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Nessler et al.

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[54] **DEVICE FOR TWISTING NATURAL AND SYNTHETIC FIBRE YARNS INTO A SINGLE THREAD**

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[63] Continuation of Ser. No. 28,744, April 15, 1970, abandoned.

[52] **U.S. Cl.** **57/58.54,** 57/35, 57/58.83

[51] **Int. Cl.** **D01h 1/10,** D01h 13/30

[58] **Field of Search** 57/7, 35, 58.52, 58.54, 57/58.55, 58.65, 58.68, 58.83, 62–64, 162, 164

[56] **References Cited**

UNITED STATES PATENTS

373,385	11/1887	Brownell	57/35
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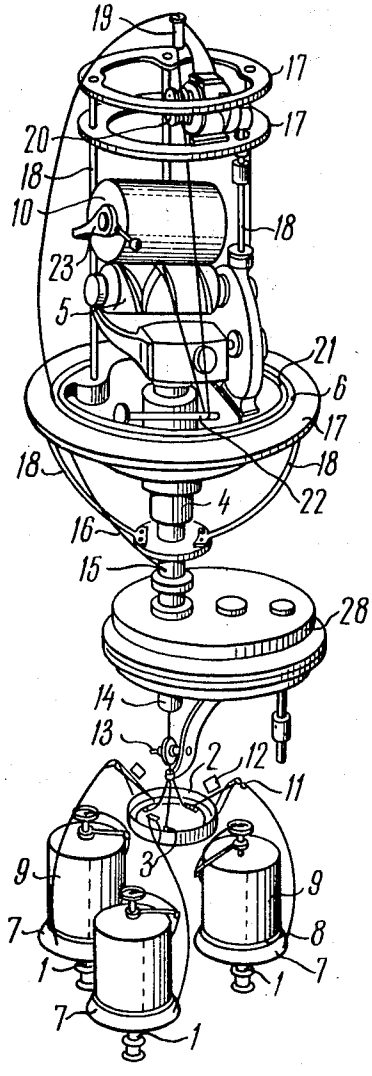
[57] **ABSTRACT**

A device for twisting natural and synthetic fibre yarns together into a single thread, comprising a double-twist receiving spindle made vertical with a horizontal winding drum; a cabling bath with an impregnating fluid mounted under said receiving spindle; and double-twist delivery spindles mounted under the bath so that the axes of rotation of their disks are disposed in different planes passing through the axis of rotation of the receiving spindle's disk, and each of these axes is equally spaced from said axis of rotation.

