Nov. 5, 1946. S. C. NELSON 2,410,674

MULTIPLE TWISTER AND DOUBLER

Filed Jan. 14, 1944 3 Sheets-Sheet 1

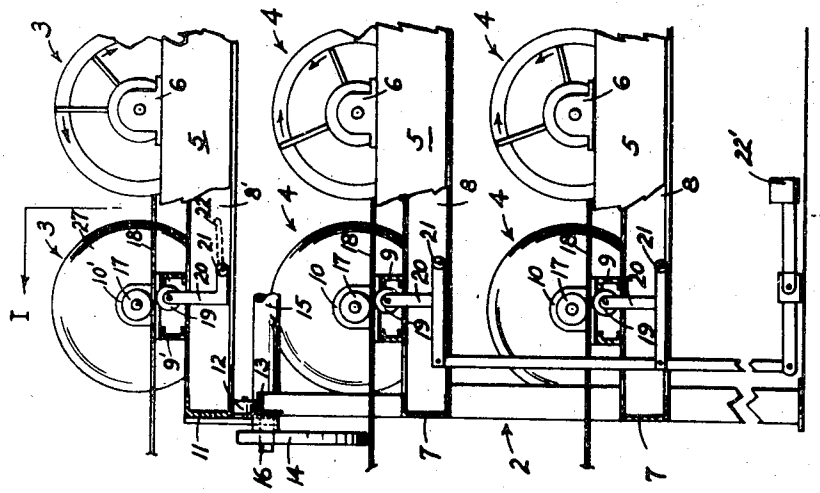


Fig. 2

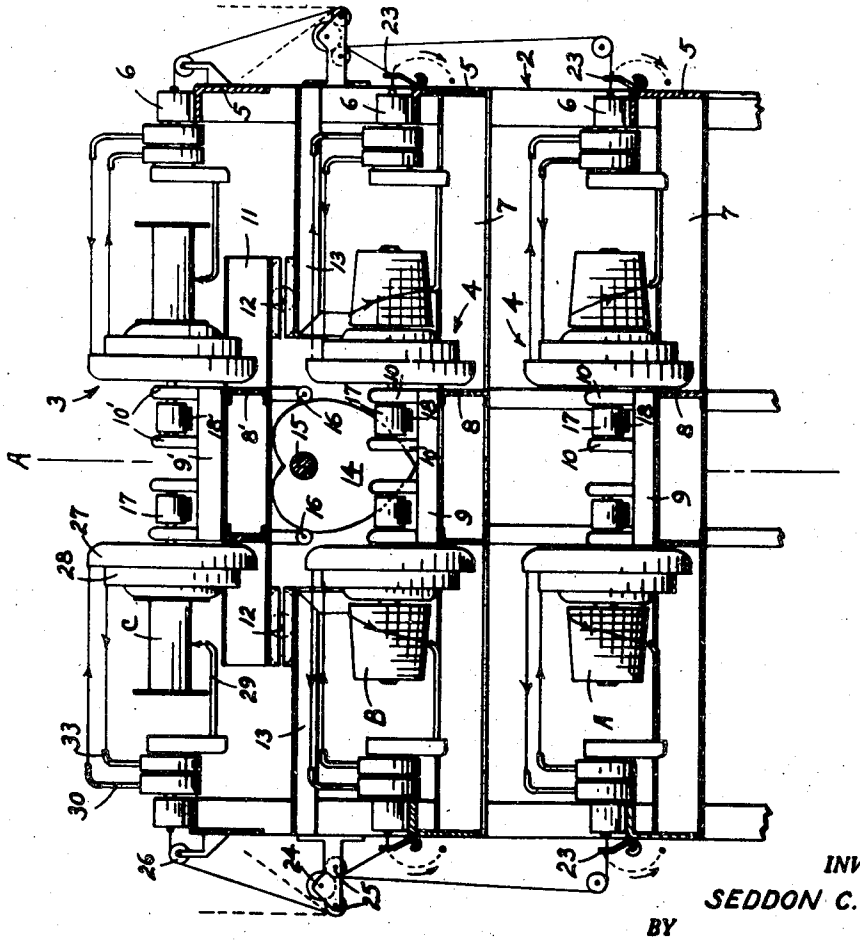


Fig. 1

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MULTIPLE TWISTER AND DOUBLER

