June 3, 1941. W. W. ARNOLD, JR 2,244,415

YARN TWISTING AND STABILIZING MACHINE

Filed Nov. 14, 1938 3 Sheets-Sheet 1

Fig. 1.

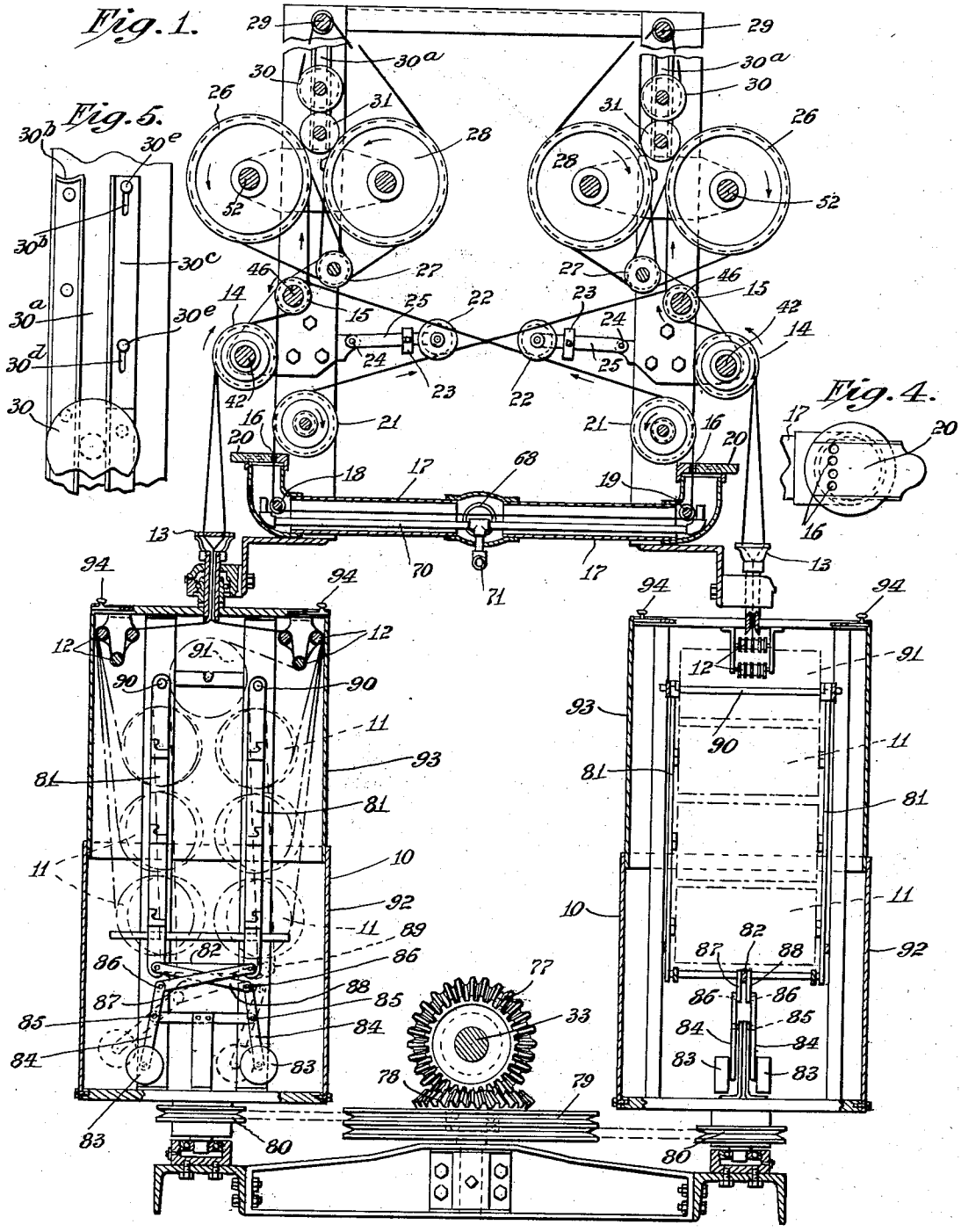


Fig. 5.