2 Claims, 3 Drawing Figures



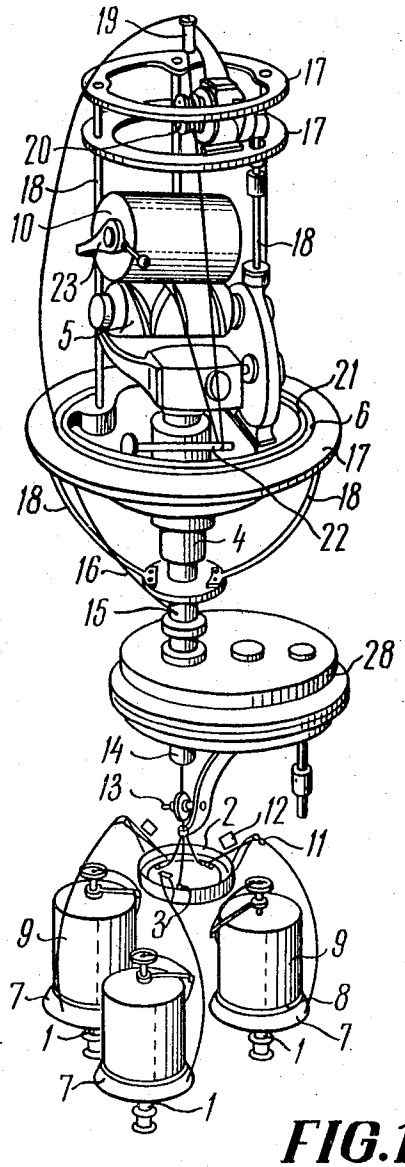


FIG.1

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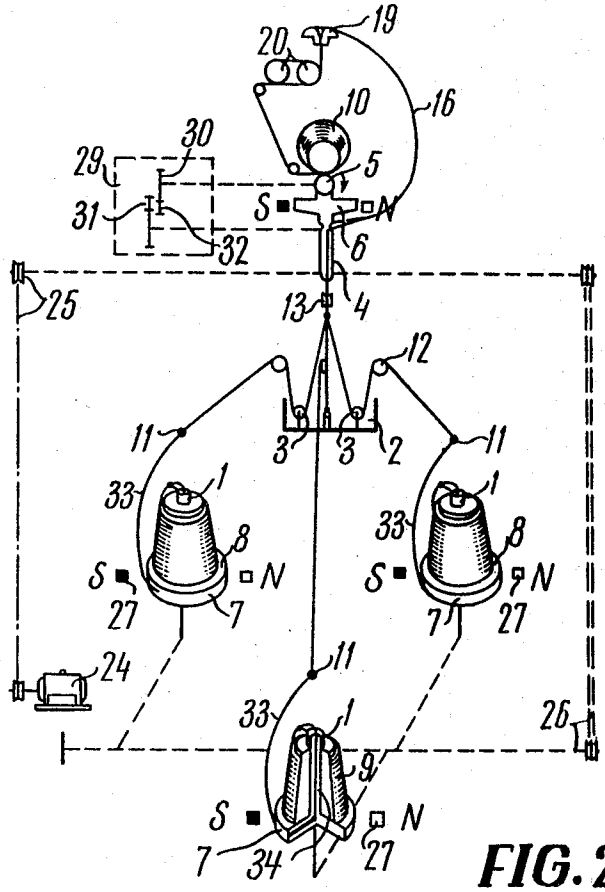

FIG. 2

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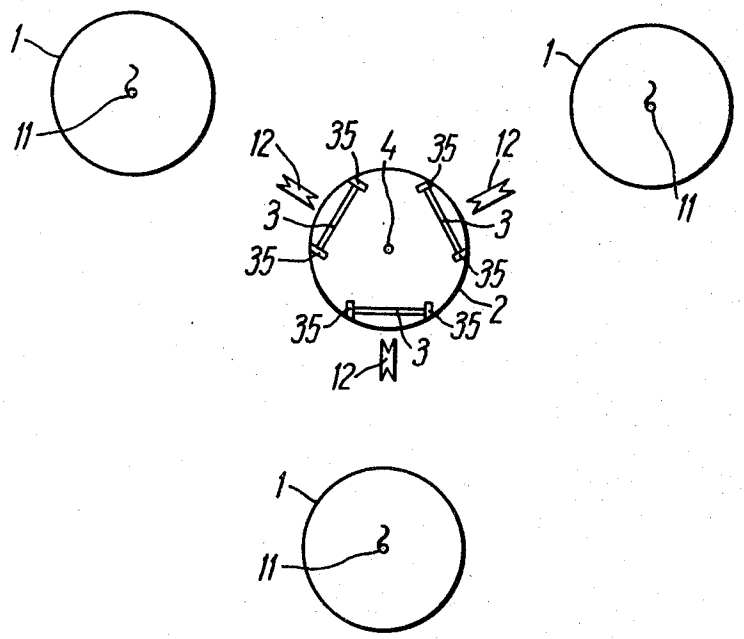

FIG. 3

DEVICE FOR TWISTING NATURAL AND SYNTHETIC FIBRE YARNS INTO A SINGLE THREAD

This is a continuation, of application Ser. No. 28,744, filed Apr. 15, 1970, now abandoned.