Filed Jan. 14, 1944 3 Sheets-Sheet 2

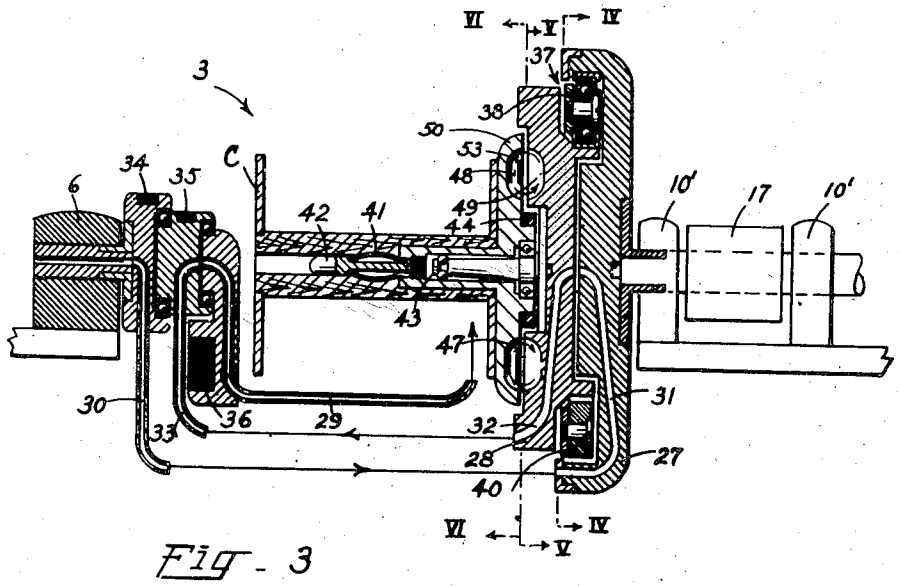


Fig. 3

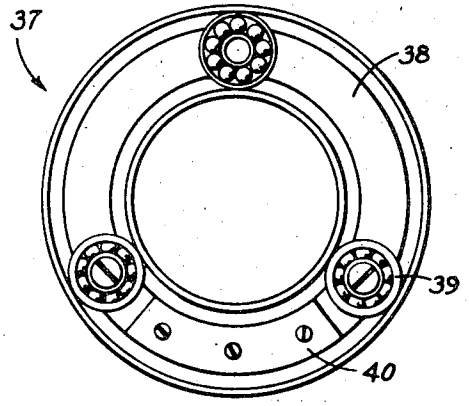


Fig. 4

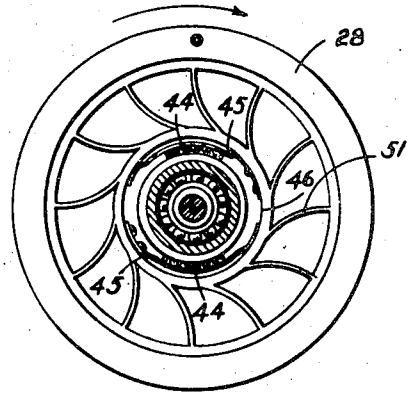


Fig. 5

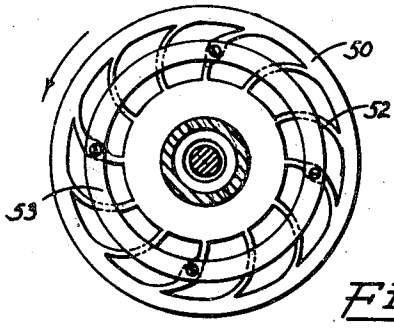


Fig. 6

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MULTIPLE TWISTER AND DOUBLER.

