

July 7, 1931.

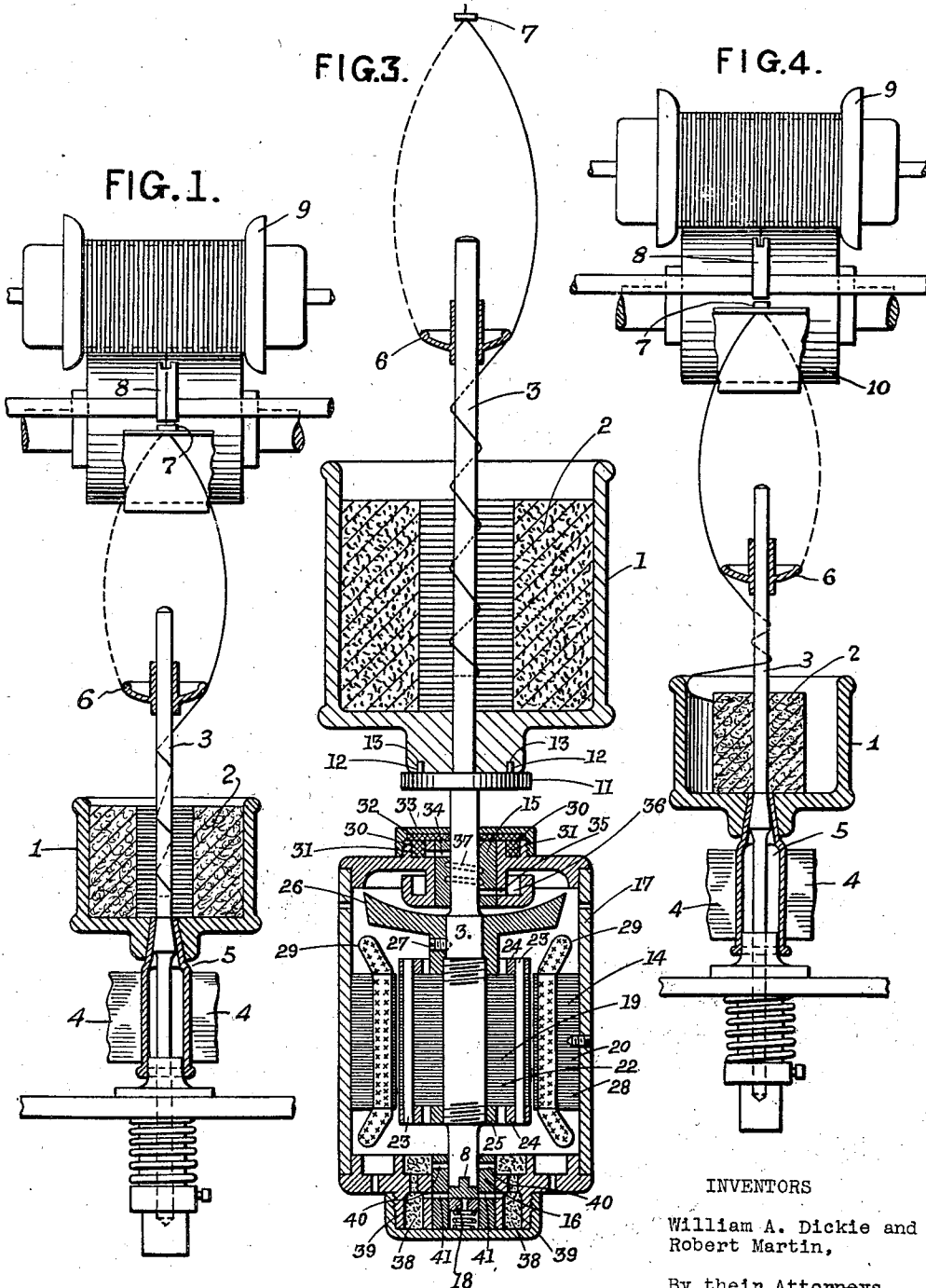
W. A. DICKIE ET AL

1,813,611

MANUFACTURE OF YARNS OR THREADS AND APPARATUS THEREFOR

Filed Oct. 11, 1927

4 Sheets-Sheet 1



INVENTORS

William A. Dickie and
Robert Martin,

By their Attorneys,

Baldwin & Wright

July 7, 1931.

