June 12, 1934. G. L. BROWNELL 1,962,424

METHOD OF TREATING FILAMENTARY MATERIAL AND MEANS THEREFOR

Filed Feb. 8, 1930 3 Sheets-Sheet 1

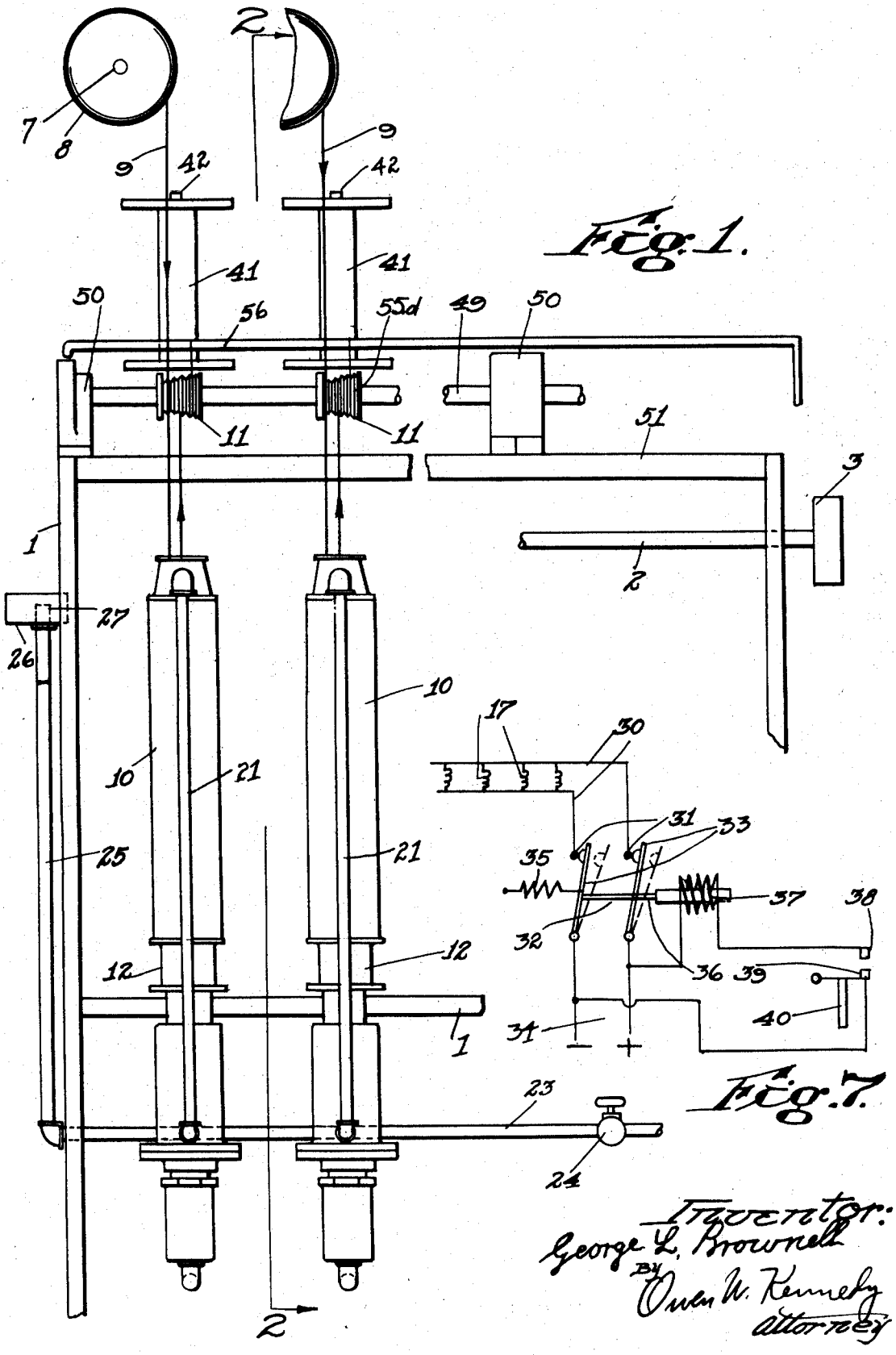


Fig. 1.

