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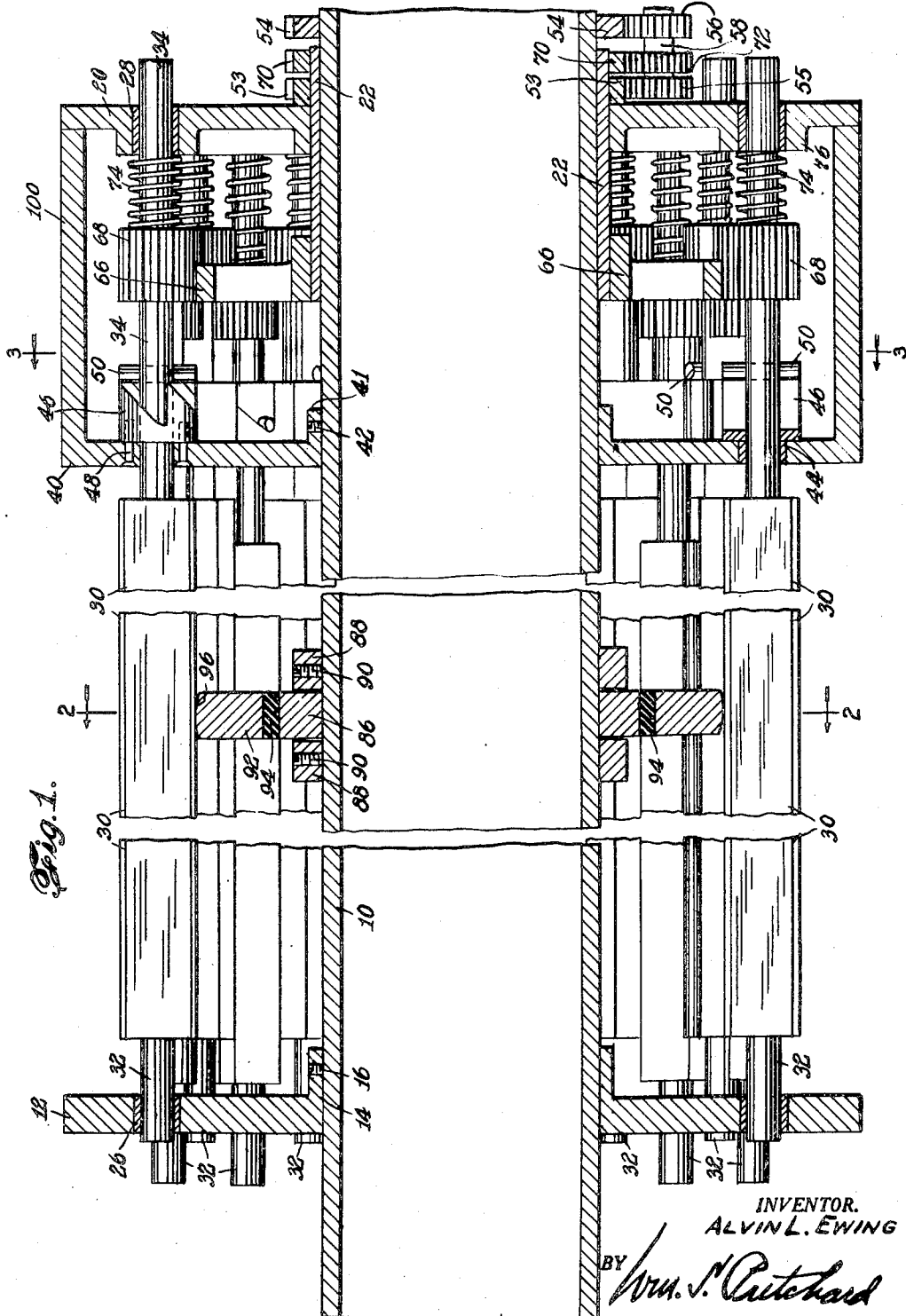
A. L. EWING