BACKGROUND OF THE INVENTION

The present invention relates to direct twisting frames, and mor particularly to devices for twisting together natural and synthetic fibre yarns into a single thread, which are used in these frames.

This invention can most successfully be employed to produce double-twist sewing, cord, and other types of threads from natural and synthetic fibres, as well as single-twist threads from synthetic fibres with twisted-in filamentary rayon.

Threads of natural and synthetic fibres used in the industry must be tight and uniform in their structure, number of twists per meter, length of their constituent elementary yarns, and in color, which necessitates their cabling and wet twisting or their treatment with well-known preparations.

Moreover, excessive extension of these threads in case of breakage, which leads to missed stitches and loosened seams in sewing, is impermissible. To reduce this extension, stretching, heating, and holding at elevated temperature, or the so-called thermal stabilization, of synthetic threads is necessary.

Double-twist threads of natural and synthetic fibres in four, six, eight, and more folds, as well as in four, eight, twelve or more folds, besides their two-, three-, and four-fold final twisting, also require preparatory twisting in two, three, four, or more folds. Single-twist synthetic threads in two, three, four, or more folds, made of unset filamentary synthetic yarn with a number of twists per meter up to 100, require one-fold preparatory twisting.

Known in the present art are devices for twisting yarns into a thread, comprising two vertical double-twist delivery spindles for preparatory or additional twisting, from whose bottins individual or doubled yarns are unwound. Located between the delivery spindles is a vertical double-twist receiving or take-up spindle with a vertical winding mandrel to wind the thread on a double-flanged spool placed on the mandrel. Mounted over the receiving spindle is a cabling arrangement defined by a system of levers equalizing the lengths of the twisted yarns in the course of their movement from the delivery spindles to the receiving spindle. In this process, the rotation axes of the disks of both delivery spindles are disposed in one plane with the axis of rotation of the receiving spindle's disk, and at equal distances from this axis (see, for example, British Pat. No. 692,027, dated 1949).

In this previously known device, it is impossible to produce a thread of three, four, or more folds in the final twist, as this would require mounting of additional delivery spindles, whose axes disposed in one plane with the axes of the main delivery spindles, would be located a greater dis- from the axis of the receiving spindle. Different distances tances between the delivery spindles and the receiving spindle involve different tension, and hence, different length, of the preparatory-twisted yarns, and non-uniform structure of the thread.

The additional spindles complicate the design of the cabling arrangement, which is sufficiently complex for

the two delivery spindles. Besides, in the prior-art device it is impossible to employ an impregnation bath, which fact excludes the wet twisting required for cotton threads, or impregnation with preparations required for synthetic, for instance, polyester threads.

In the prior-art devices close thread winding to spool rules out the possibility of its direct dyeing and combining this process with the thermal setting of this thread, which necessitates three more processes: rewinding with drafting, thermal setting, and the thread rewinding to a perforated pirn for dyeing.

Also known in the art is a device for twisting yarns together into a thread, which produces a thread of two, three, or more folds in the final twist. This device has a horizontally disposed receiving spindle, which is of the double-twist type, and has a horizontal winding mandrel to wind the thread on a spool. Yarn is delivered from a warp creel with bobbins (see French Patent No. 1,259530 C1. D 01 h, dated 1961).

However, this device is unsuitable to produce double-twist threads, or single-twist threads with twisted-in filamentary rayon, while thread winding to a spool excludes the possibility of its direct bleaching and dyeing, and combining these processes with the thermal stabilization of this thread.

OBJECT AND SUMMARY OF THE INVENTION

The principal object of the invention is to provide a device for twisting yarns together into a single thread with such a design of the delivery spindles, the cabling arrangement, and the receiving spindle, and with such a disposition of these units, that this device permits excluding the processes of twisting-in synthetic yarn, its washing, setting, and permits of rewinding to cones, and combining the processes of preparatory twisting (additional twisting), cabling, final twisting, and winding to bobbins, which enables direct dyeing of the thread combined with its stabilization, and the device also permits a substantial reduction in the amount of labor required to produce threads from natural and synthetic fibres, and at the same time ensures their high quality.