Fig. 7.

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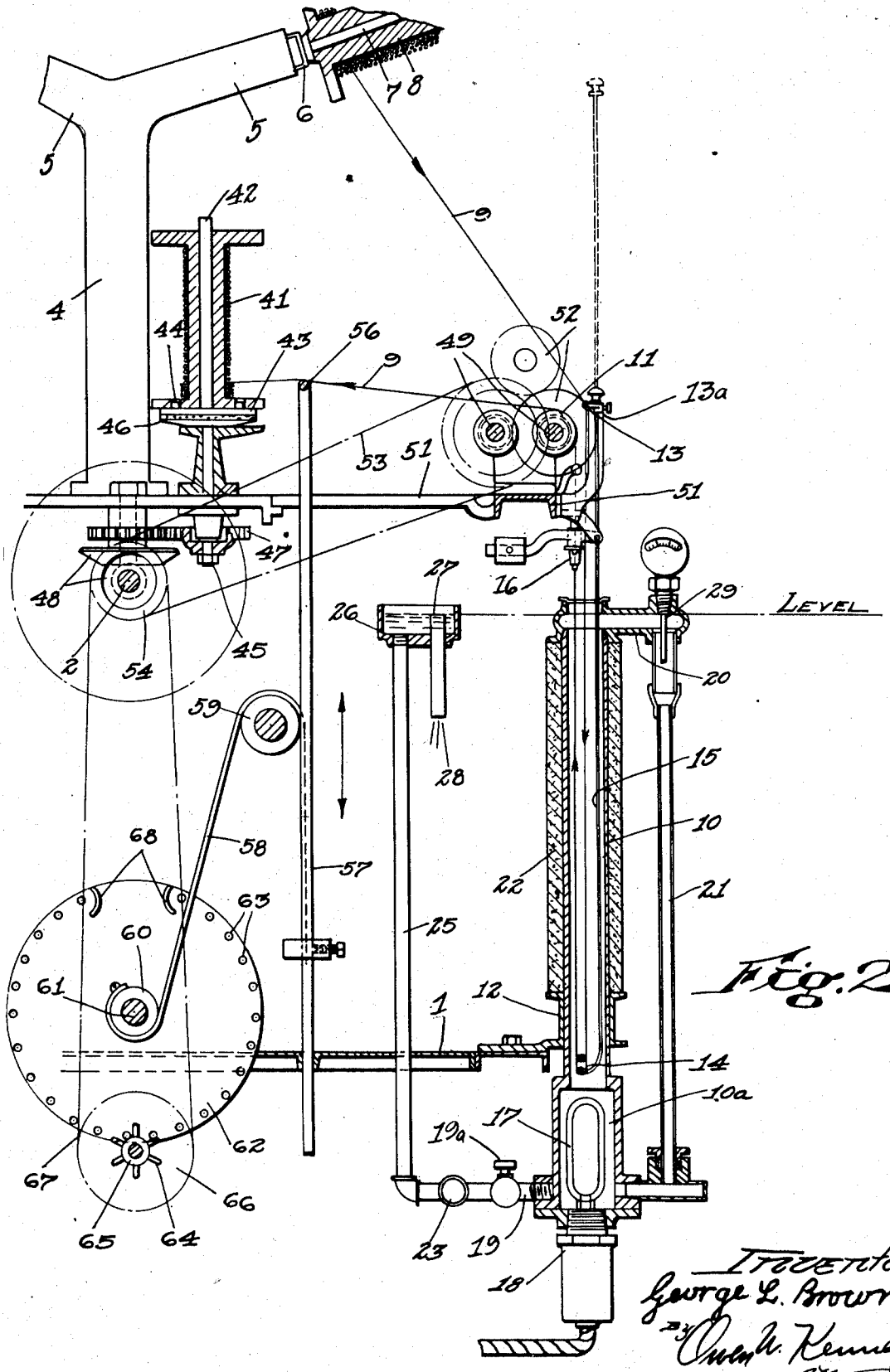


Fig. 2.