2,491,038

YARN-ADVANCING REEL

Filed April 2, 1946

3 Sheets-Sheet 1



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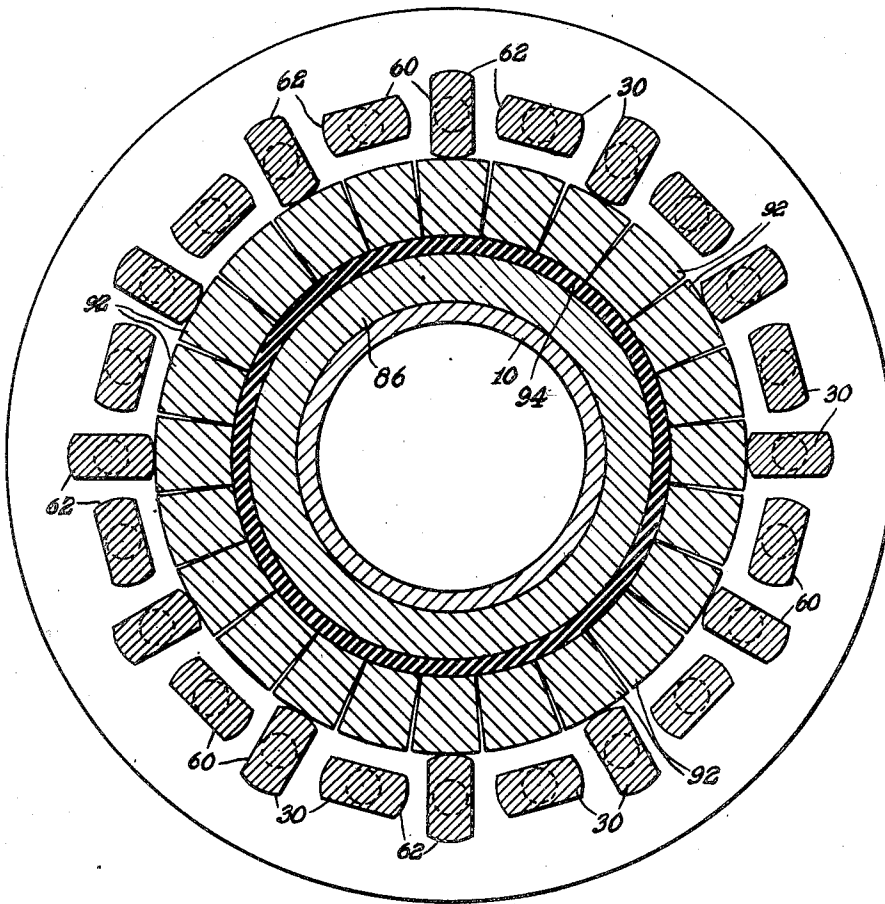
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Fig. 2.



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Fig. 3.

