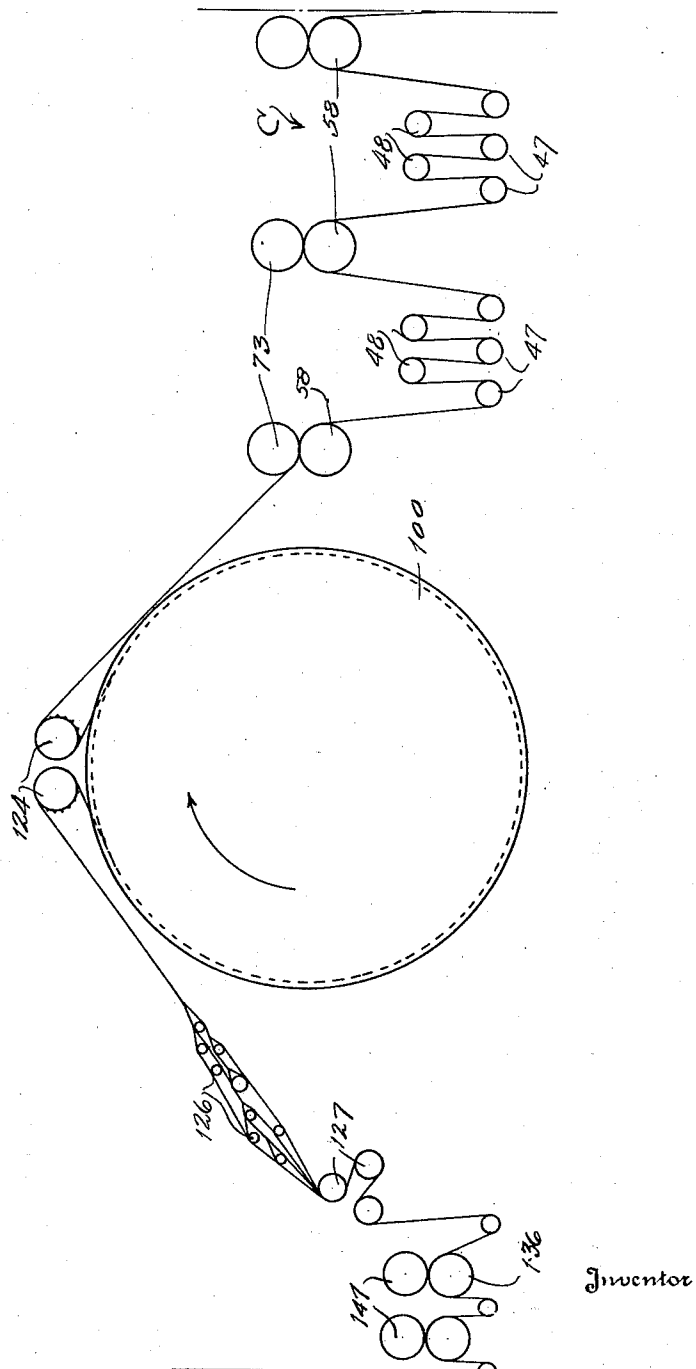
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PROCESS OF YARN DYEING, DRESSING, AND LOOM BEAMING

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Fig. 39a



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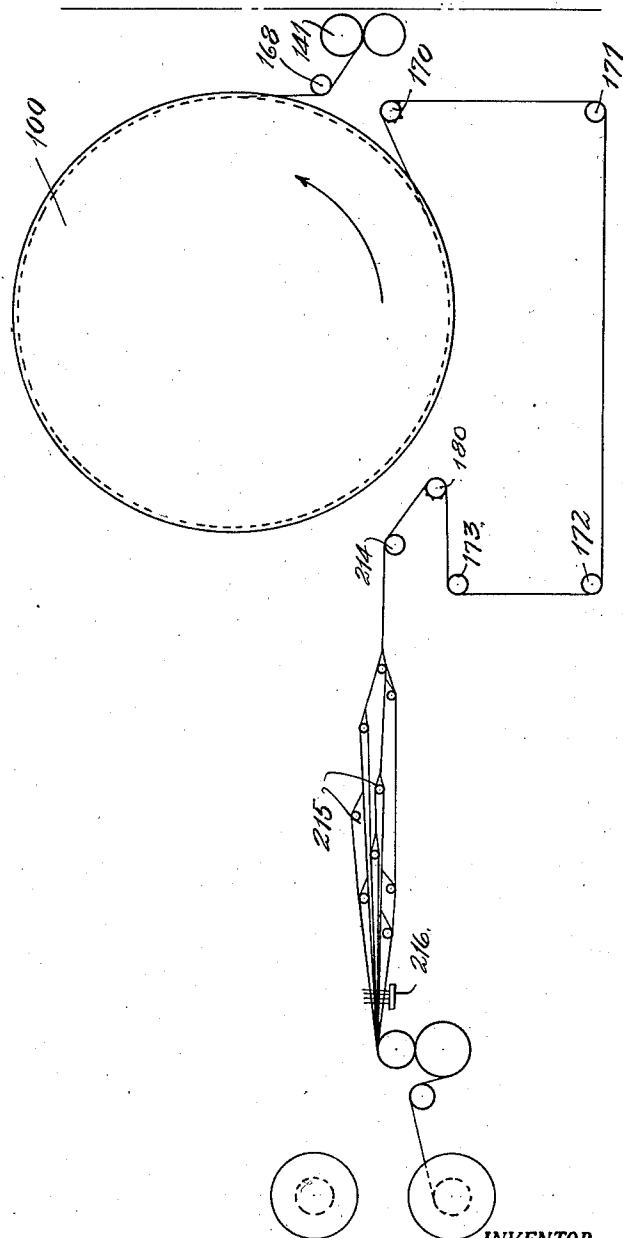
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PROCESS OF YARN DYEING, DRESSING, AND LOOM BEAMING

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Fig. 39c.



