March 8, 1949. J. L. MEADE 2,463,636

YARN TWISTING APPARATUS

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Fig. 1

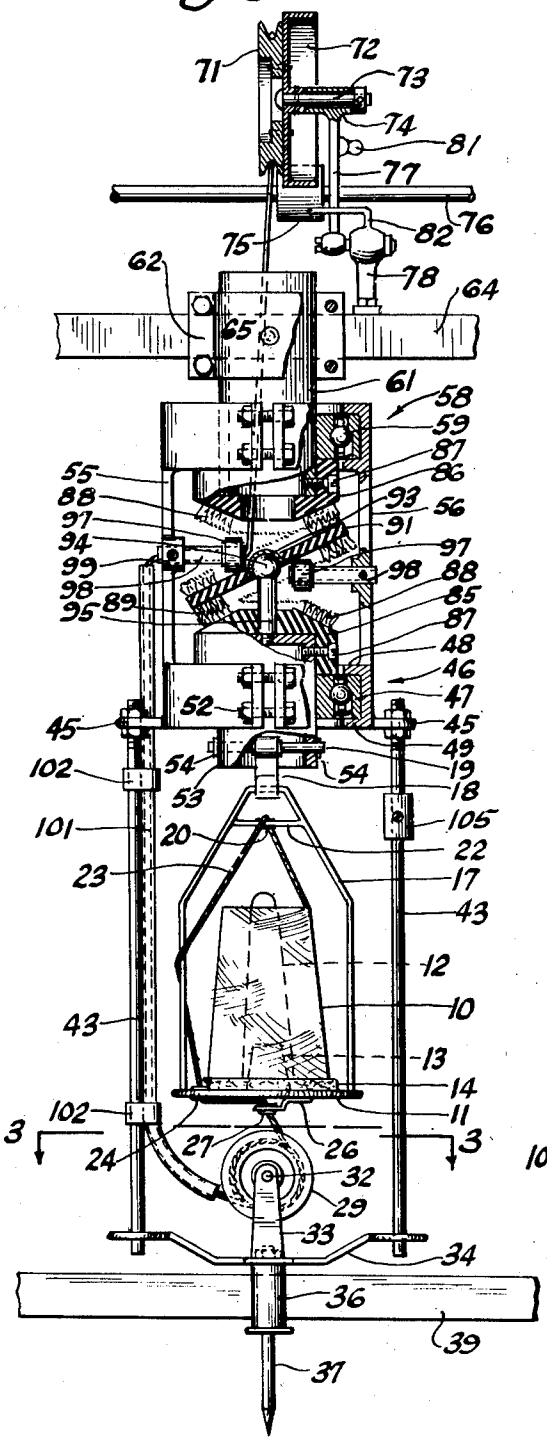


Fig. 2

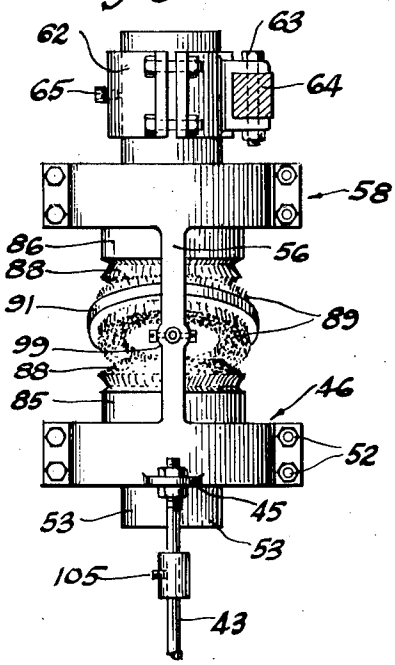
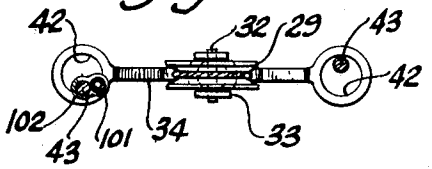


Fig. 3



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YARN TWISTING APPARATUS

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11 Claims. (Cl. 57—58)

1

This invention relates to apparatus for twisting textile yarns. More particularly it refers to apparatus that will insert in any type of textile yarn, either of single strand or multiple ply construction, two turns of twist for each revolution of the spindle. Moreover the invention is capable of processing yarns ranging from the finest denier used in the hosiery industry to the heaviest yarns, for example, as in the manufacture of cord tires, and with equal efficiency.