Fig. 4.

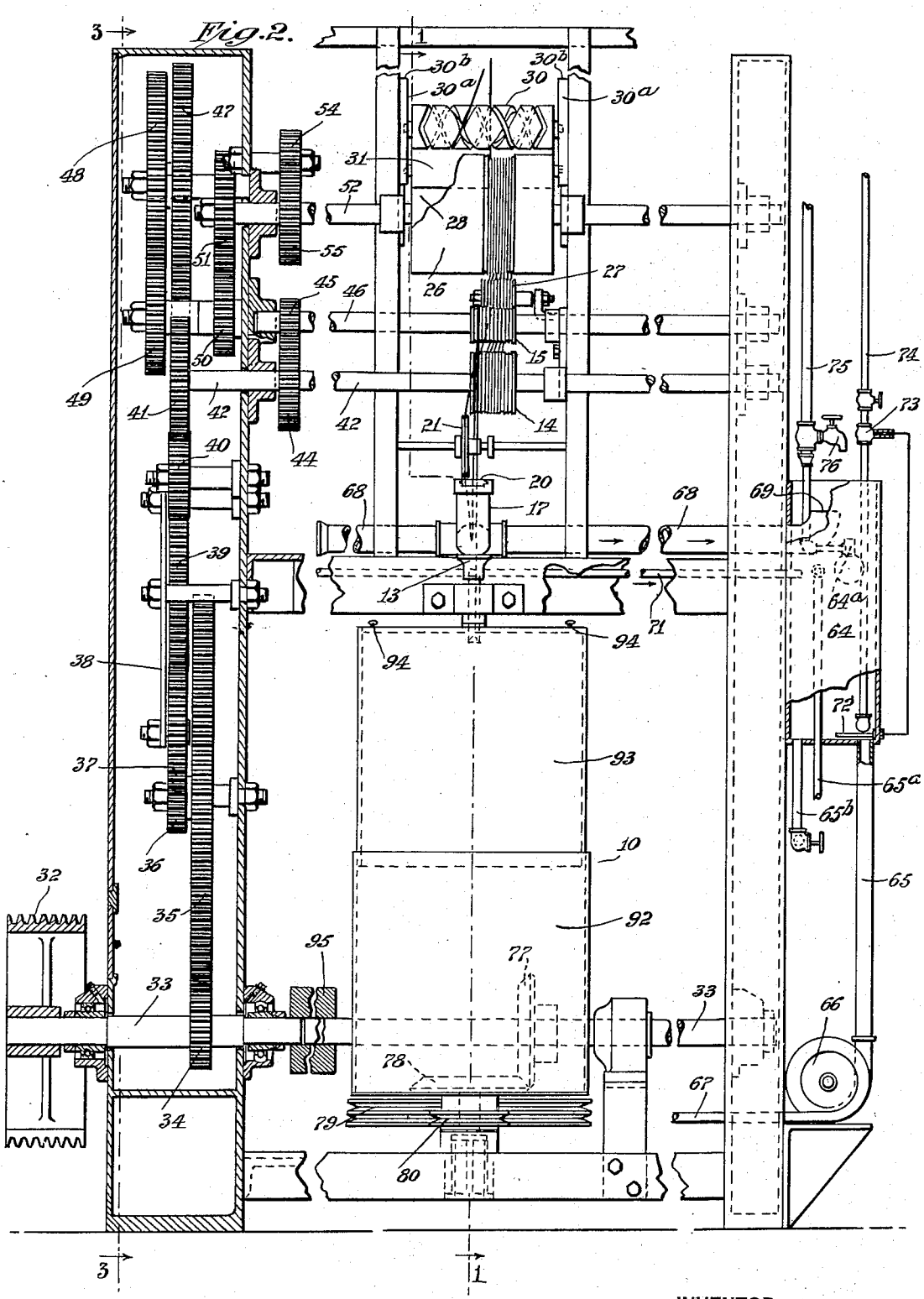
INVENTOR
William W. Arnold Jr.
BY
ATTORNEY

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Fig. 2.