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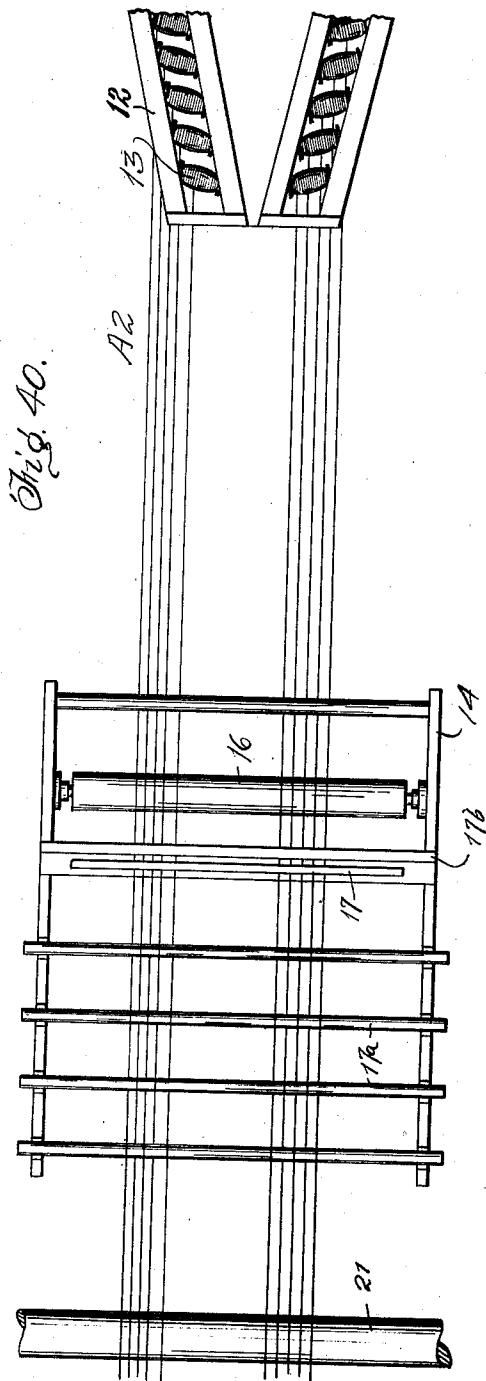
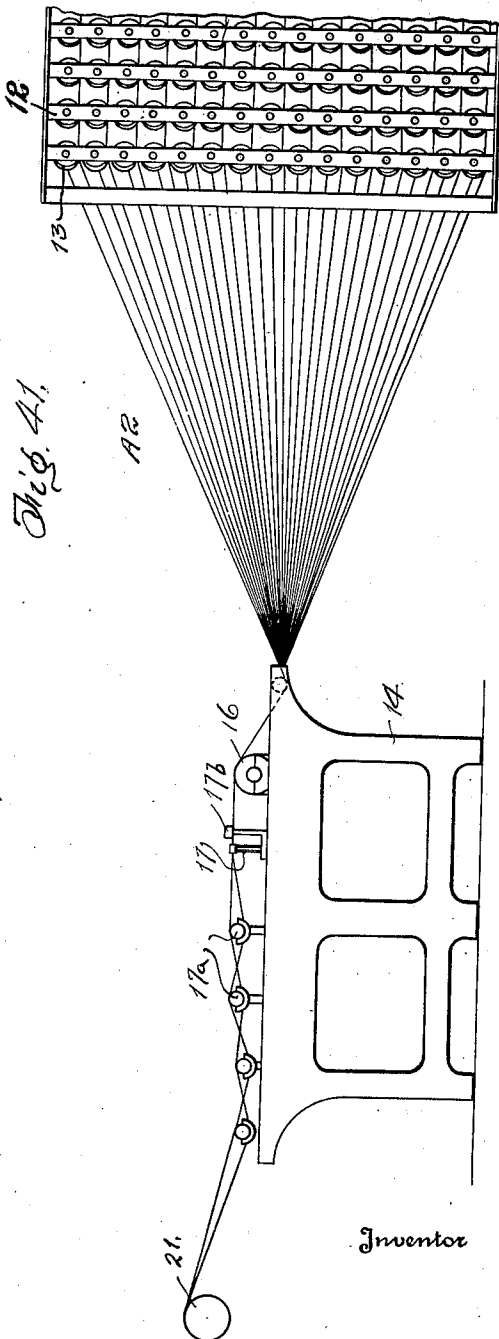
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PROCESS OF YARN DYEING, DRESSING, AND LOOM BEAMING