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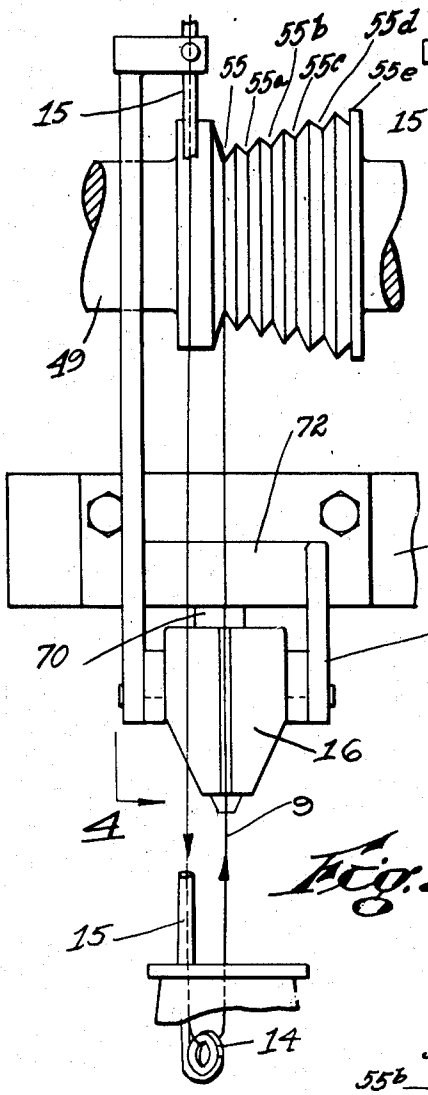


Fig. 3.

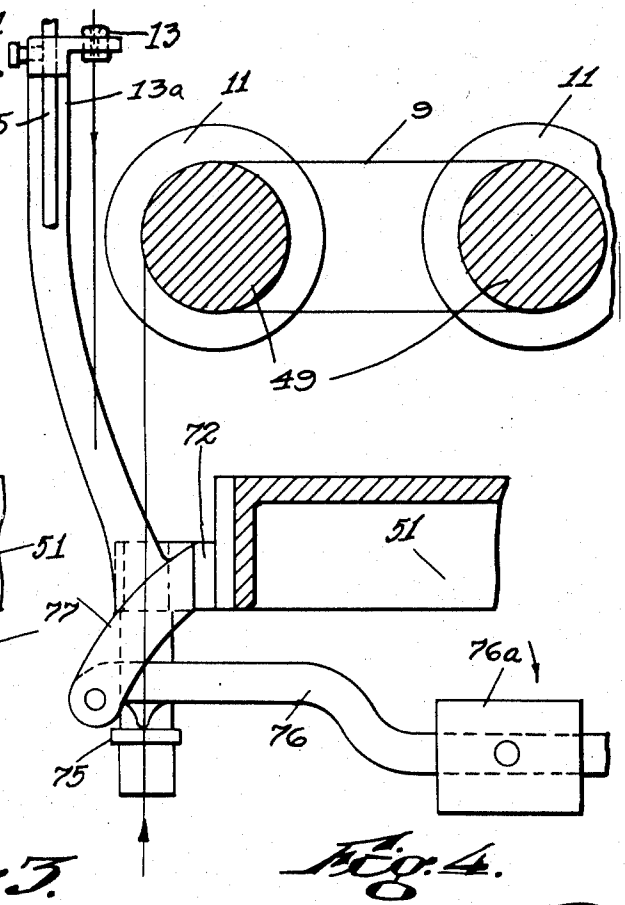


Fig. 4.

