Aug. 18, 1953 R. B. NEWTON ET AL 2,649,071

THREAD TREATING MACHINE

Filed April 24, 1948 4 Sheets-Sheet 1

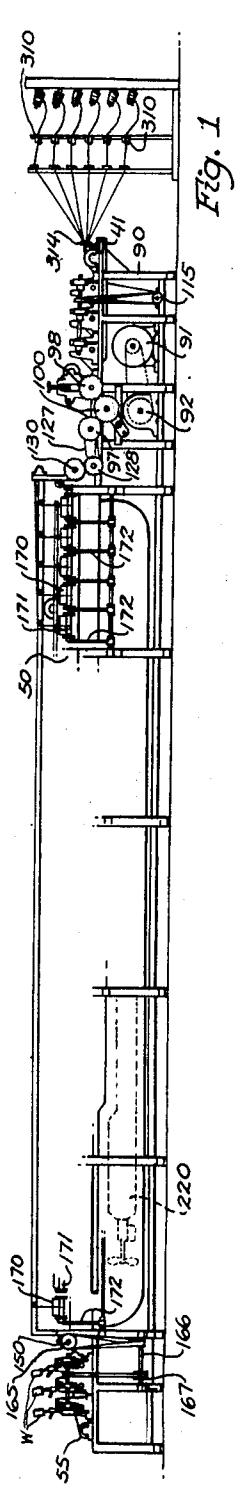


Fig. 1

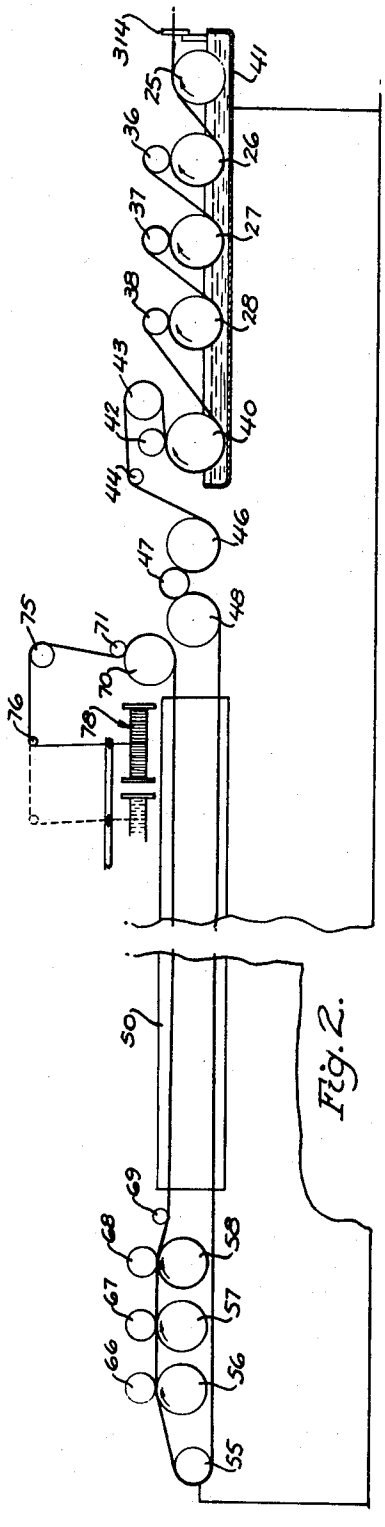


Fig. 2.

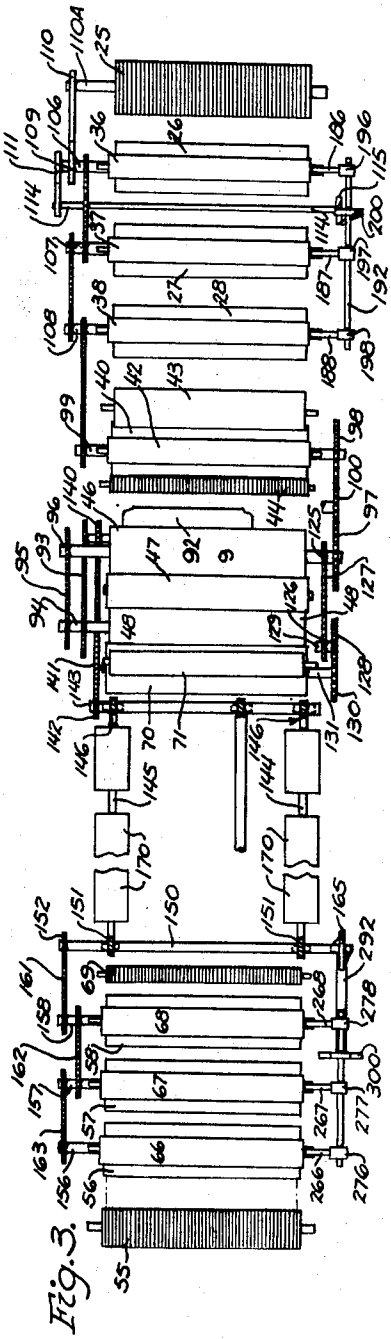


Fig. 3.

INVENTOR.
Ollie L. Williamson
& Russell B. Newton.
Barnes, Kisselle, Laughlin & Raich
ATTORNEYS.