Filed June 5, 1936

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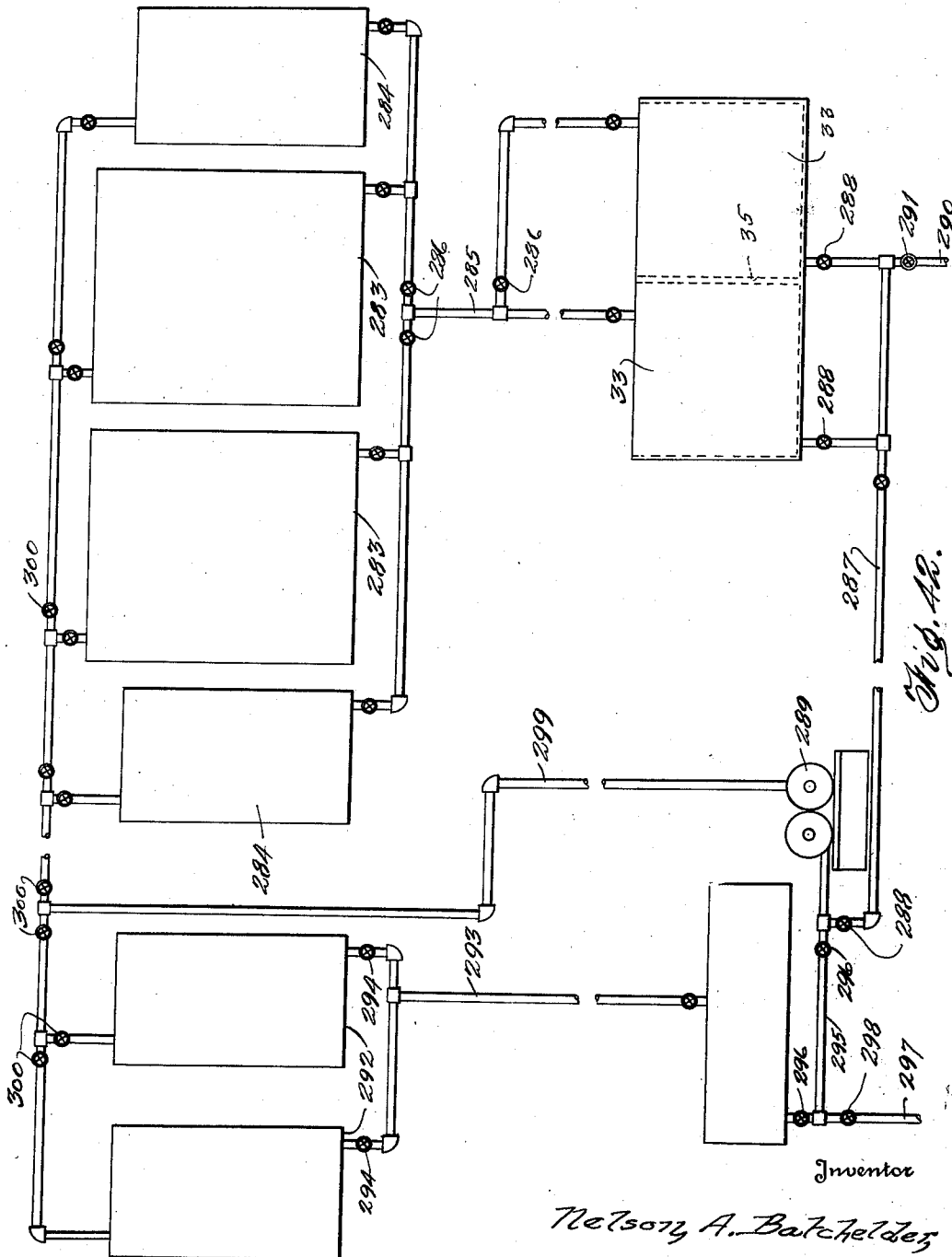
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PROCESS OF YARN DYEING, DRESSING, AND LOOM BEAMING

Filed June 5, 1936

17 Sheets-Sheet 17



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UNITED STATES PATENT OFFICE

2,108,188

PROCESS OF YARN DYEING, DRESSING,
AND LOOM BEAMING

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Application June 5, 1936, Serial No. 83,791

3 Claims. (Cl. 8—5)

This invention relates to a novel process or method of dyeing yarns.

In the dyeing of yarns one method hitherto used is to draw off the yarns from wound bodies and assemble the drawn off yarns side by side to form a sheet or ribbon. This sheet or ribbon is led to a suitable dyeing apparatus consisting of a series of vats into which the sheet or ribbon is successively dipped, a power feed being provided between each pair of adjacent vats to transfer the sheet or ribbon. Heretofore the yarn has been drawn into the first of a series of vats. This method results in a considerable tension being exerted upon the wet yarn in the first vat with the result that much breakage of the yarns occurs.

One important object of the present invention is to provide a novel method whereby the yarn is power fed into the first vat instead of being drawn through the vat.

A second important object of the invention is to provide an improved dyeing method wherein the yarns move through the various vats in a substantially tensionless condition.

In previous methods the sheet or ribbon passes from the first series of vats over a drying cylinder, through a sizing vat and over a second drying cylinder to a revolving beam. In such methods the movement from the first vats to the beam is produced entirely by the tension of winding on the beam. The yarns thus have to rotate all cylinders and rolls by a single pull which causes much breakage of the yarns.

A third important object of the invention is to provide a novel method wherein the yarns are power fed between the first and second drying operations so that each section in the length of the sheet or ribbon will be subject only to a stress sufficient to rotate one drying cylinder.

After the yarns have been assembled in a sheet or ribbon and led to the primary feeding means the methods previously used involved the sudden overcoming of the inertia or rest of the various yarn bodies, such as cops, warper beams, or the like on which the yarn to be dyed is wound, every time the apparatus is started. This causes a momentary heavy stress on the yarns with consequent great breakage of yarns.

A fourth important object of the invention is to provide an improved method of dyeing wherein the tension due to starting delivery from the feed or supply bodies will be gradually applied so that breakage from sudden pulls will be eliminated.

A fifth object of the invention is to provide a

method wherein the tension on the yarns between the supply bodies and first feeder will be yieldingly relieved or cushioned upon such tension exceeding a predetermined maximum.