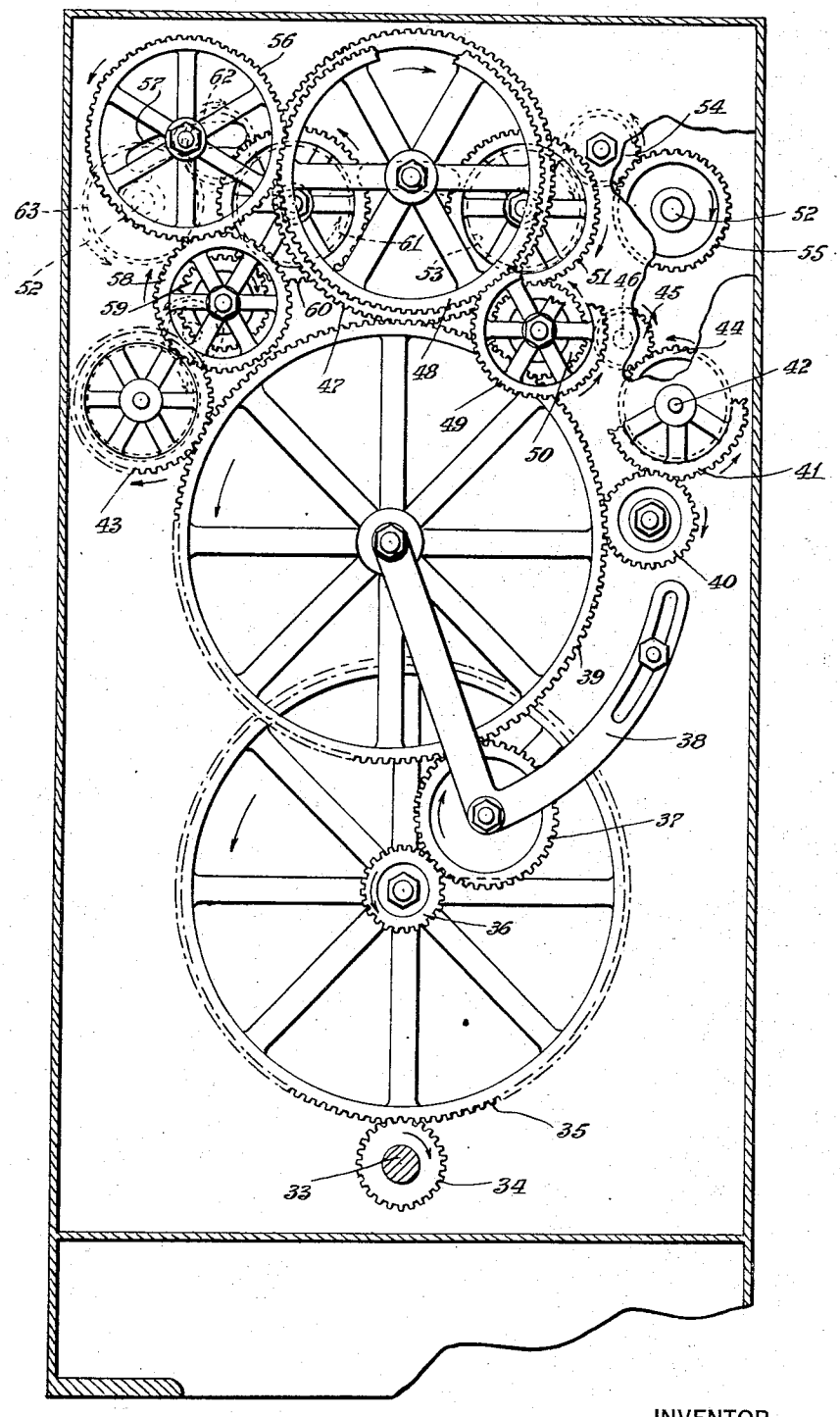
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Fig. 3.