Filed Jan. 14, 1944 3 Sheets-Sheet 3

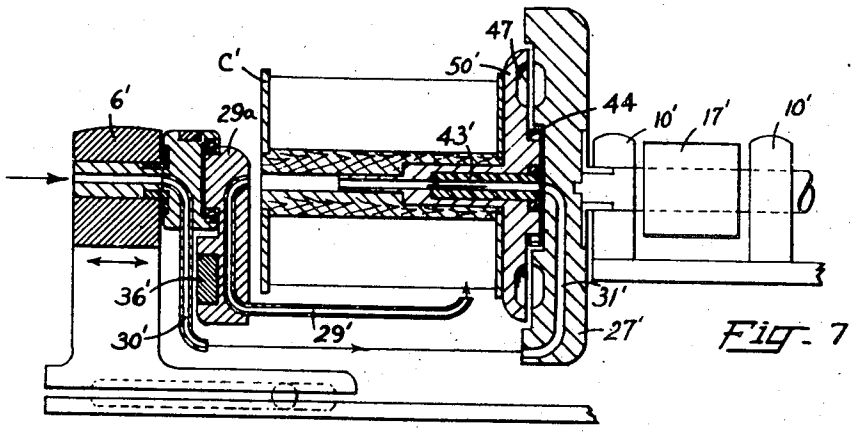


Fig. 7

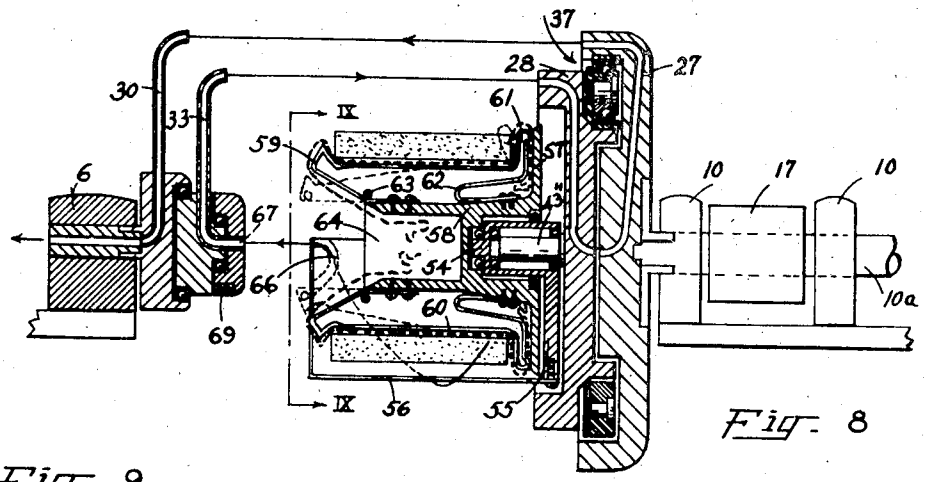
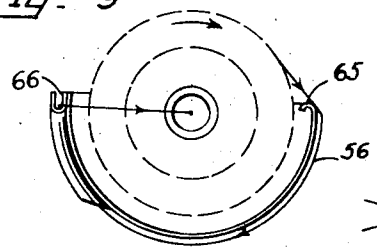


Fig. 8

Fig. 9



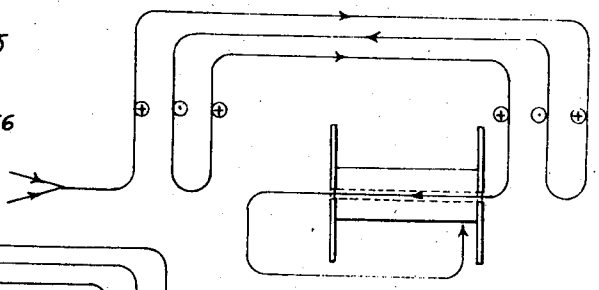


Fig. 10

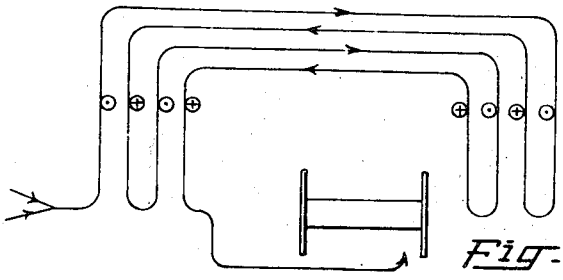


Fig. 11

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2,410,674

UNITED STATES PATENT OFFICE

2,410,674

MULTIPLE TWISTER AND DOUBLER

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Application January 14, 1944, Serial No. 518,267

20 Claims. (Cl. 57—58)

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This invention relates to improved flier type twisting machines for twisting singles yarns as well as for forming multiple ply cords from a plurality of yarns, and it relates particularly to machines of the "so-called" multiple twist type.

It is an object of this invention to provide improved twisting devices of this type which can serve equally well whether the yarn or cord being twisted is being unwound from a supply package thereof mounted in operative association with the device or is being wound to a receiving package support mounted in such relationship. It is thus an object of the invention to so construct such devices that a traverse of the yarn or cord being taken up in the device can be simply effected. It is a further object of the invention to simplify the driving connections, especially when a high ratio of twist is required from devices of this type. A further object is to provide twisting devices of this type which are readily adaptable to operation with "cakes" of rayon or other filamentary material collected in centrifugal spinning buckets.

Other objects and advantages will be apparent from the drawings, and the description thereof hereinafter, in which

Figure 1 is an elevation, partly in cross-section taken on line I—I of Figure 2, of a machine made in accordance with this invention,

Figure 2 is a front elevation, partly in cross-section, of the machine of Figure 1,

Figure 3 is a cross-section of a twister unit of Figure 1, on a larger scale,

Figure 4 is a side elevation (looking in the direction of line IV—IV of Figure 3) of the reversing bearing of the unit shown in Figure 3,

Figure 5 is a cross-section taken on line V—V of Figure 3,

Figure 6 is a cross-section taken on line VI—VI of Figure 3,

Figure 7 is a side elevation in section of a modified form of twister unit,

Figure 8 is a side elevation in section of another modification of the twister unit, and

Figure 9 is an end view taken on line IX—IX of Figure 8 of the semicylindrical guide plate.

Figures 10 and 11 show diagrammatically the travel of yarn or yarns through more elaborate twisting systems in accordance with the invention.

