

Dec. 25, 1951

C. A. CASTELLAN
THREAD-ADVANCING REEL

2,579,548

Filed Oct. 7, 1947

3 Sheets-Sheet 1

Fig. 1

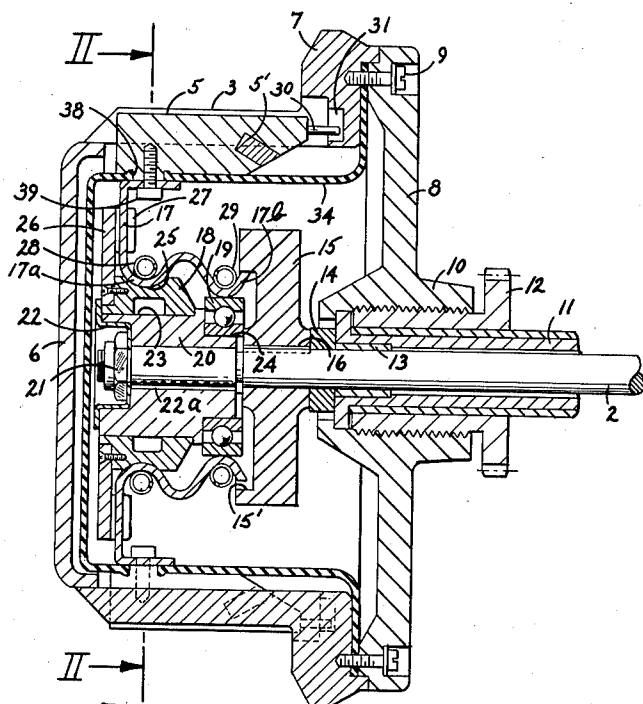
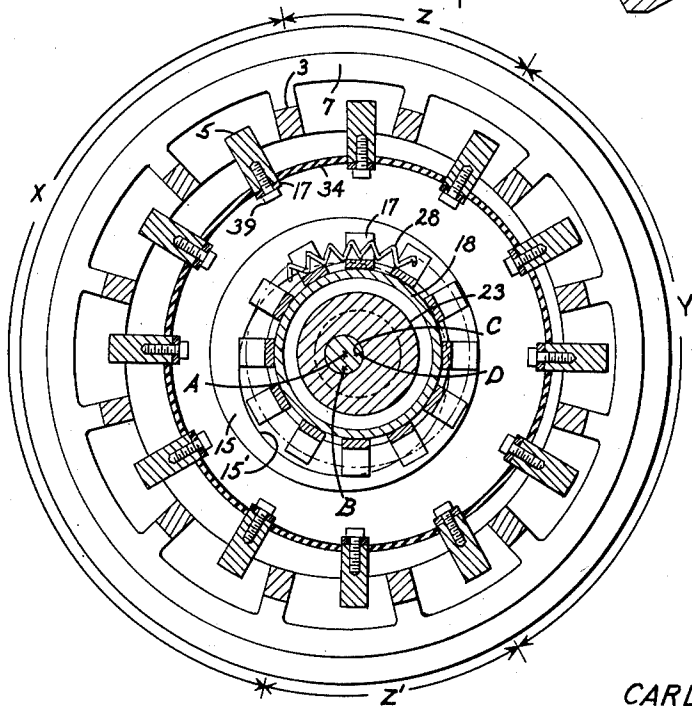