INVENTOR
William W. Arnold Jr.
BY
ATTORNEY

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2,244,415

UNITED STATES PATENT OFFICE

2,244,415

YARN TWISTING AND STABILIZING MACHINE

William W. Arnold, Jr., Knoxville, Tenn., assignor to Callaway Mills, La Grange, Ga., a corporation of Georgia

Application November 14, 1938, Serial No. 240,224

11 Claims. (Cl. 57—35)

This invention relates to a process and apparatus for forming and conditioning cord and has for its object to provide means for simultaneously and similarly forming and treating a number of cords under substantially similar conditions to make each cord more nearly uniform.

Another object is to reduce the time, labor, cost and floor space for the apparatus accomplishing these results.

A further object is to twist, stretch and wind a cord under continuous tension and as a single continuous operation instead of in two or three operations heretofore employed.

In twisting, stretching or winding under tension induced in a cord by a friction or sliding brake, it has not been possible to make the brake act uniformly at all times with the result the product is not uniform. Another cause of non-uniformity in the product has been the time during which the cords may be allowed to remain under different conditions of tension, moisture or temperature when wound up after twisting and after stretching and setting the stretch. Under this invention a number of cords are made and treated under conditions so similar that each is more nearly uniform than heretofore.

Referring to the drawings,

Fig. 1 is an end view showing one embodiment of this invention and is a section on the line 1—1 of Fig. 2.

Fig. 2 is a view partly in section showing one of the units when viewed from the right side of Fig. 1.

Fig. 3 is a section on the line 3—3 of Fig. 2.

Fig. 4 shows the top of one of the caps provided for the hot water pipe tank through which the cord is passed.

Fig. 5 is a detail showing the upper end of the guides for the traverse guide and wind-up tube.

As shown in Fig. 1 a rapidly rotating creel 10 holds a desired number of twister spools 11 from which the strands are passed over guide pulleys 12 and thence out through the separator 13 to drums 14 and 15 which assist in pulling the cord. The strands become twisted between the separator 13 and the drum or pulley 14, the degree of twist depending on the speed of rotation of the creel and the linear speed of the pulleys 14 and 15 or the cord. After passing over the grooved pulley or drum 14 the twisted cord is passed around the grooved drum 15 the desired number of times and then passes from the drum 15 almost vertically downward through one of the small holes 16 in the cap over the hot water pipe tank 17 for the purpose of wetting the cord. In this tank the cord passes around the pulley 18 and then around the pulley 19 at the other end of the tank and up through a hole 16 in the cap 20, thence over a guide pulley 21 to the drum 15. A weighted grooved guide 22 not rotatable tends to stretch the cord in event it may possess more than the usual amount of stretch, and enables slightly different tension on the several cords where desirable to equalize the stretch in the cords before they leave the drums 14 and 15 for the final stretching process.

A weight 23 is mounted on the lever 25 which is pivoted at 24 to the frame, the guide 22 being mounted on the lever 25. The cord then passes around the pulley 15 several times, thence around the pulley 14 as many times as is needed. The pulleys or drums 14 and 15 have the same peripheral or linear speeds and it is necessary to wind the cord a number of times around each of these drums preparatory to heavily stretching it.