Yarns intended for use in fabrics—for example, knitted hosiery—are twisted in various degrees. The yarn as delivered from the source of manufacture to the throwster is provided with only a slight initial twist, perhaps only one half turn per inch of length. Such yarn is not in condition for incorporation into the fabric, and is therefore further twisted to a degree depending upon the structural characteristics desired to be imparted to the yarn and to the article made therefrom. Present practice of incorporating the required additional twist contemplates two independent operations. First, a so-called down-twisting, well-known in this art, in which a further preliminary twist of from five to ten turns per inch is added to the yarn.

During down-twisting the yarn is subjected to a number of serious hazards that affect detrimentally the quality of the finished product. Filaments may be frayed or broken by sharp edges of worn spots in the traveler and by badly nicked boobin heads; the yarn may be broken from the burial of the ends behind loose or warped heads of defective bobbins; the traveler rings may be scored by vibration of off-balanced bobbins; ballooning of the yarn as it is centrifugally whirled by the action of the revolving spindle may break or damage the yarn, and the exposure of the yarn to oil, dirt, and fly waste affects the quality of the product.

After the down-twisting, it is customary to transfer the bobbins to another twister for the insertion of the final turns in the yarn. Such later process is known in the trade as "up-twisting" and details thereof are well recognized. In final twisting, the yarn is again subjected to the detrimental effects of ballooning in its delivery over the head of the revolving bobbin, and is likely to be abraded in its frictional contact with the wire tension device, and by possible slippage between the take-up spool and the surface of the cork-covered drum which drives the spool.

Prior processes as just briefly described are uneconomical and inefficient, and it is therefore one of the principal objects of my invention to provide a high-speed, yarn-twisting apparatus designed primarily for the insertion of two turns of twist in single end or multiple ply yarns for each revolution of the spindle.

2

A further object is to provide a yarn-twisting apparatus so constructed and arranged as to avoid the hazards inherent in the present down-twisting and up-twisting operations, and thus to yield a superior quality of finished product.

Still another object of my invention is to substantially reduce the twisting time now required in the processing of textile yarns, especially yarns of high twist.

An additional object is to provide a twisting apparatus in which, regardless of the size of the package under process, the load on the spindle will be a constant minimum as compared with conventional types of twisters in which the high speed spindle is required to carry variable loads from partially full to completely full bobbins from start to finish of the operation.

Another particular object is to provide flexibility of design that will permit greater economy and convenience in the matter of conversion of conventional type twisters; i. e. utilizing most of the present framework and retaining all possible standard parts and those that require only minor modification.

An additional object is to eliminate the multiplicity of bobbins or spools now required under present conventional twisting methods.

Another object is to provide a yarn-twisting apparatus as aforesaid in which a plurality of sets of twisting heads is arranged side by side for driving by common means, and each head is individually adapted to be disengaged from driving connection with said means for threading the yarn therethrough.

Still another object is to provide yarn-twisting apparatus utilizing a construction and principle of operation which avoids ballooning of the yarn and the hazards incident thereupon.

Another object is to provide yarn-twisting apparatus capable of performing its intended functions in a gentle manner as compared with present machines which break and abrade the yarn due to the frictional hazards heretofore alluded to.

Further objects will appear as the description proceeds.

The construction and arrangement of parts inherent in my invention renders the same capable of processing yarns from any type of original package, i. e., cake, pirn, cone or spool, while the size and shape of the finished package is a matter of choice. The latter object is achieved

by providing twisting means substantially independent of the take-up means whereby the latter may be arranged to produce "jumbo" sized finished packages, either of the cylindrical headless type or of cone shape.

In the drawings which show one form in which the invention may be embodied:

Fig. 1 is a front elevational view of a twisting unit embodying my invention;

Fig. 2 is a partial side elevational detail to show certain aspects of the novel connection between the upper and lower portions of the unit; and

Fig. 3 is a cross-sectional view taken on the line 3—3 of Fig. 1.

