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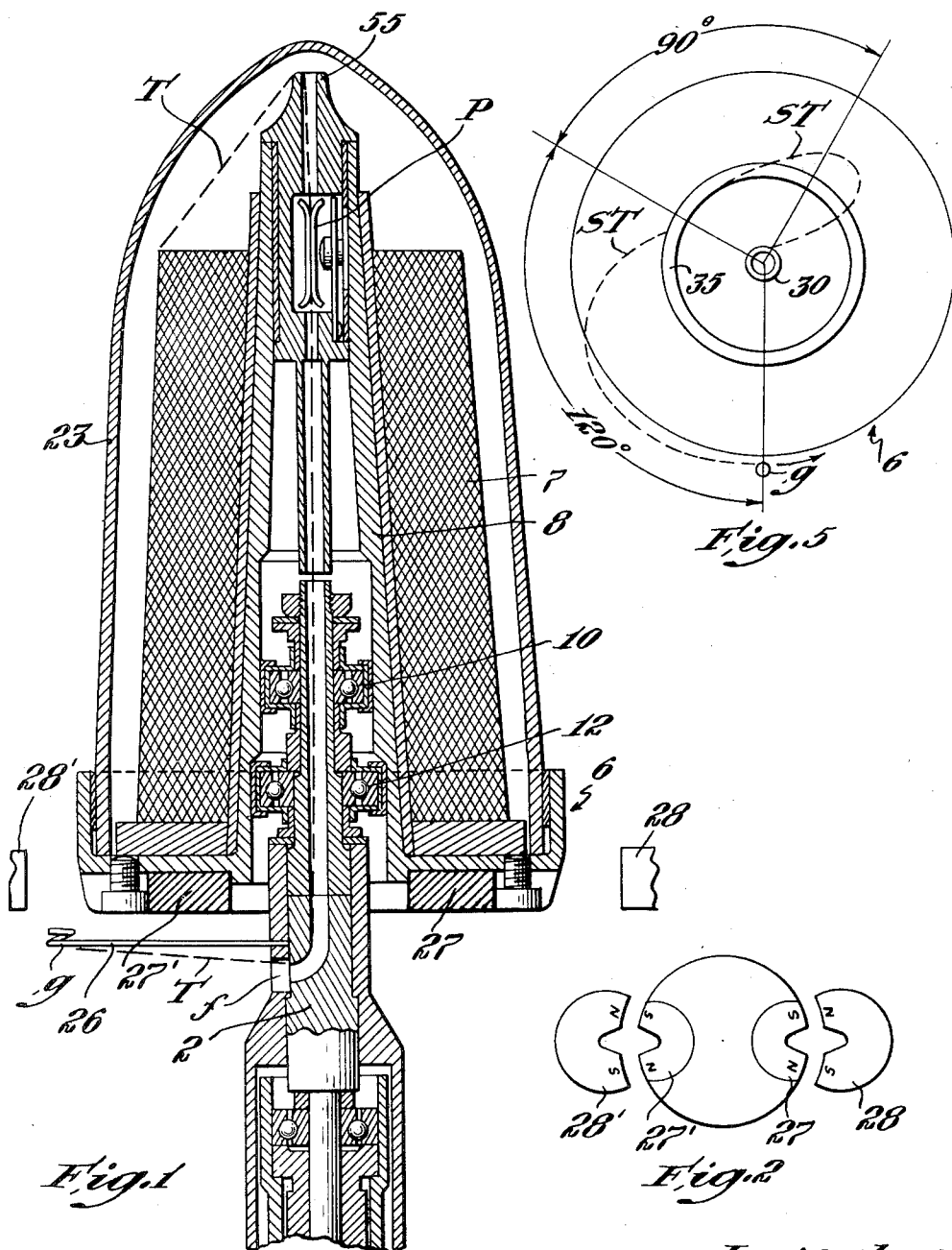
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TWISTING DEVICE AND METHOD