W. A. DICKIE ET AL

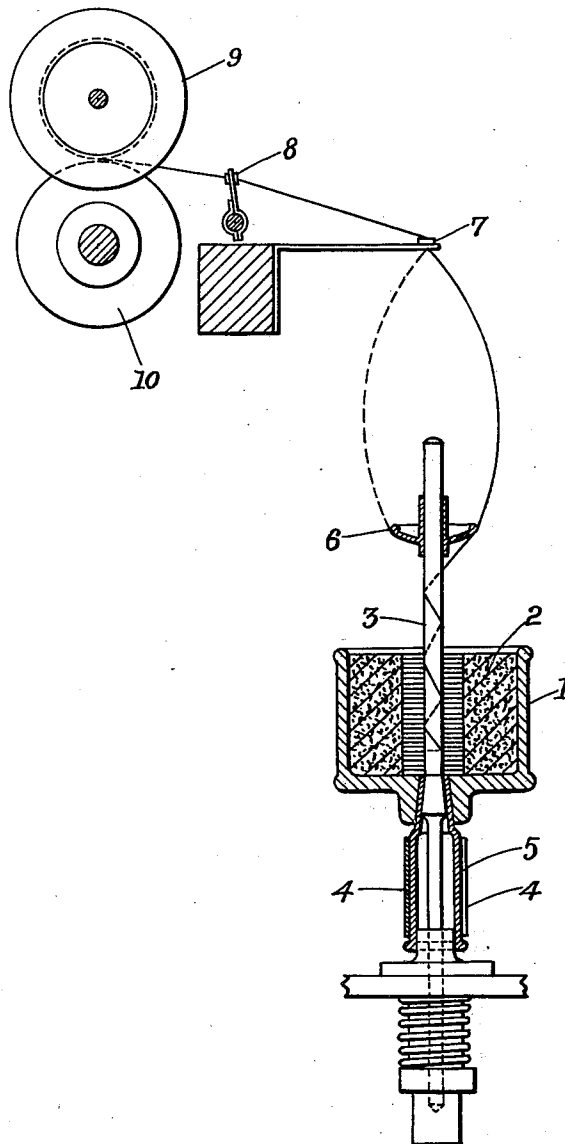
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4 Sheets-Sheet 2

FIG. 2.



INVENTORS

William A. Dickie and
Robert Martin,

By their Attorneys

Buechner & Wright

July 7, 1931.

W. A. DICKIE ET AL

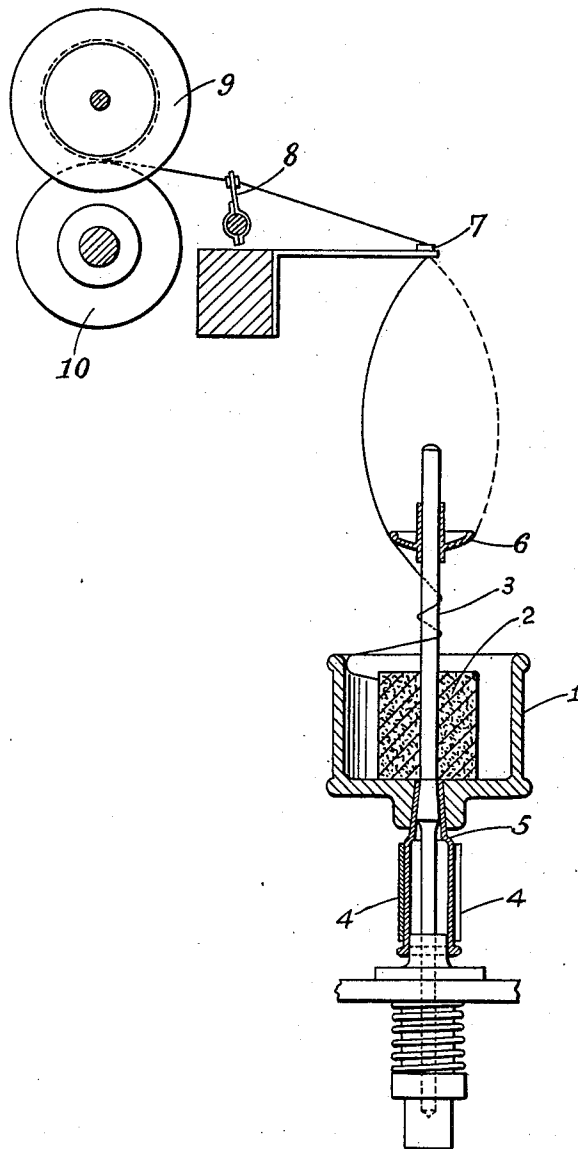
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FIG. 5.



