June 10, 1952 C. A. CASTELLAN 2,599,692

THREAD-ADVANCING REEL

Filed Sept. 26, 1947 3 Sheets-Sheet 1

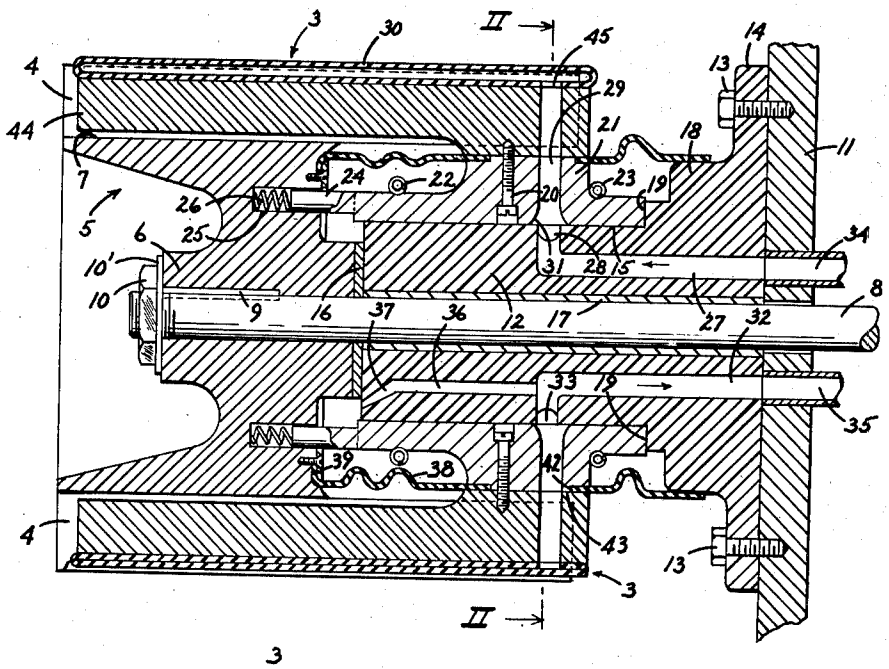


Fig. 1

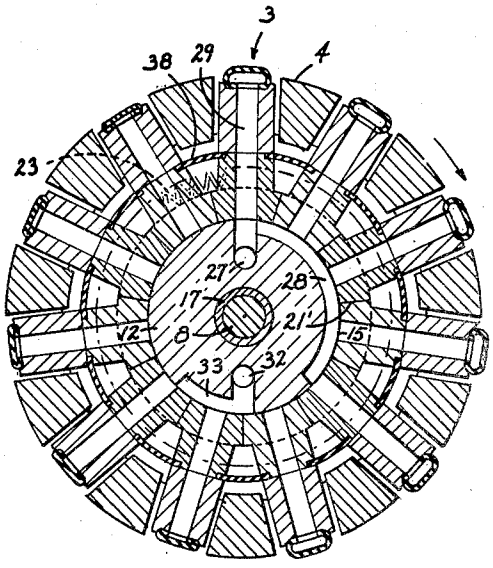


Fig. 2

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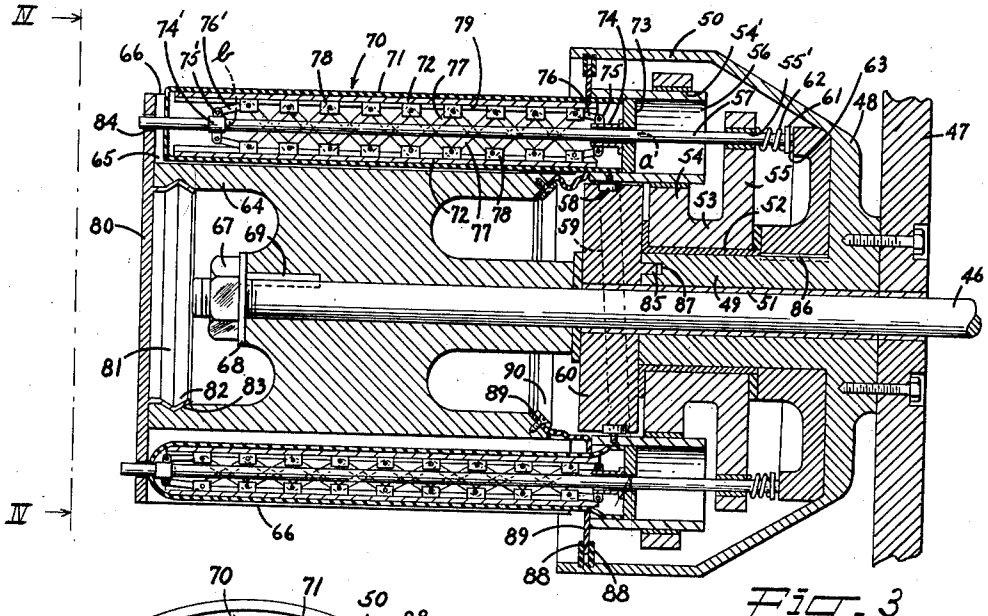