Referring first to Fig. 1 which shows an individual twisting unit embodying my invention, the product to be twisted, a supply package 10, in this instance represented as a cone, although capable of being in other conventional forms, is placed upon a pan 11. In the case of a conical package the same will be wound upon the usual conical core or tube 12 which is snugly fitted over a frusto-conical plug 13 affixed to the pan 11. If the yarn supply package to be processed is in the form of a cake, pirn, straight tube or a spool, instead of the cone illustrated, another suitable type of centering plug 13 may be readily substituted. A felt or other suitable pad 14 may be interposed between the pan and the package to insure against entanglement of the unwinding yarn, and as is common practice.

For supporting the yarn package with respect to certain parts of the mechanism to be described, a stirrup 17 is secured to the pan 11 and is supported at its upper part upon a hook 18 swingably carried on a rod 19. Stirrup 17 is provided with a cross-bar 22 in which a porcelain eyelet 20 is fixed, the yarn 23 passing therethrough, and pan 11 is provided with a porcelain eyelet 24 through which the yarn is threaded. A bracket 26 secured underneath the pan 11, and offset as shown, carries another porcelain yarn-guiding eyelet 27.

After being passed through the eyelet 20 the yarn is snubbed around a vertical leg of the stirrup 17, through eyelets 24 and 27, and thence one or more times about the periphery of grooved twisting wheel 29 (Fig. 3) supported for free rotation on pivot 32. The latter is carried in U-shaped support 33 forming part of driving member 34 secured to whorl 36, to which blade 37 is affixed. Whorl 36 and blade 37 are of conventional form, the latter being suitably supported for rotation in a bearing (not shown) and the former being in contact with a belt 39 traversing the length of the twisting frame in a well-known manner. Moreover the driving means for belt 39 is conventional and will not be detailed further.

In view of what follows it will be comprehended that by utilizing a spindle blade of common design the same may be adapted for use with either a bolster holder of the stationarily retained type or of the swingable type, as preferred. The versatility of this arrangement provides both a convenient and economical incentive for the conversion of present conventional types of twisters to embody the novel features of my invention.

To transmit rotary motion from the whorl 36 to other parts of the apparatus the member 34 is bifurcated, as shown best in Fig. 3, and the outer ends thereof are provided with rings defining apertures 42—42 in operative relation with driving rods 43—43. By allowing relatively large clearance between apertures 42—42 and rods 43—43 the whorl 36 may be disengaged from belt 39 or its rotation otherwise interrupted in any conventional manner without disturbing the fixed position of the upper portion of the twisting assembly, and moreover with regard to the angular position of the member 34 with respect to the longitudinal principal plane of the frame of the machine. Furthermore, with the stoppage of the spindle, rotation of the upper portion of the assembly will also be arrested.

Rods 43—43, at their upper end, are secured by nuts to ears 45—45 of circular lower bearing box 46 for driving the latter. Box 46 retains the outer race of an anti-friction bearing 47 by means of upper and lower flanges 48 and 49 respectively, the box being split, and joined in assembly by bolts 52. Press-fitted or otherwise suitably secured to the inner race of bearing 47 is a cylindrical member 53, preferably hollowed out for lightness, and carrying the pin 19 previously referred to. Cotter pins 54—54 may fix pin 19 axially.

Upstanding from each half of the box 46 are the posts 55 and 56 supporting a second or upper, circular bearing box 58. The latter is split and joined similarly to box 46 and for a similar purpose. Box 58 supports another anti-friction bearing 59, whose inner race carries a hollow cylindrical member 61. A split bracket 62 bolted at 63 to a fixed longitudinally extending bar 64 of the machine frame secures the member 61. A pilot set screw 65 may extend through the bracket 62 and member 61 to insure further the rigidity of the latter.

The yarn is drawn upwardly by means of a yarn control wheel 71 rotatable with a drum 72 carried on a shaft 73 in the bearing 74. Drum 72 is driven by frictional contact with a wheel 75 secured to a shaft 76 rotated by driving means at one end of the machine, and as will be understood by those in the art. In order that the driving engagement of wheel 75 and drum 72 may be interrupted for threading of the yarn through the twisting unit the bearing 74 is carried on an arm 77 swingable on a supporting post 78 carried on the bar 64. A handle 81 renders swinging movement of arm 77 more convenient, and a stop 82 forwardly of the normal driving position of arm 77 provides a rest when the arm is moved forwardly.