INVENTORS

William A. Dickie and
Robert Martin,

By their Attorneys,

Bledwin Wright

July 7, 1931.

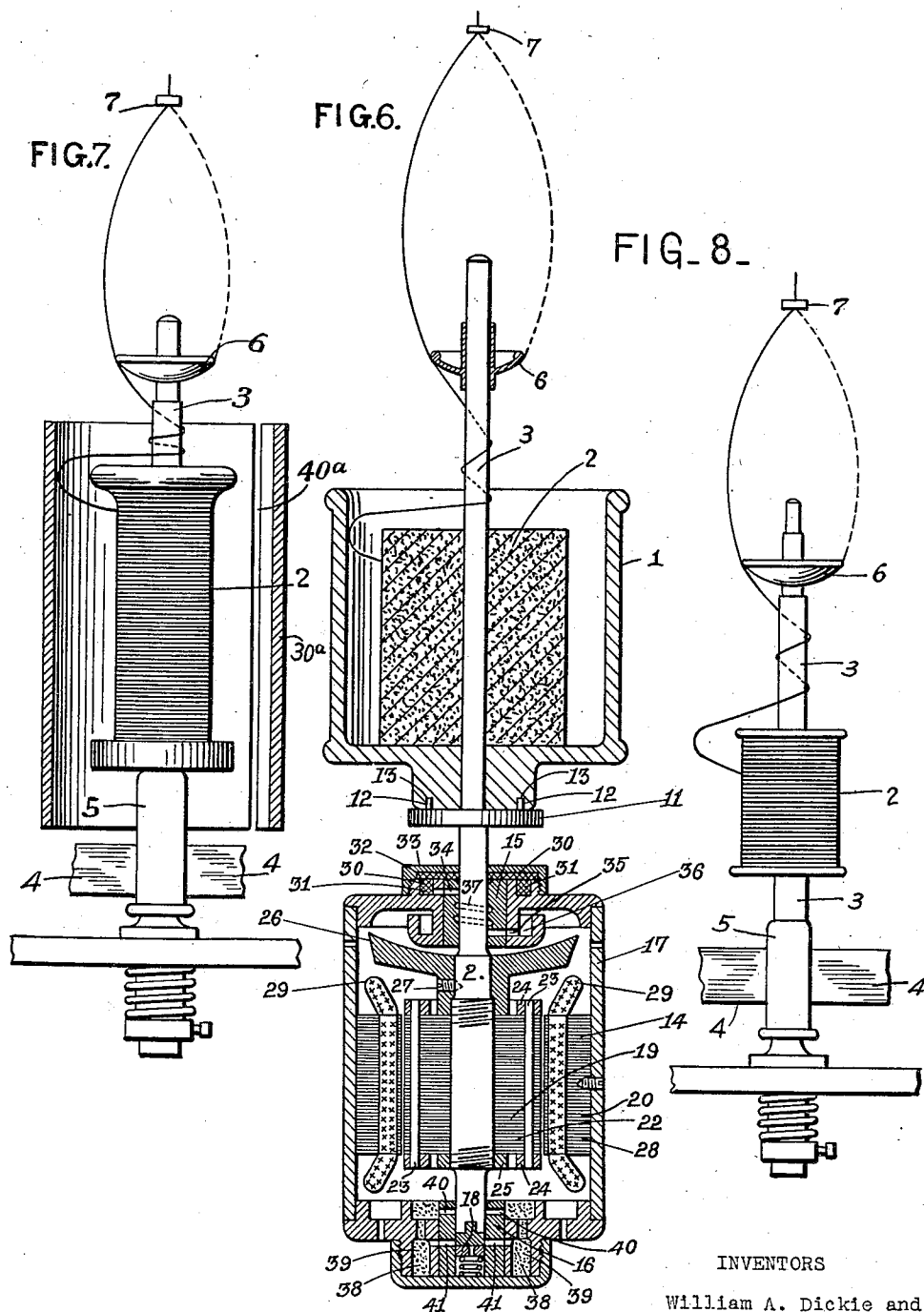
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MANUFACTURE OF YARNS OR THREADS AND APPARATUS THEREFOR

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4 Sheets-Sheet 4



INVENTORS

William A. Dickie and
Robert Martin,

By their Attorneys,

Baldwin Wright

UNITED STATES PATENT OFFICE

WILLIAM ALEXANDER DICKIE AND ROBERT MARTIN, OF SPONDON, NEAR DERBY,
ENGLAND, ASSIGNORS TO CELANESE CORPORATION OF AMERICA, A CORPORATION
OF DELAWARE

MANUFACTURE OF YARNS OR THREADS AND APPARATUS THEREFOR

Application filed October 11, 1927, Serial No. 225,537, and in Great Britain October 22, 1926.