This object is achieved by means of a device for twisting together natural and synthetic fibre yarns into a single thread, comprising vertical double-twist delivery spindles, from whose bobbins, individual or cabled yarns are wound off and are, on the same spindles, given a preparatory or additional twist, an arrangement for cabling the twisted yarns coming from said spindles, and a double-twist receiving spindle for final twisting and winding the thread on a bobbin. According to the invention, in this device, the receiving double-twist spindle is made vertical with a horizontal winding drum to wind the thread on a bobbin, and is disposed over the cabling arrangement, under which the double-twist delivery spindles are located, so that the axes of rotation of their disks are situated in different planes passing through the rotation axis of the disk of the receiving spindle, and all these axes are equally spaced from said rotation axis of the disk of the receiving spindle, with said cabling arrangement comprising a bath with a suitable impregnating fluid, wherein rigidly fixed are horizontal guide rods with collars at their ends about which pass the yarns moving from the delivery spindles to the receiving spindle.

Such a design provides for manufacturing double-twist threads of natural and synthetic fibres, which are

tight and uniform in their structure, number of twists per meter, length of their constituent individual yarns, and in color, as well as single-twist threads of synthetic fibres with twisted-in filamentary rayon, and with an elongation at breakage not exceeding 25 percent. It also permits excluding the processes of twisting-in, washing, setting, and winding the thread to a cone, and combining the processes of preparatory twisting, cabling, final twisting, and winding the thread on bobbins which allow using them directly in the processes of bleaching and dyeing the thread, and combining these processes with thread stabilization, thus resulting in a substantial reduction of labor consumed in the production of thread. Employment of the impregnating bath provides for the wet twisting required to manufacture cotton threads, or for the impregnation with preparations, which is necessary for synthetic, say, polyester threads.

To attain further improvement in the uniformity of the threads, the number of the horizontal rods with collars at their ends is advantageously equal to the number of the delivery spindles, and the ends of each of these rods are spaced at equal distances from the rotation axis of the disk of the respective delivery spindle, and are located between said rotation axis and the axis of rotation of the receiving spindle's disk.

For a better understanding of the invention, described below is a particular exemplary embodiment thereof with references to the accompanying drawings, wherein:

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1** is a general pictorial view of the device according to the invention;

FIG. **2** is a schematic diagram of the device shown in FIG. **1** in the position of twisting the yarns into a single thread; and

FIG. **3** is a schematic plan view showing the arrangement of the cabling bath, rods, and delivery and receiving spindles.

DETAILED DESCRIPTION OF THE INVENTION

The device for twisting yarns together into a single thread comprises a plurality of vertical double-twist delivery spindles **1** (FIG. **1**). Located over these spindles is a cabling bath **2** with an impregnating fluid, which bath has therein a plurality of immovable guide rods **3**, each guiding the yarn from one of the delivery spindles. Mounted over the bath is a vertical receiving spindle **4** for two-for-one twisting, provided with a horizontal winding drum **5** and a rotating disk **6**.

The supply spindles **1** each have a rotating disk **7**, over which there are respectively placed immovable supports **8** for bobbins **9**, from which the yarn is unwound.

The axes of rotation of disks **7** of spindles **1** are disposed in different parallel vertical planes passing through the axis of rotation of disk **6** of spindle **4**. All of these axes are equally spaced radially from said axis of rotation of disk **6**.

The delivery spindles **1** can be circumferentially distributed, uniformly or irregularly, about the rotation axis of disk **6**.