In Figures 1 to 3, the invention is illustrated as applied to the production of a multiple ply cord or strand. The twisting machine comprises a frame generally indicated by the reference numeral 2 which is arranged to carry in a plurality of tiers, twister units, each of the uppermost of which designated at 3 serves to collect with twisting and doubling a plurality of yarns coming from the twister units 4 arranged directly below. Two tiers of twister units 4 are

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shown so that a two-ply cord would be obtained in this case. However, instead of two lower tiers, any number in excess of two may be used to obtain a cord containing a greater multiple of singles yarns, or, if doubling is not wanted, a single tier of lower units 4 may be used. It is also within the contemplation of my invention to use a single twister unit, either as a take-up unit 3 or as an unwinding or let-off unit 4.

As shown in Figure 1 particularly, the machine is substantially symmetrical about a midplane A—A and a plurality of such machines may be placed on a floor with aisles therebetween. The frame 2 comprises suitable longitudinal members 5 in the form of channel irons for supporting the outer bearings 6 of the twister units, transverse beams 7 on which are supported the intermediate longitudinal channels 8 carrying short crosspieces 9 on which the inner bearings 10 of the twister units are secured.

The only exception to this construction is the arrangement for supporting the inner bearings 10' of the uppermost tier of twister units. These bearings are suppored on short crosspieces 9' carried by longitudinal channels 8' secured at spaced intervals along the length of the machine to transverse members 11 which ride upon rollers 12 arranged to function in suitable guides secured to the lower surface of members 11 and the upper surfaces of supporting beams 13 of the framework. This arrangement permits traversing of the take-up twister units of the top tier, as more fully explained hereinafter, by the action of the cams 14 (one being placed at each end of the machine or adjacent each transverse member 11, as desired), which are rotated by shaft 15, upon the followers 16 secured to the transverse members 11.

The twister units are driven by means of belts 18 operating upon pulleys 17. Preferably, the units in the lower tiers are driven at substantially the same speed, unless special effects are desired in the doubled cord, but the uppermost tier of units are generally but not necessarily driven at a speed which is different than that of the lower units. Ordinarily the belts 18 are pressed against pulleys 17 by rollers 19, but this driving connection can be broken by swinging of the levers 20 pivoted at 21 which may be effected by a hand lever 22 or a pedal 22'. A suitable linkage may be provided to stop all the twister units in a vertical set by a single pedal or hand lever, if desired.

In general, the operation of the machine may be described with reference to a single set of three twister units as follows:

Two separate yarns are unwound from cones A and B, proceeding through drop wire guides 23 (arranged to fall upon yarn breakage and make electrical connections which will stop the

set of twister units concerned), through delivery rolls comprising the driven roll 24 in contact with idler rolls 25 and then over a suitable guide roll 26 to the bobbin C on which doubled cord is wound. In proceeding from the cones A and B, the yarns pass through their respective twisting units 4 and as they pass to the bobbin C, the two yarns pass through an uppermost twisting unit 3. The three twisting units are generally similar (the difference being indicated in more detail hereinafter), except for the fact that the bobbin C, and flier disks 27 and 28 associated therewith are traversed as a unit, by means of the cam 14, with respect to the guide 29, so that an even distribution of the winding is produced on the bobbin C.

In Figure 3, arrowheads have been applied to indicate the course of the yarns being plied or doubled. (The direction of the yarns through twisters 4 is the reverse of that shown in Figure 3.) The yarns first pass through an axial passage through the bearing 6 and then through the flier 30 in free flight through the air to a channel 31 within the flyer 27, thence axially out of flier 27 into a channel 32 in flier 28, then in free flight to a flier 33 which is rotatably mounted with respect to the flier 30, then axially from the flier 33 into the guide 29 from the end of which the yarns pass to the bobbin C. Fliers 30 and guide 29 are all rotatable with respect to each other, and are constituted merely of hollow tubes which are suitably mounted on hubs. The fliers 30 and 33 are balanced for uniform rotation by weights 34 and 35 respectively whereas guide 29 and its hub are weighted at 36 in order to prevent their rotation.

Between the disk flier 27 and disk flier 28 there is a "reversing" bearing 37 which provides the sole operative connection therebetween. This bearing is shown more particularly in Figure 4 and comprises an annular member 38 upon which a plurality of ball bearings 39 (three being shown) are rotatably mounted and actually transmit motion from the inner peripheral surface of disk flier 27 with which it makes contact to the opposite portion of the outer peripheral surface of disk flier 28. A weight 40 prevents the annular bearing from rotating as a unit. Rotation of flier 27 in one direction by pulley 17 is transmitted through the bearing 37 to cause rotation of flier 28 in the opposite direction. Rotation of fliers 27 and 28 causes each of the idler fliers 30 and 33 respectively to follow in substantial synchronism with a slight lag that to which it is connected by the free flights of yarn or cord. Thus the outer pair 27 and 30 rotates in one direction and the inner pair 28 and 33 in the opposite direction. The result is that for each rotation of flier 27, four twists are inserted into the yarn and/or cord being handled by the unit.