In the ordinary method of sizing yarns they are simply run through a vat containing sizing material without forcing the size into the yarn. By such methods yarns dyed with certain dyes absorb the proper amount of size while yarns dyed with other dyes absorb in some instances too much size and in other instances too little size.

A sixth important feature of the present method is to provide a method step wherein size will be forced into the yarns during the sizing operation.

With the above and other objects in view the invention consists in general of a dyeing method having certain novel steps and combinations of steps hereinafter fully described and claimed, reference being had to the accompanying drawings as illustrating one form of apparatus by which the novel method may be carried into execution.

In the accompanying drawings like characters of reference indicate like parts in the several views, and

Figures 1a, 1b, 1c and 1d are plan views of consecutive portions of the novel dyeing machine, these sections when placed together show a plan view of the complete machine.

Figures 2a, 2b, 2c and 2d are side elevations of the aforesaid plan portions, these elevations when assembled showing a side elevation of the complete machine.

Figure 3 is an enlarged detail side elevation of a portion of the machine and showing the primary tensioning roll.

Figure 4 is an enlarged detail section on the line 4—4 of Figure 1b.

Figure 5 is a similar section on the line 5—5 of Figure 1b.

Figure 6 is a section on the line 6—6 of Figure 4.

Figure 7 is a section on the line 7—7 of Figure 4.

Figure 8 is an enlarged side elevation of the squeeze roll arrangement shown in Figure 2b.

Figure 9 is a section on the line 9—9 of Figure 8.

Figure 10 is a section on the line 10—10 of Figure 8.

Figure 11 is a section on the line 11—11 of Figure 8.

Figure 12 is a detail section on the line 12—12 of Figure 1a.

Figure 13 is a detail section on the line 13—13 of Figure 12.

Figure 14 is an enlarged detail section on the line 14—14 of Figure 2b.

5 Figure 15 is an enlarged detail section on the line 15—15 of Figures 1b and 2b.

Figure 16 is a section on the line 16—16 of Figure 15.

Figure 17 is an enlarged side elevation of the sizing tank used herein.

10 Figure 18 is a section, partly broken away on the line 18—18 of Figure 17.

Figure 19 is a fragmentary side elevation of the side of the tank opposite to that shown in Figure 17.

Figure 20 is a fragmentary section on the line 20—20 of Figure 18.

Figure 21 is an enlarged fragmentary section on the line 21—21 of Figure 2c.

20 Figure 22 is a section on the line 22—22 of Figure 21.

Figure 23 is a section on the line 23—23 of Figure 22.

Figure 24 is an enlarged detail section on the line 24—24 of Figure 2c.

Figure 25 is a right side elevation of the elements shown in Figure 24.

Figure 26 is a rear elevation of a certain expandible comb used in this invention, some of the associated parts of the machine being also shown in this figure.

Figure 27 is a plan view of the mechanism shown in Figure 26.

35 Figure 28 is a further enlarged detail elevation of these parts shown in Figures 26 and 27, the view being taken from the left side of Figure 26.

Figure 29 is a section on the line 29—29 of Figure 27 but showing the device to the scale used in Figure 28.

Figure 30 is an elevation similar to Figure 28 but from the opposite end.

Figure 31 is a plan view of the presser roll mechanism, certain of the parts being shown in section.

Figure 32 is a front elevation of the parts shown in Figure 31.

Figure 33 is a section on the line 33—33 of Figure 32.

50 Figure 34 is a section on the line 34—34 of Figure 31.

Figure 35 is a plan view of the calendering rolls removed from the remainder of the machine.

Figure 36 is a section on the line 36—36 of Figure 35.

Figure 37 is a detail fragmentary section showing a certain belt tightening means used herewith.

Figure 38 is a top plan view of the gear drive used herein.

Fig. 39 is a side view thereof.

Figures 39a, 39b and 39c are sectional diagrams which, taken together, show the run of the material through the machine.

65 Figure 40 is a plan of a portion of a modified feeding arrangement for supplying yarn to the machine.

Figure 41 is a side elevation of the parts shown in Figure 40.

70 Figure 42 is a diagram illustrating a dye and size distributing and storing arrangement for use in connection with this machine.

75 In the embodiment of the invention as disclosed in the several drawings it will be seen that the invention includes a series of instru-

mentalities arranged successively from right to left in the drawings. As here shown the right hand end of the machine will be referred to in what follows as the rear or feeding end and the left hand end of the machine will be termed the delivery or front end of the machine. Also, the side of the machine seen in Figures 2a, 2b, 2c and 2d will be termed the right side of the machine, the opposite side being, of course, termed the left side.

At the rear of the machine is located a yarn supply means indicated in general at A1 in one form and in general at A2 in a second form. The remainder of the mechanism has a frame structure common to substantially all of the other features except certain auxiliary apparatus such as pumps, tanks and pipe connections therefor. At the rear of the main frame is arranged a yarn tensioning and feeding device indicated in general at B. This feeds the yarn to a dyeing and treating apparatus indicated in general at C from whence the yarn passes to a preliminary dryer indicated in general at D. Forward of this dryer is a sizing apparatus indicated in general at E and from this sizing apparatus the yarn passes to a second drying arrangement indicated in general at F. Finally, the dried yarn passes to the delivery apparatus indicated in general at G. It will be seen from what follows that certain of these generally designated sections of the machine are accompanied by associated devices. The several sections of the apparatus will be presently specifically described, the associated devices being also specifically described in connection with the main devices with which they are associated.