Aug. 18, 1953 R. B. NEWTON ET AL 2,649,071

THREAD TREATING MACHINE

Filed April 24, 1948 4 Sheets-Sheet 2

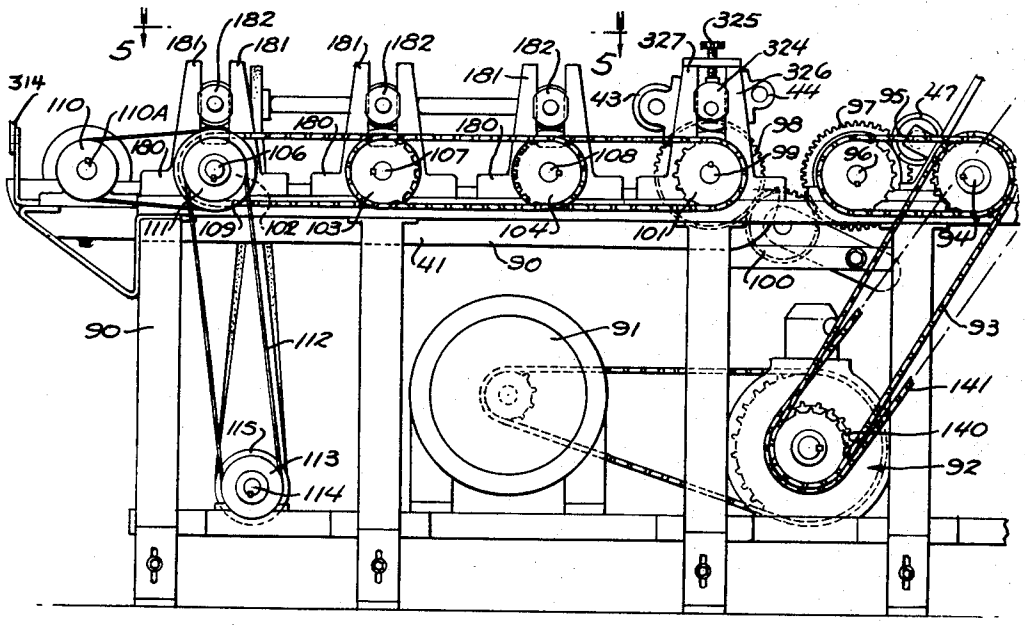


Fig. 4.

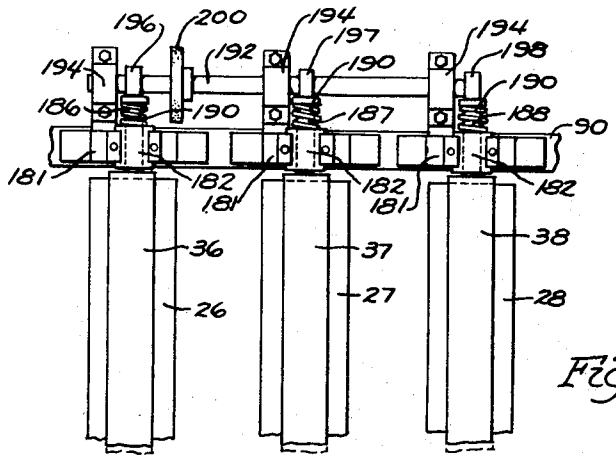


Fig. 5.

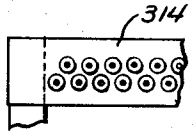


Fig. 6.

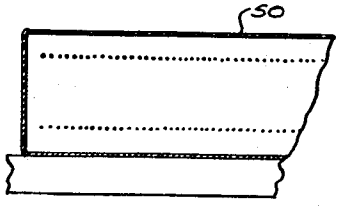


Fig. 7.

INVENTORS
Ollie L. Williamson
& Russell B. Newton.
Barnes, Kisselle, Laughlin & Raisch
ATTORNEYS.

Aug. 18, 1953 R. B. NEWTON ET AL 2,649,071

THREAD TREATING MACHINE

Filed April 24, 1948 4 Sheets-Sheet 3

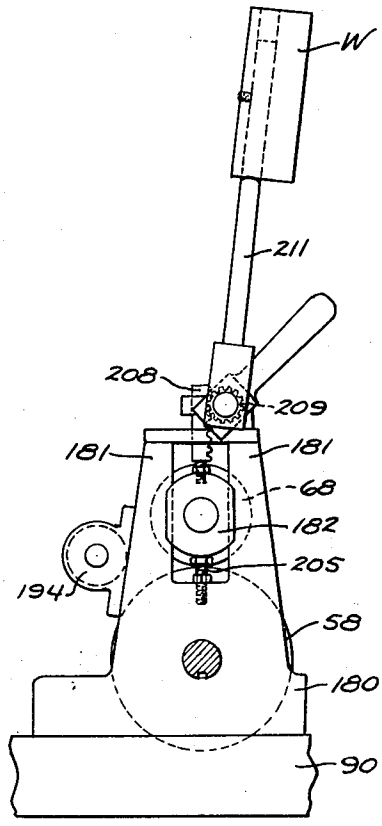


Fig. 8.