Filed Jan. 29, 1947

2 Sheets-Sheet 1



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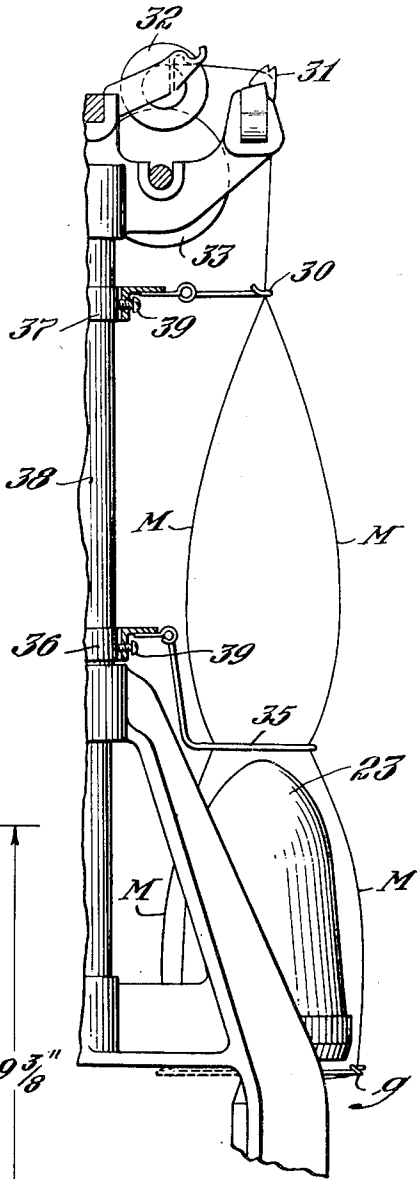
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UNITED STATES PATENT OFFICE

2,473,521

TWISTING DEVICE AND METHOD

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Application January 29, 1947, Serial No. 724,988

24 Claims. (Cl. 57—58)

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This invention relates to twisting in which a thread under tension is twisted by being given a circular motion of several thousand revolutions a minute.

My patent specification, Serial No. 724,987, for Twisting and spinning, filed simultaneously, describes several examples of an improvement involving establishment and modification of a figure of revolution of the twisting thread between a circularly moving generator and an apex, and claims said improvement generally and also in its application to ring spinning and twisting. The present specification relates particularly to application of such improvement to twisting procedures in which the twisting thread is conveyed from the generator to the apex of the figure of revolution, as in up-twisting.

Although capable of application in a variety of specific forms, the present invention is best explained by reference to the form of twisting called two-for-one twisting, in which approximately two turns of twist are imparted to the thread for each revolution of a flier. The thread travels from the flier to a guide such as a stationary eye, this guide defining an apex for the figure of revolution of the twisting thread.

The production of more than one turn of twist for each revolution of the flier in this type of machine arises from the fact that the thread is supplied to the flier from a supply package contained within the figure of revolution but not partaking of the flier rotation. Thus when the supply package is stationary within the figure of revolution of the thread, one turn of twist is imparted by each revolution of the flier with relation to the stationary package, and a second turn of twist is simultaneously imparted by the same revolution of the flier with relation to the guide at the apex of the figure of revolution.

The present invention is particularly useful in permitting up-twisting operations such as two-for-one twisting to be operated at a high flier speed, to employ a large supply package of thread enveloped by the figure of revolution of the twisting thread, and to employ so moderate a thread tension as not to injure delicate threads.

Other objects and advantages of the invention will be apparent from this specification and its drawings wherein the invention is explained by way of example.

In the drawings:

Fig. 1 is a vertical sectional view of the delivery portion of one of the numerous adjacent units of a two-for-one up-twister;

Fig. 2 is a diagrammatic view in plan, on a

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smaller scale than Fig. 1, showing the magnets for holding the thread supply carrier stationary in the device of Fig. 1;

Fig. 3 is a diagrammatic view of one of the units of up-twisting apparatus employing the delivery portion of Fig. 1, showing outlines of a natural figure of revolution having an exteriorly concave reduced-diameter neck and of a modified figure of revolution secured by applying inwardly directed force to the natural figure of revolution intermediate its ends; Fig. 3 also shows an instantaneous position of the thread of the modified figure of revolution;

Fig. 4 is a side elevation of one of the twisting units of apparatus embodying the present invention employing the modified figure of revolution of Fig. 3; and

Fig. 5 is a diagram in the nature of a plan view of the instantaneous position of the thread of the modified figure of revolution of Fig. 3.

The two-for-one up-twister to which the invention is shown as applied is like that described and claimed in United States Patent No. 2,374,085, dated April 17, 1945, although the invention is applicable to any suitable up-twister. The twisting mechanism shown in Fig. 1 includes a rotatable spindle shaft 2 driven at high speed by any suitable means such as a belt, or individual electric motor.

A stationary holder or carrier 6 for the thread supply package 7 includes an integral, hollow tapered extension 8 within which spindle shaft ball bearings 10 and 12 are interposed, so that the thread supply carrier can be held stationary while the spindle shaft 2 is rotated. The thread supply carrier is held against rotation by the cooperative action of magnets 27 and 27' which are carried by the thread supply carrier and stationarily mounted external magnets 28 and 28'.