The invention relates to a new or improved method and apparatus for the twisting of yarns and threads of fibres or filaments of any kind, and especially yarns or threads of cellulose acetate or other artificial silk filaments or fibres. The invention is particularly applicable for the production of yarns or threads of high twist, especially those known as "crêpe threads" such as are used in weaving looms in the manufacture of natural or artificial silk crêpe fabrics, such as crêpe de Chine, crêpe marocain, georgette, etc.

According to the invention we twist threads or yarns by drawing them off from rotating cheeses or other packages in such a way that the thread or yarn, in travelling from the rotating package to the winding device, passes from the rotating package, laps or coils around a rotating vertical blade, rod or spindle coaxial with and extending above the package, and passes thence in a balloon-shaped path to a point or guide (preferably fixed) above the blade, rod or spindle and preferably centrally over the blade, rod or spindle; the rod, blade or spindle is preferably rotated at the same speed as or at a lower speed than the yarn package. The tension of the yarn being twisted may be controlled by adjusting the length of the balloon-shaped path.

The package may be composed of any thread or yarn, whether twisted or non-twisted, as for instance a twisted or non-twisted thread or yarn of filaments or fibres of cellulose acetate artificial silk or other artificial or natural filaments or fibres, or two or more ends of parallel or doubled yarn or thread, whether of similar or dissimilar material.

In performing the invention we may draw the thread or yarn off from the interior or from the exterior of the rotating yarn package. In some cases when the yarn is drawn from the exterior of a package, it may be necessary to limit the outward movement due to centrifugal force of the yarn leaving the package to ensure that it laps or coils round the rotating member.

Apparatus according to the present inven-

tion comprises a yarn package support, a rod, spindle, blade or other member coaxial with and extending through the package to provide a lapping or coiling surface for the yarn leaving the package, means for rotating said support and said member, a thread guide spaced from and substantially in alinement with said member, and winding means for drawing the yarn from the package.

When the yarn is drawn from the interior of the package, the support is preferably in the form of a box or cup into which the package is placed, and the rod, spindle, or blade extends through but clear of the interior of the package. A similar box or cup may be employed when the yarn is to be drawn from the exterior of the package, the package being placed on the rod, spindle, or blade and the wall of the box or cup serving as a rotating shell to limit the outward movement of the yarn under centrifugal force and ensuring that it coils round the rotating rod, spindle, or blade. The package may, however, be supported on a spindle that forms or carries the member forming the lapping or coiling surface for the yarn, and in this case the yarn package may be rotated within a stationary shell, such shell being, if desired, furnished with a slit to facilitate threading up on starting.

A deflecting member may be provided on the rod, blade, or spindle to determine the point at which the yarn leaves the rod, blade, or spindle, and the length of the balloon-shaped path, and consequently, the tension in the yarn may be controlled by adjusting the position of the deflecting member.

In order to obtain high speeds of rotation, electric motor means are preferably employed to rotate the yarn package support and the member extending therethrough, and particularly the polyphase motor having unbalanced windings and/or driven by a generator having unbalanced windings as described in U. S. application Serial No. 138,062, filed September 27, 1926.

The method according to the present invention permits of obtaining a high degree

of uniformity of twist, even when high twist is being imparted to the thread or yarn, this being possible owing to the fact that the thread or yarn on leaving the package wraps itself round the rotating rod, blade or spindle under considerable but controllable tension; and if the package and the rod, blade or spindle are rotated at high speed to produce a high twist, the drag or friction exerted by the rotating rod, blade or spindle controls the ballooning of the thread between the rotating rod, blade or spindle and the hereinbefore mentioned guide or point above the same, and thereby controls the twist imparted to the yarn or thread, so that very high twist may be inserted without the twist running back into the package and causing sloughing.

Further, as the twist is inserted in gradual stages there is greater flexibility than in flyer or ring twisting, and fewer breakages, the yarn being subjected to smaller strains. The stages in which the twist is inserted being more gradual, higher speeds, greater strength of thread and more equality of twist are obtainable.