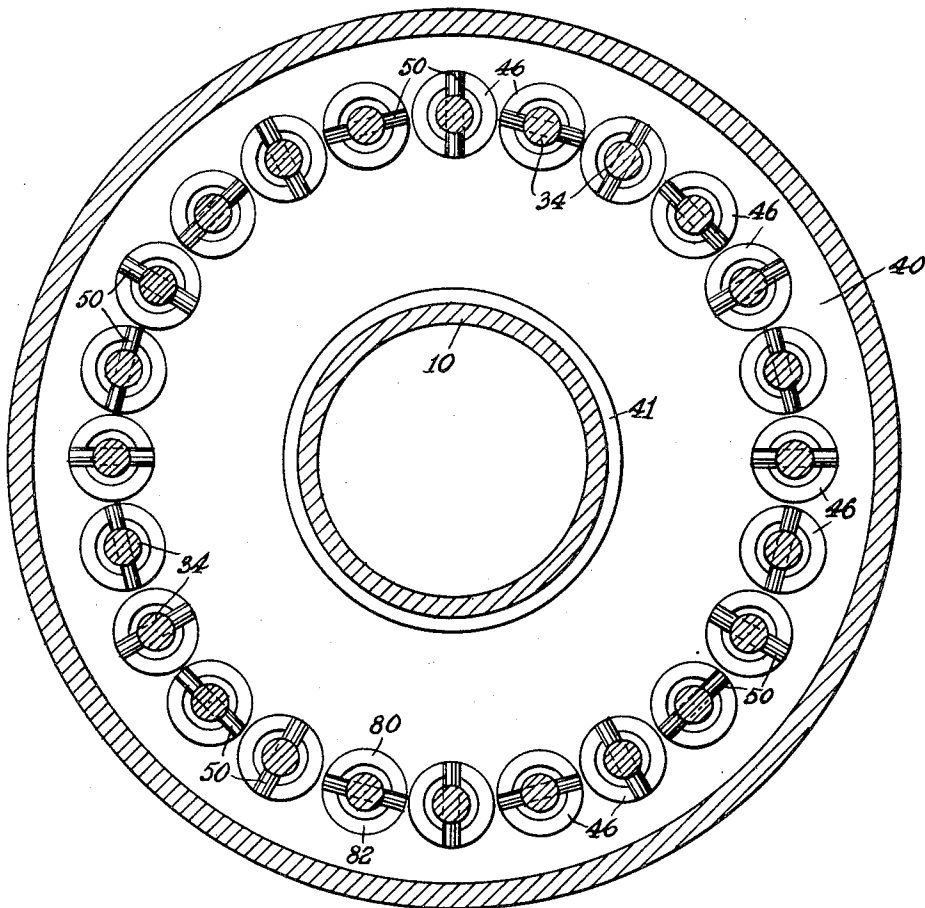
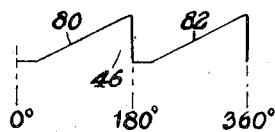


Fig. 4.



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YARN-ADVANCING REEL

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6 Claims. (Cl. 28—71.6)

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This invention relates to a yarn-advancing apparatus, and more particularly to a yarn-advancing reel in which yarn is continuously and progressively advanced in the form of a helix.

An object of this invention is to provide a new and improved yarn-advancing reel.

Another object of this invention is to provide a yarn-advancing reel which effectively and continuously advances a yarn in the form of a helix along the length thereof.

Other and additional objects will become apparent hereinafter.

The objects of this invention are accomplished, in general, by winding yarn in the form of a helix onto a reel having a plurality of yarn-supporting bars arranged in spaced relationship circumferentially around the main reel axle, each of which bars is rotated about its own longitudinal axis and, when the yarn is in contact with said bar, the latter is moved axially in the direction of yarn advancement over the reel whereby the yarn is advanced over the reel, and, when the yarn is out of contact with said bar, the latter is moved axially in a direction opposite to the yarn advancement over the reel.

Each rotating bar has associated therewith a cam mechanism which is designed to impart the axial movement to the bar in the appropriate direction at the desired times. Means are provided to effect very rapidly the axial movement of each bar in the direction opposite to the direction of yarn advancement over the reel.

Each bar has two of its opposite sides straight and the other two opposite sides round (convex) so that, upon rotation of a bar about its longitudinal axis, the straight and round sides will be positioned alternately parallel to the yarn sheet. The dimensions of each bar are such that, when the straight sides of the bar lie parallel to the yarn sheet, the bar will be out of contact with the yarn and, when a round side of the bar is parallel to the yarn sheet, the bar will be in yarn-contacting and supporting position.

In one embodiment of the invention, the arrangement of the bars is such that a round surface of every other bar is in yarn-contacting and supporting position while the intermediate bars are out of yarn-contacting position.

The bars are rotated about their central axes by a planetary gear train at the one end of the reel, the ratio of which together with the slope of the cams controls the spacing of the thread wraps on the reel. The main shaft of the reel can be stationary or rotated about its longitudinal axis in either direction as desired.

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The present invention will be more easily understood by reference to the following detailed description when taken in connection with the accompanying drawings, in which:

Figure 1 is a longitudinal section of one embodiment of a yarn-advancing reel, with parts removed for clarity, embodying the principles of the invention

Figure 2 is a section taken on the line 2—2 of Figure 1;

Figure 3 is a section taken on the line 3—3 of Figure 1; and

Figure 4 is a detail showing the cam development.