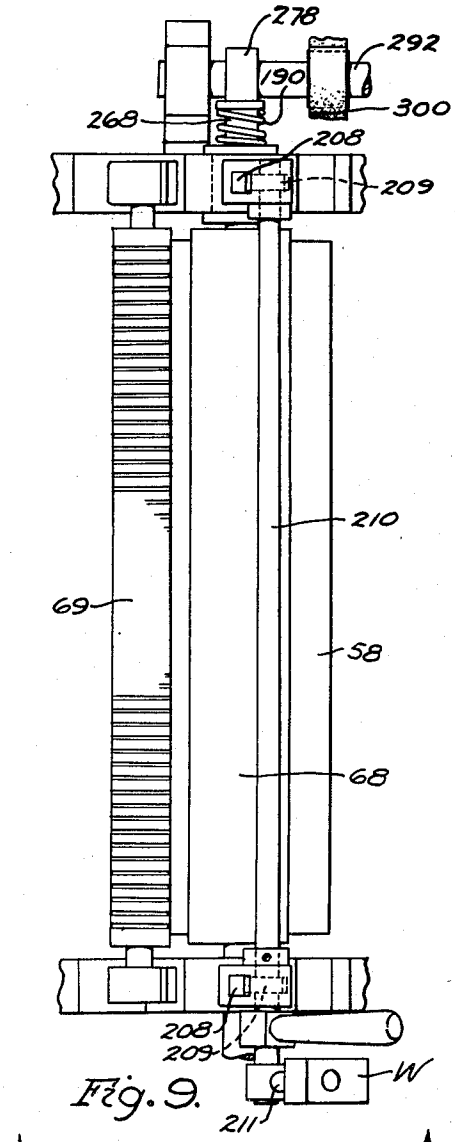


Fig. 9.

INVENTORS
Ollie L. Williamson
& Russell B. Newton.
Barnes, Kisselle, Laughlin & Raisch
ATTORNEYS.

Aug. 18, 1953 R. B. NEWTON ET AL 2,649,071

THREAD TREATING MACHINE

Filed April 24, 1948 4 Sheets-Sheet 4

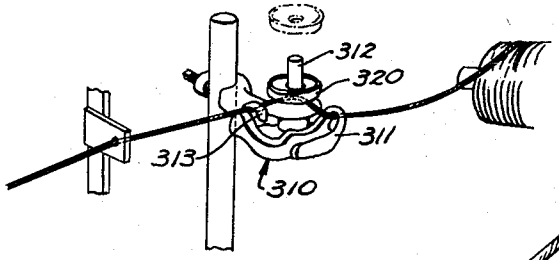


Fig. 10

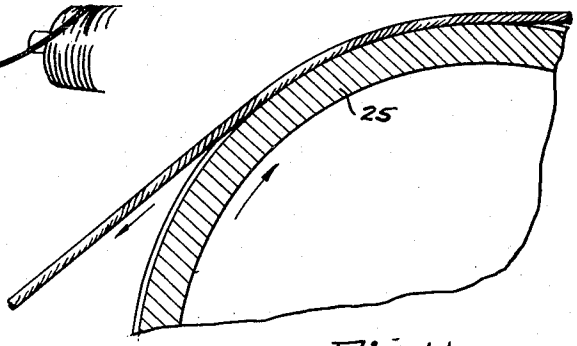


Fig. 11.

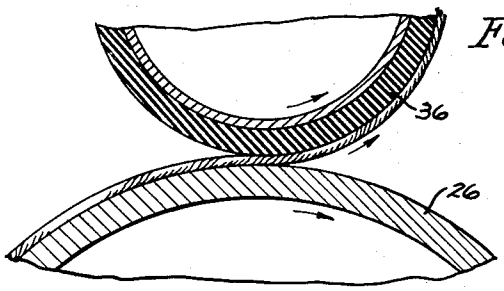


Fig. 12.

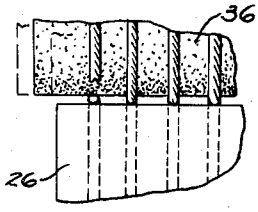


Fig. 13.

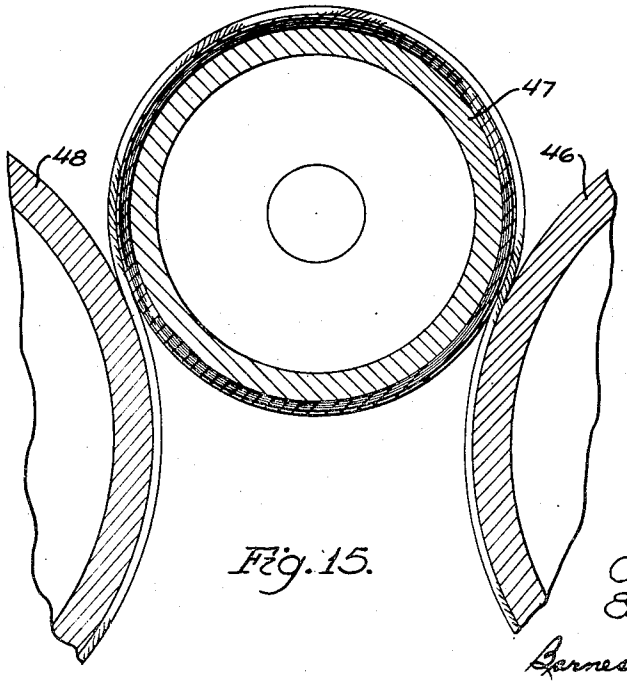


Fig. 15.