The yarn supply means

In the form of this part of the machine shown in Figs. 1a, 2a and 39a at A1 there is provided a pair of frame or creel sides 10 adapted to revolvably support a series of drums or beams 11 having the yarn to be dyed wound thereon, these beams being preferably of standard width. The creel is so designed that the yarns from the different beams may be doubled together in unwinding to have the several yarns lie side by side to form a flat sheet or a tape depending on the number and arrangement of the beams. If desired a scallop board (not shown) may be used to assist in the taping operation.

In the form of supply means shown in Figs. 40 and 41 and indicated at A2 there is provided a creel frame 12 supporting a multiplicity of spools or tubes 13 wound with yarn. Forward of the frame 12 is a leasing frame 14 provided at its rear end with a transverse guide rod 15 which guides the yarns from the lower spools 13 to pass with the yarns from the upper spools 13, over a roller 16 revolvably mounted on the frame 14. A comb 17 is supported by the frame 14 just forward of the roller 16. The yarn passes through the comb to a set of leasing or separating rods 17a and the several strands of yarn are interlaced with the leasing rods in such manner that, upon the strands having passed the foremost rod these strands will be uniformly spaced laterally of the machine to form a flat sheet. A bar 17b holds the yarn in the comb.

The feeding and tensioning device

This part of the apparatus is shown in Figs. 1a, 2a, 3 and 39a.

At the rear of the main portion of the machine is a pair of brackets 19 on each of which

is mounted a set of three bearings 20 wherein are journaled three feed rollers 21. At the left side of the machine these rollers have their journals 22 provided with meshing gears 23 of equal pitch diameter so that the rollers are geared together to revolve at equal speeds. On the journal 22 of one of these rollers is fixed a bevel gear 24 where-with meshes a bevel gear 25 fixed on a shaft 26. The supports and drive for this shaft will be described hereinafter but it is to be now understood that, during the operation of the machine the shaft 26 is constantly rotated. Pivoted to each of the brackets 19 is a depending tension roll arm 27 and in the lower ends of these arms are revolubly mounted the journals 28 of a tension roll 29. To each arm 27 is connected the rear end of a forwardly extending tension spring 30 which has its forward end anchored to the bracket 19 so that the tension roll is constantly urged forwardly. This tension roll is located normally vertically below the middle feed roller 21. The yarn strands pass from the rear under the tension roll and around the forward part of this roll. The strands pass from the tension roll rearwardly beneath and around the rear feed roll then forwardly and downwardly to run under the middle feed roll and then forwardly and upwardly over the front feed roll. In Figure 2a an auxiliary creel frame 31 is shown carrying beams 32 and the strands pass from the forward beam forwardly to the tension roll. Under these conditions when the machine is started the springs 30 yield to allow the tension roll to swing rearwardly and relieve the jerk on the strands which would occur if the strands ran directly from the beams to the feed roll, considerable force being necessary to overcome the inertia of the heavy beams in starting them to revolve to unwind the yarn.

The dyeing and treating apparatus

The apparatus shown in Figs. 1a, 2a, 1b, 4 to 14, 39a and 39b and indicated at C' includes a vat or tank 33 extending longitudinally of the machine and supported on bearers 34. This tank, at its rear end supports the brackets 19 and extends forwardly from these brackets. Spaced from the rear end of the tank is a transverse partition 35 which divides the tank into a rear dyeing section and a forward treating section centrally of the dyeing section is a partition 36 dividing the dyeing section into rear and forward compartments. The partition 36 is provided with a manhole which may be closed by a manhole cover 38 which may thus separate the two compartments or may be removed to throw the two compartments into one. In dyeing for the darker or more pronounced shades the manhole is opened but, for lighter and more delicate shades the manhole may be closed and the forward compartment alone used for dyeing, the rear compartment being used, if desired, to effect a preliminary washing or other treating of the yarn. In each of the dyeing compartments, at the sides thereof are four pairs of bearing standards 38', the standards of each pair being oppositely disposed. The lower parts of each pair of standards support the journals 39 of lower yarn guiding rollers 40. These rollers revolve on fixed axes. At the upper end of each standard is a bearing fork 41 and intermediate its height each standard 39 has a rearwardly opening and downwardly directed bearing slot 42. Upper yarn guiding rollers 43 are provided with journals 44 which may be positioned either in the forks 41 or the slots 42 so that these upper rollers may be positioned

above the water line of the dye bath or below this water line. The water line thus lies between the two positions of the upper rollers. The yarn passes around these rollers in the manner shown in Figure 39a. By means of this selective positioning of the upper yarn guide rollers the yarn may be kept immersed during its entire travel through each compartment or may be caused to pass into the air above the bath any number of times within the limits of the arrangement (as shown from one to eight times) in order to effect oxidization of the dye when using certain types of dyes. The forward section of the tank 34 is preferably divided into four compartments by transverse partitions 45 and in each of the compartments thus formed there is provided a set of three pairs of bearing standards 46 carrying lower guide rollers 47 and upper guide rollers 48. The standards 46 are identical in form and function with the standards 38 so that the upper guide rollers may be positioned in the baths in these treatment compartments or above said baths. Thus each standard 46 has a fork bearing 49 at its upper ends and an inclined slot bearing 50 below the fork.