Fig. 2

INVENTOR.
CARL A. CASTELLAN
BY

Thomas R. Mally

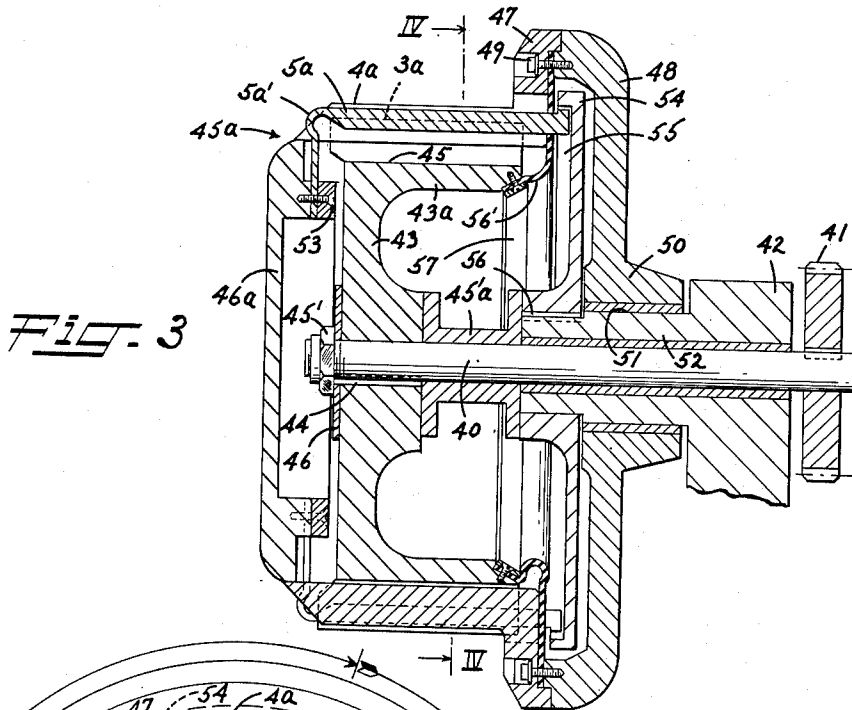
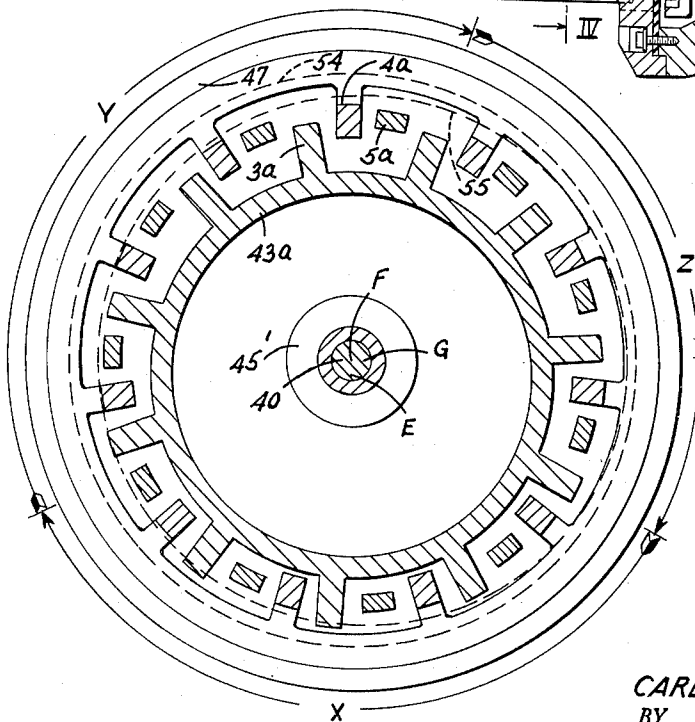
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INVENTOR.
CARL A. CASTELLAN
BY