The thread T is unwound from the thread supply package 7 and is drawn upwardly to a guide 55, thence downwardly through this guide 55 along the axis of the spindle and between opposed frictional plates of an adjustable tension device P, described in detail in said patent, through a hollow portion of the spindle shaft 2 and then out through an eye f to a thread guiding eye g at the end of a flier 26 which is attached rigidly to the spindle shaft. The flier eye g constitutes the generator of a figure of revolution of the twisting thread with which the invention is especially concerned. A casing 23 of moulded plastic, fitting frictionally inside of a flange of the thread supply carrier 6, serves

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to prevent air currents set up by the flier and revolving thread from interfering with the withdrawal of the thread from the supply package.

The twisting mechanism of Fig. 1 thus far described is typical of the general organization of a two-for-one twister although particular features of its construction are illustrated and covered by the said Patent No. 2,374,085, and that patent may be referred to for detailed descriptions of such construction.

If the flier were operated at high speed and the thread were led from the flier eye *g* to a guide eye above and closely adjacent to the casing 23 and thence directed onto a winding package, and only a relatively low tension was permissible, the figure of revolution of the thread would bulge outwardly so much, particularly near the flier, that it would strike the magnets 28 and 28' and even the adjacent units of the apparatus. Reduction of the amount of such outward bulge could be accomplished by increasing the tension applied to the thread by the adjustable tension device *P*, but this is disadvantageous and only partly effective at high speeds, for two reasons:

First, in twisting certain synthetic threads, such as rayon, excessive tensioning is injurious to the thread. Increased speeds of the flier increase the tendency of the thread to bulge outwardly and, if it is attempted to control this bulging by increasing the tension, the point is eventually reached at which the tension required to control the bulging is so high as to be injurious to the thread; accordingly, the speed would need to be lowered so as not to require so much tension.

Second, the application of increased tension to the thread to draw in the lower portion of the bulging figure of revolution also draws in the figure of revolution at its upper smaller-diameter portions. It is important that the whirling figure of revolution of the thread be kept clear of the casing 23; thus, as the figure of revolution is drawn in by the application of increased degrees of tension, the upper part of casing 23 would need to be reduced in size, thus reducing the space available for the thread package 7.

In the practice of the present invention the guide eye 30 (Fig. 3), which establishes the apex of the figure of revolution of the twisting thread, is located high enough above the plane of the flier eye, the flier is driven fast enough, and the tension applied to the thread is slight enough, to permit the flier to form the rotating thread into a figure of revolution tending to assume an exteriorly concave neck if allowed to follow its natural course in between the flier eye *g* and the apex eye 30. Curves *N* in Fig. 3 show the outline of a necked figure of revolution such as would be thus formed between the flier and the apex defined by eye 30 if this figure of revolution merely ran freely in its natural course between the flier and eye 30, in the absence of the ring 35 subsequently described.

A notched porcelain guide 31 (Fig. 4) may be provided to lead the thread onto a spool 32 which is driven by surface contact with a drive roll 33.

The phenomenon of the formation of a node or reduced diameter neck in a lengthy run of thread in a ring spinning machine has been described in the book "Studies of Quality in Cotton" by W. Lawrence Balls, published by Macmillan & Co. Limited, in London, 1928, from page 103 to page 107, inclusive, and at pages 173 and 182.

In the present situation it is necessary to em-

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ploy the package casing 23 which should not be allowed to contact with the thread which is being revolved by the flier. The casing 23 is preferably of large size in order to accommodate a large supply package 7 shown herein as a 2 pound cone of rayon yarn.

It will be observed from curve *N* in Fig. 3 that the outline of the natural necked figure of revolution has an exteriorly concave necked portion of substantial length. This necked portion merges into the larger-diameter portions above and below it, with accompanying change in curvature from exteriorly concave in the zone between points *x* and *y* to exteriorly convex above and below this zone. The exteriorly concave portion of the natural figure of revolution could be shifted downwardly by lowering the guide eye 30, although this would generally be undesirable in further limiting the space available for the casing 23. This exteriorly concave portion could also be shifted upwardly by raising the guide eye 30, and if the guide eye 30 were raised sufficiently, a second exteriorly concave reduced-diameter neck would be formed adjacent to the generator.