Depending on the number of folds in the final-twisted thread, the number of spindles **1** can be two, three, or more. Location of spindles **1** at equal radial distances from the axis of disk **6**, and their automatic adjustment for tension in the yarns being twisted, provide for equal lengths of the individual yarns to be twisted into one thread.

The guide rods **3** are immovably fixed and have collars at their ends to prevent yarn from slipping off, and the number of these rods equals the number of the delivery spindles **1**. The ends of each rod **3** are equally spaced from the axis of rotation of disk **7** of the respective delivery spindle **1**, and are disposed between said axis of rotation of disk **7** and the axis of rotation of disk **6**. These rods are passed about by the yarns moving from the supply spindles **1** to the receiving spindle **4**, thus helping to wet and impregnate the yarns with the impregnating fluid in bath **3** and additionally to equalize their tensioning.

The winding drum **5** (grooved or driver type) of the receiving spindle **4** is the only member pulling all the yarns and winding the thread on bobbin **10** (cylindrical or tapered), as is shown in FIG. **2**. If perforated pirns are employed, the bobbins can be directly used in the processes of bleaching and dyeing with simultaneous stabilization of the thread.

Fixed above the middle of each supply spindle **1** is a yarn guide **11**, and located between the guide and the immovable rod **3** is a stop motion means **12** for checking yarn for breakages and stopping the device. Mounted over the middle of the bath is tensioning unit **13**, which adjsts the tension of all the yarns before they reach spindle **4**. Rod **14** of this spindle is hollow, and has a radial eye **15** to bring the thread out of this rod.

To limit the balloon formed by thread **16** issuing from eye **15**, used in the device are rings **17**, which are mounted by means of supports **18** at different heights around spindle **4**. At the top end of spindle **4** there is a mushroom-shaped guide **19** leading thread **16** upwardly, which provides for the second twist of the thread within one revolution of disk **6**. Located under guide **19** are capstans **20** serving to slightly stretch out, and even out the structure of thread **16**, as well as to maintain a certain tension in the thread while wound on bobbin **10**.

Mounted on an unmovably support **21** of spindle **4** is a thread guide **22**.

Bobbin **10** is held in place by head **23**.

When a driver type winding drum is used, the driver is mounted in front thereof in spindle **4**.

Disks **7** of spindles **1** are rotated by an electric motor **24** (FIG. **2**) through a vee-belt transmission means **25**, a flat belt transmission means **26**, and gears (not shown in the drawing). Supports **8** and **21** are retained against rotation by magnets **27**.

Disk **6** of spindle **4** is driven by the electric motor **24** through the vee-belt transmission **25** and a reduction gear **28** (FIG. **1**).

The winding drum **5** rotates from rod **14** through a worm-and-pinion reduction gear **29** means (FIG. **2**). In this reduction gear means **29**, gears **30** and **31** are changeable, and gear **32** is idle.

To change the speed of rotation of disks **7**, pulleys in transmission **26** are changed to another diameter. To alter the rotational speed of disk **6** a similar change is effected with the pulleys in the transmission means **25**. To alter the speed of the winding drum **5** and the number of preparatory and final twists, gears **30** and **31** are changed to another diameter. Reversal of the direction of the preparatory and final twisting can be performed

by switching over the phases in the electric motor **24,** changing transmission means **26** to a cross one, and engaging or disengaging the idle gear **32** in reduction gear **29,** to retain the correct direction of rotation of the winding drum **5.**

Referring to FIG. **3,** it will be seen that the bath **2** is installed coaxially under the spindle **4.** The ends of rods **3** with collars **35** are equidistant by pairs from the axes of delivery spindles **1** and the axis of the receiving spindle **4.** Yarns unwound from the bobbins installed on the delivery spindles **1** after being twisted pass through the thread guides **11** and fixed rollers **12** under the rods **3** and join each other in the tension unit **13.**

Before starting the device, placed on spidles **1** (FIG. **2**) are bobbins **9** with single or cabled yarn. Yarn **33** from each bobbin is taken into channel **34** of spindle **1,** with the yarn being then led through guide **11,** stop motion **12,** rods **3,** and tensioning unit **13.** Then, the electric motor **24** is actuated, and some length of the head-twisted yarns is unwound manually, whereupon the electric motor is disconnected.