Fig. 3

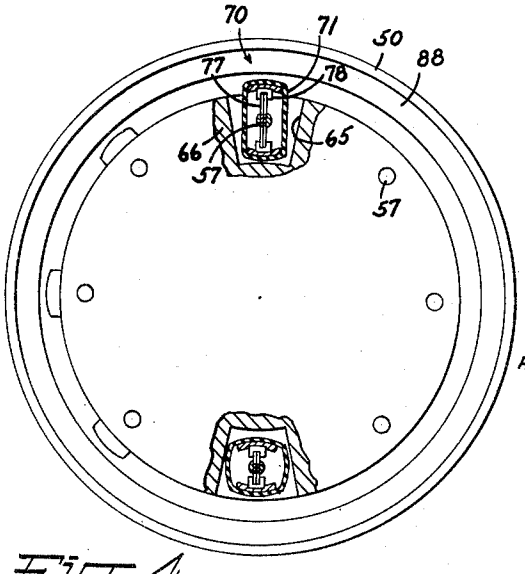


Fig. 4

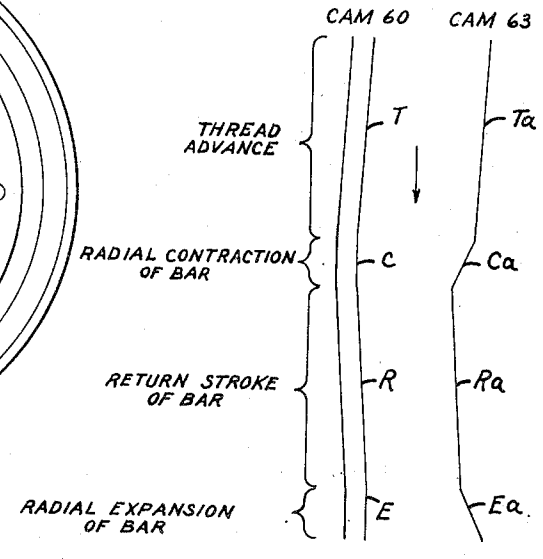


Fig. 5

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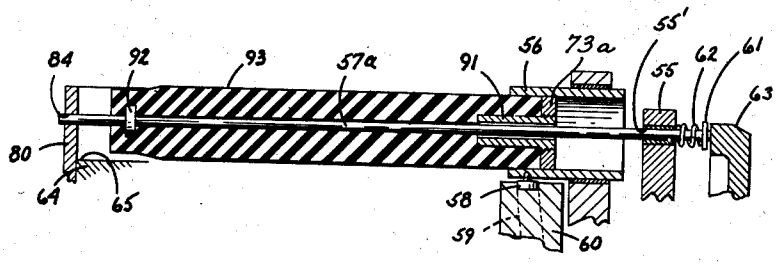


Fig. 6.

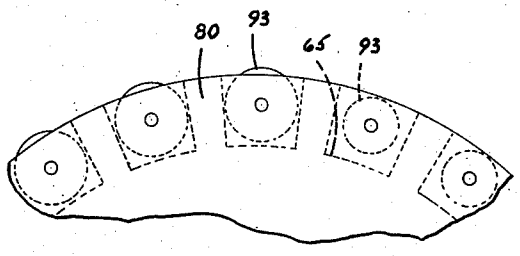


Fig. 7

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UNITED STATES PATENT OFFICE

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THREAD-ADVANCING REEL

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Application September 26, 1947, Serial No. 776,379

19 Claims. (Cl. 28—71.7)

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This invention relates to thread-advancing reels and is primarily concerned with a novel form of reel embodying a new principle of construction and operation.

It is an object of the present invention to provide a thread-advancing reel which does not require the provision of eccentric or askew axes for mounting certain of the thread-carrying bars thereof. Another object of the invention is to provide a form of reel utilizing bars for carrying the thread which are expansible and contractible in a generally radial direction relative to the reel. Other objects and advantages of the invention will be apparent from the drawing and the description thereof hereinafter.