The bobbin C is held by a spring 41 upon a spindle 42 so that it rotates therewith. The spindle 42 is rotatably mounted on a spindle 43 secured to, and extending axially from, the disk flier 28. As better shown in Figure 5, a pair of brake blocks 44 fixed on springs 45 are secured to the flier 28 in a recess 46 and normally tend to prevent relative rotation between the flier 28 and the spindle 42. This action serves to start the twisting unit and to overcome the inertia of the bobbin and supporting spindle 42. However, the springs are so constructed as to release the brakes 44 under the action of centrifugal force after considerable speed is attained. However, under full

driven by the fluid or fan drive connection shown generally in cross-section in Figure 3 where it is designated by reference numeral 47 and more particularly in Figures 5 and 6. The drive comprises a pair of what would be annular grooves 48 and 49 facing each other in the adjacent surfaces of the disk flier 28 and disk base 50 of the spindle 42 except for the fact that the continuity of each of the grooves is broken by the spaced arcuate vanes 51 and 52 respectively, and a baffle ring 53 is secured over the vanes 51. The vanes 51 and 52 as shown are designed for rotation of the disks in the direction of the arrows of Figures 5 and 6. The direction of air flow is indicated by the arrows in Figure 3. Thus, the rotation of the take-up bobbin C is obtained from the flier 28.

When the twister unit just described is used for the lower units 4 of the machine of Figures 1 and 2, and the yarn proceeds through the twister from a supply package thereof within the unit, the package is preferably mounted for free rotation and the brakes 44 and fluid drive 47 are preferably omitted.

Figure 7 shows a modification in which the yarn to be twisted or yarns to be twisted and plied is or are passed through an axial passage in the bearing 6' through a rotatably mounted flier 30', in free flight to the channel 31' of disk flier 27' then through an axial passage through a spindle 43' and through the bobbin C' to a passage in a member 29a communicating with the tubular guide 29'. Member 29a is rotatably mounted upon the hub carrying flier 30' but is prevented from rotating by the counterweight 36'. As shown, the flier system supported on bearing 6' is mounted for traversing motion which has the advantage that much less weight must be traversed than is the case in Figures 1 to 3 in which the package supporting end is traversed. This arrangement can be used to supplant the upper tier of twisters in Figures 1 and 2 by simply modifying the structure of these figures so that the uppermost outer bearings 6 are traversed by the cam 16 and the inner bearings are made stationary. In the embodiment of Figure 7 the disk 50' may be connected to the disk flier 27' by the centrifugally released brakes and the fluid drive described above in relation to the connection between disk 50 and disk flier 28 of Figure 3.

Figures 8 and 9 show an arrangement for unwinding and twisting rayon cakes. As in the unit shown in Figure 3, that in Figure 8 comprises an outer bearing 6 rotatably supporting fliers 30 and 33, and inner bearing 10 supporting the drive shaft 10—a driven by pulley 17. It also comprises the disk fliers 27 and 28 interconnected by the reversing bearing 37. From this point on, the structure is modified. The spindle 43'' carried by the flier for rotation therewith carries for independent rotation thereon a sleeve 54 provided with a semicircular plate 55 depending therefrom. A semicylindrical shell 56 is secured to the periphery of plate 55 and by virtue of gravity remains stationarily suspended upon the rotating spindle 43''.

Upon the sleeve 54 there is rotatably mounted a cake supporting member comprising a flange 57 and an axially extending portion 58 of generally cylindrical cross-section, the latter having secured thereto at spaced intervals about its periphery a plurality of resilient members 59, preferably of spring metal, which are adapted to resiliently support the cake internally in the manner shown. Each of the members 59 comprises

a substantially straight portion 60 adapted to bear against the internal periphery of the cake. The member 59 is bent outwardly and doubled back upon itself at 61 adjacent the base 57 and the inner portion is bent away from the base 57 and extends inwardly of the cake a substantial distance from the base 57 and finally the end portion of it is reversed inwardly and back under toward the base from a bight 62. The other end portion of member 59 extends outwardly to keep the cake from falling off and is looped back upon itself inwardly and to the outer portion of member 58 where it is secured. A ring 63 surrounds the latter inwardly bent ends of the members 59 and may be manually grasped and pulled out to cause retraction of the outer looped portions into the dotted line positions shown in Figure 8 which facilitates insertion or removal of the cake with respect to the spring members. The cake is usually wrapped by a sleeve extending through its interior and overlapped about its exterior. One end of the wrapping may be removed from the exterior of the cake and folded back under the doubled portions at 61 of the resilient members 59 while the other end of the wrapper may be folded around the outer bent portions into the recess 64 within the members 58. If desired a "cuff" member of Celluloid or other resilient material may be interposed between the cake and the members 60.