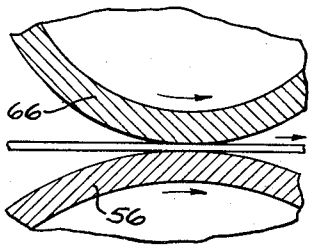


Fig. 14.

INVENTORS
Ollie L. Williamson
& Russell B. Newton.

Barnes, Kisselle, Laughlin & Raisch
ATTORNEYS.

Patented Aug. 18, 1953

2,649,071

UNITED STATES PATENT OFFICE

2,649,071

THREAD TREATING MACHINE

Russell B. Newton and Ollie L. Williamson, Danville, Va., assignors to Dan River Mills, Inc., Danville, Va., a corporation of Virginia

Application April 24, 1948, Serial No. 23,057

10 Claims. (Cl. 118—33)

1

This invention relates to a thread treating machine that has provisions for dipping, stretching, compressing, drying and packaging yarns, cords, rovings, threads and the like, and particularly those which are formed of short fibers such as cotton, spun rayon, flax, jute, etc.

In the treatment of roving to obtain the maximum increase in strength and maximum density in accordance with co-pending application of Russell B. Newton, Serial No. 558,635, filed October 14, 1944, now Patent No. 2,454,830, issued November 30, 1948, it is taught to treat the roving with a bonding material, stretch it to a point just short of the breaking point, compress it just short of the damaging point, dry it and set it. In another co-pending application of Russell B. Newton, Serial No. 765,339, filed August 1, 1947, it is proposed to prepare low stretch tire cord by a similar procedure, the particular emphasis in this application being placed on specific limitations necessary for the production of cords for tires. In each case it is desirable to have maximum compression to produce the most satisfactory product and it is highly desirable to obtain good penetration of the bonding material into treated yarns.

In the present invention a plurality of ends of cord or roving are dipped into a treating solution, untwisted, twisted, compressed, squeezed, partially dried, compressed, dried, set and packaged. After the squeezing operation all the yarns are held under predetermined tension during all the other operations. The outstanding novelty of the present apparatus is the means provided for simultaneously aiding penetration of the bonding material and compressing the treated yarns, and the compression device itself which makes it possible to obtain high tensile strength and low gauge of treated yarns without the extreme tension necessary when following the teaching of the prior art, for example, Jennings U. S. Patent No. 2,220,958, issued November 12, 1940. Although the present invention finds its primary applications in the short fiber yarn field, highly beneficial results may also be obtained on continuous filament yarns such as rayon and nylon.

An object of this invention is to provide means for increasing the strength, decreasing the stretch, decreasing the gauge and increasing the density of short fiber yarns.

Another purpose of this invention is to provide means for simultaneously stretching and compacting short fiber yarns.

A further purpose of this invention is to provide means for aiding the impregnation of bonding material into the yarns.

2

Another object of the invention relates to limiting stretch to avoid breakage and yet to obtain highest strength by oscillatory compression on all ends being treated in the machine.

Other objects and features of the invention relating to a means of untwisting and retwisting threads during the solution treating stage and means for slacking tension at the same stage will be described.

Various additional features of the invention will be apparent in the following description and claims.

Drawings accompanying the detailed description of the invention and the various views thereof may be briefly described as:

Figure 1, a general view of the complete machine.

Figure 2, a flow diagram of yarn passage through the entire treating process.

Figure 3, a plan view of the treating and handling rolls of the machine.

Figure 4, a side elevation of the feed and dipping end of the machine showing the driving elements of the respective rolls, viewed from the back of Figure 1.

Figure 5, a plan view at line 5—5 of Figure 4 showing reciprocating mechanism.

Figure 6, a detailed view of an eye-board guide.

Figure 7, a partial transverse section of the drying oven.

Figure 8, a side elevation of a compression roll assembly at the intermediate stage of the drying process view taken at line 8—8 of Figure 9.

Figure 9, a plan view showing the reciprocating mechanism for the compression or finishing roll.

Figure 10, a view of a pretension device on the multiple creel.

Figure 11, a view showing the manner in which first dip roll moves in a reverse direction to yarn travel.

Figure 12, a view showing the relationship of the first reciprocating rolls, end view.

Figure 13, a view showing the relationship of the first reciprocating rolls, elevation.

Figure 14, a view showing the controlled spacing between reciprocating compression rolls at the end of the machine in the intermediate drying stage.

Figure 15, a view showing the relationship of the nip rolls in section.

The machine to be described can probably be best understood if each of the rolls which contact the yarn as it passes through the machine

is identified and then the empowering means is described with relation to the identified rolls.

