May 5, 1953 L. P. MILLER 2,637,658

METHOD OF TREATING YARN

Filed Nov. 6, 1948 2 SHEETS--SHEET 1

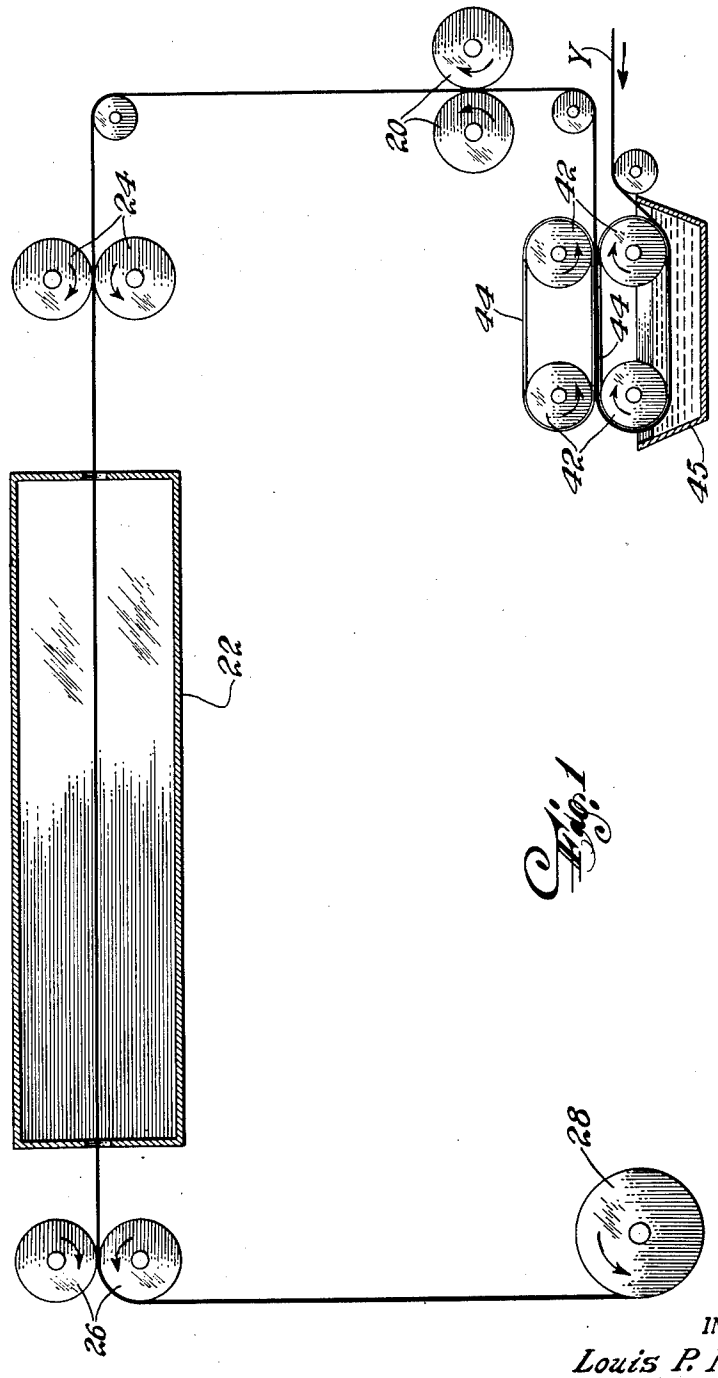


Fig. 1

INVENTOR.
Louis P. Miller
BY Ernest A. Joerren
ATTORNEY

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Fig. 2

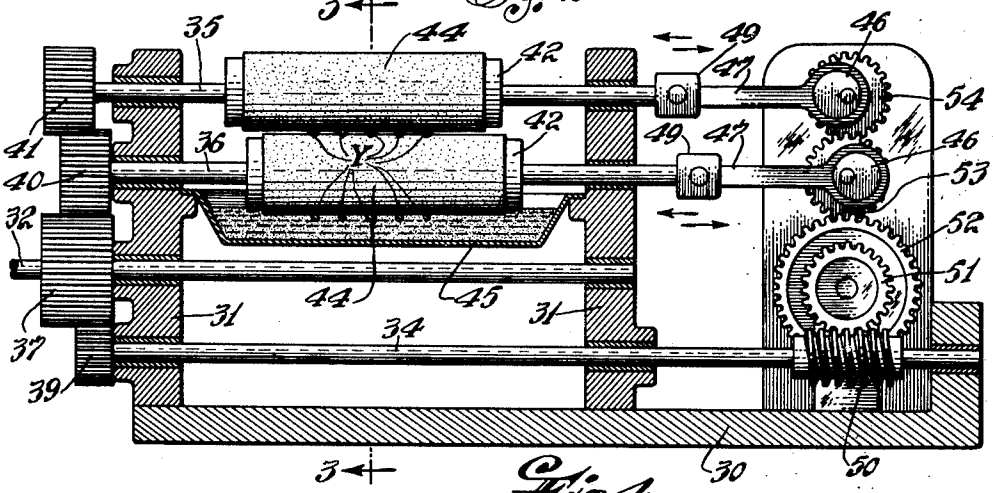
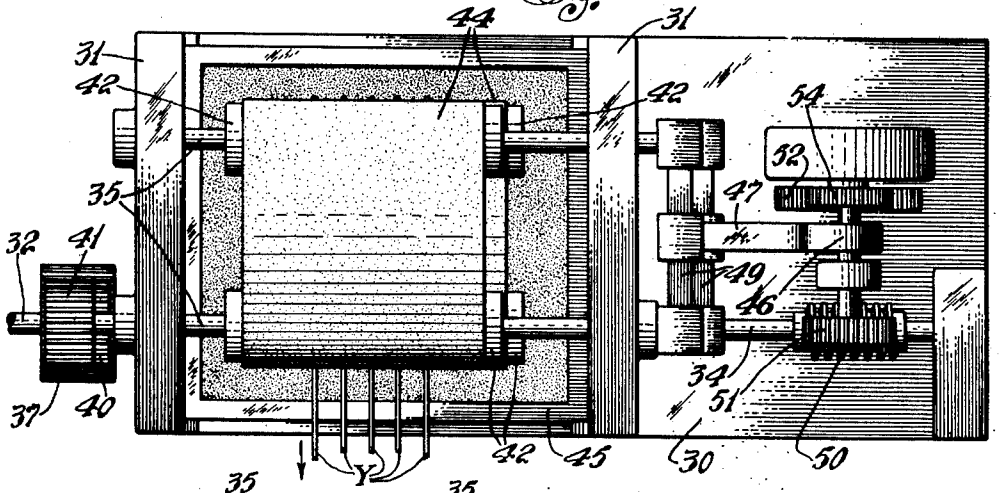


Fig. 4



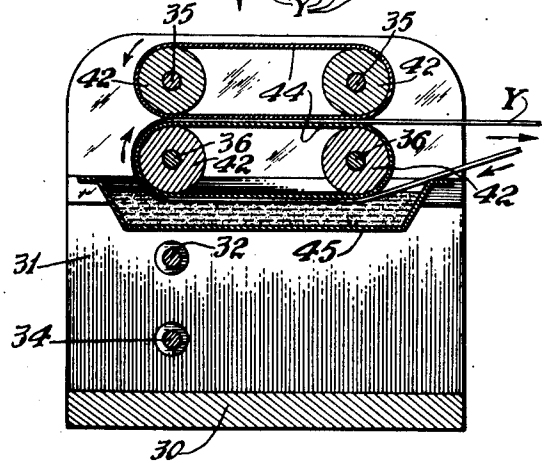


Fig. 3

INVENTOR.
Louis P. Miller
BY Ernest A. Joerren
ATTORNEY

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METHOD OF TREATING YARN

Louis P. Miller, Plainfield, N. J., assignor to Specialties Development Corporation, Belleville, N. J., a corporation of New Jersey

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3 Claims. (Cl. 117—7)

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The present invention relates to treating yarn and the like, and, more particularly, to a method of treating yarn to increase the tensile strength and decrease the stretch thereof wherein the yarn is impregnated with a treating solution, is elongated and is then dried.

Such methods have been proposed for treating yarn, cord, thread, rope and the like, composed of bundled and twisted animal and vegetable fibers as well as synthetic fibers, which are to be used for sewing the soles on shoes, tying bouquets of flowers, the production of tire fabric and many other uses where high tensile strength and low stretch are desirable.

Accordingly, an object of the present invention is to provide an improved and useful method of treating yarn and the like in such manner.

Another object is to provide a method wherein the impregnation period of the yarn is prolonged to insure thorough penetration of a treating liquid preferably containing a bonding agent.

Another object is to attain such prolonged impregnation while carrying out the treating process at a rapid rate.