Thomas R. O'Malley

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3 Sheets-Sheet 3

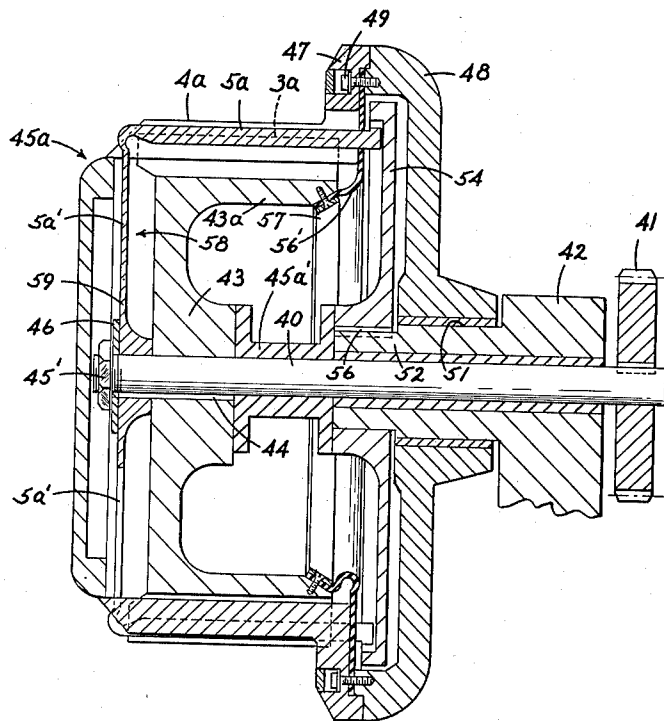


Fig. 5

INVENTOR.
CARL A. CASTELLAN
BY

Thomas R. Mally

UNITED STATES PATENT OFFICE

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THREAD-ADVANCING REEL

Carl A. Castellan, Media, Pa., assignor to American Viscose Corporation, Wilmington, Del., a corporation of Delaware

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10 Claims. (Cl. 28—71.7)

1

This invention relates to thread-conveying devices and more particularly to thread-advancing reels which may be used for the production of a yarn store in the form of a helix which is continuously advanced axially of the periphery of the reel for various purposes. One such purpose may be merely to change the direction of travel of the yarn. Another purpose may be to support the yarn in a plurality of convolutions which may be subjected to fluid treatment as it passes through a helix on the thread-advancing reel. The present application is a continuation-in-part of my copending application Serial No. 638,266, filed December 29, 1945, now Patent 2,446,525.

The present invention provides a distinctly novel type of thread-conveying device or thread-advancing reel of essentially simple construction and involving the utilization of centrifugal force for imparting relative motion between thread-supporting elements for effecting advance of the thread carried by the device. The construction of the present device or reel is of such a character that the bearings and driving mechanism may be readily protected by a relatively simple and inexpensive form of sealing diaphragm or membrane. The device or reel of the present invention may be either of cantilever or double-end supported construction. In one form the thread-conveying device operates to advance the thread axially thereof at one speed of rotation but at another speed, no axial advance occurs. Other advantageous characteristics of the device will be apparent from the drawing and the description thereof hereinafter.

In the drawing, which is illustrative of the invention,

Figure 1 is a transverse cross-section of one embodiment of the invention,

Figure 2 is a section on line II—II of Figure 1,

Figure 3 is a transverse cross-section of a modification,

Figure 4 is a section on line IV—IV of Figure 3, and

Figure 5 is a part of a section of another modification similar to the section of Figure 3.

In general, the devices or reels of the present invention comprise two sets of thread-carrying elements or bars interdigitating with each other and serving to carry the thread roughly in the form of a helix. The two sets of bars rotate about axes which are displaced from one another or offset, preferably with their axis of rotation parallel, though a certain amount of deviation from a strict parallel relationship may be permitted, and means is provided for moving the

2

helix of thread relative thereto endwise of the reel. This means may involve actuating certain of the thread-carrying elements by centrifugal force developed during rotation of the reel. This means may advantageously comprise either of the first two sets of bars or a third set of thread-carrying bars or elements which are actuated during rotation of the device in such a manner as to protrude from the bars of the other set or sets at a certain portion of the cycle of revolution of the device. During such protrusion, these bars carry the thread and their motion comprises a component directed toward one end of the device so as to advance the thread carried thereby endwise of the device, thereby operating as a thread-advancing reel. Thus, the bars projected outwardly by centrifugal force serve to carry the thread that they take from the other bars endwise of the device to an axially displaced position from which the thread is returned to the other bars.