Reference should first be made to Figures 2 and 3. All the rolls are parallel and mounted in suitable bearings on the frame of the machine. Starting at the right, a driven reverse roll 25 is the first roll to contact the yarn. This roll 25 lies transversely of the machine which is relatively long and narrow. Proceeding to the left, the next rolls are dip rolls 26, 27 and 28, each power driven, and on top of these rolls are, respectively, smaller rolls 36, 37 and 38 mounted to rotate and reciprocate as will be described.

A last driven dip roll 40 lies at the end of a dip tank 41 and above roll 40 is a squeeze roll 42. Two guide rolls 43 and 44 lead to a set of three rolls 46, 47, and 48, the first and last of which are driven rolls; roll 47 rests between rolls 46 and 48 and creates a nipping and compression effect on yarn passing the set.

A drying chamber 50 is now placed in the circuit and the next roll 55 reverses the direction of the yarn to driven rolls 56, 57, and 58 over which are mounted, respectively, reciprocating compression rolls 66, 67 and 68.

A guide roll 69 lowers the yarn level to another drying chamber traverse and a take-up roll 70. A lock roll 71 squeezes against roll 70 to aid in preventing excessive yarn slippage. An idle roll 75 carries yarn to suitable individual take-up guide means 76 and spools 78.

All of the rolls are mounted on a suitable frame 90, which elevates the yarn flow to a belt-high position. A constant speed motor 91 drives a gear reducing unit 92 and a chain 93 leads to a sprocket on shaft 94 on which roll 48 is mounted. A chain drive 95 connects shaft 94 with shaft 96 mounting roll 46. A gear 97 on shaft 96 drives a gear 98 on a shaft 99 through an idler gear 100. Suitable sprockets 101, 102, 103, 104 are mounted on shafts 99, 106, 107, 108, mounting respectively the rolls 40, 26, 27 and 28. Thus each of these rolls is power driven in the same direction and at the same speed. A pulley 109 on shaft 106 is connected by a belt to a pulley 110 on shaft 110A mounting the roll 25 which is a grooved metallic roll. Another pulley 111 on shaft 106 is connected by a belt 112 to a pulley 113 on a shaft 114 at the bottom of the frame 90. Shaft 114 extends across the frame and has a pulley 115 mounted thereon for purposes later to be described.

Returning now to shaft 96 of roll 46, on the end opposite the chain drive 95 is a gear 125 connected to an independently mounted gear 126 by a chain 127. Gear 126 rotates with a gear 128 on a shaft 129 and gear 128 meshes with a gear 130 on a shaft 131 mounting roll 70.

Gear reducer unit 92 also has a sprocket take-off 140 with drive chain 141 leading to a sprocket 142 on shaft 143 which extends transversely of the machine, (Fig. 3). Extending longitudinally of the machine are parallel shafts 144 and 145, one to each side of the machine, each being connected by a worm drive 146 to shaft 143. These shafts extend down the machine to another cross shaft 150 which is connected thereto by worm drives 151. Shaft 150 is connected to shafts 156, 157, and 158 by a chain sprocket 152 and chain drives 161, 162, and 163 running on suitable sprockets. Rolls 56, 57 and 58, which are mounted on shafts 156, 157, and 158, are thus power driven at equal speeds from shaft 150. At the other end of shaft 150 a pulley 165 connects to a shaft 166 on which a pulley 167 is mounted for purposes to be described below.

On the shafts 144 and 145 are friction rolls 170 adapted to drive winding or take-up spools 171 mounted on pivotal supports 172 along the machine (Fig. 1).

Rolls 36, 37, and 38 and rolls 66, 67 and 68 have been described above as reciprocating rolls. These rolls are mounted on suitable shafts which are in turn mounted for vertical adjustment. For example, in Figure 4 it will be seen that shafts 106, 107 and 108, which mount rolls 26, 27 and 28, are each journaled in the base of a bearing block 180 which has upright spaced projections 181 between which are slidably mounted journal blocks 182. Rolls 36, 37 and 38 at the dipping end of the machine rest by gravity on rolls 26, 27 and 28 and each has a shaft 186, 187, 188 the ends of which are slidably journaled in journal blocks. For some materials higher compression is desirable and pressure means may be used to control the force of rolls 36, 37 and 38 against rolls 26, 27 and 28. Springs 190 urge the roll shafts 186, 187, 188 toward a cam shaft 192 mounted at the ends thereof on suitable bearing extensions 194 mounted on uprights 181. On this shaft 192 are cams 196, 197 and 198 which when rotated will cause reciprocation of rolls 36, 37 and 38. A pulley 200 on shaft 192 is connected by a belt to pulley 115, previously described, on shaft 114.

At the other end of the machine, rolls 66, 67 and 68 are mounted similarly to rolls 36, 37 and 38, that is, on shafts which are axially slidable in vertically shiftable journal blocks 182. As shown in Figures 8 and 9 controls are provided to regulate the vertical position of these rolls. A bolt 205 between uprights 181 is adjustable to position the axial spacing between rolls 58 and 68. Extending upwardly from each journal 182 is a toothed rack finger 208 positioned to cooperate with a pinion 209 on a shaft 210. Rotation of shaft 210 in a clockwise direction as viewed in Figure 8 will cause raising of roll 68. A weight (W) on arm 211 acts to assist in this lifting movement as a counterbalance and also to control the weight of the top roll on the yarn and thereby predetermine the amount of compression applied to the yarns.