The shell 56 has an inturned lip 65 along that edge adjacent the periphery of the cake over which the unwinding yarn proceeds from the cake about the shell. Near the outer end of the edge of the shell at the other side of the cake, there is formed an arcuate channel or groove 66 through which the yarn proceeds as it leaves the shell to enter the axial passage 67 of the disk 68 weighted at 69 which is rotatably mounted upon the flier 33.

Upon comparison of the unit of Figure 8 with that of Figure 3, it will be seen that when operating the twister as a let-off or unwinding system, the package is allowed to rotate freely as the yarn is drawn therefrom through the twister such as by delivery rolls 24 and 25, of Figure 1. Also, when cakes are unwound instead of bobbins, the guide 29 (see Figure 3) with its rotatable mounting is omitted and the shell 56 is used instead.

Figure 7 shows the application of one pair of fliers, while Figures 3 and 8 show two pairs. The twister units may be designed with three, four, or any greater number of pairs of fliers, by adding the yarn travel system of Figure 7 to that of Figure 3 or 8, or by combining additional pairs of fliers in multiples of two with the yarn travel system of Figure 3 or Figure 8. Figures 10 and 11 show diagrammatically three and four pairs of fliers respectively. In all cases, the fliers are positively driven at one end only, reversing bearings being arranged between adjacent fliers to be driven in oppostie directions at the driving end of the twister unit.

In the claims, the term "strand" is intended in the generic sense as inclusive of yarns, plied yarns, cords, and the like, as well as of bundles of filaments having little or no twist, such as are obtained in the production of artificial filaments when collection occurs on bobbins or in centrifugal spinning buckets.

While preferred embodiments have been disclosed, it is to be understood that the description is merely illustrative and that changes and variations may be made without departing from the spirit and scope of the invention as defined by the appended claims.

I claim:

1. A device for twisting a strand comprising at least one pair of axially spaced substantially coaxial fliers through the air space between which the strand is adapted to travel in free flight, one of the fliers of each pair being an idler, means for rotating the other flier of each pair, a rotatable support for the strand mounted coaxially with and intermediate of the spaced members of each pair of fliers, and means for traversing at least one of the fliers adjacent one end of the support with respect to the support.

2. A device for twisting a strand comprising a plurality of pairs of substantially coaxial fliers, one of the fliers of each pair being an idler arranged in a group with each of the other idlers, the other fliers of each pair being arranged in a second group spaced axially from the idler group, means for rotating the fliers in the second group, and a substantially coaxial rotatable support for the strand intermediate the two groups.

3. A device for twisting a strand comprising a plurality of pairs of coaxial fliers, one of the fliers of each pair being an idler arranged in a group with the other idler fliers, the other fliers of each pair being arranged in a second group spaced axially from the idler group, the several pairs of the fliers being arranged to swing or balloon the several portions of the strand traveling in free flight through the intervening air space between the individual fliers of each pair in generally concentric paths of different average diameters, means for rotating the fliers in the second group so that adjacent fliers therein rotate in opposite directions, and a substantially coaxial rotatable support for the strand intermediate the two groups.

4. A device for twisting a strand comprising a plurality of pairs of coaxial fliers, one of the fliers of each pair being an idler arranged in a group with the other idler fliers, the other fliers of each pair being arranged in a second group spaced axially from the idler group, the several pairs of the fliers being arranged to swing or balloon the several portions of the strand traveling in free flight through the intervening air space between the individual fliers of each pair in generally concentric paths of different average diameters, means for rotating the fliers in the second group so that adjacent fliers therein rotate in opposite directions, a substantially coaxial rotatable support for the strand intermediate the two groups, and means for axially traversing one group of fliers with respect to the support.

5. A device for twisting a strand comprising a plurality of pairs of coaxial fliers, one of the fliers of each pair being an idler arranged in a group with the other idler fliers, the other fliers of each pair being arranged in a second group spaced axially from the idler group, the several pairs of fliers being arranged to swing or balloon the several portions of the strand traveling in free flight through the intervening air space between the individual fliers of each pair in generally concentric paths of different average diameters, means for rotating the fliers in the second group so that adjacent fliers therein rotate in opposite directions, and a substantially coaxial rotatable support for the strand intermediate the two groups, a guide rotatably mounted with respect to the innermost of the idler fliers, and means for traversing the guide axially relative to the support.

6. A device for twisting a strand comprising a plurality of pairs of substantially coaxial fliers, spaced bearings, one of the fliers of each pair being an idler, the idler fliers being arranged in a group and being rotatably mounted with respect to each other in one of the bearings, an axial passage for the strand in said bearing, the other fliers of each pair being arranged in a second group and being mounted rotatably with respect to each other in the other bearing, means for rotating the fliers in the second group, a rotatable support for the strand mounted coaxially and rotatably on the innermost of the second group of fliers, a guide rotatably mounted on the innermost of the idler fliers and extending laterally of the strand support, means for preventing rotation of the guide, and means for traversing the guide axially with respect to the support.