Another object is to provide a method wherein prolonged impregnation is aided by working the yarn during this period to slightly loosen or untwist the fibers of which the yarn is composed to release entrapped air and enable the impregnant to penetrate substantially to the center of the yarn.

Another object is to provide a method wherein the yarn is compressed to effect or aid elongation thereof.

A further object is to effect such compression at a plurality of points during the impregnation of the yarn.

A still further object is to provide a method wherein the fibers of the yarn so treated are permanently set by the bonding agent.

Other and further objects of the invention will be obvious upon an understanding of the illustrative embodiment about to be described, or will be indicated in the appended claims, and various advantages not referred to herein will occur to one skilled in the art upon employment of the invention in practice.

In accordance with the invention, these objects are accomplished by supplying to the yarn an impregnant, preferably containing a bonding agent, working the yarn while the impregnant is being supplied, for example, rolling the yarn at a plurality of points or along a length thereof to slightly loosen or untwist the individual fibers to relieve entrapped air and to maintain the yarn

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open for a prolonged period or a plurality of intervals to enable the impregnant to penetrate substantially to the center of the yarn.

More specifically, the yarn is treated to facilitate impregnation by utilizing a method which includes advancing the yarn in a lengthwise axial direction, applying pressure to the length of yarn at diametrically opposite continuous lengthwise extending zones of engagement along the length of yarn while being advanced, applying back and forth movement tangentially with respect to the yarn at the zones of engagement to effect rolling of the yarn, and supplying liquid impregnant to the length of yarn within the zones of engagement.

In working the yarn, compression is applied at a plurality of points or along a length thereof while in the impregnating zone which effects elongation of the yarn as observed by its increase in length. The yarn is then dried to effect hardening of the bonding agent and a permanent set of the fibers while advancing the yarn under sufficient tension to effect stretch and further elongation thereof or under only such tension required to take up the slack or stretch caused by the relaxation of the yarn during the drying operation and required to maintain the fibers of the yarn in their rearranged position while the bonding agent is permitted or caused to harden to permanently set the fibers.

A preferred embodiment of the invention has been chosen for purposes of illustration and description, and is shown in the accompanying drawings, forming a part of the specification, wherein:

Figure 1 is a schematic view of apparatus diagrammatically illustrating the treatment of the yarn in accordance with the invention.

Figure 2 is an end view, partly in elevation and partly in section, illustrating apparatus for performing the impregnating and compressing steps.

Figure 3 is a sectional view taken along the line 3—3 on Figure 2.

Figure 4 is a plan view of the machine shown in Figures 2 and 3.

Referring to the drawings in detail, apparatus is shown in Figure 1 thereof for performing the method of the present invention, the operation of which will serve to illustrate the method in which the yarn is treated. One or more strands of yarn Y are pulled or delivered from a source of supply and are passed between a pair of upper and lower belts 44, each supported on a pair of rolls 42 and arranged so that the lower strand of the upper belt contacts the upper strand of the

lower belt and the lower strand of the lower belt passes through a bath of impregnant in a receptacle **45**. The rolls **42** are moved endwise with respect to each other in a manner about to be described hereinafter whereby the belts **44** cooperate to work the yarn while passing between the belts to slightly loosen or untwist the fibers of the yarn to relieve entrapped air and thereby enable the impregnant, supplied by the lower belt, to penetrate substantially to the center of the yarn. These belts also effect compression of the yarn along the length thereof passing between the belts to produce an elongation or increase of length in the yarn.

It will be understood that the yarn could be passed under the lower belt and through the bath before passing between the adjacent strands of the belts, as shown, or could be passed directly from the source of yarn supply between the belts whereby the lower belt serves as the sole means for supplying the impregnant to the yarn. Also, it will be appreciated that the belts could be dispensed with and that the yarn could be merely passed between the pairs of rolls **42**, whereby working of the yarn including compression thereof occurs at the points defined by the nips of the rolls.

The impregnated yarn is passed through power driven squeeze rolls **20** which are operated at a surface speed slightly greater than the surface speed of the belts **44** (or the rolls **42**) to take up the elongation in the yarn which occurs in passing through the belts. The yarn may then be passed directly through a drying chamber **22**, such as an oven or the like, wherein the liquid in the impregnant is removed by evaporation while the bonding agent contained therein is permitted or caused to be hardened to set the fibers as conditioned by the belts **44**.