Referring now to the drawings wherein like reference numerals designate like parts, the reference numeral 10 designates the main shaft of the reel and is rotatably supported adjacent its ends in outboard bearings (not shown) appropriately mounted in the machine. An end plate 12 having a central hub 14 is fixedly secured to the shaft 10 by means of a set screw 16. An end plate 20, disposed in spaced relationship to the end plate 12, is rotatably positioned on a drive sleeve 22 rotatably mounted with respect to the shaft 10.

The end plate 12 and the end plate 20 are provided circumferentially thereof with a plurality of spaced bushed holes 26 and sleeved journals 28 respectively. Each pair of correspondingly positioned holes 26 and journals 28 are in alignment and constitute bearings in which the trunnions 32 and 34 respectively of a yarn-supporting bar 30 are rotatably and slidably mounted. Due to this construction, the yarn-supporting bars 30 are arranged in spaced relationship with respect to each other and circumferentially of the reel. Any number of yarn bars 30 can be used, but such a number of yarn bars 30 are used as to form, as nearly as possible, a true circle at the periphery of the reel.

Intermediate the ends of the trunnion 34, there is provided a cam-supporting plate 40 having a central hub 41 which is fixedly secured to the shaft 10 by means of set screws 42. Each trunnion 34 extends through a bushed hole 44 in the cam-supporting plate 40, which is in alignment with the journals 28 and also constitutes a bearing for the trunnion 34. Adjacent each bushed hole 44, a cam 46 is secured to the cam-supporting plate by means of lag screws 48. A cam follower 50 is secured on each trunnion 34 and, as will hereafter be explained, axial movement is imparted to each bar 30 due to the cooperation of the respective cam 46 and cam follower 50 associated with each yarn-supporting bar.

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In the form shown, each cam follower 50 is a pin extending through the respective trunnion perpendicular to the axis thereof, and the protruding ends cooperate with the cam 46.

In the embodiment wherein the main shaft 10 is rotated, the main shaft carries a gear 54 which is driven by a gear 56 on a shaft 58 driven from a suitable source by means not shown, and the end plate 26 has secured thereto a gear 53 which is driven by a gear 55 on the shaft 58. The shaft 10 and the end plate 20 are driven at such speeds that the rates of rotation of the end plates 12 and 20 are the same. This can be accomplished by making the gears 54 and 56 identical with the gears 53 and 55 respectively. Due to this construction, upon rotation of the end plate 20 and shaft 10, the end plate 12 and the cam support plate 40 which are secured to the shaft will rotate therewith and the bars 30 will be revolved about the central axis of the main shaft 10.

As is shown in Figure 2, each of the bars 30 is symmetrical and consists of a flattened roller and has two straight sides 60 and two round (convex) surfaces 62. As also shown in Figure 2, the cross-sectional dimensions of the bars 30 are such that when the straight sides 60 of any bar 30 are parallel to the yarn sheet they are out of contact with the yarn sheet and, when the round surfaces 62 are parallel to the yarn sheet, they are in yarn-supporting and carrying position.

Each of the yarn-supporting bars 30 is rotated about its central axis whereby a straight surface 60 and a round surface 62 will be alternately positioned parallel to the yarn sheet. In the form shown in Figure 1 the rotary movement of each yarn bar 30 about its axis is secured by a planetary gear train in which the main gear 66 is in cooperative relationship with a yarn bar gear 68 carried on the trunnions 34 of the respective bars. The main gear 66 is secured, in any appropriate manner, to the drive sleeve 22, which carries a gear 70 which is in cooperative relationship with a gear 72 on the shaft 58. It is thus apparent that, upon rotation of the sleeve 22, rotary movement will be imparted to each of the trunnions 34 of the respective bars through the planetary gear train.

Each respective cam follower 50 is maintained in contact with its respective cam by means of a spring 74 positioned intermediate a collar 76 on the inner end of the journal 28 and the side of the gear 68. Due to this construction, the spring 74 will continuously urge the trunnion 34 to the left, as viewed in Figure 1, whereby the cam follower 50 will be maintained continuously in contact with its respective cam 46.