By building the package to be drawn off and twisted, for example a bobbin, cheese or the like, from two or more ends of parallel yarns of different materials or from a doubled yarn, the method is capable of producing mixed twisted yarns for special effects.

Other features of the invention will appear from the following description and from the appended claims.

The accompanying drawings serve to illustrate some forms of execution of the invention, it being understood that they are given only by way of illustration and may be varied widely. These drawings illustrate forms which are very useful for the production of highly twisted or crêpe threads. In the forms illustrated in Figures 1, 2 and 3 the thread is drawn off from the interior of the package, whereas in the forms illustrated in Figures 4, 5, 6, 7 and 8, the thread is drawn off from the exterior of the package.

Figure 1 is an elevation in part mid vertical section of one form of apparatus in accordance with the invention, the yarn package in this form being adapted to be driven by belt drive.

Figure 2 is a sectional view in a plane at right angles to Figure 1, also in part mid vertical section.

These two figures show the elements of one complete drawing off and twisting unit, and it is of course understood that the machine or apparatus may comprise any desired number of such units arranged in a row or otherwise as desired.

Figure 3 is a sectional elevation showing the form of apparatus illustrated in Figures 1 and 2 but with the yarn package adapted

to be driven by one form of the electrical means described in prior application S. No. 138062.

Figure 4 is an elevation in part mid vertical section of one form of apparatus applicable for twisting the thread whilst drawing the same from the exterior of the rotating package, the yarn package in this form being adapted to be driven by belt drive and being rotated within and together with a surrounding shell in the form of a cylindrical box.

Figure 5 is a sectional view in a plan at right angles to Figure 4.

These Figures 4 and 5 show the elements of one complete drawing off and twisting unit, and it is of course understood that the machine or apparatus may comprise any desired number of such units arranged in a row or otherwise.

Figure 6 is a sectional elevation showing a form of apparatus similar to that illustrated in Figures 4 and 5 but with the yarn package and cylindrical box adapted to be driven by one form of the electrical driving means described in prior U. S. application S. No. 138062.

Figure 7 is a sectional elevation of one form of apparatus in accordance with the invention, the yarn package in this form being rotated within a stationary surrounding shell or member and being driven by belt drive.

Figure 8 is an elevation of one form of apparatus in accordance with the invention, wherein the yarn package is not surrounded by any shell or member.

Referring to Figures 1 and 2, 1 is a cylindrical box or cup carrying the cheese or cross wound package 2 of yarn to be twisted. The rod, blade or spindle 3 carries a whorl 5 on which the cylindrical box 1 is mounted, and the box 1 and the spindle 3 are driven at the desired speed by means of the belt 4 passing over the whorl 5. It is not essential, however, that the members 1 and 3 be driven at the same speed or by the same means. The yarn on leaving the package 2 laps or coils round the spindle 3, bears against the disc or deflecting member 6 which is adjustably mounted on the spindle 3, and passes to the fixed guide eye 7 above the spindle 3. The spindle may be of any suitable diameter depending on the yarn, counts, speeds, and degrees of twists required and the part of the spindle forming the lapping surface need not be limited to a cylindrical shape but may be conical, double conical, barrel shape, waisted, etc. The thread balloons in passing from the disc or deflecting member 6 to a point which is preferably constituted by a guide eye 7, and by adjusting the position of the disc 6 on the spindle 3 the length of the balloon may be adjusted, which adjust-

ment provides a convenient and ready means for changing the tension to the requirements of the thread or yarn being twisted and to avoid snarling taking place. The deflector 5 6 may be spherical, conical etc. in form and may be mounted on the spindle 3 in any desired way, as by springing it thereon. It should have a smooth or polished surface where it contacts with the yarn. After 10 leaving the fixed guide eye 7, the thread preferably passes through a traversing guide eye 8 carried by a traversing rod as shown and which traverses the thread on to the bobbin or the like 9, which is driven frictionally by means of a driven roller 10 bearing 15 against the surface of the thread wound on the bobbin or the like 9. The means described for driving the bobbin ensure a constant speed of drawing off the yarn and hence even twisting of the threads, yarns or 20 filaments, but any other suitable winding means may be employed. The cup or box 1 may be full-walled, perforated, or of cage-like or skeleton form. In operation the cylindrical box 1 is rotated in a "winding" 25 direction, that is to say the same direction as would be followed when tracing the yarn back from the spindle to the package. The above apparatus may be employed for yarn packages of any type capable of being unwound from the interior. Centrifugal force 30 assists in maintaining the package in position inside the box 1.