If a casing 23 of the size here shown were used, the thread of the natural figure of revolution indicated by the outline curves *N* in Fig. 3 would rub against this casing. Thus as a practical matter in order to accommodate the natural figure of revolution of the curve *N* it would be necessary to employ a smaller sized casing than the one shown, and hence a smaller sized supply package. In addition, even with a substantially smaller casing than the casing 23, lowering of the exteriorly concave neck such as would result from reduction in speed of rotation could still cause undesirable contact of the natural figure of revolution with the casing. It will be understood that the casing will not ordinarily be sufficiently slippery and sufficiently accurately formed and positioned to allow the fast whirling thread to run in contact with it. Contact of the thread with the casing would also be undesirable because of the lint and dust that accumulate on the casing.

The natural figure of revolution indicated by curves *N* is modified and stabilized by applying inwardly directed force intermediate its ends, and this is most conveniently accomplished by a ring or a ring-like element having a smooth polished interior surface. Fig. 3 shows the effect of such a ring 35 in modifying the figure of revolution, curves *M* showing the outline of the modified and stabilized figure of revolution obtained by applying the ring 35 to the natural figure of revolution. It will be seen from curve *M* that exterior concavity of the figure of revolution has been substantially eliminated, the figure of revolution showing only the negligible extent of exterior concavity which corresponds to the inside surface of the ring 35, and being everywhere else exteriorly convex in outline. Particularly below the ring, the modified figure of revolution is exteriorly convex in outline throughout a substantial zone where the natural necked figure of revolution is concave in outline. The portion of the outline of the figure of revolution below the ring is seen to have a relatively flat curvature adapted for adequate clearance of the casing 23, passage through the gap between the magnets 28, 28' and the package-holder 6, without interference, and adequate clearance of the threads of closely disposed neighboring units of the apparatus.

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The action of the ring 35 does not appear necessarily to require any radical constriction of the figure of revolution at the place where the figure of revolution runs in contact with the ring. In the preferred example shown in Fig. 3, the ring is applied a short distance above the top of the casing 23 at a level between a normally concave portion of the figure of revolution (that is, the portion of the natural figure of revolution from the level of the ring down to the point *x*) and the level of natural formation of the uppermost enlargement of the figure of revolution. Also, the ring 35 may be described as being located in the region of natural formation of a neck, and near the level of the smallest diameter portion of this neck. In Fig. 3 in which the natural figure of revolution and the modified figure of revolution represent 100 denier thread being twisted at 12,200 R. P. M., the ring 35 only slightly constricts the natural figure of revolution, the constriction being only approximately $\frac{1}{4}$ inch in radius.

A greater degree of constriction than shown in Fig. 3 can be employed, but an unnecessary degree of constriction is preferably avoided and the ring 35 is preferably of an internal diameter equal to a substantial part of the diameter of the flier path at the base of the figure, for example, about one-fourth or more of the diameter of the flier path. Such substantial diameter of the ring is helpful in enabling the thread adequately to clear the casing 23, and is also advantageous in not unnecessarily reducing the circular path of the portion of the figure of revolution above the ring. As will appear below, the portion of the figure above the ring and which bows outwardly appears to exercise a control over the portion of the figure below the ring.

The action of ring 35 can, if desired, be supplemented by other controlling rings which apply inwardly directed force and some degree of constriction to the figure of revolution in between its base and the apex, and my said patent specification for Twisting and spinning, Serial No. 724,987, may be referred to as illustrating the cooperative action of a plurality of controlling rings. However, in the present apparatus where the path of the generator is constant, and the figure of revolution has a constant height, a single ring 35 applied so as only slightly to constrict the figure of revolution near its natural neck is deemed preferable. Application of a single smooth polished ring 35 as herein shown apparently does not add materially to the tension of the thread of the figure of revolution because both the natural and the modified figures of revolution of 100 denier thread twisting at 12,200 R. P. M. in Fig. 3 had a tension (measured above the guide eye 30) of approximately 38 grams.

In Fig. 3, the curve ST indicates one instantaneous position of the thread of the modified figure of revolution whose outline is shown by the curves M, and in the plan view of Fig. 5, the curve ST shows an instantaneous position of the thread of the modified figure of revolution, corresponding to the curve ST of Fig. 3, the curve ST in Fig. 5 showing particularly the angular lag of the twisting thread. Between the flier and the ring 35 this angular lag amounts to approximately 120° and between the ring 35 and the eye 30 there is a further angular lag of approximately 30°, amounting altogether to an angular lag of approximately 210° between the flier and eye 30. This amount of angular lag is very much larger

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than the angular lag which occurs in the ordinary conventional balloon and is more nearly like the amount of angular lag which the thread of the natural necked figure of revolution would have in the absence of the ring 35.