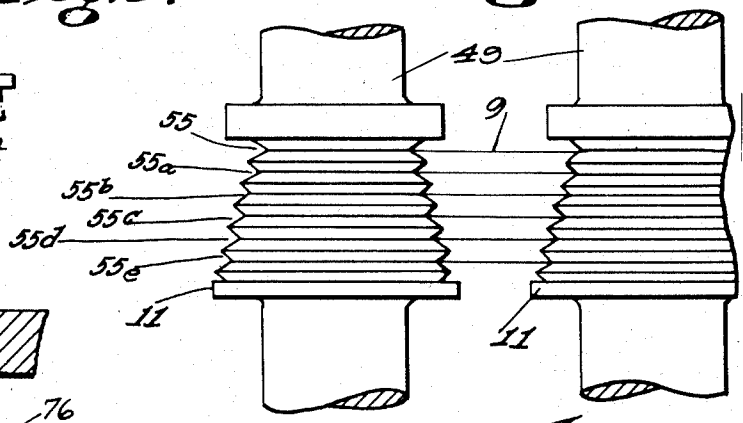


Fig. 5.

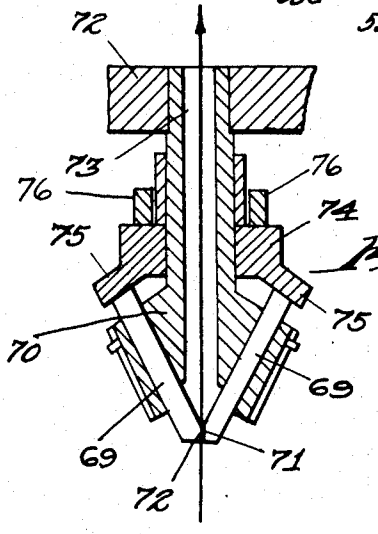


Fig. 6.

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UNITED STATES PATENT OFFICE

1,962,424

METHOD OF TREATING FILAMENTARY MATERIAL AND MEANS THEREFOR

George L. Brownell, Worcester, Mass.

Application February 8, 1930, Serial No. 427,032

3 Claims. (Cl. 28—59)

The present invention relates to an improved method of treating preformed filamentary material, such as twisted, braided or otherwise prepared twines or cords of cotton, linen or other fibrous materials susceptible of improvement in their tensile strength by the practice of the treatment hereinafter described.

The object of the invention is to provide an improved method by the practice of which filamentary material of the above indicated character may be uniformly treated and stretched a predetermined amount to improve its tensile strength before being wound on the carriers from which it is withdrawn as used for various purposes. The underlying principle of the present invention resides in drawing filamentary material, such as twine or cord as it comes from a twisting or similar machine, through a liquid maintained at a constant desired temperature and immediately thereafter stretching it a predetermined amount and winding the stretched material on a suitable carrier under sufficient tension to hold the stretch until the material has become permanently set by cooling and drying. The above and other advantageous features of the invention will hereinafter more fully appear with reference to the accompanying drawings, in which—

Fig. 1 is a view in front elevation of a portion of a machine for carrying out my invention.

Fig. 2 is a vertical sectional view along the line 2—2 of Fig. 1 looking in the direction of the arrows.

Fig. 3 is a fragmentary view in front elevation showing one of the stretching devices of Fig. 1 on an enlarged scale.

Fig. 4 is a sectional view along the line 4—4 of Fig. 3 looking in the direction of the arrows.

Fig. 5 is a fragmentary plan view of the parts shown in Fig. 4.

Fig. 6 is a fragmentary sectional view showing the details of one of the devices for removing moisture from the thread prior to the stretching.

Fig. 7 is a diagrammatic view illustrating means for automatically controlling the temperature of the liquid in which the material is immersed.

Like reference characters refer to like parts in the different figures.

Referring first to Figs. 1 and 2 the machine comprises a frame 1 in which is journalled a driving shaft 2 provided at one end with a pulley 3 whereby the shaft 2 may be rotatably driven from a suitable source of power not shown. The frame 1 provides an upwardly extending bracket 4 with oppositely projecting arms 5—5 each supporting a spindle rail 6 extending longitudinally of the frame 1. Each spindle rail 6 carries a number of spindles 7, 7 inclined upwardly from the horizontal and each spindle 7 loosely supports a spool 8 on which is wound thread 9 in the condition that it comes from the twisting machine. As best shown in Fig. 1, each thread spool 8 has associated therewith a moistening cylinder 10 and a pair of stretching drums 11, and as all of the cylinders 10 and drums 11 are identical in construction only one cylinder 10 and pair of drums 11 will be described in detail.