Shafts 266, 267, and 268 mount rolls 66, 67 and 68 in slide journals 182 and project to engage cams 276, 277 and 278 on a cam shaft 292. A pulley 300 on shaft 292 accepts belt drive from pulley 167 previously described.

The oven 50 for drying the yarn is conventionally heated by a force draft heater using fluid fuel and shown diagrammatically at 220. Suitable controls may be used to regulate temperature and to cause entry of cool air during stoppage periods.

When the entire machine is threaded, each yarn originates at a package in a multiple creel, Figure 1, and passes through a pig-tail guide 310, Figure 10; under hook 311, around pin 312, under hook 313 to an eye-board 314, Figure 6, at the near end of the machine. The pin 312 has a weighted washer 320 which bears by gravity on the yarn passing around pin 312 to create a tension on the yarn as it approaches the machine to reduce residual stretch on the yarn.

The finished end of each yarn is wrapped on a spool 171 and suitable guide means may be employed to insure even wrapping.

The operation of the machine is at follows:

As the yarn is pulled from the cones, predetermined tension is applied by regulation of the number of weighted washers 320 so that the variations in residual stretch ("Zero" stretch) of different yarns are to a large extent removed.

From the pig-tail guide **310** yarn passes through eye-board **314** over roll **25** which at the point of contact is moving in direction opposite to the yarn movement. Roll **25** is a grooved metallic roll which creates a relatively uniform tension on the yet unconfined yarn further to remove residual stretch before dipping. The yarn then passes under, between, and over the pairs of rollers **26—36**, **27—37**, and **28—38**. Each roller **26**, **27** and **28** rotates in dip tank **41** so that the yarn is repeatedly exposed to bonding liquid. The number of these rolls can be increased or decreased or relative position changed as desired but their function will remain the same. The reciprocating action untwists and retwists the fibers to allow the bonding material to enter the yarn with the greatest ease, and at the same time compress the wet yarns or rovings. Finally, the yarn passes under and over a stainless steel roll **40**, which may be the same size as rolls **26**, **27** and **28**, or slightly larger, depending upon the type of yarn being processed and the amount of tension of relaxation desired during the treating step.

At the top of roll **40** is a squeeze roll **42** mounted in bearing blocks **324** which may be forced down by screws **325**. Bearing blocks **324** are mounted between uprights **326** and **327**. Squeeze roll **42** is made of synthetic rubber to prevent crushing of the yarn where extreme pressures are applied. Yarn passes next to idle roll **43** which is mounted in suitable bearings on uprights **326** and which is made of steel and serves to carry yarn more or less tangentially away from the soft squeeze roll **42** to prevent cutting of the roll caused by stretched yarn.

The yarn then reverses to grooved metal idle roll **44** and passes under driven roll **46**. This group of rolls is called a nip and compression group. The yarn pulls idle roll **47** down against rolls **46** and **48** to compress the yarn and create friction. Instead of the nip roll set **46**, **47** and **48**, it may be desirable in some cases to use a grooved snub or slip roll such as that shown in copending application Serial No. 765,339.

During the passage between the roll sets **26—36**, **27—37** and **28—38**, the top rolls **36**, **37** and **38** are reciprocating back and forth (see Figs. 12 and 13). The top rolls are preferably made or covered with synthetic rubber having a resilient surface. The speed of reciprocation, determined by cam speed, is directly proportional to roll speed so that the number of reversals per unit length of yarn is always constant. Thereby, even penetration and uniform compression are applied to each length of each yarn.

The purpose of the reciprocating rolls is twofold. First, the rubbing action on the yarn untwists the yarn allowing the bonding material to move between the fibers and then retwists the yarn so that it holds its strength in operation. This untwisting action also intermittently relaxes the yarn and renders it more susceptible to treatment. This relaxing may be enhanced by making the center roll **27** smaller in diameter than rolls **26** and **28** traveling at the same speed. Secondly, the rubbing action compresses the yarn in a manner to increase the tensile strength due to the fact that the individual strands are forced close together and in and around each other to lock in place. This compression can be carried almost to the crushing point of any individual fiber.

From the roll **48**, the yarn goes to the lower pass of the drawing oven **50**, and then to the idling, grooved end roll **55** where direction is reversed and the yarn passes between the sets **56—66**, **57—67**, **58—68**, of compression rolls. Each roll of these sets may be metallic and the clearance between them is closely regulable (Fig. 14). However, for some yarns it is preferable to use a resilient substance such as synthetic rubber for either top rolls **66**, **67** and **68**, or bottom rolls **56**, **57**, **58**. In each case, sufficient pressure is maintained to decrease gauge of yarn and increase density. These rolls **56**, **57** and **58** are preferably driven at a slightly greater rate of speed than the rolls **46** and **48** to create a definite stretch during the first pass of the yarn through the oven. It is also possible to set the clearance between these rolls so that they may be driven considerably faster than the yarn moves, thus acting as a polishing medium. The size of the chain sprocket **152** will govern the speed of the compression rolls. Preferably the machine speed and temperature are so regulated that the bonding material is in a semi-dry plastic state at the rolls **56—66**, **57—67**, **58—68** so that when the compression and rolling actions are applied the plastic bonding materials will hold the fibers in their close union and compact state as they pass into the oven to be dried and set.