It will have been noted that although member 53 is supported in bearing 47, it must be fixed in space in order that the yarn package 10 may remain stationary. To accomplish this result in one prefered manner, there is secured to the upper end of the member 53 a lightweight, preferably plastic composition collar 85, and to the lower end of the member 61 a similar collar 86. Screws 87—87 unite the members with their respective heads. Each said head has a frusto-conical face in which is set an annular array of stiff bristles or equivalent means 88 adapted to engage a pair of similar groups of bristles or means 89—89 set into each face of a tiltable disc 91 of plastic composition or equivalent material. Disc 91 is provided at its center with a substantially spherical cup 93 adapted to rest on the correspondingly formed head 94 of the post 95 secured in the member 53.

To preserve meshing engagement of the bristles 88 and 89 a pair of anti-friction bearings 97 are provided, the outer race thereof serving as rollers between which the disc 91 is confined in a predetermined tilted position. Bearings 97 are se-

cured at the inner ends of supports 98 held by set screws in suitable bosses 99 in the posts 55 and 56. Supports 98 are hollow for convenience of manufacture, the central bore thereof, however, having significance only insofar as one of them is concerned.

The yarn is led through a tube 101 secured by clamps 102 to one of the rods 43 and then guided through the aperture of one of the supports 98. From the inner open end thereof the yarn is led upward through the opening of the member 61, thence one or more times around the wheel 71 and then to suitable take-up or winding means. The latter device may take any suitable form, for example, a paper tube mounted on a mandrel and driven by surface contact with a drum mounted on a shaft extending lengthwise of the twisting frame, as is understood.

Stirrup 17, being fixed in space, the cone of yarn 10 supported thereby will likewise be fixed. Yarn 23 leaving the cone will travel downwardly under the pull applied thereto by wheel 71, and, being wound around the wheel 29 one or more times, the wheel is caused to rotate. However, wheel 29 is undergoing rotation on a vertical axis, i. e., on the axis of the entire twisting unit shown, and by virtue of whorl 36 and belt 39. Accordingly the yarn is given a first twist intermediate the eyelet 27 and the point where the yarn first contacts wheel 29. Additionally, driving member 34 causes rods 43—43 to rotate therewith and thus to rotate bearing boxes 46 and 58. However the yarn also being fixed at the point where it first contacts wheel 71 is again twisted between that point and the inner open end of support 98, and accordingly a secondary twist is imparted thereto. The thus dually twisted yarn is taken up by the yarn control wheel 71 and then by the additional winding means already referred to.

The interlocking arrangement whereby the groups of bristles 88 and 89 are kept in continuous mesh constitutes a brake to prevent stirrup 17 and hence yarn supply package 10 from turning when the outer race of bearing 47 is rotated. It will be understood that tilting plate 91 does not revolve on its axis but is merely progressively raised and lowered on opposite ends of a diameter, by a rolling surface contact. I may, without departing from the basic principles of my invention, employ contact facings of cork, leather, rubber etc., or any other material presenting greater frictional contact than that produced by the rolling action of the balls of bearing 47 against the inner race thereof.

Tilting plate 91 has a twofold function. First, it prevents the package 10 from rotating by providing an interlock between the upper stationary collar 86 and the lower collar 85. Second, it provides for the rotational entrance and free exit of the yarn through the stationary member 61.

From the drawing and foregoing description it will have been noted that only the outer race of the bearings 47 and 59 rotates, while the inner race of each is held stationary by means already described.

Linear speed of the yarn is governed by the constant peripheral speed of the wheel 71, so that by correlating the latter factor with the rotational speed of the whorl 36 any predetermined number of turns per inch may be imparted to the yarn. Rotary movement of the wheel 29 about a vertical axis will cause the yarn to pivot on its axis at the two arbitrary anchoring points, i. e., the package 10 and wheel 71. The duplicate

turns of twist produced at each side of the wheel 29 are retained by guiding the yarn away as it leaves that wheel. Not only are the duplicate turns twist produced at each side of the revolving wheel 29 retained by guiding the yarn away as it leaves the wheel, but entangling is prevented and the twisted yarn cleared around the supply package. By reversing the direction of travel of the yarn the consolidated twist spirals so inserted in the yarn will incline upwards either to the right or left, as desired, depending upon the predetermined direction of travel of the belt 39, which latter is reversible.