It is preferred to provide for adjustment of both the ring 35 and the guide eye 30 in order to adapt the apparatus to a wide variety of operating conditions, and to provide the most desirable shape of the modified figure of revolution, particularly in its portion between the ring and the flier, under all conditions. Thus, as indicated in Fig. 4, the ring 35 and the guide eye 30 are preferably carried by brackets 36 and 37 which may be adjusted vertically on a vertical post 38 and secured in position by set screws 39.

The portions of the modified figure of revolution above and below the ring appear to exert upon each other a balancing effect which is advantageous in controlling the degree of outward bowing of the portion below the ring. Thus, changes in the lengths of the portions of the figure above and below the ring 35 affect the degree of outward bowing of the portion below the ring. Increasing the length of the portion above the ring or decreasing the length of the portion below the ring tends within limits to decrease the outward bowing of the portion below the ring. Reducing the length of the portion above the ring or increasing the length of the portion below the ring tends within limits to increase the outward bowing of the portion below the ring. Raising the eye 30 or lowering the ring 35, or both raising the eye and lowering the ring, tends to decrease the degree of outward bowing of the portion of the figure below the ring. Lowering the eye 30 or raising the ring 35, or both lowering the eye and raising the ring, tends to increase the degree of outward bowing of the portion below the ring. These adjustments of the ring and guide eye are advantageous in establishing the desired course of the portion of the modified figure of revolution extending from the flier to the ring, in which course the thread should adequately clear the magnets 28 and 29, the thread supply carrier 6 and the casing 23. These adjustments are also useful in counter-balancing and offsetting the effect of changes in operating conditions such as speed and denier upon this portion of the figure of revolution.

In the construction shown in Fig. 3, the ring 35 has an internal diameter of $2\frac{1}{2}$ " (dimension A) and is located $10\frac{1}{2}$ " (dimension C) above the plane of rotation of the flier eye *g*, and for the uptwisting of 100 denier thread, the guide eye 30 at the top of the figure of revolution is located 13" (dimension D) above the level of the ring 35. The diameter of the path of the flier eye *g* is $5\frac{7}{8}$ " (dimension B), and typical speeds of the flier are 10,000 R. P. M., 11,100 R. P. M., and 12,200 R. P. M., the curves N and M representing 100 denier thread at 12,200 R. P. M. These figures are cited as an aid to understanding certain adjustments which can be made for the purpose of accommodating thread of various deniers in the best manner. The shape of the figure of revolution below the ring can be kept approximately constant for threads of various deniers by adjustments in the amount of tension applied by the tension device P and by adjustments in the height of the eye 30 above the level of the ring (indicated by the dimension D in Fig. 3). A reduction of the internal diameter of the ring from $2\frac{1}{2}$ " to 2" (dimension A) has

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also been found advisable in twisting 40 denier thread on this machine.

The following tables show observations of the operation of the device of Fig. 3 at various speeds with rayon yarn of various deniers. In these tables and in Fig. 3 the dimension E is the distance from the vertical axis to the largest diameter portion of the modified and stabilized figure of revolution below the ring 35, and the dimension F is the distance from the vertical axis to the largest diameter portion of the modified and stabilized figure of revolution above the ring 35.

40 Denier Thread

R. P. M. of flier.....	10,000	11,100	12,200
Internal diameter A of ring in inches.....	2	2	2
Dimension D in inches.....	12	12	12
Approximate Tension in grams.....	13	15	18
Dimension E in inches.....	3	3	3
Dimension F in inches.....	1½	2	2

75 Denier Thread

R. P. M. of flier.....	10,000	11,100	12,200
Internal diameter A of ring in inches.....	2½	2½	2½
Distance D in inches.....	12½	12½	12½
Approximate tension in grams.....	22	25	28
Dimension E in inches.....	3½	3½	3½
Dimension F in inches.....	2½	2½	2½

100 Denier Thread

R. P. M. of flier.....	10,000	11,100	12,200
Internal diameter A of ring in inches.....	2½	2½	2½
Distance D in inches.....	13	13	13
Approximate tension in grams.....	30	35	38
Dimension E in inches.....	3½	3½	3½
Dimension F in inches.....	2½	2½	2½

150 Denier Thread

R. P. M. of flier.....	10,000	11,100	12,200
Internal diameter A of ring in inches.....	2½	2½	2½
Distance D in inches.....	14½	14½	14½
Approximate tension in grams.....	48	50	56
Dimension E in inches.....	3½	3½	3½
Dimension F in inches.....	3½	3½	3½

As shown by Fig. 3 the modified and stabilized figure indicated by curves M has a generally flat but somewhat outwardly bowed outline from the flier eye *g* to the ring 35, adapting this portion of the figure to clear the casing 23 and the thread package-holder 6 on the one hand and the magnets 23, 28' on the other hand. The foregoing tables show how this portion of the modified figure of revolution below the ring 35 can be kept approximately constant in shape for a wide range of deniers and a considerable variation in flier speed.