7. A device for twisting a strand comprising a plurality of pairs of substantially coaxial fliers, spaced bearings, one of the fliers of each pair being an idler, the idler fliers being arranged in a group and being rotatably mounted with respect to each other in one of the bearings, an axial passage for the strand in said bearing, the other fliers of each pair being arranged in a second group and being mounted rotatably with respect to each other in the other bearing, means for rotating the fliers in the second group, a rotatable support for the strand mounted coaxially and rotatably on the innermost of the second group of fliers, means associated with the innermost of the second group of fliers for rotating the strand support, a guide rotatably mounted on the innermost of the idler fliers and extending laterally of the strand support, means for preventing rotation of the guide, and means for traversing the guide axially with respect to the support.

8. A device for twisting a strand comprising a plurality of pairs of substantially coaxial fliers, spaced bearings, one of the fliers of each pair being an idler, the idler fliers being arranged in a group and being rotatably mounted with respect to each other in one of the bearings, an axial passage for the strand in said bearing, the other fliers of each pair being arranged in a second group and being mounted rotatably with respect to each other in the other bearing, means for rotating the fliers in the second group, a rotatable support for the strand mounted coaxially and rotatably on the innermost of the second group of fliers, fluid drive means associated with the innermost of the second group of fliers for rotating the strand support, a guide rotatably mounted on the innermost of the idler fliers and extending laterally of the strand support, means for preventing rotation of the guide, and means for traversing the guide axially with respect to the support.

9. A device for twisting a strand comprising a plurality of pairs of substantially coaxial fliers, spaced bearings, one of the fliers of each pair being an idler, the idler fliers being arranged in a group and being rotatably mounted with respect to each other in one of the bearings, an axial passage for the strand in said bearing, the other fliers of each pair being arranged in a second group and being mounted rotatably with respect to each other in the other bearing, means for rotating the fliers in the second group comprising means disposed between adjacent fliers in the second group for rotating said adjacent fliers in opposite directions, a rotatable support for the strand mounted coaxially and rotatably on the innermost of the second group of fliers, fluid drive means associated with the innermost of the second group of fliers for rotating the strand support, a guide rotatably mounted on the innermost of the idler fliers and extending laterally of the strand support, means for preventing rotation of the guide, and means for traversing the guide axially with respect to the support.

10. A device for twisting a strand comprising a plurality of pairs of substantially coaxial fliers, spaced bearings, one of the fliers of each pair being an idler, the idler fliers being arranged in a group and being rotatably mounted with respect to each other in one of the bearings, an axial passage for the strand in said bearing, the other fliers of each pair being arranged in a second group and being mounted rotatably with respect to each other in the other bearing, means for rotating the fliers in the second group, a guide means rotatably mounted on the innermost of the second group of fliers, a support for a wound package of the strand also rotatably mounted on the innermost of the second group of fliers, and means for preventing rotation of the guide means.

11. A device for twisting a strand comprising a plurality of pairs of substantially coaxial fliers, spaced bearings, one of the fliers of each pair being an idler, the idler fliers being arranged in a group and being rotatably mounted with respect to each other in one of the bearings, an axial passage for the strand in said bearing, the other fliers of each pair being arranged in a second group and being mounted rotatably with respect to each other in the other bearing, means for rotating the fliers in the second group comprising means disposed between adjacent fliers in the second group for rotating said adjacent fliers in opposite directions, a rotatable support for the strand mounted coaxially and rotatably on the innermost of the second group of fliers, fluid drive means associated with the innermost of the second group of fliers for rotating the strand support, a guide rotatably mounted on the innermost of the idler fliers and extending laterally of the strand support, gravity means for preventing rotation of the guide, and means for traversing the guide axially with respect to the support, the device being disposed so that its axis of rotation is inclined from the vertical.

12. A device for twisting a strand comprising a plurality of pairs of substantially coaxial fliers, spaced bearings, one of the fliers of each pair being an idler, the idler fliers being arranged in a group and being rotatably mounted with respect to each other in one of the bearings, an axial passage for the strand in said bearing, the other fliers of each pair being arranged in a second group and being mounted rotatably with respect to each other in the other bearing, means for rotating the fliers in the second group comprising means disposed between adjacent fliers in the second group for rotating said adjacent fliers in opposite directions, a rotatable support for the strand mounted coaxially and rotatably on the innermost of the second group of fliers, fluid drive means associated with the innermost of the second group of fliers for rotating the strand support, a guide rotatably mounted on the innermost of the idler fliers and extending laterally of the strand support, gravity means for preventing rotation of the guide, and means for traversing the guide axially with respect to the support, the device being disposed so that its axis of rotation is approximately horizontal.