For example, if the whorl 36 is operating at 12,000 R. P. M. while wheel 71 is drawing the yarn through the apparatus at the rate of 800 inches per minute, there will be, due to the dual twisting action, 15 turns twist inserted intermediate the package 10 and wheel 29. and a duplicate 15 turns twist inserted intermediate wheel 29 and wheel 71, or a total of 30 turns twist per inch in the finished product. Accordingly the invention unit is twice as productive as a conventional spindle operating at the same speed. Moreover, the yarn under process is not exposed to the hazards of free ballooning inherent in ring frames, inasmuch as the yarn in its rotary movement about the vertical axis of the unit is conveyed and protected from air currents, oil, etc., by tubing 101.

To establish balance in the revolving parts rod 43 shown at the right in Fig. 1, may carry a counterweight 105, adjustable vertically, and obviously of any desired weight.

The specific function of wheel 71 is both to draw the yarn through the apparatus, and to regulate the linear speed thereof. In view of the joint relation of the speed of the wheel 71 to the whorl 36, varying degrees of twist dictate an independent adjustment of such speeds. For that purpose change gears at the end of the frame may be employed to vary the speed of shaft 76 and wheel 71.

In the case of conventional ring frame twisters, wherein the yarn supply is both measured and delivered in advance of the spindle, contraction in length due to twisting is a factor in all twist calculations. However, in the instant invention, where the linear velocity of the yarn running on the yarn control wheel 71 is based on the finished or post-contracted length, the contraction factor is automatically eliminated, and does not enter into the twist calculations.

The invention also contemplates the employment of transparent plastic composition covers enveloping both the upper rotatable parts of the device and the stirrup and pan upon which the supply package is carried.

In its commercial form it is contemplated that the frame be provided with twisting and winding facilities on both sides of a central frame. A single vertical shaft type of motor may drive belt 39 and shaft 76. An idler pulley at that end of the frame remote from the motor may receive the return loop of the belt, and there may be provided additional tensioning idlers distributed along the length of the frame for retaining the belt in proper contact with all of the whorls 36. The motor referred to may be equipped with a worm in mesh with a worm gear through which a set of change gears may operate shaft 76 and additional parts which may be installed in connection with a take-up arrangement for the winding of the type of finished package desired.

While I have shown a particular embodiment

of my invention, it will be understood, of course, that I do not wish to be limited thereto, since many modifications may be made, and I therefore contemplate by the appended claims to cover any such modifications as fall within the true spirit and scope of my invention.

Having thus described my invention, what I claim and desire to secure by Letters Patent is:

1. Yarn twisting apparatus comprising a fixed support for the yarn supply package to be twisted; a second fixed support, a framework supported for rotation relatively to said supports, means for rotating said framework, twisting means including a wheel mounted for free rotation on said framework about an axis perpendicular to the axis of rotation of the framework, a take-off wheel having a fixed axis of rotation and a member associated with the framework for guiding the yarn from said twisting means to said take-off wheel, a bearing intermediate said first support and said framework, said member lying intermediate said supports, and means for maintaining said first support fixed in space including a disc, frictional members carried respectively by said supports and frictional members carried on both faces of said disc, said disc being arranged for universal tilting movement with respect to the axis of rotation of said framework, and a bearing for said disc carried on said first support.

2. Yarn twisting apparatus comprising a head having a longitudinal axis of rotation, a carrier for the yarn supply package arranged to be held fixed with respect to said axis, a framework arranged for rotation about said axis, and a fixed member for supporting the head, said carrier and fixed member each having a bearing upon which said framework is revolubly carried, twisting means including a wheel having an axis of rotation at right angles to said first axis, means for guiding the untwisted yarn from the package and around the periphery of said wheel, means fixed to said framework for guiding the twisted yarn from said twisting means to a point lying substantially on the said longitudinal axis and intermediate said carrier and fixed member, said member being centrally apertured for passage of the yarn; a take-up wheel disposed exteriorly of said member and revoluble on an axis perpendicular to said longitudinal axis, power means for rotating said take-up wheel, and means for maintaining said carrier fixed in space comprising a friction pad affixed to said fixed member, a friction pad affixed to said carrier, and a tiltable disc having friction pads in continuous mesh with said first and second friction pads, the said point on the longitudinal axis lying above said disc, a bearing for universal tilting of said disc, and rollers carried on the framework and engaging the surface of the disc for maintaining the same in meshing contact.