Alternatively, before passing the yard through the oven, the yarn may be passed through a pair of pull rolls **24**, as shown, to tension the yarn almost to its breaking point and to effect further elongation thereof to decrease stretch.

The yarn is removed from the oven by power driven feed rolls **26** which are operated at a surface speed to take up any slack in the yarn occasioned by the drying thereof, and is then delivered to a winder **28** for packaging the yarn.

Referring now to Figures 2, 3 and 4 of the drawings, there is shown apparatus for working the yarn during impregnation thereof which comprises a base **30** and a pair of upright side frames **31** mounted on the base for rotatably mounting a drive shaft **32** and an operating shaft **34** and for rotatably and slidably mounting a pair of upper roll shafts **35** and a pair of lower roll shafts **36**.

The operating shaft **34** is adapted to be rotated by the drive shaft through a gear **37** on the drive shaft meshing with a gear **38** on the cam operating shaft. One of the shafts **35** and one of the shafts **36** are adapted to be rotated by the drive shaft through a gear **40** on the shaft **36** meshing with the gear **37** on the drive shaft and a gear **41** on the shaft **35** meshing with the gear **40**.

Each of the shafts **35** and **36** has a roll **42** keyed thereon for rotation therewith, and a continuous belt or apron **44** is mounted on the pair of upper rolls and on the pair of lower rolls. These belts are formed of relatively soft pliable material and are constructed and arranged for feeding any desired number of strands of yarn therebetween.

The receptacle **45**, adapted to contain the impregnant, is supported by the side frames **31** in a position whereby the lower strand of the lower belt **44** passes through the impregnant and applies the same to the yarn passing between the belts.

Both the upper shafts **35** and the lower shafts **36** are adapted to be moved back and forth endwise to effect sidewise back and forth movement of the belts. This is accomplished by eccentric mechanisms **46**, each provided with an arm **47** connected to a cross bar **49** (Figure 5), each bar having a pair of shafts **35** and **36** rotatably journalled therein in a manner to effect endwise movement thereof. The eccentric mechanisms are driven from the operating shaft **34** by intermeshing gears **50**, **51**, **52**, **53**, **54**, respectively, and are constructed and arranged to provide opposed cycles of movement, that is, one eccentric mechanism moves the shafts **35** towards the right while the other moves the shafts **36** towards the left and vice versa.

In operation, yarn is fed between the belts **44** and the back and forth movement thereof, while in rubbing contact with each other, subjects the yarn to a kneading or rolling action which opens the yarn sufficiently to enable the impregnant to penetrate to the center. By feeding the yarn between belt strands of a substantial length, one of which carries the impregnant, the yarn is subjected to an impregnating action for a duration of time which insures penetration of the impregnant.

Also, the belts serve to compress the yarn, particularly if the yarn has a light twist, to thereby compress and compact the same and effect the resulting elongation thereof.

From the foregoing description, it will be seen that the present invention provides an improved method of treating yarn and the like which is simple, practical and economical and readily lends itself to the production of yarn having increased tensile strength and decreased stretch.

As various changes may be made in the form, construction and arrangement of the parts herein, without departing from the spirit and scope of the invention and without sacrificing any of its advantages, it is to be understood that all matter herein is to be interpreted as illustrative and not in any limiting sense.

It is also to be understood that the following claims are intended to cover all the generic and specific features of the invention herein described, and all statements of the scope of the invention which, as a matter of language, might be said to fall therebetween.

This application is a continuation-in-part of my prior application for Letters Patent of the United States, Serial No. 755,078, filed June 17, 1947, now Patent 2,577,793.

I claim:

1. The method of treating a strand of yarn in twisted condition which comprises advancing the yarn in a lengthwise axial direction, applying pressure to a length of the yarn at diametrically opposite continuous lengthwise extending zones of engagement along the length of yarn while being advanced, applying back and forth movement tangentially with respect to the yarn at said zones of engagement to subject the yarn to a rolling action back and forth transversely to the axis of movement of the yarn while being advanced to thereby slightly untwist the yarn and open the same within said zones of engagement, and supplying liquid impregnant to the length of yarn within said zones of engagement.

2. The method according to claim 1, wherein the speed at which the yarn is advanced, the length of said zones of engagement and the am-

plitude at which the yarn is rolled back and forth are such that a given point in the length of yarn while within said zones of engagement is untwisted and retwisted.

3. The method according to claim 1, wherein said yarn is first passed through a bath of liquid impregnant.

LOUIS P. MILLER.

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