The degree of twist imparted to the thread 35 or yarn is of course governed by the speed of rotation of the cylindrical box and the rate at which the thread is drawn off (i. e. the speed of the driven roller 10), and by rotating the cylindrical box at high or very 40 high speeds, high or very high degrees of twist, for instance 50 to 60 or more turns per inch, can be readily imparted to the thread or yarn.

Referring to Figure 3, as above mentioned 45 this figure shows how the apparatus illustrated in Figures 1 and 2 may be adapted to be driven by one form of the electrical driving means described in prior U. S. application S. No. 138062.

50 Similar numerals in Figure 3 indicate corresponding parts to those in Figures 1 and 2.

Referring to Figure 3, the cylindrical box 1 carrying the yarn package 2 is carried by 55 the spindle 3, the spindle 3 being formed with a step or flange 11 having pins 12 engaging with recesses 13 in the bottom of the cylindrical box 1, the spindle 3 being also the spindle of the electric motor 14. The 60 motor 14 is of the squirrel cage type and has a star-wound 3 phase 2 pole 24 slot stator provided with the "unbalanced windings", the stator being wound with 100 turns on the first phase, 97 turns on the second phase and 94 turns on the third phase; the motor (or

it may be a plurality of such motors, each driving a cylindrical box in the manner aforesaid) being fed by an ordinary three phase high frequency generator (not shown) 70 having the ordinary balanced windings (i. e. an equal number of turns on each phase) and operated in the known manner to supply current at the high frequency necessary to drive the motor at the desired high or very 75 high speed. The spindle of the motor 14 runs in an upper bearing 15 and a lower bearing 16 in the motor casing 17, and is supported by the spring-mounted thrust bearing 18. The squirrel cage rotor 19 is 80 rigidly fixed to the motor spindle 3. The stator core 20 is rigidly fixed to the enclosing motor casing 17.

The rotor 19 is similar to the usual type of squirrel cage rotor, having a laminated 85 iron core built up from soft iron stampings 22 (care being taken to ensure good insulation between the stampings) and copper squirrel cage bars 23 passing through the rotor slots and fixed in the squirrel cage end rings 24. 90

The rotor is fixed rigidly to the motor spindle, being locked in position by the nut 25 and the screw-threaded fly wheel member 26, the latter having also a grub screw 27 engaging 95 with the spindle 3.

The stator core 20 is built up from laminated slotted soft iron stampings 28 (care being taken to ensure good insulation between the stampings) and is provided with 100 the unbalanced winding 29, care being taken to ensure good insulation between the winding and the stator core.

The upper bearing 15 is lubricated from the annular oil well 30 provided with an oil wick 31, the oil well being covered by a felt washer 32 and a cover 33. When the spindle 105 is stationary the oil from the wick 31 runs through the channel or boring 34 on to the spindle 3 and through the channel or boring 35 into the annular sump 36. When the spindle is in motion the oil is pumped by the spindle 3 upwards from the sump 36 through the spiral groove 37 in the bearing 15, thus maintaining lubrication of the bearing. 110 The dish shaped fly wheel member 26 prevents oil from falling on to the rotor or stator, as any oil falling from the sump 36 is thrown out from the fly-wheel member 26 by centrifugal action, passing round the top of the casing 17 and back into the sump 36; 120 thus any oil flowing from the sump 36 will be circulated by means of the flywheel member 26 back into the sump 36.

The lower bearing 16 is lubricated from oil wells such as 38 disposed in any suitable 125 number around the spindle and provided with oil wicks 39 which feed the oil to the spindle 3 through channels or borings such as 40; the thrust bearing 18 is lubricated by the wicks 39 which feed the oil through chan- 130

nels or borings such as 41 on to the bearing.

Referring to Figures 4 and 5, 2 is a cheese or cross wound package of yarn to be twisted, fitted firmly on the driving spindle 3. The driving spindle 3 carries a whorl 5 on which a cylindrical box 1 is firmly mounted, the cylindrical box being of somewhat larger diameter than the yarn package which it surrounds. The driving spindle 3 also extends above the yarn package and constitutes the before mentioned rod, blade or spindle around which the yarn or thread laps or coils. The spindle 3 and the cylindrical box 1 are driven at the desired speed by the belt 4 passing over the whorl 5. The yarn on leaving exterior of the package, balloons to a greater or less extent outwards to or towards the inner wall of the cylindrical box 1, passes to the upward extension of the spindle 3 around which it laps or coils, bears against the disc or deflecting member 6 adjustably mounted on the spindle 3, and passes to the fixed guide eye 7 disposed centrally above the spindle 3. The wall of the box 1 limits the outward movement or ballooning of the yarn leaving the package and ensures that it coils round the member 3, but otherwise the operation of the apparatus is similar to that described with reference to Figs. 1 and 2.