In the drawing, which is illustrative of preferred embodiments of the invention:

Figure 1 is an axial cross-section through one embodiment,

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

Figure 3 is an axial cross-section through a modification,

Figure 4 is an end view with the topmost and lowermost bars shown in section taken on lines IV—IV of Figure 3,

Figure 5 is a developed view of the cam grooves of the reel in Figure 3,

Figure 6 is a longitudinal cross-section through a modified form of expansible bar which can be substituted for that shown in Figure 3, and

Figure 7 is an end view of an upper portion of a reel embodying bars of the type shown in Figure 6.

The thread-advancing action of reels constructed in accordance with the present invention involves the lifting of the thread from one set of bars by the radial expansion of another set of bars so that the outer surface of the second set project beyond the periphery defined by the bars of the first set. After the expanded bars lift the thread from the other bars, such expanded bars are moved axially to advance the thread and after such movement, they are contracted radially so that their outer surfaces are retracted to positions within the periphery defined by the other set, at which time they can be moved back in preparation for the subsequent expansion and thread-advancing stroke. One or both sets of bars may be radially expansible in this manner, it being only necessary when both sets are expansible that each set be expanded at a part of the cycle of operations during which the other set is in a contracted condition.

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Accordingly, the reel of the present invention comprises a plurality of bars, certain of which are radially expanded relative to certain other bars alternating therewith at one part of the cycle of rotation and radially contracted relative to the other set of bars at a succeeding part of the cycle of rotation and either or both sets may be moved while carrying the thread to advance the thread toward one end of the reel.

Figures 1 and 2 illustrate one form of the invention comprising a plurality of radially expansible and contractible bars 3 and these bars interdigitate with bars 4 which may also be radially expansible and contractible, but as shown, the bars 4 are of rigid construction, being formed at the outer periphery of a generally cylindrical member 5 having a hub 6 by grooving such periphery in a generally axial direction. The bottom of the grooves are indicated at 7. The rotatable member 5 is secured to a driving shaft 8 for rotation therewith such as by means of a key 9, a nut 10 and washer 10'. The shaft 8 projects through a frame member 11 and through a sleeve 12 which is secured to the frame member 11 by means of cap screws 13 extending through the flange 14 and has a projecting cylindrical bearing surface 15. Between the end of the sleeve 12 and the hub 6, there is provided a bearing washer 16 and a bushing 17 may be provided between the shaft and the sleeve. Adjacent the shoulder 18 there may be provided on the sleeve 12 a cam having an annular cam surface 19. The expansible and contractible bars 3 are secured by screws 20 to shoes 21 axially slidable on the surface 15. As shown clearly in Figure 2, the base portion of the shoes may be of wedge shape to provide lateral bearing planes 21' between adjacent shoes. Springs 22 and 23 surround the axially projecting portions of these shoes and press them against the surface 15. These shoes have axially projecting rods 24 extending into bores 25 within the rotatable member 5 and springs 26 bearing against the pins 24 urge the shoes against the cam surface 19 at all times.

The stationary sleeve 12 is provided with a bore 27 terminating in an arcuate port 28 extending circumferentially about the sleeve and communicating with the bore 29 extending through the shoe and the bar to an inflatable element 30 at the outer periphery of the bar. Element 30 may be made of rubber, substitute or synthetic rubber and normally takes the flattened or deflected condition shown at the bottom of Figures 1 and 2 unless inflated. The passage

29 is provided with a widened port 31 to assure intercommunication between port 28 and bore 29 regardless of the axial portion of the shoe which depends upon the position thereof relative to the cam.

An axially extending bore 32 communicates with a port 33 extending circumferentially about the sleeve 12 and approximately in the same axial plane as that of port 28. A conduit 34 serves as the inlet to passage 27 and is connected to any suitable source of fluid, either liquid or gaseous. Compressed air is of advantage for reasons of economy though water supplied under pressure may be used. The passage 32 is connected to a conduit 35 which may simply be open to the atmosphere. Optionally, a passage 36 may communicate with port 33 either exclusively or along with passage 32 and this passage 36 terminates in a port 37 opening to the interior of the reel. It may co-operate with the sleeve-like sealing boot 38 to prevent entrance of corrosive liquids into the bearing system by creating a pressure above atmospheric within the boot. The sleeve sealing boot 38 may be secured at one end by a ring 39 and the other end may simply have a sliding fit around the shoulder 18 on the sleeve 12. The sleeve sealing membrane 38 is provided with openings at 42 in the plane of which the juncture 43 between the shoe and the bar is made so that the edge of the membrane surrounding the opening is clamped between the shoe and the bar in tight sealing engagement.