From the last group of rolls **58—68** the yarn goes under a grooved roll **69** to be positioned for the second oven pass. At the exit of the oven is the driven take-up roll **70** associated with squeeze roll **71** made of or covered with a resilient material such as synthetic rubber. The speed of roll **70** determines the amount of stretching of the yarn and this can be controlled by the size, that is, the number of teeth in gear **130** (Figs. 1 and 3). From roll **71** yarn passes to idle roll **75** and then to individual guide runs **76** and the individual spools which are driven from shafts **144** and **145** by friction rolls **170**.

Intermediate compression rolls **56—66**, **57—67**, and **58—68** may be moved either at a slightly faster rate than the initial treating rolls and the roll set **46—47—48** to create a stretching force on the multiple ends passing through the oven, or at a much faster rate to effect a polishing action by slippage. Take-up roll **70** is rotated faster for the same reason. It has been found that during the drying stage a slackening takes place in some stretched yarn, particularly cotton yarn, and consequently this slackening must be considered in setting the speed of these intermediate and take-up rolls.

It will thus be seen that there is disclosed a machine for creating an initial dry tension, untwisting and retwisting during a wetting and a drying stage, controlled stretching during a drying or setting stage, and an intense compression of the yarn, preferably at the semi-dry stage. It will further be seen that the machine disclosed will treat a plurality of threads and yarns which initially may have different stretch characteristics or varying stretch characteristics without breakage. Removal of initial stretch variations and permissible slippage in the machine contribute to this result, but the reciprocating rolls compacting the semi-dry yarns assure lowest gauge and highest strength without the necessity for maximum tension.

What we claim is:

1. A multiple end thread treating machine having a bath of treating liquid, which comprises a plurality of supply spools, common means for simultaneously conducting ends from said sup-

ply spools through a bath of treating liquid, means comprising a reverse rotation roll with slip contact on said ends for exerting light individual tension on said ends between the spools and said bath to remove low stretch characteristics, extended means having an initial entrance and a final outlet for drying said treated ends, means for compacting said ends ahead of said drying means, common means for simultaneously conducting said treated ends through said drying means and to impart thereto a predetermined stretch, and means between the entrance and the exit of the drying means for materially compressing said ends while stretched and drying, said last named means comprising at least one pair of rollers arranged outside and independently of said drying means with parallel but spaced axes, one on each side of said ends, to carry said ends out of and back into said drying means during the drying thereof, and means for accurately controlling the space between surfaces of said rolls to exert a compressing force on said ends.

2. A multiple end thread treating machine having a bath of treating liquid, which comprises a plurality of supply spools, means for conducting ends from said supply spools through a bath of treating liquid, means for exerting light tension on said individual ends between the spools and said bath to remove low stretch characteristics, extended means having an initial entrance and a final exit for drying said treated ends, means for simultaneously conducting said treated ends through said drying means and to impart thereto a predetermined stretch, and means between the entrance and the exit of the drying means for materially compressing said ends while being dried, said last named means comprising at least one pair of rollers arranged at one end and outside said drying means with parallel but spaced axes, one on each side of said ends, means for accurately controlling the space between surfaces of said rolls to exert a compressing force on said ends, and means to impart relative axial reciprocation between the rollers of said pair.

3. A multiple end thread treating machine having a bath of treating liquid, which comprises a plurality of supply spools, a creel for said spools, means for conducting ends from said spools through a bath of treating liquid comprising at least one pair of applicator rollers, one roller of which is partially immersed in a treating solution and the other of which is arranged in parallel relation thereto for friction contact therewith, means for imparting relative axial reciprocation between the rollers of said pair of rollers, a grooved slip roll contacting each end between the creel and the applicator rolls, said slip roll moving in a direction opposite to the thread movement to apply light slipping tension on each end to remove low stretch variation therein, and means for drying said treated ends.

4. A multiple end thread treating machine having a bath of treating liquid, which comprises a plurality of supply spools, a creel for said spools, means for conducting ends from said spools through a bath of treating liquid comprising at least one pair of applicator rollers, one roller of which is partially immersed in a treating solution and the other of which is arranged in parallel relation thereto for friction contact therewith, means for imparting relative axial reciprocation between the rollers of said pair of rollers, a grooved slip roll contacting each end between the creel and the applicator rolls, said slip roll moving in a direction opposite to the thread movement to apply light slipping tension on each end to remove low stretch variation therein; means for drying said treated ends, and means for simultaneously imparting to said threads a predetermined stretch during the drying thereof and prior to winding on individual take-up spools.

5. A multiple end thread treating machine having a bath of treating liquid, which comprises a plurality of supply spools, a creel for said spools, means for conducting ends from said spools through a bath of treating liquid comprising at least one pair of applicator rollers, one roller of which is partially immersed in a treating solution and the other of which is arranged in parallel relation thereto for friction contact therewith, means for imparting relative axial reciprocation between the rollers of said pair of rollers, a grooved slip roll contacting each end between the creel and the applicator rolls, said slip roll moving in a direction opposite to the thread movement to apply light slipping tension on each end to remove low stretch variation therein, extended means having an initial entrance and a final outlet for drying the treating solution on said treated ends, and means between the entrance and the exit of the drying means in the form of closely spaced, parallel, relatively reciprocable rolls positioned outside and independently of the drying means for compressing said ends during the drying.