In the embodiment of Figures 1 and 2, the device constitutes a reel mounted for rotation about a fixed shaft 2 and comprises two sets of thread-carrying elements or bars 3 and 5, respectively, the bars of each set, as shown, having thread-conveying peripheral surfaces of approximately the same length, axially of the reel. One set of thread-carrying bars 3 is in the form of a cylindrical cage closed at one end by the plate 6. This cage of bars, which may be termed the concentric cage, has a flange 7 extending outwardly from the periphery of the end of the bars away from the plate 6. The cage is secured to a web or plate 8 by means of cap screws 9. The hub 10 is secured to the driving spindle 11 by means of a nut 12. A bushing 13 is provided between the spindle 11 and the fixed shaft 2 and is so constructed that the bars 3 are concentric with and rotate about the axis of shaft 2. A bushing 14 spaces the end of spindle 11 from a cam 15 keyed to the shaft 2 at 16. The cam surface 15' may be of special shape or it may simply be an eccentric cylindrical surface on the inside face of an axially projecting flange on the rim of cam 15.

The bars of the other set are secured to rigid supporting elements 17 which extend downwardly therefrom and are urged against bearing elements 18 and 19 which are spaced axially from each other and are carried rotatably upon a central bushing 20 fixedly secured to the shaft 2 by means of nut 21, cup-shaped washer 22 and key 22a. The bearing surfaces of the central sleeve 20 which carry the bearing members 18 and 19 are eccentric with respect to the axis of shaft 2 and

3

are designated by numerals 23 and 24, respectively. The axis or axes of revolution of these bearing surfaces 23 and 24 are displaced from the axis of shaft 2, preferably so that they are parallel to the axis of shaft 2, but in a different direction from such axis than the center of the cam surface 15' of cam 15. A small deviation from the parallel may be permissible, but is not desired. Also, the axis of the surface 24 may be coincidental with the axis of surface 23 or it may be displaced further from the axis of shaft 2 than the axis of surface 23, though in the same direction. The location of these centers are as follows: shaft 2 at A, cam surface 15' at B, bearing 23 at C and bearing 24 at D or E. (See Figure 2.)

The bearing member 18 may be provided with an arcuate groove comprising a plurality of seats 25 for receiving the complementarily formed convex foot portion 17a of the supporting elements 17. An annular plate 26 has a plurality of radially extending, axially projecting lugs 27. The radial portion of the supporting elements 17 work slidably within the guideways formed between adjacent lugs 27 thereby limiting angular movement of the bars 5 relative to the bearings 18 and 19. Garter springs 28 and 29, respectively, hold the bases or feet of the supporting elements 17 in contact with the bearing members 18 and 19, respectively. The spring 29 exerts predetermined inward force upon the ends 17b of the supporting elements 17 so that when the speed of rotation of the reel exceeds a predetermined limit, the centrifugal force causes bars 5 to pivot about the centers of seats 25 in opposition to spring 29 until the ends 17b engage the cam surface 15'. Thus, the cam surface 15' controls the rocking or pivoting motion of bars 5. The bars 5 may be weighted with inserts 5' of denser materials, such as lead, to increase the effectiveness of centrifugal force in swinging the weighted ends of the bars.

In order to prevent striking of the bars of each set against those of the other, the bars 5 are provided with endwise projecting pins 30 extending into recesses 31 in the flange 7 carrying the bars 3. Recesses 31 are formed with sufficient play to allow for the eccentricity and other relative movement which are required of the pins carried by the bars as a result of the actuation of the bars during rotation of the reel.

The bearings and driving mechanisms may be protected from processing liquids or gas when it is desired to subject the threads on the reel to such by means of a flexible sealing membrane, such as of rubber, synthetic rubber or the like. Thus, the membrane designated 34 is generally of cup-shape and has its outer periphery clamped between the flange 7 and the plate 8 by means of cap screws 9. This seal is provided with openings 38 through which bossed portions of the bars 5 extend to be secured to supporting elements 17 by means of cap screws 39. The securement at this position is such as to make a tight seal. This membrane 34 is entirely enclosed at its outer end and forms a tight housing about the driving parts and bearings, while permitting relative movement of the bars 5.