As shown in Figure 4, each cam 46 has two straight rises 80 and 82 for approximately 180°, and both of such rises slope in the same direction. As the bar 30 rotates, the follower 50 rises on the cam 46 causing axial movement of the bar in one direction for approximately 180°. Upon reaching this point, the follower 50 drops suddenly back to the 0° point, causing axial movement of the bar 30 in the opposite direction while returning to the 0° point.

Each cam 46 is positioned so that axial movement is transmitted to the bar 30 in the direction of the yarn advancement over the reel while the yarn is engaging the round surface 62 of the bar. When a flattened surface 60 of the bar 30 becomes parallel to the yarn sheet, the bar is out of yarn-contacting position and at this moment the follower 50 passes the 180° point of the cam slope and, by means of the spring 74, axial move-

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ment of the bar 30 is reversed back to the 0° point on the cam.

In the construction shown, for each complete revolution of the bar 30 about its longitudinal axis, the axial movement thereof is reversed twice and, as previously mentioned, the yarn is in contact with a round surface 62 of the bar only while axial movement is imparted to the bar 30 in the direction of the yarn advancement over the reel.

In the embodiment shown in Figure 2, the bars 30 are so arranged that a round surface of every other bar is in yarn-contacting and supporting position while the intermediate bars are out of yarn-contacting position. In this construction, the yarn is carried and advanced by approximately one-half of the yarn-contacting bars while the remaining one-half of the yarn-contacting bars are out of yarn-contacting position.

From the foregoing description, it is manifest that each bar 30, together with its respective trunnions, is also moved axially during operation of the reel. In order that rotation of each bar 30 about its axis is maintained continuously during such axial movements, the gear 68 is provided with a wide face so that, during the axial movements, it will always be in cooperative relationship with the gear 66.

When the reel is relatively long, means are provided to prevent distortion of the bars 30 caused by the yarn tension of the yarn sheet wrapped around the reel and tending to bend the bars inwardly on a long span. The means for preventing such distortion is positioned centrally of the reel and is shown in Figures 1 and 2. Referring to Figures 1 and 2, the reference numeral 86 designates a ring which floats or is rotatably mounted on the shaft 10 and prevented from lateral movement by two collars 88 secured to the shaft 10 by set screws 90. A plurality of segments 92, one cooperating with each bar 30, are hinged to the ring 86 by a flexible vulcanized rubber strip 94 so that in the reposed position each segment is extended perpendicular to the reel axle. When a round surface 62 of a bar in contact with a segment revolves, the lateral movement tips the segment in the same lateral direction. When the flat surface 60 of a bar turns to the point where disengagement with the segment takes place, the segment 92 reflects to its reposed position.

The ends 96 of the segments contacting the rollers are preferably round in shape with a radius taken from the center of the hinge 94. During operation, axial movement of a roller in contact with a segment causes the latter to tip. By making the ends 96 of the segments curved, as described, any roller in contact therewith will not be moved either in or out radially in respect to the reel axis and no tension difference on the advancing yarn sheet will be obtained.

In operation of the reel previously described, a yarn is drawn onto and wound in a helix on the reel to a point where it is to be drawn off the reel. The yarn is disposed on the rounded end 62 of every other yarn bar and the intermediate bars are out of yarn-contacting position. The reel is rotated about the center axis of the main shaft, and also the planetary gear train is actuated so that each bar is rotated about its longitudinal axis. Each spring 74 continuously maintains the follower 50 with which it cooperates in contact with the respective cam 46. So long as the yarn is in contact with a yarn bar, the latter is moved axially in the direction of the yarn advancement over the reel whereby the yarn carried thereby

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is advanced across the reel. Upon reaching the limit of such axial movement, the round end is moved out of yarn-contacting position and the axial movement of the bar is reversed very rapidly. Due to the rotation of each bar, it is positioned alternately in and out of yarn-contacting position.

Preferably, the cam-supporting plate 40 is formed integral with a flange 100 which cooperates with the end plate 20 to form a housing for the elements positioned intermediate the cam support plate 40 and the end plate 20.