3. Yarn twisting apparatus comprising a carrier for a yarn supply package, means for suspending said carrier, a fixed support, a framework, means for revolubly supporting said framework on said support, means for supporting said carrier upon said framework for relative rotation between said carrier and framework, yarn twisting means, means for feeding the yarn from the package at a predetermined linear speed, means for transferring the twisted yarn from said twisting means to said feeding means, and means cooperating with said fixed support and carrier to maintain said carrier fixed in space including a disc supported for universal tilting movement on said carrier and said disc, support and carrier having interengaging surfaces.

4. Apparatus as in claim 3 in which said yarn twisting means includes a wheel supported for rotation on an axis substantially perpendicular to the axis of rotation of said carrier and about which wheel the yarn is wrapped in its feeding movement from the package.

5. Yarn twisting apparatus comprising a non-revoluble yarn package carrier, twisting means including a framework arranged for rotation relatively to said carrier and a freely rotatable twist wheel supported on an axis normal to the axis of rotation of said framework, means for guiding untwisted yarn from the package and about the periphery of said wheel, means including a power-driven yarn control wheel rotatably supported on an axis normal to the axis of rotation of said framework, a fixed support having an aperture coaxial with the axis of rotation of said framework, means for guiding the twisted yarn from the periphery of said twist wheel through said aperture and about the periphery of said yarn control wheel, bearing means intermediate said carrier and framework, and means for preventing relative rotation between said carrier and framework resulting from friction of said bearing including a disc supported for universal tilting movement on said carrier and said fixed support, carrier and disc having interengaging surfaces.

6. Apparatus as recited in claim 5 in which said interengaging surfaces are held in engagement by a pair of rollers supported on said framework, one of each of said rollers bearing against opposite faces of said disc.

7. Apparatus as in claim 5 in which the yarn package carrier is positioned above the twist wheel and the fixed support is positioned above the carrier whereby the untwisted yarn is drawn downwardly to the twist wheel and the partially twisted yarn is drawn upward therefrom whereby to introduce a first twist in the downwardly traveling yarn and to introduce additional twist in the upwardly traveling yarn.

8. Apparatus as in claim 5 in which power driven means is arranged for rotating said framework, and other power driven means rotates said yarn control wheel, and means for changing the relative speeds of said two power-driven means.

9. Yarn twisting apparatus comprising in combination a stationary source of supply of yarn, twisting means including a freely rotatable wheel, a shaft for said wheel, a rotatable support for said shaft, driving means for said wheel, the axes of rotation of said wheel and support being perpendicular to each other, means for guiding the yarn from said source to the periphery of said wheel and away from the periphery of said wheel to a point fixed with respect to said support, the yarn delivered to and removed from said wheel at points substantially 180° apart, means including a rotatable yarn control wheel, a shaft for said control wheel and second driving means for said control wheel, the axis of rotation of said control wheel being perpendicular to the axis of rotation of said support, and means for guiding the yarn removed from said first wheel to the periphery of said control wheel.

10. Yarn twisting apparatus comprising a carrier for a yarn supply package, a fixed support, a framework revolubly carried on said support, bearing means intermediate said carrier and framework for relative rotation therebetween, connecting means intermediate said support and carrier for fixing said carrier in space including

an annular frictional face on said support, an annular frictional face on said carrier, and a universally tiltable disc interposed between said two frictional faces and having a pair of frictional faces in engagement respectively with said other frictional faces, twisting means carried on said framework, yarn feeding means, means for guiding yarn from the package to said twisting means and from said twisting means to said feeding means, and means for driving said framework.

11. Apparatus as in claim 10 in which said framework includes a plurality of elongated members, and said driving means includes a rotatable spider having a plurality of radial arms, each said arm having an aperture at the outer end thereof, there being a member engaged in each aperture and the area of the aperture being larger than the cross section of the member, a pulley secured to said spider, a bearing for rotatably supporting said pulley, and a belt for driving said pulley.

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No references cited.