The inflatable element 30 extends longitudinally and forms the outer periphery of the bar. It may simply consist of a long rubber tube which normally takes a deflated form as shown at the bottom of Figures 1 and 2. The lower surface of the tube is secured to the longitudinally extending rigid supporting structure or bar-like element 44, such as by cement, an adhesive, or by vulcanization. This securement may be provided over the entire width of the tube or it may be only along a central strip thereof extending the entire length of the bar and, of course, surrounding the opening 45 by which the fluid is introduced into the tube.

In operation, the shaft 8 is driven which rotates the member 5 and the bars 3. As the shoes 21 pass over the port 23, fluid is forced into the tubes 30 which then lift the yarn or thread off the bars 4. After this lifting, the cam surface 19 slides the bars 3 to advance the thread, preferably toward the free end of the reel (that is, to the left of Figure 1). Thereafter, the shoes reach a dwell portion of the cam surface 19 and then pass over the port 33 so that the fluid in tubes 30 is discharged. When this discharge occurs, the thread is transferred to the bars 4 and the shoes of the bars 3 then proceed over a portion of cam surface 19 which allows them to be returned under the action of springs 26 in preparation for subsequent inflation and thread-advancing motion. The discharge of the fluid, especially if it is air or other non-corrosive material, such as oil, through passage 36 into the region surrounding the working parts within the flexible sealing membrane 38 prevents any corrosive liquids or gases from entering such region through the sliding juncture between the seal 38 and shoulder 18.

Figures 3 to 5 illustrate a modification comprising a drive shaft 46 extending through the frame member 47 to which is secured a member 48 having a sleeve projection 49 and a hood or shroud 50. A bushing 51 may be provided between the shaft 46 and the sleeve 49 and on the

outside of the sleeve another bushing 52 is provided between it and a supporting member 53. The supporting member 53 is provided with axially spaced disc-shaped members 54 and 55, each having bushed openings 54' and 55' respectively disposed in circular rows. A plurality of sleeves 56 are axially slidable within the bushed openings 54' within the member 54 and rods 57 disposed concentrically within the sleeve 56 are axially slidable within the bushed openings 55' of the member 55.

The sleeves 56 are provided with cam follower rolls 58 which ride in a cam groove 59 in a cam 60. Rods 57 are provided with collars 61 and springs 62 bearing against the collars press the ends of the rods 57 against a cam 63.

At its outer end, the shaft carries a generally cylindrical member 64 having a plurality of peripheral grooves 65 extending parallel to the axis, which grooves leave a plurality of thread-carrying lands or bars 66 therebetween. A nut 67 and washer 68 serve to hold the assembly upon the shaft 46 and a key 69 assures rotation of member 64 with the shaft.

Within the peripheral grooves 65 of the member 64 a plurality of expansible bars 70 are provided. Such bars comprise the centrally disposed rod 57, an external elastic sleeve 71 (such as of rubber, or synthetic or substitute rubbers) a pair of long shoes or plates 72 extending parallel to each other and disposed so that one is radially outwardly spaced from the other and serves to support the elastic sleeve or tube 71 and any thread convolutions surrounding the reel periphery and is in contact with the elastic tubes. Each of the tubes 71 is secured at one end to the inside periphery of a sleeve 56 and to a plate or disc 73 fixed within the sleeve 56. The securement may be effected by any suitable cement or adhesive, or by direct vulcanization thereto. A collar 74 secured to the plate 73 carries ears or lugs 75 to which are pivotally secured links 76 which constitute the end links of a lazy-tong lever system comprising a plurality of intermediate links 77 which are pivotally connected together where they cross one another and have their ends pivotally joined to shoes 78 which slidably engage within a groove 79 within the plate 72. The rod 57 is slotted from point *a* to point *b* (Figure 3) to accommodate the crossed links 77 slidably between the lateral sections of the rod 57. End links 76' are secured to ears 75' on a collar 74' fixed to rod 57. Advantageously, the end shoes 78' adjacent collar 74 may be secured rigidly to the plates 72 whereas the remainder of such shoes 78 are adapted to slide in the grooves 79 on plate 72.

An end plate 80 may be secured to the outer end of the reel member 64, such as by means of a spring metal disc 81 secured thereto having the spring prongs 82 adapted to resiliently grip an annular recess or groove 83 provided within the member 64. The plate 80 is provided with a plurality of bores 84 through which rods 57 are adapted to reciprocate.

The member 64 and expansible bars 70 are rotated by the shaft 46 relative to cams 60 and 63 which may be prevented from rotation by means of one or more pins 85 and a key 86 respectively. The pin 85 projects into a bore 87 within the sleeve 49 and the key 86 secures cam 63 to the sleeve 49 to prevent its rotation.