Extending along each side of the tank 33 is a top flange 51 and on each of these flanges is mounted a series of bearing standards each of which consists of a base 52 carrying an upwardly extending pair of spaced guides 53 having parallel confronting faces each of which is provided with a vertical guide slot 54. Thus a vertical guide slot is formed in each of these bearing standards and in the bottom of each slot rests a spacer block 55 which is secured in position as by bolts 56. On the block 55 rests a lower and stationary bearing 56' wherein is supported one of the journals 57 of a lower squeeze roll 58. On the upper end of one of the guide members 53 is formed a pivot ear 59 which is straddled by the forked end 60 of a presser lever 61, this forked end being connected to the ear 59 by a pivot pin 62. From the free end of the lever 61 extends a lateral arm 63 which supports a depending hanger 64 carrying removable weights 65 which thus urge the free end of the lever downwardly. Between the arms of the forked end 60 is located a nut 66 which is pivotally connected to the lever by aligned screws 67. Through this nut passes an adjusting screw 68 having a hand wheel 69 at its upper end. The lower end of this screw is provided with a head 70. Slidably mounted for vertical movement between the guides 53 is an upper bearing 71 which carries one of the journals 72 of an upper squeeze roll 73. This bearing 71 has a T-slot 74 in its upper end and in the slot 74 is fitted the lower end of the screw 68, its head engaging in the wider part of the T-slot so that the screw, upon rotation, will raise or lower the upper bearing. Fitted between the upper ends of the guides 53 is a block 75 which is secured in position by bolts 76. This block is provided with a stop lug 77 upon which the lever 61 may rest when the screw is turned to raise the upper bearing. Each of the bearings and the blocks 55 and 75 are provided with ribs 78 which fit in the guide grooves 54 to prevent lateral movement of these parts in the guides 53. These pairs of squeeze rolls are arranged on the tank in such positions that the yarn, in passing from a compartment of the tank will pass between the rolls of a pair so as to have the major part of the liquid squeezed or expressed from the yarn. By regulating the amount of weight carried by the

hangers the extent of pressure of the upper roll on the lower may be controlled.

The shaft 26 extends along the tank 33 and bearings 79 are fixed to the tank and support said shaft. One journal 57 of each lower roll is extended at 56 through its bearing towards the shaft 26 and on the extended journal is fixed a bevel gear 80 which meshes with a similar bevel gear 81 fixed on the shaft 26. Thus revolution of the shaft drives each lower squeeze roll 56 and this in turn causes frictional drive of the upper squeeze rolls 73. Fixed on the shaft 26 is a sprocket 82 which is connected by a chain 83 with a sprocket 84 fixed on a main shaft 85 extending forwardly from a point adjacent to the tank, this shaft being supported by bearings 86 carried by the main frame sides 87 of the machine.

In each of the compartments of the tank 33, just below the lower guide rollers, is a steam coil 88 supported on bearers 89 carried by the compartment walls. The piping forming this coil is imperforate so that the steam flows through the coil to a steam trap 90 located outside the respective compartment. A steam main 91 supplies each of the coils 88, being connected thereto by branch pipes 92 controlled by valves 93. Below the coil 88 is a second coil 94 having pipes which are perforated as at 95 to permit steam to flow directly into the baths of the several compartments. The coils or heaters 94 receive live steam from a steam main 96 connected to each heater 94 by a branch pipe 97 controlled by a valve 98. By means of this arrangement the baths may be heated with or without the mixing of live steam with such baths.

The dryers

The first drying cylinder is shown in Figs. 1b, 2b, 1c, 2c, 15, 16 and 39b.

The drying arrangements, at both D and F, include identical drying drums each of which includes a cylindrical body 100 provided with heads 101. Centrally of each head there is fixed a tubular journal 102. A pipe 103 extends through the journals 102 and fits steam tight in these journals. The major portion of this pipe between the heads 101 is provided with perforations 104. Extending from one head 101 to the other is a set of buckets 105. One side wall 106 of each bucket extends to the cylinder wall 100 and its other side wall has an inwardly curved lip 107. Each bucket has its bottom inclined from one head 101 to the other towards the axis of the drum. Thus, as each bucket, upon rotation of the drum, arrives at its uppermost point of travel one end of the bucket will be lower than the other. The end of each bucket which thus becomes the lower end is connected to the pipe 103 by a drain pipe 108. By this means any condensate is picked up by the buckets as the cylinder revolves and is returned to the pipe 103, it being noted that the condensate is returned adjacent the exhaust end of said pipe 103. A steam supply pipe 109 leads from any convenient source of steam and to this pipe is connected a steam gauge 110 and a safety valve 111. This safety valve is provided for the purpose of preventing collapse of the heating drum by sudden condensation of the steam therein. On each end of the pipe 103 is fitted a flange 112 against which bears a union nut 113 which screws onto a collar 114. One of the collars 114 is fixed on the pipe 103. The other collar 114 is fixed on the end of a pipe 115 which leads to a steam

trap 116 and thence, through a pipe 117 back to the source of steam supply. One of the heads 101 is provided with a suitable manhole and cover 118.

In the first dryer (at D) there is provided on each frame side 87 a bearing stand 119 wherein is journaled a pair of anti-friction rollers 120 which lie beneath and on each side of the journal 102 so that the drying drum may revolve with great freedom. On each bearing stand 119 is an upstanding frame 121. A pair of bearings 122 is mounted on top of each frame 121 and in these bearings are mounted the journals 123 of strand guide rollers 124. By this arrangement the two guide rollers 124 are positioned close together above and close to the drying drum at D. As will be seen by the dotted line S in Figures 2b and 2c the strands leave the front squeezing roll 73 up and over the rear roll 124, then down and around the rear drying drum and back up and over the front roll 124. Thus the sheet or tap of strands pass substantially around the entire circumference of the drying drum. Now, since this drum is maintained, by its steam content, at a temperature sufficient to vaporize any moisture which may remain in the dyed strands, the drying is accompanied by an evolution of steam from the strands so that they are dried in a steam atmosphere.