From the pulleys 14 and 15 the cord passes under heavy tension to the drum 26 around which the cord is wound a number of times in order to hold it tightly by friction. From the drum 26 the cord is passed around the pulley 27 and thence around the drum 28, back again around the pulley 27 and over the drum 26. The drums 26 and 28 revolve at the same peripheral speed but their peripheral speed is greater than that of the drums 14 and 15 with the result that the wet cord is stretched beyond its elastic limit to the desired amount to give the cord a permanent set in elongation. This permanent set causes the cord to lose some of its elasticity in tension and it does not possess anywhere near the same residual ability to stretch as it did previously to the stretching. The stretch therefore occurs between the pair of drums 14 and 15 and the pair of drums 26 and 28. Two drums instead of one are used at each end of the stretching operation in order to assist in frictionally holding the cord and also in kneading the cord to aid in setting the fibres of their strands to other new positions, or in other words in setting the stretch. The cord may be wrapped around the drums 26 and 28 in any convenient and desired manner since both of these drums have the same peripheral speed.

After passing the drum 28 the cord travels up and over a guide pulley 29, thence down to the traverse guide 30 which directs the cord movement onto the winding or packaging tube 31 on which the cord is wound under tension. The tube 31 rests on and is driven from the periph-

eries of the drums **26** and **28**. Since this tube contacts with the peripheries of these drums there is only an almost negligible slippage since the peripheral speed of these drums is slightly larger than the speed of the cord, the cord being set in grooves in these drums. The weight of the traverse guide **30** rests upon the wind-up tube. When the tube **31** is of the desired size the machine may be stopped, the traverse guide **30** raised and set in the notch **30b** (Fig. 5). One side **30c** of the guides **30a** in which the tube and traverse guide rotate, is made shiftable by means of the pins **30e** and slots **30d**, enabling this side **30c** to be raised so that the wind-up tube may be removed and a new one inserted. The wind-up tube has substantially the same peripheral speed regardless of whether there be much or little cord wound on it.

All pulleys and drums are adjustable on their shafts so that they may be alined as desired.

Gearing

As shown in Fig. 2 a motor or other prime mover may drive the pulley **32**, preferably through the aid of a number of flexible belts. This pulley **32** is mounted to drive the shaft **33** carrying the gear **34** which as shown in Figs. 2 and 3 meshes with the gear **35**. A gear **36** keyed to the gear **35** drives the gears **37** and **39**, the gear **37** being mounted on an adjustable lever so that the gear **36** may be of different sizes, that is, one gear may be taken off and another gear of different size replaced. This change gear **36** controls the amount of twist to be given to the cord as will be described later. From the gear **39** motion is transmitted through the gears **40**, **41** to the shaft **42** and thence through the gears **44** and **45** to the shaft **46** (see Fig. 2). The drum **14** is keyed on the shaft **42** and the drum **15** on the shaft **46**. Also meshing with the gear **39** is a gear **47** shown at the top center of Fig. 3 and keyed on the same shaft with the gear **47** is another or changeable gear **48**, the size of which is adapted to control the amount of stretch given the cord since this gear **48** drives the drums **26** and **28** on each side of the machine. From the gear **48** motion is transmitted to the gear **49**, thence to the gear **50** keyed thereto, gear **51**, shaft **52** carrying the drum **28** shown on the right side of Fig. 1. From the shaft **52** motion is transmitted through the gears **53** and **54** to the gear **55** on the shaft carrying the drum **26**. At the upper left portion of Fig. 3 will be found the gear **56** driven from gear **48**. This gear **56** drives gear **58** to which is keyed the gear **59** which drives the gear **60** on whose shaft is mounted the drum **28** shown at the left side of Fig. 1. The gear **61** keyed to gear **60** drives the gear **62** and the gear **63**. The drum **26** shown at the left side of Fig. 1 is mounted on the shaft of gear **63**, shown in dotted lines in Fig. 3. The change gear **48** meshes with the gears described and the arcuate slots **57** are provided to enable the cooperating gears to properly mesh when a different size change gear **48** is used.