The foregoing tables show that for a given denier, each of the several speeds yielded the same dimension E for the portion of the modified figure of revolution between the flier eye and ring 35. Although increasing the denier tended to enlarge the modified figure of revolution as a whole, that is both above and below the ring 35, such enlargement took place mainly in the portion above the ring 35, which fact is advantageous in maintaining the lower portion of the modified figure of revolution nearly constant in shape throughout the wide range of deniers.

The foregoing tables also show the moderate tensions of the threads, these tensions being measured at a point above the guide eye 30. In each

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case, the tension, expressed in grams, was in the neighborhood of one-third the denier of the thread, which is desirable.

I claim:

1. Method of twisting a thread comprising establishing, between an apex and a circularly moving generator, a figure of revolution of the thread adapted to assume an exteriorly concave necked configuration if allowed to follow its natural course between said apex and generator, drawing the thread from a package to said generator and thence to the apex, and causing the figure to react against encircling confining force at a level between said generator and apex to stabilize the portion of the figure extending from the generator to said level.

2. Method of twisting a thread comprising establishing, between an apex and a circularly moving generator, a figure of revolution of the thread adapted to assume an exteriorly concave necked configuration if allowed to follow its natural course between said apex and generator, drawing the thread from a package to said generator and thence to the apex, and causing the figure to react against an encircling ring at a level between said generator and apex to stabilize the portion of the figure extending from the generator to said level.

3. Method of twisting a thread comprising establishing, between an apex and a circularly moving generator, a figure of revolution of the thread adapted to assume an exteriorly concave necked configuration if allowed to follow its natural course between said apex and generator, drawing the thread from a package to said generator and thence to the apex, and stabilizing a normally outwardly concave portion of the figure in an exteriorly convex outline by causing the figure to react against an encircling ring between said portion and the apex while allowing the figure to bulge outwardly between said ring and the apex.

4. Method of twisting a thread comprising establishing, between an apex and a circularly moving generator, a figure of revolution of the thread adapted to assume an exteriorly concave necked configuration if allowed to follow its natural course between said apex and generator, drawing the thread from a package to said generator and thence to the apex, and stabilizing a normally outwardly concave portion of the figure in an exteriorly convex outline by causing the figure to react against encircling confining force between said portion and a level in the general region of the uppermost natural enlargement of the figure.

5. Method of twisting a thread comprising establishing, between an apex and a circularly moving generator, a figure of revolution of the thread adapted to assume an exteriorly concave necked configuration if allowed to follow its natural course between said apex and generator, drawing the thread from a package to said generator and thence to the apex, and stabilizing a normally outwardly concave portion of the figure in an exteriorly convex outline by causing the figure to react against encircling confining force in the region of natural formation of a neck therein.

6. Method of twisting a thread comprising establishing, between an apex and a circularly moving generator, a figure of revolution of the thread adapted to assume an exteriorly concave necked configuration if allowed to follow its natural course between said apex and generator, said generator defining the base of said figure, supporting a package of the thread at least partially

within the figure of revolution, drawing the thread from said package to said generator and thence to the apex, imparting twist to the thread between the package and the generator and further twist between the generator and apex, and stabilizing a portion of the figure of revolution in an exteriorly convex outline in the region of the package by causing the figure of revolution to react against an encircling ring between said portion and the apex.

7. Method of twisting a thread comprising establishing, between an apex and a circularly moving generator a figure of revolution of the thread adapted to assume an exteriorly concave necked configuration if allowed to follow its natural course between said apex and generator, said generator defining the base of said figure, supporting a package of the thread at least partially within the figure of revolution, drawing the thread from said package to said generator and thence to the apex, imparting twist to the thread between the package and the generator and further twist between the generator and apex, and stabilizing a portion of the figure of revolution in an exteriorly convex outline in the region of the package by causing the figure of revolution to react against an encircling ring between the top of the package and the apex.