In operation, assuming the reel to be rotating in a clockwise direction as viewed in Figure 2, at a speed in excess of that at which centrifugal force exerted on the bars 5 overcomes spring 29, the helix of thread upon the reel at any given instant is carried by the set of bars 3 approximately throughout the fixed arc X; by the bars 5 approximately throughout the fixed arc Y, and by

4

both sets of bars 3 and 5 approximately throughout the fixed arcs Z and Z'. As the turns of the helix leave the fixed arc X they are transferred to bars 5 in arc Z and are entirely carried by the bars 5 in arc Y. Bars 5 are so actuated as to displace the turns endwise of the reel. Preferably, at about the maximum of their displacement, the turns are transferred from bars 5 in arc Z' and are returned therein to bars 3.

This operation is accomplished by virtue of the fact that during rotation of the reel, the two sets of bars 3 and 5 alternately recede and protrude with respect to the adjacent bars of the other set with which they interdigitate. Bars 3 protrude along arc X and bars 5 protrude along arc Y, each set of bars 3 and 5 carrying the thread turns through an arc somewhat less than 180° independently of the other set. This effect is accomplished by virtue of the fact that the centers C and/or D of the bearing surfaces 23 and 24 are displaced eccentrically from the center A in a direction at an angle to the direction of displacement of the center B of the cam surface 15'. The angle between a line drawn from A to B and a line drawn from A to D may vary widely and preferably may be as much as 90°. At 90° angle, the arc Y is a maximum.

Because of the shape of cam surface 15', the bars 5 are alternately rocked under centrifugal force about the center of curvature of the seats 25 to effect alternate protrusion and recession of the bars 5 with respect to bars 3. The rocking during the time of the protrusion of such bars 5 from the bars of the other sets (that is adjacent arc Y) imparts a component of motion to the thread turns carried thereon in the direction to the left or free end of the reel, as viewed in Figure 1.

When the reel is driven at speeds below the critical limit at which centrifugal force actuates the bars 5, it operates as a simple godet or rotor without advancing the turns of the thread axially of the reel.

Figures 3 and 4 show an embodiment comprising three sets of bars having thread-conveying peripheral surfaces of approximately the same length, axially of the reel, two of which 3a and 4a are mounted for rotation about displaced axes, preferably parallel to one another, but the third set of bars 5a is carried by one of the first two sets, and means is provided for actuating the third set of bars to effect alternate protrusion and recession thereof with respect to the other two sets of bars. In this embodiment, a shaft 40, adapted to be driven by gear 41 within a fixed bearing 42, carries a concentric reel member 43 keyed to the shaft at 44. The nut 45' and spacing bushing 45'a serve to prevent axial displacement of the concentric rigid reel member 43. A sealing gasket 46 may be provided. The member 43 has an outer generally cylindrical portion 43a grooved axially or endwise of the reel at 45, thereby leaving the intermediate peripherally spaced parallel reel bars 3a integrally formed on and projecting radially outwardly from the reel member 43. The second set of bars 4a may be formed as the peripheral elements of a rigid cage-like member 45a comprising the flange 47 at one end of the bars 4a secured to the flange or plate 48 by means of cap screws 49. The outer end of the cage is formed with an enclosing plate 46a. The hub 50 is retained upon a bearing surface 51 formed of a boss 52 from the fixed bearing 42. The center of revolution of the bearing 51 is eccentric of the axis of shaft 40 as shown particu-

larly in Figure 4 where the axis of bearing 51 is designated E and the axis of the shaft 40 is designated F.