The sizing arrangement

During the drying just described there may be some tendency for adjacent strands to adhere which would interfere with proper absorption of size in the sizing bath. This bath is shown in Figs. 1c, 2c, 17 to 20, 24, 25, 39b and 39c. In order to overcome this condition and to separate adherent strands the sheet is led from the forward roller 124 over a leasing table 125 provided with a set of leasing rods 126.

Forward of and below the leasing table 125 is a set of three tensioning or evener rolls 127 which have their journals 128 supported in triangular formation in bearings 129 supported from the frame sides 87. The sheet or tape of strands passes from the leasing table 125 over the top roller 127, around that roller and back to the upper side of the rear roller 127 and from under this last over and down from the front roller 127.

From the front roller 127 the sheet or ribbon passes to the sizing vat or tank 130. This vat or tank is of ordinary rectangular form and its upper edge is flanged outwardly by flanges 131. The shaft 85 extends along the left side of the tank or vat 130 and has bevel gears 132 fixed thereon. Cast or otherwise formed on each side of the vat 130 is a set of brackets 133 whereon are fixed bearings 134 which are arranged in aligned pairs. The walls of the tank are provided with suitable openings aligned with these bearings so that the journals 135 of the lower squeeze rolls 136 may pass through such openings and be journaled in said bearings. The journals on the left side of the machine carry bevel gears 137 which mesh with the gears 132. Mounted on the flanges 131, directly above the bearings 133 are castings 138 each having a vertical slot 139 to receive one of the journals 140 of an upper squeezing roll 141 which bears, by its weight, downwardly toward the respective roll 136. These castings have sockets 142 on one side of the slots 139 so that the upper rolls 141 may, if desired, be lifted and positioned with their journals 140 in said sockets to hold the rolls 141 out of engagement with the lower rolls 130. Also, each casting 138 carries a

pivot ear 143 and to certain of the ears 143 is pivoted one end of a lever 144 which extends over and bears on a journal 140. From the free end of each lever extends an arm 145 from which is suspended a hanger 146 carrying weights 147. By regulating the weights 147 pressure of the upper rolls on the lower may be adjusted to suit the particular treatment or sizing desired.

In order to dip the material into the sizing bath prior to its passage between each set of squeezing rolls there is provided, below and to the rear of each roll 136, a dipping roll 148 having journals 149 which are held in bearings 150 carried on the lower ends of hanger bars 151 which fit closely against the sides of the vat 130. These bars 151 are connected at their upper ends by cross pieces 152 with supporting bars 153 sliding through guides 154 on the outside of the tank or vat 130. The lower ends of the bars 153 are formed as racks 155 wherewith mesh gears 156 mounted on shafts 157 supported in bearings 158 secured to the tank or vat 130. On each of the shafts 157 is fixed a worm wheel 159 wherewith meshes a worm 160. Each pair of worm wheels 159 lies opposite each other so that a pair of the worms 160 is carried on a single shaft 161 which extends beneath the vat 130 from side to side thereof, being supported in bearings 162. On one end of each shaft 161 is fixed an operating crank 163 by means of which the shaft 161 may be rotated to raise each end of the respective roll simultaneously.

In order to prevent sedimentation and to keep the size in the tank 130 at the proper temperature there is provided, preferably beneath each roll 148, a perforated pipe 164 connected by suitable piping to a circulating pump, (not shown) the pump receiving the tank bath through an out-flow pipe 165. The perforations in the pipe 164 are directed downwardly at suitable angles to scour the bottom of the vat.

The adjustable dipping rolls just described enable the operator to control the length of travel of the strand sheet or ribbon through the sizing bath and thus to regulate the amount of size absorbed by the material.

The second dryer

The second dryer is shown in Figs. 1c, 2c, 1d, 2d and 39c, its details being shown in Figs. 15 and 16.

Forward of the sizing vat there is mounted on the frame sides 87 a pair of oppositely disposed bearing members 166 similar to the previously described members 119. These bearing members support the forward drying cylinder or drum indicated in general at 167. As previously explained the detail construction of this drum 167 is identical with the first drum. The drum 167 accordingly has journals 102 supported by the bearing members 166. To the rear of this drum is located a lead-on roller 168 which lies opposite the lower part of the drum, being journaled in bearings 169 supported on the frame sides 87. The material passes from the forward squeezing rolls of the size vat 130 under this roller 168 and up and around the drum 167 to a stripping roller 170 which is supported from the frame sides 87 just forward of and below the level of the roller 168. The roller 170 is thus located to the rear of the drum 167 and the material, in passing around the drum 167 extends around substantially the entire periphery of the drum. From the stripping roller 170 the material passes downwardly to a guide roller 171 journaled in the frame sides 87 and thence for-

wardly from beneath the roller 171 to a roller 172 from whence it passes upwardly in a vertical direction to a roller 173. It will now be observed that the material under treatment passes, between the rollers 170 and 173, in a trough like formation, the rear side of the trough being located behind the lower part of the drum 167 while the forward side of the trough lies in front of the lower part of said drum 167. Forward of the drum 167 there is provided a pair of spaced fans 174 and 175, the fan 174 being located close to the drum 167 while the fan 175 is located close to the rear side of the run of the material from roller 172 to roller 173. Also a fan 176 is provided between the lower part of the drum 167 and the run of the material between the rollers 170 and 171. Furthermore, a fan 177 may be provided forward of the lower part of the first described drying drum. All of these fans are connected for driving in unison by pulleys 178 and belts 179. From the roller 173 the material runs back to pass beneath and around a roller 180 supported by suitable bearings from the frame sides 87. The material thus partially encloses the fan 175.