As best shown in Fig. 2, each cylinder 10 is supported by a bracket 12 carried by the frame 1 so as to maintain the cylinder 10 in a vertical position, and the thread 9 from the spool 8 just above the cylinder 10 is led downwardly into the open top of the cylinder 10 through a suitable guide 13 supported by a holder 13a carried by the frame 1. At the bottom of the cylinder 10 the thread 9 passes through a second guide 14 which is carried at the end of a rod 15 slidable in the guide holder 13a, so that the guide 14 may be raised to pass the thread 9 through it. The guide 14 serves to reverse the direction of the thread 9, the thread 9 leading upwardly through the open end of the cylinder 10 to a squeezing or liquid removing device 16, the details of which device will be hereinafter more fully described. The open lower end of the cylinder 10 communicates with a heating chamber 10a in which is supported an electrical heating element 17 by means of a plug connection 18 screwed into the bottom of the chamber 16. Liquid is admitted to the bottom of the heating chamber 10a by means of a pipe 19 through a valve 19a and the upper end of the cylinder 10 provides a pipe coupling 20 connected to the inlet chamber 10a by vertical pipe 21. With the above described arrangement it is apparent that the liquid is free to circulate between the cylinder 10 and the pipe 21, and for the purpose of retaining the heat in the liquid within the cylinder 10 it is provided with a casing 22 of insulating material.

In order to prevent liquid in the several cylinders 10 from overflowing through the open ends of the cylinders 10 and for maintaining the liquid in the several cylinders 10 at a constant level, all of the inlet pipes 19 are connected in parallel to a supply pipe 23 which, as shown in Fig. 1, provides a control valve 24 which can be set to supply just enough water to maintain the liquid in the cylinders 10 at the level indicated by the dotted line. In order to take care of liquid supplied by

the pipe 23 in excess of the normal evaporation which takes place in the cylinders 10, the supply pipe 23 provides an upwardly extending overflow pipe 25 which discharges into an open bowl 26 having an opening 27 at exactly the level at which it is desired to maintain the liquid in the several cylinders 10, that is, a short distance below the tops of the cylinders. Obviously any excess liquid supplied to the system of cylinders 10 will flow from the bowl 26 into the overflow opening 27 and its discharge pipe 28.

For the purpose of maintaining the temperature in the liquid in all of the cylinders 10 substantially constant, and for preventing the temperature from reaching a point which would be injurious to the thread, a control thermostat 29 is provided in one of the pipe couplings 20 leading from the top of a cylinder 10. Since devices of this sort are well known in the art, the thermostat 29 is not shown in detail and it is sufficient for the present disclosure to state that the function of the thermostat 29 is to simultaneously disconnect all of the heating elements 17 from the source of power when the liquid in the cylinder 19 is heated above a certain temperature. One way of accomplishing this purpose is illustrated diagrammatically in Fig. 7 which shows the electrical conductors 30 for supplying the several heating elements 17 in parallel connected to the contacts 31 of an automatic switch 32. The switch arms 33 are connected to the suitable source of electrical energy indicated at 34 and normally the switch arms 33 are held in engagement with the contacts 31 by a spring 35. The switch arms 33, however, are adapted to be opened by means of a plunger 36 under the control of a solenoid 37, one terminal of which is connected to the source 34 while the other terminal thereof is connected to a contact 38 of the thermostat device 29. The thermostat 29 provides a movable contact 39 under the control of the thermostat element 40, and when the temperature of the liquid in a cylinder 10 exceeds a predetermined value, expansion of the thermostat element 40 closes the contacts 38 and 39. This energizes the solenoid 37, thereby moving the switch arms 33 out of engagement with the contacts 31 and deenergizing all of the heating elements 17.