8. Method of twisting a thread comprising establishing, between an apex and a flier rotating at a speed of 10,000 or more revolutions per minute, a figure of revolution of the thread adapted to assume an exteriorly concave necked configuration if allowed to follow its natural course between said apex and generator, said flier defining the base of said figure, supporting a package of the thread at least partially within the figure of revolution, drawing the thread from said package to said generator and thence to the apex, imparting twist to the thread between the package and the generator and further twist between the generator and apex, and stabilizing a portion of the figure of revolution in an exteriorly convex outline in the region of the package by causing the figure of revolution to react against an encircling ring between said portion and the apex.

9. Method of twisting a thread comprising establishing, between an apex and a flier rotating at a speed of 10,000 or more revolutions per minute, a figure of revolution of the thread adapted to assume an exteriorly concave necked configuration if allowed to follow its natural course between said apex and generator, said flier defining the base of said figure, supporting a package of the thread at least partially within the figure of revolution, drawing the thread from said package to said generator and thence to the apex, imparting twist to the thread between the package and the generator and further twist between the generator and apex, stabilizing a portion of the figure of revolution in an exteriorly convex outline in the region of the package by causing the figure of revolution to react against an encircling ring between said portion and the apex, and applying tension to the thread between the package and the flier in an amount such that after the thread passes the apex the thread tension, expressed in grams, does not materially exceed one-third the denier of the thread.

10. Method of twisting a thread comprising establishing, between an apex and a circularly moving generator, a figure of revolution of the thread adapted to assume an exteriorly concave necked configuration if allowed to follow its natural course between said generator and apex, said gen-

erator having a constant path, defining two sections of the figure of revolution by encircling the figure of revolution with a ring in contact therewith, and adjusting the outline of the section of the figure of revolution between the ring and the generator path by adjusting the relative lengths of the said two sections.

11. Method of twisting a thread comprising establishing, between an apex and a circularly moving generator, a figure of revolution of the thread adapted to assume an exteriorly concave necked configuration if allowed to follow its natural course between said generator and apex, said generator having a constant path, defining two sections of the figure of revolution by encircling the figure of revolution with a ring in contact therewith, and adjusting the outline of the section of the figure of revolution between the ring and the generator path by adjusting the distance from said ring to the generator path.

12. Method of twisting a thread comprising establishing, between an apex and a circularly moving generator, a figure of revolution of the thread adapted to assume an exteriorly concave necked configuration if allowed to follow its natural course between said generator and apex, said generator having a constant path, defining two sections of the figure of revolution by encircling the figure of revolution with a ring in contact therewith, and adjusting the outline of the section of the figure of revolution between the ring and the generator path by adjusting the total height of the figure of revolution.

13. A twisting machine including means defining an apex, a circularly moving generator cooperating with said apex-defining means to form a figure of revolution of the thread adapted to assume an exteriorly concave necked configuration if allowed to follow its natural course between said generator and apex, means for supporting a package of thread, means for drawing the thread from the package to the generator and thence to the apex, in combination with means for applying encircling confining force to the figure of revolution at a level between said generator and apex to stabilize the portion of the figure extending from the generator to said level.

14. A twisting machine including means defining an apex, a circularly moving generator cooperating with said apex-defining means to form a figure of revolution of the thread adapted to assume an exteriorly concave necked configuration if allowed to follow its natural course between said generator and apex, means for supporting a package of thread, means for drawing the thread from the package to the generator and thence to the apex, in combination with means for applying encircling confining force to a naturally reduced-diameter portion of the figure of revolution.

15. A twisting machine including means defining an apex, a circularly moving generator cooperating with said apex-defining means to form a figure of revolution of the thread adapted to assume an exteriorly concave necked configuration if allowed to follow its natural course between said generator and apex, means for supporting a package of thread, means for drawing the thread from the package to the generator and thence to the apex, in combination with an encircling ring contacting with the figure of revolution at a level between said generator and apex to stabilize the portion of the figure extending from the generator to said level.

16. A twisting machine including means defining an apex, a circularly moving generator cooperating with said apex-defining means to form a figure of revolution of the thread adapted to assume an exteriorly concave necked configuration if allowed to follow its natural course between said generator and apex, means for supporting a package of thread, means for drawing the thread from the package to the generator and thence to the apex, in combination with an encircling ring contacting with the figure of revolution at a level between said generator and apex to stabilize the portion of the figure extending from the generator to said level, said ring having an internal diameter less than but equal to a substantial part of the diameter of the path of the circularly moving generator.

17. A twisting machine including means defining an apex, a circularly moving generator cooperating with said apex-defining means to form a figure of revolution of the thread adapted to assume an exteriorly concave necked configuration if allowed to follow its natural course between said generator and apex, means for supporting a package of thread, means for drawing the thread from the package to the generator and thence to the apex, in combination with an encircling ring contacting with the figure of revolution at a level between said generator and apex to stabilize the portion of the figure extending from the generator to said level, said ring having an internal diameter of approximately one-fourth or more of the diameter of the path of the circularly moving generator.