Beneath the run of the material from the roller 171 to the roller 172 is a steam coil 181, so that, the material which is substantially dried by passing around the drum 167 will be fully dried by passing close over this steam coil 181.

The main drive

The main drive is shown in general in Figs. 1a to 2d inclusive and details are also shown in Figs. 14, 18, 19, 37, 38 and 39.

Mounted at the right side of the machine and near its forward end is a bearing pedestal 182 which supports one end of a main drive shaft 183 which has its remaining part supported by the frame sides 87 across which it extends. On the shaft 183, adjacent the bearing 182, is fixed a fast pulley 184 and adjacent the pulley 184 a loose pulley 185 is mounted on said shaft 183. Bearings 186, carried by the right hand frame member 87, support a vertical rock shaft 187. An arm 188 extends forwardly from this rock shaft and operates a belt shipper rod 189 provided on its outboard end with a shipper fork 190 embracing the driving belt 191 which is connected to some suitable source of power (not shown). Extending laterally from the shaft is a rock arm 192 to which is connected an operating rod 193 which runs along the right side of the machine. A bearing 194 has the lower end of an operating lever 195 pivoted thereto and the rod 193 is suitably connected to this lever so that, by shifting the lever, the belt may be moved from one of the pulleys 184 and 185 to the other. Inasmuch as the speed at which the fans are driven is, for practical purposes, immaterial, the forward fan shaft 196 is connected by a belt 197 with pulleys 198 and 199 on the shafts 196 and 183.

On the shaft 183 is mounted a long cone pulley 200 which is connected by a belt 201 with a similar but reversely positioned cone pulley 202. Extending transversely of the machine is an adjusting screw 203 adapted to be rotated by a hand wheel 204. On this screw is mounted a nut which carries a shipper fork 205 straddling the belt 201 so that rotation of the hand wheel 204 shifts the belt 201 along the cone pulleys. A shaft 206 carries the pulley 202 and is journaled in brackets 207 fixed to the frame sides 87. On the left hand end of the shaft 206 is fixed a gear 208 which meshes with a gear 209 fixed on



time to time to indicate the proper place for cutting such material into lengths.

On the shaft 271 is hung a weight 271a which is connected to the shaft by a pin 271b and a dog 271c.

The storage arrangements

In connection with this machine storage and supply means shown in Fig. 42 may be used to conserve the dye and size used in the machine. Such an arrangement is diagrammatically illustrated in Figure 40. As there shown there are provided storage tanks 283 and dye tanks 284 connected by a pipe system 285 with the dye vat 33, the pipe system being provided with valves 286 so that dyes may be selectively supplied from the tanks 283 and 284 to the dye vat compartments as desired. A return pipe system 287, provided with control valves 288, leads from these dye vats to a pump 289. This return pipe system may be connected to a sewer or the like by a pipe 290 controlled by a valve 291 so that spent dye may be wasted.

Similarly, there are provided size tanks 292 connected by a pipe system 293 with the size box 130, this pipe system being provided with control valves 294. Preferably the several tanks 283, 284 and 292 are located at such heights that there will be gravity flow of their contents to the dye vats and the size box. The size box 130 is connected to the pump 289 by a return pipe 295 provided with control valves 296 and this pipe may be connected to a sewer or the like by a waste pipe 297 controlled by a valve 298 in order to dispose of spent size solution. A return pipe system 299 leads from the pump to the several storage receptacles, this system being provided with suitable valves 300 to control the direction of flow of fluid from the pump.

It will be understood that the expression "wound yarn bodies" is to be understood as including any means for supplying yarn in its undyed state wherein the yarn is formed in wound bodies such as are produced by winding on spools, beams or in any other manner.

It will now be seen that this method involves power drawing the yarns from the creels in such

manner as to prevent sudden shocks, the same power device being used to feed the dry yarn into the first of a series of baths through which the sheet passes with little or no tension on the yarn. The yarn is then fed from the last treatment bath and to and through a sizing bath while the tension is just enough to rotate a single drying cylinder. Again the yarn is fed over a drying cylinder and is then subjected to a stream of hot air for final drying after which it is combed and beamed.

Having thus described the invention, what is claimed as new, is:

1. That method of continuous dyeing of yarn collected from a plurality of undyed yarn bodies which consists in absorbing the starting torque resultant from the unwinding of the yarn from said yarn bodies and then power feeding the yarn at a predetermined positive speed from said bodies to and through a series of successive dye treatments while maintaining a constant uniform lineal speed of all parts of said yarn without appreciably tensioning the yarn.

2. That method of continuous dyeing of yarn collected from a plurality of yarn bodies which consists in absorbing starting torque resultant from the unwinding of the yarn from said yarn bodies, power feeding the yarn into the first of a series of successive dye treatments, and then power feeding the yarn at a predetermined positive speed through the successive dye treatments while maintaining a constant uniform lineal speed of all parts of said yarn without appreciably tensioning the yarn.

3. That method of continuous dyeing of yarn collected from a plurality of undyed yarn bodies which consists in absorbing the starting torque resultant from the unwinding of the yarn from said yarn bodies and then power feeding the yarn at a predetermined positive speed from said bodies to and through a series of successive dye treatments while maintaining a constant uniform lineal speed of all parts of said yarn without appreciably tensioning the yarn, and beaming the treated yarns at the same lineal speed with which they enter and pass through said dye treatments.

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