Referring to Figure 6, as above mentioned this figure shows a form of apparatus similar to that illustrated in Figures 4 and 5, adapted to be driven by one form of the electrical driving means described in prior U. S. application S. No. 138062.

Similar numerals in Figure 6 indicate corresponding parts to those in Figures 4 and 5.

Referring to Figure 6, the cheese or cross wound package 2 is fitted to the driving spindle 3, the spindle 3 being formed with a step or flange 11 having pins 12 engaging with recesses 13 in the bottom of the cylindrical box 1 which is of somewhat larger diameter than the yarn package which it surrounds. The spindle 3 extends above the yarn package and serves as the before mentioned rod, blade or spindle, for the lapping or coiling of the yarn or thread and also extends downwards, its lower extension forming the spindle of an electric motor 14, as described with reference to Fig. 3.

Referring to Figure 7, the bobbin 2 or other package of the yarn to be twisted is fitted to the driving spindle 3 and surrounded by a stationary shell or member 30^a of cylindrical form, of somewhat larger diameter than the yarn package. The cylindrical member 30^a has a vertical split or slit 40^a to facilitate threading up the yarn before starting. The driving spindle 3 extends above the package and serves as the before mentioned rod, blade or spindle for the lapping or coiling of the yarn. The spindle 3 and the yarn package are driven at the desired speed by the belt 4

passing over the whorl 5. The yarn on leaving the exterior of the package balloons to a greater or less extent outwards to or towards the inner wall of the stationary cylindrical member 30, passes to the upward extension of the spindle 3, around which it laps or coils, bears against the disc or deflecting member 6 adjustably mounted on the spindle 3, passes to the fixed guide eye 7 placed centrally above the spindle 3, and from thence it continues its travel to the winding device (not shown). The shell or member 30 limits the outward movement or ballooning of the yarn leaving the package and ensures that it coils round the member 3, but otherwise the operation of the apparatus is similar to that described with reference to Figs. 1, 2, 4 and 5.

Referring to Figure 8, the apparatus shown in this figure is similar to the apparatus shown in Figure 7, but in Figure 8 a surrounding shell or member for the bobbin or yarn package is not employed. The thread or yarn balloons to a greater or less extent from the exterior of the yarn package 2, passes to the upward extension of the spindle 3, around which it laps or coils, bears against the disc or deflecting member 6 adjustably mounted on the spindle 3, and passes to the fixed guide eye placed centrally above the spindle 3, and from thence it continues its travel to the winding device (not shown). As in Figure 7 the thread or yarn balloons in passing from the deflecting member 6 to the fixed guide eye 7, and by adjusting the position of the disc 6 on the spindle 3, the length of balloon may be adjusted, which adjustment provides a convenient and ready means for changing the tension to the requirements of the thread or yarn being twisted and to avoid snarling.

It should be observed in connection with the apparatus illustrated in Figure 8, that when high speeds of yarn package and spindle are employed for producing high degrees of twist, the diameter of the yarn package relatively to that of the spindle at the part around which the yarn laps or coils is of importance, as with too large a diameter of package relatively to that of the spindle at this part there is a tendency for the thread or yarn to leave the spindle and balloon straight from the exterior of the yarn package direct to the guide eye 7. We have found it desirable when employing such a form of apparatus at high speeds, to employ for instance with a spindle of $\frac{3}{8}$ " diameter (at the part around which the yarn laps or coils) a yarn package of not more than about $1\frac{1}{2}$ " diameter.

It will be understood in performing the present invention, that where high or very high speeds are employed for producing high or very high degrees of twist, care should be taken that the yarn package carriers, spindles or other parts of the apparatus revolving

at the high or very high speeds, should be mechanically balanced to a high degree of accuracy.