When the liquid in the system has cooled off, the thermostat element 40 contracts to separate the contact 39 from contact 38, thereby deenergizing the solenoid 37 and permitting the spring 35 to close the switch 32 and again connect all of the heating elements 17 to the source 34. From the foregoing, it is apparent that during the operation of the device the liquid in all of the cylinders 10 is maintained at a substantially uniform temperature which is best suited for soaking the threads 9 passing through the cylinders the desired amount preparatory to stretching the same, as will next be described.

As best shown in Fig. 2, the wet thread 9 from each cylinder 10 is adapted to be wound on a spool 41 after passing around a pair of stretching drums 11, and, as indicated in Fig. 1, a separate spool 41 is provided for each pair of drums 11. Each winding spool 41 is supported by a spindle 42 providing an integral flange 43 which is adapted to impart its rotation to the spool 41 by means of coupling pins 44. The spindle 42 and its flange 43 are adapted to be rotatably driven from a vertical shaft 45 by means of a suitable friction clutch 46 interposed between the shaft 45 and flange 43, the purpose of which is to provide for a certain amount of slippage between the shaft 45 and spindle 42 during the winding operation. Each shaft 45 is driven from the main drive shaft 2 through spur gears 47 and bevel gears 48, so that rotation of the drive shaft 2 causes all of the spindles 42 and spools 41 to be driven in unison at the same speed.

Each pair of stretching drums 11 are adapted to be driven in unison with the corresponding spool 41 at substantially the same speed, and to this end the several pairs of drums 11 are mounted on spaced shafts 49 rotatably supported in bearings 50 carried by a horizontal frame member 51. The shafts 49 are driven in unison and in the same direction of rotation, indicated by the arrow in Fig. 2, by means of suitable gearing 52 connected by a chain 53 to a sprocket wheel 54 on the drive shaft 2, so that stretching drums 11 are positively driven in unison with the winding spools 41 which, however, are frictionally driven, as previously described.

As best shown in Fig. 5, the drums 11 of a pair are identical and each drum 11 provides a series of grooves 55, 55*a*, 55*b*, to 55*e* of different diameters with the grooves of the same diameter on the spaced drums 11 in accurate alinement with each other. The moistened thread 9 from a cylinder 10 passes directly upwardly through the liquid removing device to the smallest groove 55 of the foremost drum 11, from which it passes to the corresponding groove 55 of the rear drum. The thread then passes back and forth between the drums in the other grooves 55*a*, 55*b* to 55*e* and finally leads from the groove 55*e* of the foremost drum 11 to the spool 41, as clearly indicated in Fig. 2. As previously pointed out, the several pairs of drums 11 are positively driven in unison at the same speed of rotation, and since the thread passes back and forth in grooves of increasing diameter, it is evident that the peripheral speed at the bottom of the groove 55*e* is greater than at the bottom of the groove 55 where the thread passes on to the drums. Consequently, the thread is subjected to a stretching action as it passes back and forth over the drums 11 before being wound on the spool 41, which is frictionally driven at a speed sufficient to wind the thread tightly thereon, without losing the stretch.

In order to distribute the thread evenly on a spool 41 as it is wound thereon, the several threads leading to the spools 41 pass over a traversing bar 56 which is adapted to have an up and down reciprocatory movement imparted thereto, as indicated by the arrows in Fig. 2. The traversing bar 56 is supported by vertical rods 57 slidably supported by the frame 1 and a reciprocatory movement is adapted to be imparted to the rods 57 by means of a chain 58 passing over a pulley 59. The chain 58 passes downwardly to a collar 60 mounted on a shaft 61 which is adapted to have an oscillatory movement imparted thereto so as to intermittently wind and unwind the chain 58 on the collar 60. Obviously, any suitable means may be employed for obtaining oscillatory movement of the shaft 61, and, as shown, this movement is obtained by means of a so-called mangle motion comprising a disk 62 mounted on the shaft 61 and providing pins 63 cooperating with a star wheel 64 on a shaft 65. The shaft 65 is continuously driven from the drive shaft 2 by means of sprocket wheels 66 and a chain 67, and rotation of the star wheel 64 imparts a slow rotative movement to the disk 62 by cooperation with the pins 63. As is usual in motions of this sort, the direction of rotation

of the disk 62 is reversed at the end of a partial revolution of the shaft 61 by means of guides 68, so that as the drive shaft 2 continues to rotate the winding and unwinding of the chain 58 on the collar 60 imparts a slow up and down motion to the traversing bar 56. This traversing motion distributes the winding of the threads 9 on the spools 41 so as to form a more or less open winding on the spools 41 which permits the thread to dry more readily in its stretched condition.