It should be understood that the two units illustrated in Fig. 1 are each driven through the gearing illustrated in Fig. 3. The drum **14** at the right side of Fig. 1 is driven by the shaft containing the gears **41** and **44** whereas the corresponding drum **14** on the left side of Fig. 1 is driven by the shaft containing the gear **43** which meshes with gear **39**. The drums **26** and **28** at the right side of Fig. 1 are on the shafts containing the gears **55** and **53** in Fig. 3, whereas the gears **26** and **28** on the left side of Fig. 1 are on the shafts containing the gears **63—61**.

The sizes and speeds of the various gears just described are shown in the following table for the particular embodiment of this invention which has been illustrated:

Reference numeral of gear	Number of teeth	R. P. M.
34	32	500
35	160	100
36	29	
37	50	
39	155	
40	32	
41	50	58
43	50	58
44	54	
45	27	
47	102	28
48	93	28
49	47	
50	36	
51	64	31.645
53	42	31.645
54	25	
55	42	31.645
56	70	
58	47	
59	36	
60	64	31.645
61	42	31.645
62	25	
63	42	31.645

The surface speed of the drum **14** is about 728.48" per minute. With a creel speed of 1500 R. P. M. then the twist per inch is approximately 2.059. This multiplied by the number of teeth on the change gear **36** gives a twist constant of approximately 59.45. With the size of change gear **48** illustrated, the stretch in the cord detween the drums **14** and **15** on the one hand and the drums **26** and **28** on the other hand will be 9.16%. For each tooth more or less the percentage will increase or decrease 1.17%.

Wetting and heating

The cord in passing through the pipe tank **17** comes in contact with hot water caused to circulate through the pipe tank. This hot water comes from the tank **64** shown in Fig. 2 as being located at one end of the machine. An outlet pipe **65** from this tank leads to the circulating pump **66** which supplies hot water through the pipe **67** to the pipe or header **68** extending along the machine.

At each unit or pair of creels and drums is provided a pipe tank **17**. Overflow from the header **68** occurs at **69** into the tank **64**. In order to induce circulation of hot water in each of the pipe tanks **17** which extend at right angles to the header **68**, a small pipe **70** arranged as shown in Fig. 1 leads to adjacent the end portions of the pipe tank **17**, this smaller pipe **70** being connected through the pipe **71** with the tank **64** as shown in Fig. 2. Water is drawn off continually through the pipes **70** and **71** but the capacity of the pump **66** exceeds the total capacity of the pipes **70** and **71** so that water is returned to the tank **64** through the headers **68**, and its overflow, and also through the pipe **71**. A thermostat **72** controls a valve **73** in the steam line **74**, automatically in response to the temperature of the water at the thermostat **72**, which is so designed as to maintain the water at substantially 200° F. The water at remote portions from the heater tank should not fall below about 180°. The pipe **75** and the spigot **76** provide water, preferably hot, for the tank **64**.

Creels

Each of the units as shown in Fig. 1 has two creels and two sets of stretching pulleys or drums. Each creel unit is driven from a bevel gear 77 on the shaft 33, bevel gear 78 and the puleys 79. Each of the pulleys 79 drives a pulley 80 located beneath the creel housing.

Within a creel the strand supply spools are suspended by a pair of rods 81 which are pivotally connected at their lower end portion by the links 82. In event the weight of the spools on one side should exceed those on the other side, weights 83 are so arranged as to be automatically shifted far enough to reduce vibration in the rapidly rotating creel and thereby reduce vibration. Each of these weights is suspended by a lever 84 pivoted at 85 and pivotally connected at its upper end portion 86 to the links 87 and 88, which in turn are pivotally connected at the ends of the links 82 to the lower ends of the suspensions 81.

In event the right side of the left creel indicated in Fig. 1 might be heavier and during rotation cause the strand spools to shift to the dotted line positions indicated at 89 for the suspensions and spools, then the left weight 83 is swung radially outward while the right weight 83 is swung radially inward to automatically compensate for the shifting weight in the strand spools. This has the effect of maintaining the center of gravity substantially alined with the axis of the creel so that vibration is reduced and the strands may be twisted under substantially uniform tension. The strand spool suspensions are pivoted adjacent the upper portion of the creel at 90. Where the number of strands is odd, the odd spool 91 may be mounted in the upper central portion of the creel independently of the pivotal mounting or suspensions for the other spools.