It will be understood that in twisting yarns or threads according to the method or process of the present invention, the degree of twist imparted to the thread or yarn is governed by the speed of rotation of the yarn package relatively to the rate at which the thread or yarn is drawn off from the rotating yarn package, and that the winding device will be driven at a lower speed, and usually a very much lower circumferential speed, than the speed of rotation of the yarn package.

What we claim and desire to secure by Letters Patent is:—

1. Process for the production of twisted yarns, said process comprising drawing the yarn from a rotating yarn package, and leading the yarn to a point above and substantially in alinement with the axis of the package, causing said yarn to coil round a rotating member coaxial with and extending through the package and to pass in a balloon-shaped path from the said member to the said point.

2. Process for the production of twisted yarns, said process comprising drawing the yarn from a rotating yarn package, leading the yarn to a point above and substantially in alinement with the axis of the package, causing said yarn to coil round a rotating member coaxial with and extending through the package and to pass in a balloon-shaped path from the said member to the said point, and adjusting the length of the balloon-shaped path to control the tension of the yarn being twisted.

3. Process for the production of twisted yarns, said process comprising drawing the yarn from the exterior of a rotating yarn package, and leading the yarn to a point above and substantially in alinement with the axis of the package, causing said yarn to coil round a rotating member coaxial with and extending through the package and to pass in a balloon-shaped path from the said member to the said point.

4. Process for the production of twisted yarns, said process comprising drawing the yarn from the exterior of a rotating yarn package, leading the yarn to a point above and substantially in alinement with the axis of the package, causing said yarn to coil round a rotating member coaxial with and extending through the package and to pass in a balloon-shaped path from the said member to the said point, and adjusting the length of the balloon-shaped path to control the tension of the yarn being twisted.

5. Process for the production of twisted yarns, said process comprising drawing the yarn from a rotating yarn package to a point above and substantially in alinement with the axis of the package, and limiting the outward

movement of the yarn due to centrifugal force, causing said yarn to coil round a rotating member coaxial with and extending through the package and to pass in a balloon-shaped path from the said member to the said point.

6. Process for the production of twisted yarns, said process comprising drawing the yarn from a rotating yarn package to a point above and substantially in alinement with the axis of the package, limiting the outward movement of the yarn due to centrifugal force, causing said yarn to coil round a rotating member coaxial with and extending through the package and to pass in a balloon-shaped path from the said member to the said point, and adjusting the length of the balloon-shaped path to control the tension of the yarn being twisted.

7. Apparatus for the production of twisted yarns, said apparatus comprising a yarn package support, winding means for drawing the yarn from the package, a member coaxial with the package and extending beyond the end thereof to provide a coiling surface for the yarn, means for rotating the said support and the said member, a yarn deflecting device on said member, and a thread guide spaced a substantial distance beyond and substantially in alinement with said member.

8. Apparatus for the production of twisted yarns, said apparatus comprising a yarn package support which forms a shell spaced from and surrounding the package, winding means for drawing the yarn from the package, a member coaxial with the package and extending beyond the end thereof to provide a coiling surface for the yarn, means for rotating the said support and the said member, a yarn deflecting device on said member, and a thread guide spaced a substantial distance beyond and substantially in alinement with said member.

9. Apparatus for the production of twisted yarns, said apparatus comprising a yarn package support which forms a shell spaced from and surrounding the package, winding means for drawing the yarn from the package, a member coaxial with the package and extending therefrom to provide a coiling surface for the yarn, means for rotating the said support and the said member, an adjustable yarn deflecting device on said member, and a thread guide spaced from and substantially in alinement with said member.

10. Apparatus for the production of twisted yarns, said apparatus comprising a yarn package support which forms a shell spaced from and surrounding the package, winding means for drawing the yarn from the package, a member coaxial with the package and extending therefrom to provide a coiling surface for the yarn, electric motor means for rotating the said support and the

said member, an adjustable yarn deflecting device on said member, and a thread guide spaced from and substantially in alinement with said member.

- 5 11. Apparatus for the production of twisted yarns, said apparatus comprising a yarn package support which forms a shell spaced from and surrounding the package, winding means for drawing the yarn from the pack-
10 age, a member coaxial with the package and extending therefrom to provide a coiling surface for the yarn, means for rotating the said support and the said member, said means comprising a polyphase electric motor hav-
15 ing unbalanced windings, an adjustable yarn deflecting device on said member, and a thread guide spaced from and substantially in alinement with said member.

In testimony whereof we have hereunto
20 subscribed our names.

WILLIAM ALEXANDER DICKIE.
ROBERT MARTIN.

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