As previously pointed out, a thread in passing upwardly from a cylinder 10 to a pair of stretching drums 11 is subjected to the action of a moisture removing device 16 which forms no part of the present invention and may be of any desired construction. As best shown in Fig. 6 the moisture removing device 16 comprises a pair of pins 69 slidably supported in a bracket 70 along divergent axes so that the lower ends of the pins 69 are in abutting relation. The pins 69 are flattened at 71 along their zone of contact, and each flattened surface 71 provides a groove 72, the grooves 72 being in alinement so as to inclose the thread 9 passing upwardly between the abutting surfaces of the pins 69. The bracket member 70 is rigidly supported in a suitable holder 72 and provides a central passage 73 for the thread 9, the passage 73 being large enough to provide plenty of clearance for the thread. A pressure collar 74 is slidably mounted on the bracket 70 and provides oppositely projecting lugs 75 adapted to bear on the upper ends of the pins 69. In order to cause the collar 74 to exert a definite pressure on the pins, a weighted lever 76 cooperates with each side of the collar 74, as shown in Fig. 4, each lever 76 being pivotally supported by means of a bracket arm 77 at a point adjacent to a lug 75 of the collar. As a result of the pressure simultaneously exerted on each pin 69, the thread 9 is closely engaged by the sides of the grooves 72 so that as the wet thread 9 passes upwardly through the device 15, moisture is squeezed out of the thread and runs back into the cylinder 10. This action prevents excess moisture from being carried upwardly onto the drums 11, and obviously the amount of pressure that is exerted on the thread can be regulated by positioning the weights 76*a* on the pressure levers 76.

From the foregoing, it is apparent that by the present invention there is provided an improved method of treating preformed filamentary material such as twisted or braided twines or cords, so that the material is uniformly stretched as it is withdrawn from one carrier and wound on another under sufficient tension to hold the stretch. By drawing the material through a heated liquid prior to the stretching operation, it is possible to stretch it the desired amount to improve its tensile strength, and since the stretched material is dried under tension, it is practically impossible to stretch it any further without exerting a force so great as to break the same. It has been found that thread treated in accordance with the practice of my invention is greatly superior in its qualities to unstretched thread when used in manufacturing operations which subject the material to a considerable tension and in which it is essential that the thread must not stretch after being sewn, as in the manufacture of shoes.

I claim,

1. The improvement in the treatment of filamentary material, such as twine or cord, to increase its tensile strength, which consists in thoroughly wetting the material by submerging a considerable length thereof in a hot liquid, progressively and uniformly increasing the draft on the wet material as it emerges from the liquid to stretch the same and thereafter winding the stretched material on a carrier under sufficient tension to hold the stretch therein while the material is drying on the carrier.

2. The improvement in the treatment of filamentary material, such as twine or cord, to increase its tensile strength, which consists in subjecting the material to a soaking action for an appreciable period by drawing it through a hot liquid maintained at a constant temperature, progressively and uniformly increasing the draft on the wet material as it emerges from the hot liquid to stretch the same and thereafter winding the stretched material on a carrier under sufficient tension to hold the stretch therein while the material is drying on the carrier.

3. The improvement in the treatment of filamentary material, such as twine or cord, to increase its tensile strength, which consists in subjecting the material to a soaking action for an appreciable period by drawing it through a hot liquid maintained at a constant temperature, removing excess moisture from the wet material as it emerges from the liquid and is subjected to a progressive and uniform increase of draft to stretch the same, and thereafter winding the stretched material on a carrier under sufficient tension to hold the stretch therein while the material is drying on the carrier.

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