The third set of bars 5a are secured at one end to the cage-like reel member 45a by means of cap screws 53. Each of the bars 5a comprises a relatively heavy rigid thread-carrying portion extending longitudinally or axially of the reel and a radially inwardly extending flexible portion 5a' connecting the rigid portion to the point of securement to the cage 45a. While the position of securement is shown near the inner periphery of bars 4a, this position may be much nearer to, or even right at, the center of the reel or the center of plate 46a, thereby allowing greater flexing length to the supporting portion 5a' and increasing the axial component of the arc through which the bar 5a is swung. A stationary cam 54 having an internal cam surface 55 is secured by a key 56' to the boss 52 of the fixed bearing 42. The cam surface 55 is constructed to form a controlled path for guiding the bars 5a. For example, in its simplest form, it may be a cylindrical surface having a center disposed at G in Figure 4. In this embodiment, the bars 5a normally take a position parallel to the axis of the reel and are flexed under the action of centrifugal force into engagement with the cam surface 55. The cam surface 55 alternately allows protrusion and forces recession of the bars 5a with respect to the peripheries of the sets of bars 3a and 4a. In this arrangement, the device would act as a simple godet or delivery wheel or drum until a critical speed is attained (which would depend upon the characteristics, particularly the size, of the yarn being handled), when centrifugal force is sufficient to cause the bars 5a to protrude from the periphery of the reel otherwise defined by the other sets of bars.

The bearings and driving mechanism may be protected by a simple annular seal 56' of flexible material having its inner periphery secured to the outer cylindrical portion 43a of the concentric reel member by means of a ring 57 and with its outer periphery clamped between flanges 47 and 48 by means of cap screws 49. Thus each of the bars 5a extends through an aperture in membrane 56' with which it makes a tight sealing engagement.

Rotation of the reel by driving of gear 41 causes alternate protrusion and recession of bars 3a and 4a with respect to each other. In addition, during such rotation, bars 5a are caused to protrude by centrifugal force under the control of the cam surface 55, such protrusion occurring along the fixed arc designated Z in Figure 4. The springing of the bars 5a to effect such protrusion imparts a component of motion to the threads carried thereby in a direction endwise of the reel and when the bars have attained approximately their maximum deflection, the threads are picked up by bars 3a and subsequently by the bars 4a.

Figure 5 illustrates a modification in which the construction of the reel is substantially the same as in Figures 3 and 4 except for the third set of bars 5a which, instead of being mounted upon the reel cage 45a, are carried by a spider 58 having a hub 59 secured to the shaft 40 for rotation therewith by means of the nut 45 which also clamps the concentric reel member 43. The individual flexible and resilient arms 5a' connecting the hub 59 with the bars 5a gives a greater length of material to be flexed so that

a longer flexing life can be expected of the reel system. Also, by flexing from the hub 59, the arc of swinging of bars 5a has the maximum possible axial component.

The various parts of the reel may be made of various materials, depending upon the conditions of use of the reel. For example, if the reel is to be subjected to corrosive liquids the parts of the reel exposed to such liquids and not protected by the flexible sealing means, are made of a material capable of resisting the attack of such processing fluids. Examples of such compositions are stainless steel, Hastelloy, other special metallic alloys; phenol-aldehyde resin products, such as Bakelite, Durez; or even of non-resistant metals covered by a protective material, such as rubber, Heresite, vinyl resins, such as polymers of vinyl chloride and also copolymers thereof. The flexible arms carrying bars 5a in the embodiment of Figures 3 to 6 may advantageously be formed of a fabric-reinforced phenolaldehyde resin or of a coated metal, thereby obtaining in each case a flexible and resilient mounting.

The reel of the present invention is of simple and inexpensive construction and can readily be sealed against attack of its bearings and driving connections by processing fluids that may be applied to the thread carried by the reel.

It is to be understood that changes and variations may be made without departing from the spirit and scope of the invention as defined in the appended claims.

I claim:

1. A thread-handling device adapted to convey thread carried in convolutions thereabout comprising a plurality of interdigitating sets of longitudinally extending bars forming the periphery of the reel, means for rotating the reel about its axis, the bars of at least one set being relatively movable by centrifugal force developed during rotation of the reel between recessed and protruding positions relative to other bars adjacent thereto to effect transfer of the thread in sequential order to the bars of the several sets, and a cam for controlling the relative movement to effect advance of the thread axially of the reel, said cam having, as its sole effective cam surface, an inwardly facing cam surface for limiting the outward movement of the movable bars caused by centrifugal force.