In the form described, the shaft 10 is rotated about its own axis. It is to be understood that it can be rotated in either direction. However, it is preferred that the rotation of the shaft 10 be in the direction opposite to the direction of yarn advancement over the reel.

In the preferred form of that embodiment wherein the shaft is stationary, the end plates 12 and 20 as well as the cam plate 40 are also stationary and the yarn advancement obtained by the rotation of the rollers 30. This mode of operation can be obtained by appropriately modifying the drive mechanisms of the reel shown in Figure 1, as by driving only the sleeve 22 and fixedly securing the shaft 10. In such modification, gears 53 and 54 together with the respective drive gears 55 and 56 are omitted.

Instead of reversing one-half of the number of bars at one time, the yarn bars 30 are arranged preferably so that the reversing movement is made in successive order around the reel. Such construction tends to eliminate possible sudden tension changes in the yarn at the reversal of the bars.

The ratio of the planetary gear train, together with the slope of the cams, controls the spacing of the thread wraps on the reel. Thus, the yarn-advancing increment can be made smaller or larger as desired.

Though in the preferred embodiment the quick reversal of axial movement is obtained by a spring, the invention is not restricted to such means. Hydraulic or pneumatic pressure, a fast-acting cam or other means can be used to produce fast reversing movement.

The invention is applicable to yarn or tow composed of continuous films, yarn or tow composed of staple fibers, rope, ribbons, and similar articles of continuous length.

The reel is intended to be used preferably when the shaft 10 is in a horizontal position. Though it has been described as being supported at both ends, it can be supported at one end by a cantilever support.

The yarn advancing reel herein described can be used for the advancement of yarn alone or while it is being processed by appropriate fluids.

The yarn-supporting bars 30 are made of a material which does not deleteriously affect the yarn and which is inert to yarn-processing liquids if used. They can be made of various materials, such as ceramics, stainless steel, alloys of nickel containing a major portion of nickel, such as Hastelloy, etc. depending on the nature of the processing liquids if used.

If the reel is to be of a type which is to stretch the yarn, the round sides may be formed with a taper in accordance with the desired degree of stretch.

The reel can be made self-cleaning by the addition of a brush fastened to the main axle and which would wipe the rounded surfaces of the

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bars as they are turned toward the axle and are not in contact with the yarn sheet.

The invention provides a reel wherein the helically formed wraps of yarn are advanced along the reel spirally instead of a straight line path parallel to the axis of the reel, whereby the yarn is not contacted by the bars repeatedly on the same point and more even distribution of yarn tension, as well as more even exposure to the processing solution (when used), are obtained.

Since it is obvious that many changes and modifications can be made in the above-described details without departing from the nature and spirit of the invention, it is to be understood that the invention is not to be limited thereto except as set forth in the appended claims.

I claim:

1. A reel for continuously advancing yarn in the form of a helix comprising a central reel shaft, a plurality of spaced yarn-contacting bars arranged circumferentially of the reel, each of said bars having two opposite flat sides, each of which when positioned parallel to the yarn sheet on the reel is out of yarn contact, and two opposite round sides, each of which when positioned immediately beneath the yarn sheet on the reel is in yarn-contacting position, means to rotate each of said bars about its respective center axis whereby it will be alternately positioned in and out of yarn-contacting position, means to move each of said bars axially in the direction of yarn advancement when said bar is in yarn-contacting position, and means to move each of said bars axially in the direction opposite to that of the yarn advancement when said bar is out of yarn-contacting position.

2. A reel for continuously advancing yarn in the form of a helix comprising a central reel shaft, a plurality of spaced yarn-contacting bars arranged circumferentially of the reel, means to revolve said yarn-contacting bars about the center axis of said reel shaft, each of said bars having two opposite flat sides, each of which when positioned parallel to the yarn sheet on the reel is out of yarn contact, and two opposite round sides, each of which when positioned immediately beneath the yarn sheet on the reel is in yarn-contacting position, means to rotate each of said bars about its respective center axis whereby it will be alternately positioned in and out of yarn-contacting position, means to move each of said bars axially in the direction of yarn advancement when said bar is in yarn-contacting position, and means to move each of said bars axially in the direction opposite to that of the yarn advancement when said bar is out of yarn-contacting position.