18. A twisting machine including means defining an apex, a circularly moving generator cooperating with said apex-defining means to form a figure of revolution of the thread adapted to assume an exteriorly concave necked configuration if allowed to follow its natural course between said generator and apex, means for supporting a package of thread, means for drawing the thread from the package to the generator and thence to the apex, in combination with an encircling ring contacting with the figure of revolution between a normally concave portion thereof and a level in the general region of the uppermost natural enlargement of the figure to stabilize said normally outwardly concave portion thereof in an exteriorly convex outline.

19. A twisting machine including means defining an apex, a circularly moving generator cooperating with said apex-defining means to form a figure of revolution of the thread adapted to assume an exteriorly concave necked configuration if allowed to follow its natural course between said generator and apex, means for supporting a package of thread at least partially within the figure of revolution, means for drawing the thread from the package to the generator and thence to the apex, the package supporting means being so arranged within relation to the generator that twist is imparted to the thread between the package and generator, further twist being imparted to the thread between the generator and said apex, in combination with an encircling ring contacting with the figure of revolution in the region of natural formation of a neck therein.

20. A twisting machine including means defining an apex, a circularly moving flier defining a circular base and cooperating with said apex-defining means to form a figure of revolution of the thread adapted to assume an exteriorly concave necked configuration if allowed to follow its

natural course between said flier and apex, means for supporting a package of thread at least partially within the figure of revolution, means for drawing the thread from the package to the flier and thence to the apex, the package supporting means being so arranged with relation to the flier that twist is imparted to the thread between the package and flier, further twist being imparted to the thread between the flier and said apex, in combination with an encircling ring contacting with the figure of revolution at a level between the top of the package and the apex to stabilize the portion of the figure in the region of the package.

21. A twisting machine including means defining an apex, a circularly moving flier defining a circular base and cooperating with said apex-defining means to form a figure of revolution of the thread adapted to assume an exteriorly concave necked configuration if allowed to follow its natural course between said flier and apex, means for supporting a package of thread at least partially within the figure of revolution, means for drawing the thread from the package to the flier and thence to the apex, the package supporting means being so arranged with relation to the flier that twist is imparted to the thread between the package and flier, further twist being imparted to the thread between the flier and said apex, and a casing for the package within the figure of revolution, in combination with an encircling ring contacting with the figure of revolution at a level between the top of the casing and the apex to stabilize the portion of the figure in the region of the casing.

22. A twisting machine including means defining an apex, a circularly moving generator defining a circular base and cooperating with said apex-defining means to form a figure of revolution of the thread adapted to assume an exteriorly concave necked configuration if allowed to follow its natural course between said generator and apex, means for supporting a package of thread, means for drawing the thread from the package to the generator and thence to the apex, an encircling ring contacting the figure of revolution and defining two sections thereof, and means for adjusting the distance from the ring to the path of the generator thereby to adjust the outline of the section of the figure of revolution which extends between the generator and the ring.

23. A twisting machine including means defining an apex, a circularly moving generator defining a circular base and cooperating with said apex-defining means to form a figure of revolution of the thread adapted to assume an exteriorly concave necked configuration if allowed to follow its natural course between said generator and apex, means for supporting a package of thread, means for drawing the thread from the package to the generator and thence to the apex, an encircling ring contacting the figure of revolution and defining two sections thereof, and means for adjusting the distance from the apex-defining means to the path of the generator thereby to adjust the outline of the section of the figure of revolution which extends between the generator and the ring.

24. A twisting machine including means defining an apex, a circularly moving flier defining a circular base and cooperating with said apex-defining means to form a figure of revolution of the thread adapted to assume an exteriorly concave necked configuration if allowed to follow its natural course between said flier and apex, a

rotatably mounted package-holder adapted to support a package of thread within the figure of revolution, a casing for the package, means for drawing the thread through the interior of the package, thence to the flier and thence to the apex, means for magnetically retaining the package-holder stationary including cooperating magnetic holding elements mounted on the package-holder and on a stationary part of the machine respectively and spaced by a gap through which the thread is adapted to run from the flier toward the apex, and an encircling ring contacting with the figure of revolution between the package and the apex and stabilizing the portion of the figure of revolution between the ring and the flier in an exteriorly convex outline adapted

to clear said package holder, said magnetic elements and said casing.

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