2. A thread-handling device adapted to convey thread carried in convolutions thereabout comprising a plurality of interdigitating sets of longitudinally extending bars forming the periphery of the reel, means for rotating the reel about its axis, the bars of at least one set being relatively movable by centrifugal force developed during rotation of the reel between recessed and protruding positions relative to other bars adjacent thereto to effect transfer of the thread in sequential order to the bars of the several sets, resilient means urging the movable bars to one of said positions, in opposition to centrifugal force, and a cam for controlling the protrusion of the movable bars to effect advance of the thread axially of the reel, said cam having, as its sole effective cam surface, an inwardly facing cam surface for limiting the outward movement of the movable bars caused by centrifugal force.

3. A thread-handling device adapted to convey thread carried in convolutions thereabout comprising a plurality of interdigitating sets of longitudinally extending bars forming the periphery of the reel, means for rotating the reel about its axis, the bars of at least one set being

7

relatively movable by centrifugal force developed during rotation of the reel from recessed to protruding positions relative to other bars adjacent thereto to effect transfer of the thread in sequential order to the bars of the several sets, resilient means urging the movable bars to the recessed position, and a cam for controlling the protrusion of the movable bars under the influence of centrifugal force to effect advance of the thread axially of the reel, said cam having, as its sole effective cam surface, an inwardly facing cam surface for limiting the outward movement of the movable bars caused by centrifugal force.

4. A device in accordance with claim 3 in which the movable set of bars is mounted for rotation upon an axis displaced from that of another set of bars.

5. A device in accordance with claim 3 in which the movable set of bars is mounted for rotation upon an axis displaced from, and parallel to, that of another set of bars.

6. A thread-handling device adapted to convey thread carried in convolutions thereabout comprising a plurality of interdigitating sets of longitudinally extending bars forming the periphery of the reel, means for rotating the reel about its axis, the bars of at least one set being relatively movable by centrifugal force developed during rotation of the reel from recessed to protruding positions relative to other bars adjacent thereto to effect transfer of the thread in sequential order to the bars of the several sets, resilient supporting means for the movable bars normally tending to retain the movable bars in recessed position, and cam means for controlling the protrusion of the movable bars to effect advance of the thread axially of the reel.

7. A device in accordance with claim 6 in which the movable set of bars is mounted for rotation upon an axis displaced from, and parallel to, that of another set of bars.

8. A thread-handling device adapted to convey thread carried in convolutions thereabout comprising a set of longitudinally extending bars rotatable about an axis, a second set of bars interdigitating with those of the first set mounted for rotation about an axis displaced from the axis

8

of rotation of the first set, and means interdigitating with the two sets of bars and movable by centrifugal force developed during rotation of the device for moving the thread relative to the two sets of bars in a direction comprising a component parallel to the axis of the device.

9. A thread-handling device adapted to convey thread carried in convolutions thereabout comprising a set of longitudinally extending bars rotatable about an axis, a second set of bars interdigitating with those of the first set mounted for rotation about an axis displaced from the axis of rotation of the first set, means interdigitating with the two sets of bars and movable by centrifugal force developed during rotation of the device for moving the thread relative to the two sets of bars in a direction comprising a component parallel to the axis of the device, and controlling means for effecting alternate engagement and disengagement of the moving means with the thread during rotation of the device.

10. A thread-advancing reel comprising three sets of interdigitating bars forming a generally cylindrical thread-carrying periphery, at least one set of the bar members being mounted for rotation about an axis eccentric to the axis of rotation of at least one other set of bars, resilient supporting means for a third set of bars, whereby centrifugal force imparts motion to the third set of bars comprising a radial and axial component relative to the bars of the other sets, and a cam surface engaged by the bars of the third set for limiting the motion imparted by the centrifugal force.

CARL A. CASTELLAN.

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