13. A device for supporting a wound filamentary cake or package of annular form to facilitate unwinding thereof comprising a supporting base having a flange and a member projecting axially therefrom, a plurality of axially extending resilient members spaced about and secured to the periphery of the projecting member, each of said resilient members having an intermediate substantially straight portion adapted to support the annular package internally and having end portions bent outwardly and then inwardly into loops between the straight portion and their points of fastening to the projecting member, a ring within the loops of the resilient members slidable with respect thereto to flex the resilient members inwardly to permit installation and removal of the annular package with respect thereto.

14. A device for supporting a wound filamentary cake or package of annular form to facilitate unwinding thereof comprising a supporting base having a flange and a member projecting axially therefrom, a plurality of axially extending resilient members spaced about and secured to the periphery of the projecting member, each of said resilient members having an intermediate substantially straight portion adapted to support the annular package internally and having end portions bent outwardly and then inwardly into loops between the straight portion and their points of fastening to the projecting members, the extremities of the loops of the end portions adjacent the flange being bent back away from the flange under the straight portions and then bent into a bight inwardly and back under toward the flange to the position of fastening, a ring within the loops of the resilient members slidable with respect thereto to flex the outer ends of the resilient members inwardly and to shift the remainder thereof generally axially with respect to said bights to permit installation and removal of the annular package with respect thereto.

15. A device for unwinding filamentary cakes or other wound packages in a direction generally axially of the annular package comprising a rotatable supporting member arranged to extend into the interior of the annular package, and a rotatable guide member comprising a curved sheet extending partially around but spaced from the supporting member, said sheet having a smoothly curved lip formed along one edge of the sheet extending substantially the full length of the cake and having a radially outwardly extending guiding surface adjacent the other edge toward the take-off end thereof.

16. In a device for twisting a strand, a flier assembly comprising a group of at least two coaxial fliers, each of said fliers having means for guiding a strand between its axis and an outer terminal point spaced radially from its axis, the guiding means of one flier communicating with the guiding means of an adjacent flier substantially along the common axis thereof and the outer terminal points of the guiding means of the several fliers being offset radially from each other, means for rotating one of the fliers, and roller bearing means interconnecting the fliers for rotating adjacent fliers of the group in opposite directions.

17. In a device for twisting a strand, a flier assembly comprising a group of at least two coaxial fliers, each of said fliers having means for guiding a strand between its axis and an outer terminal point spaced radially from its axis, the guiding means of one flier communicating with the guiding means of an adjacent flier substantially along the common axis thereof and the outer terminal points of the guiding means of the several fliers being offset radially from each other, means for rotating one of the fliers, a floating annular support arranged between adjacent fliers, means for opposing rotation of the support, a plurality of roller bearings mounted rotatably on the support and arranged to bear against opposite surfaces on adjacent fliers whereby the adjacent fliers are rotated in opposite directions.

18. In a device for twisting a strand, a flier assembly comprising a group of at least two coaxial fliers, each of said fliers having means for guiding a strand between its axis and an outer terminal point spaced radially from its axis, the guiding means of one flier communicating with the guiding means of an adjacent flier substantially along the common axis thereof and the outer terminal points of the guiding means of the several fliers being offset radially from each other, means for rotating one of the fliers, a rotatable support for the strand mounted coaxially and rotatably on the innermost of the fliers, roller bearing means interconnecting the fliers for rotating adjacent fliers of the group in opposite directions, and fluid drive means associated with the innermost of the fliers for rotating the strand support.

19. In a device for twisting a strand, a flier assembly comprising a group of at least two coaxial fliers, each of said fliers having means for guiding a strand between its axis and an outer terminal point spaced radially from its axis, the guiding means of one flier communicating with the guiding means of an adjacent flier substantially along the common axis thereof and the outer terminal points of the guiding means of the several fliers being offset radially from each other, means for rotating one of the fliers, a rotatable support for the strand mounted coaxially and rotatably on the innermost of the fliers, a floating annular support arranged between adjacent fliers, means for opposing rotation of each floating support, a plurality of roller bearings mounted rotatably on each floating support and arranged to bear against opposite surfaces on the adjacent fliers whereby the adjacent fliers are rotated in opposite directions, and fluid drive means associated with the innermost of the fliers for rotating the strand support.

20. In a device for twisting a strand, a flier assembly comprising a group of at least two coaxial fliers, each of said fliers having means for guiding a strand between its axis and an outer terminal point spaced radially from its axis, the guiding means of one flier communicating with the guiding means of an adjacent flier substantially along the common axis thereof and the outer terminal points of the guiding means of the several fliers being offset radially from each other, means for rotating one of the fliers, a rotatable support for the strand mounted coaxially and rotatably on the innermost of the fliers, and roller bearing means interconnecting the fliers for rotating adjacent fliers of the group in opposite directions.

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