6. A multiple end thread treating machine having a bath of treating liquid, which comprises a plurality of supply spools, means for conducting ends from said spools through a bath of treating liquid comprising at least one pair of rollers, one roller of which is partially immersed in a treating solution and the other of which is arranged in parallel relation thereto for friction contact therewith, means for imparting relative axial reciprocation between the rollers of said pair of rollers, extended means having an initial entrance and a final outlet for drying the treating solution on said treated ends without removal thereof, and means between the entrance and the exit of the drying means in the form of closely spaced, parallel, relatively reciprocable rolls positioned outside and independently of the drying means for compressing said ends during the drying.

7. A multiple end thread treating machine which comprises a plurality of individual supply spools, a plurality of individual take-up spools, a supply of treating solution, and means to treat a plurality of threads simultaneously between said supply spools and said take-up spools comprising a roll moving in a direction opposite to said yarn to apply an initial tensioning to said yarn to remove low stretch variation, at least one pair of adjacent rolls relatively reciprocable and one of which is in contact with treating solution in said supply to apply transverse compression and a twisting-untwisting motion to the thread to insure maximum saturation, additional rolls for stretching the treated thread to elongate the same, means to dry the treated thread, additional compression rolls positioned independently of the drying means to exert compression and twisting forces on said thread while partially dried, and final tension rolls to elongate said thread during the further setting of the treating material in drying.

8. A multiple end thread treating machine

which comprises a plurality of individual supply spools, a plurality of individual take-up spools, a supply of treating solution, and means to treat a plurality of threads simultaneously between said supply spools and said take-up spools comprising at least one pair of adjacent rolls relatively reciprocable and one of which is in contact with treating solution in said supply to apply transverse compression and a twisting-untwisting motion to the thread to insure maximum saturation, additional rolls for stretching the treated thread to elongate the same, means to dry the treated thread, additional compression rolls positioned independently of the drying means to exert compression and twisting forces on said thread while partially dried, and final tension rolls to elongate said thread during the further setting of the treating material in drying.

9. A multiple end thread treating machine which comprises a plurality of individual supply spools, a plurality of individual take-up spools, a supply of treating solution, a plurality of equal size driven rolls partially immersed in said solution, a plurality of resilient surfaced compression rolls paired with said driven rolls, means to impart a relative reciprocal movement between the rolls of each pair whereby thread passing under and over each driven roll will be compressed and rubbed, a set of nip rolls comprising two spaced and parallel driven rolls and a third roll wedged between them whereby thread passing said compressing rolls and between said spaced parallel rolls is pinched and frictionally engaged by the third roll, a double-pass drying oven adjacent the nip rolls providing a drying passage for said multiple ends, a take-up roll at one end of said drying passage rotating at a greater surface speed than said nip rolls, means at the other end of said drying passage for compressing and rubbing the partially dried threads between the first and second pass through the oven comprising a plurality of driven rolls and a contact roll adjacent each of said last mentioned driven rolls to form a restricted opening for thread passage, and means to impart relative reciprocation between said last named driven rolls and its respective contact roll.

10. A multiple-end thread treating machine which comprises a plurality of individual supply spools, a plurality of take-up spools, a supply of treating solution, and means to treat a plurality of threads simultaneously between said supply spools and said take-up spools comprising three pairs of adjacent rolls relatively reciprocable and one of which is in contact with treating solution in said supply, means to drive said rolls at equal speeds, one of the intermediate rolls of said three pairs having a diameter smaller than the others whereby thread or yarn passing said rolls will be fed from roll to roll in a relaxed state, said reciprocable motion applying a transverse compression and a twisting-untwisting motion to the thread or yarn to insure maximum saturation and to reduce the gauge of thread or yarn being treated, means to dry said treated yarn, and supplemental compacting rolls to compact further the treated material positioned relative to the drying means to act on the thread or yarn when partially dried.

RUSSELL B. NEWTON.
OLLIE L. WILLIAMSON.

References Cited in the file of this patent

UNITED STATES PATENTS

Number	Name	Date
1,197,396	Price	Sept. 5, 1916
1,729,272	King	Sept. 24, 1929
1,745,285	Whiffen	Jan. 28, 1930
1,820,621	Junkers	Aug. 25, 1931
1,877,488	Allen	Sept. 13, 1932
1,893,107	Severson	Jan. 3, 1933
2,040,105	Ritzert	May 12, 1936
2,128,121	Craig	Aug. 23, 1938
2,162,551	Hawley	June 13, 1939
2,220,958	Jennings	Nov. 12, 1940
2,260,860	Newton et al.	Oct. 28, 1941
2,381,398	Bosomworth	Aug. 7, 1945
2,404,952	Fiechter	July 30, 1946
2,419,922	Tippetts	Apr. 29, 1947
2,476,298	Heizer	July 19, 1949
2,601,394	Hansen	June 24, 1952

FOREIGN PATENTS

Number	Country	Date
531,910	Germany	Aug. 17, 1931