3. A reel for continuously advancing yarn in the form of a helix comprising a central reel shaft, a plurality of spaced yarn-contacting bars arranged circumferentially of the reel, means to revolve said yarn-contacting bars about the center axis of said reel shaft, each of said bars being adapted to be disposed in and out of yarn-contacting position upon rotation thereof about its center axis, means to rotate each of said bars about its respective center axis whereby it will be alternately positioned in and out of yarn-contacting position, a plurality of hinged segments carried on said reel shaft and disposed beneath said bars, each of said segments being in repose normally perpendicular to the reel axis and adapted to engage the lower side of one of said bars when in yarn-supporting position, means to move each of said bars axially in the direction of

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yarn advancement when said bar is in yarn-contacting position, and means to move each of said bars axially in the direction opposite to that of the yarn advancement when said bar is out of yarn-contacting position.

4. A reel for continuously advancing yarn in the form of a helix comprising a central reel shaft, a plurality of spaced yarn-contacting bars arranged circumferentially of the reel, means to revolve said yarn-contacting bars about the center axis of said reel shaft, each of said bars being of such cross-section that upon rotation thereof about its respective center axis it will be alternately disposed in and out of yarn-contacting position, means to rotate each of said bars about its respective center axis whereby it will be alternately positioned in and out of yarn-contacting position, a plurality of hinged segments carried on said reel shaft and disposed beneath said bars, each of said segments being in repose normally perpendicular to the reel axis and adapted to engage the lower side of one of said bars when in yarn-supporting position, means to move each of said bars axially in the direction of yarn advancement when said bar is in yarn-contacting position and means to move each of said bars axially in the direction opposite to that of the yarn advancement when said bar is out of yarn-contacting position.

5. A reel for continuously advancing yarn in the form of a helix comprising a central reel shaft, a plurality of spaced yarn-contacting bars arranged circumferentially of the reel, means to revolve said yarn-contacting bars about the center axis of said reel shaft, each of said bars having two opposite flat sides, each of which when positioned parallel to the yarn sheet on the reel is out of yarn contact and two opposite round sides, each of which when positioned immediately beneath the yarn sheet on the reel is in yarn-contacting position, means to rotate each of said bars about its respective center axis whereby it will be alternately positioned in and out of yarn-contacting position, a plurality of hinged segments carried on said reel shaft and disposed beneath said bars, each of said segments being in repose normally perpendicular to the reel axis

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and adapted to engage the lower side of one of said bars when in yarn-supporting position, means to move each of said bars axially in the direction of yarn advancement when said bar is in yarn-contacting position, and means to move each of said bars axially in the direction opposite to that of the yarn advancement when said bar is out of yarn-contacting position.

6. A reel for continuously advancing yarn in the form of a helix comprising a central reel shaft, a plurality of spaced yarn-contacting bars arranged circumferentially of the reel, means to revolve said yarn-contacting bars about the center axis of said reel shaft, each of said bars having two opposite flat sides, each of which when positioned parallel to the yarn sheet on the reel is out of yarn contact and two opposite round sides, each of which when positioned immediately beneath the yarn sheet on the reel is in yarn-contacting position, means to rotate each of said bars about its respective center axis whereby it will be alternately positioned in and out of yarn-contacting position, a plurality of hinged segments carried on said reel shaft and disposed beneath said bars, each of said segments being in repose normally perpendicular to the reel axis and having a round free end adapted to engage the lower round side of one of the bars when the other round side of the bar is in yarn-contacting position, means to move each of said bars axially in the direction of yarn advancement when said bar is in yarn-contacting position, and means to move each of said bars axially in the direction opposite to that of the yarn advancement when said bar is out of yarn-contacting position.

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REFERENCES CITED

The following references are of record in the file of this patent:

UNITED STATES PATENTS

Number	Name	Date
2,317,747	Ewing	Apr. 27, 1943
2,380,526	Hoagland	July 31, 1945
2,384,963	Pollak	Sept. 18, 1945