These spools are enclosed to prevent air currents affecting the spools or strands during their rapid rotation. The casing is made in two telescopic sections, the bottom section 92 and the top section 93 being capable of being lowered within the bottom section when it is necessary to replace the strand carrying spools. At the top of the creel is located a latch 94 for holding the top section 93 in place. By releasing these latches 94 the section 93 may be dropped to provide access to the strand spools. A coupling 95 on the shaft 33 enables the machine to be adapted for stretching even though the creels may not be operated.

Miscellaneous

The machine may be built as long as is conveniently desired to contain as many units as desired. In Fig. 1 is illustrated one unit comprised of two creels and two sets of wetting and stretching pulleys so that one unit handles two cords. As shown in Fig. 2 there may be as many units arranged along the machine as is desired. One embodiment of this invention has been comprised of seven units spaced twenty inches on centers.

The revolving creels, sheave pulleys 78, 79, and the main drive shaft 33 are all equipped with ball bearings as illustrated. With a creel speed of 1500 R. P. M. the automatic self balancing feature previously described is desirable to equalize the tension in each of the cord strands.

Among the advantages of this invention may be mentioned the single operation described for twisting and stretching which has taken the place of two or three separate operations heretofore customary, the cord being maintained continually under tension from its twisting until after it has been wound up. The tension used is not dependent on brakes or other needless power consuming devices. The amount of twist is adjusted by means of the change gear 36 and the amount of stretch by the change gear 48. The wind-up spool is maintained under uniform tension and driven at a constant linear speed regardless of the amount of cord it contains. Economy in floor space and elimination of waste in material and time are also features. The pipe tank 17 at each end has a sliding cover 20 and when these covers are closed the four holes shown in Fig. 4 are provided, two of these holes being used for the active cords being conditioned and the other two holes being maintained in reserve. There may be suitable lengths of cord provided in these reserve holes and portions of the pipe tank ready to be connected and used in event one of the active cords might break while being wetted although this is not probable. The revolving creels makes it possible to twist the cord and maintain it continually under tension without interruption.

Maintaining the wind-up tubes 31 under tension gives time for both the stretch and twist imparted to the cords to be set before the tension is released. These wind-up tubes, while the cord thereon is under tension, might be carried to a steam chamber or given other customary treatment to assist in permanently setting the stretch and twist, but principally the stretch. The winding mechanism for these tubes 31 is adapted to handle almost any type of package desired.

While this device has been designed primarily for the treatment of cotton cords, it is adapted also for the treatment of cords of wool and other fibres.

The machine is illustrated for operating with wet treatment. If the product being twisted, stretched and wound does not require wetting, the cord may be threaded around the drums 14 and 15 and then passed to the drums 26 and 28 without passing through the pipe tank 17.

The weight of the traverse guide 30 should assist in determining the tension on the cable strand or cord as it is wound in the finished package. This tension plus the number of crossings per inch in winding determines the density of the package.

The grooved guide 22 being fastened at the end of lever 25 will stretch the contacting cord if the tension thereof does not support the lever in a substantially horizontal position. As the grooved guide 22 swings downward the increased angle and friction on the cable will tend to equalize the stretch in the cable between drum 15 and the point of contact with the guide 22.

Roughly the degree of tension applied at this point should be about 15% of the tension required between the stretching drums 15 and 26. The degree of tension in the winding-up operation should be enough to make a firm compact package and this tension should be governed to a substantial extent by the weight of the traverse guide 30.

The water level in the tank 64 may be controlled manually or regulated by a float valve 64*a* controlling preferably the water supply. A float valve may also control the overflow pipe 65*a*. The pipe 65*b* is a drain pipe from the tank.