The cabled head-twisted yarns are led through the hollow rod **14** of spindle **4,** and after coming out from its eye **15** and an eye of disk **6,** are led inside rings **17** through guide **19,** capstans **20,** and the thread guide **22** onto the winding drum **5,** where they are manually wound on the pirn of bobbin **10.** Guiding of yarn through channels **34** of spindles **1** and through the holow rod **14** of spindle **4** can be effected by a conventional pneumatic arrangement (not shown). Then the electric motor **24** is switched in, and disks **7** and **6.** as well as the winding drum **5,** start rotating.

The winding drum **5,** which reels thread **16** on bobbin **10,** provides for the unwinding of yarns **33** from bobbins **9,** and for their movement through the device. Passing through spindle **1,** yarns **33** attain the preparatory twist, i.e., two twists for one revolution of disk **7.** The vertical double-twist spindle **1** is capable of automatically equalizing the tension of yarn, gathering the excess length thereof to the disk, or paying it off.

The head-twisted yarns **33,** having passed through guide **11** and unit **12,** enter bath **2,** where moving around the fixed rods **3,** they are impregnated with the fluid. The fixed dispositioned of the rods provides for adequate impregnation of the yarns and further evening of their lengths, i.e., for their cabling. The head-twisted and cabled yarns pass through the tensioning unit **13,** which can set a desirable tension on thread **16.** Thread **16** passing through the hollow rod **14,** its eye **15,** the eye of disk **6,** and guide **19,** forms a balloon limited by rings **17,** and receives the final twists, two such for each revolution of disk **6.** Then thread **16** reaches capstans **20,** where it is slightly drawn to even out the thread structure and tension it in winding.

Having passed through the thread guide **22** and the grooves of the winding drum **5,** the thread is wound onto bobbin **10** placed on the drum.

Winding can be cylindrical or tapered, on a smooth or perforated pirn, which, combined with uniform and tight winding, makes it possible to use such bobbins directly in the processes of bleaching and dyeing with simultaneous thermal stabilization.

What is claimed is:

1. An apparatus for twisting natural and synthetic fibre yarns into a single thread and impregnating the twisted thread for thermal stabilization thereof, comprising a vertical double-twist receiving spindle for the final twisting of the thread and winding the thread to a bobbin; a horizontal driver-type winding drum coupled to said receiving spindle to wind the thread after final twisting to said bobbin; capstan means secured above said winding drum and intended for small stretching and equalizing the structure of the thread and disposed to control a pre-determined tension of the thread before winding onto said winding drum; a first rotation disk mounted on said vertical double-twist receiving spindle and having an axis of rotation coaxial therewith; a cabling bath having an impregnating fluid and disposed under said vertical double-twist receiving spindle; hoizontal guide rods fixed in said bath and passed about by the moving yarn; each said guide rod having means to prevent the yarn from slipping off; a plurality of vertical double-twist delivery spindles mounted under said bath and additional rotation disks mounted coaxially with said delivery spindles, each of which has its axis of rotation; each said axis of rotation of the delivery spindles being in different planes passing through the axis of rotation of said first rotation disk and being at equal distances therefrom; said plurality of vertical double-twist delivery spindles providing for preparatory or additional twisting of the yarns being unwound from the bobbins installed on these spindles.

2. The apparatus as claimed in claim **1,** wherein said horizontal guide rods equal the number of said delivery spindles, and each said guide rod has its ends equidistant from the axis of rotation of a respective of said additional rotation disks and wherein each said guide rod is disposed between the axis of rotation of said receiving spindle and an axis of rotation of a respective of said additional rotation disks.

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