I claim:

1. An apparatus for forming and conditioning

cord which includes means for rotating strands to form a cord, means for pulling the rotating strands and cord formed thereby, and means for stretching the twisted cord while continuing and increasing the tension on the strands, said first mentioned means including strand spools, angularly spaced around their axis of rotation, a weight, and means for radially adjusting said weight to compensate for any unbalance in the weights of the rotating strand spools and their contents.

2. The combination with means for rotating strands to form a twisted cord, of means for stretching the cord while continuing tension from the twisting through the stretching means, and means for reducing vibration in said first means which comprises a radially adjustable weight and mechanism for automatically shifting said weight in response to any excess weight of strand on a side of said rotating means.

3. A creel comprising at least two angularly spaced spools, means for rotating said spools, means including a radially adjustable mechanism responsive to any unbalance in weight of said spools or their contents, and a housing enclosing said spools and the last mentioned means.

4. The combination with a pair of spaced rotatable creels, a liquid receptacle extending between said creels, winding drums over which the cord is formed from the strands issuing from each reel may pass before and after passing through said liquid in an opposite direction to the cord formed from the other creel, a pair of drums for each creel and between which the cord may be stretched, and a wind-up reel for each cord.

5. In an apparatus for forming and conditioning cord, a longitudinal liquid pipe, a plurality of lateral pipes connected with the longitudinal pipe, means including pulleys for passing cords through said lateral pipes, another longitudinal pipe connected to said lateral pipes, means for circulating liquid through said longitudinal pipes, and means for causing liquid to flow in each of said lateral pipes after being supplied from one of the longitudinal pipes and removed by another of the longitudinal pipes.

6. The combination with spaced rows of rotating strand holding creels, substantially alined drums, adjacent each row of creels, spaced pairs of stretching drums, each drum of each pair being alined with a corresponding drum of another pair, substantially alined winding drums forming two rows, and means for driving each corresponding part at the same speed.

7. An apparatus for simultaneously and similarly stretching at least two cords comprising sets of drums for stretching the cords, a liquid passage between said sets of drums and through which at least two cords may pass in opposite directions, and means for supplying and withdrawing heated liquid to and from said passage in such manner that the temperature difference between each end of the passage and its center is substantially the same.

8. An apparatus for simultaneously and similarly stretching at least two cords comprising sets of drums for stretching the cords, a liquid passage between said sets of drums and through which at least two cords may pass in opposite directions, liquid supply and outlet pipes for said passage, one connected to the central portion of the passage and the other connected to the opposite ends of said passage.

9. An apparatus for twisting and stretching cord comprising spaced creels, a shaft for driving both creels at the same speed, drums above and adjacent each creel for stretching a cord, a frame in which said drums are journalled, gears for simultaneously driving the drums adjacent each creel at corresponding speeds, means including interchangeable gears for controlling the degree of twist simultaneously applied to each cord, and means including other interchangeable gears for controlling the degree of stretch simultaneously applied to each cord.

10. An apparatus for twisting and stretching cord comprising spaced creels, a shaft for driving both creels at the same speed, drums above and adjacent each creel for stretching a cord, a frame in which said drums are journalled, gears for simultaneously driving the drums adjacent each creel at corresponding speeds, means including interchangeable gears for controlling the degree of twist simultaneously applied to each cord, and means including other interchangeable gears for controlling the degree of stretch simultaneously applied to each cord, said gears being located adjacent the same end portion of the drums.

11. An apparatus for twisting and stretching at least two cords the same amount at the same time comprising means for twisting each cord and subsequently stretching it while continuously under tension, a liquid holder through which each of the two cords may pass before completion of said stretching, said liquid holder extending between two cord twisting means, and means for driving each twisting and stretching means at the same speeds from a common power source.

WILLIAM W. ARNOLD, JR.