The space occupied by the bearings may be protected from the action of any liquids showered upon threads carried on the reels by providing a

labyrinthine seal comprising one or more inwardly projecting rings 88 within the inner periphery of the hood 50 adjacent the outer ends of sleeves 56 and another flexible ring 89. The ring 89 may be secured to the member 64 by means of a ring 90 and may be provided with openings adapted to surround the expansible bars 71 and to be secured to the outer ends of the sleeves 56 from which the expansible bars project. The ring 89 may be provided with accordion-like annular pleats between its positions of securement to the member 64 and the sleeves 56 to allow relative axial motion therebetween. Advantageously, the rings 88 and 89 may be formed of any flexible material, such as leather, rubber, synthetic or substitute rubbers.

Figure 5 shows the developed cam groove of cam 60 and the path of cam after projected upon a common cylindrical plane 63 and the legends adjacent the cam tracks indicate the effect of the cams upon the operation of the reel. The arrow indicates the direction of travel of the followers and it will be noted that the portions T and T*a* of the cam tracks at the top of Figure 5 are parallel and the bars 70 are in radially expanded condition so that they carry the thread convolutions thereon. The parallel portions of the cam tracks cause both the rod 57 and the sleeve 56 (carrying the bar 70 associated therewith) to move to the left as viewed in Figure 3, thereby advancing the thread toward the free end of the reel. At the end of this parallel portion of the cam tracks, cam 60 turns back so that the center line of the follower 58 follows a circular arc C in a plane at right angles to the axis of the reel, whereas the track C*a* of cam 63 is inclined at a much sharper angle to such a plane than its previous portion T*a*. This causes the rod 57 to move further to the left, thereby moving the collar 74′ with it and expanding the lazy-tong lever system lengthwise. In so expanding the lazy-tong lever system, the radial dimension thereof is contracted as viewed at the bottom of Figures 3 and 4. When this contraction occurs, the thread convolutions are returned to the bars 66 of the reel member 64 and it will be noted that the next portions R and R*a* of the cam tracks return the rod 57 with the sleeve 56 (and the bar carried thereby) as a unit while maintaining the bar in the contracted condition. This is accomplished by making cam track portions R and R*a* parallel. When the expansible bar has thus been returned, cam 6 veers back into an arc E in a plane which is at right angles to the axis of the reel and cam 63 changes along E*a* to a direction inclined more steeply relative to such a plane so that rod 57 is moved axially toward the right as viewed in Figure 3 which causes shortening of the lever tong system and radial expansion of the bar 70. This causes bars 70 to protrude from, and lift the thread from, the periphery of bars 66 in preparation for another thread-advancing cycle.

As in the embodiment of Figures 1 and 2, that of Figures 3 to 5 also utilizes a plurality of expansible and contractible bars which are mounted concentrically with respect to the axis of rotation of the reel and when the other set of bars are of rigid construction as shown, the reel may be considered to be constituted of two sets of bars rotated about the same axis. Each set is concentrically related to that of the other.

Figures 6 and 7 illustrate a modification of an expansible and contractible bar adapted to be substituted for that shown in Figures 3 to 5. It

consists of a rod 57*a* slidable in the bushed opening 55′ of the disc 55 and having a collar 61 and a spring 62 by which it is urged against the cam 63 as in the embodiment of Figures 3 to 5. This rod projects and is slidably mounted within a sleeve 91 which may be threadedly secured within a plate 73*a*, in turn secured within a sleeve 56, such sleeve having a follower 58 co-operating with the groove 56 of a cam 60 as in Figures 3 to 5. The rod 57*a* may be of cylindrical or any other cross-section and is provided toward its outer end with an enlarged ring or flange 92 from which it has a continuation or extension projecting through a bore 84 within the plate 80 as in Figures 3 to 5. A rubber tube 93 surrounds the rod 57*a* and is secured to the sleeve 91, plate 73*a*, and sleeve 56 at one end and to the ring or flange 92 at the other end. The rod 57*a* is not secured to the inside wall of the tube 93 except adjacent the enlarged ring or flange 92. The tube 93 is formed of an elastic material which normally tends to contract lengthwise and has a peripheral wall of such a thickness that in changing from contracted to fully expanded condition longitudinally (which change is effected by forcing the shoulder 92 further away from the sleeve 91 in response to the movement of cam 63), the effective diameter of the bar is reduced so as to recede entirely into the groove 65 of the reel member 64, whereas in being shortened upon the movement of flange 92 in the opposite direction, the peripheral wall thickness of tube 93 increases to such an extent as to project out beyond the periphery defined by bars 66 and lift the thread convolutions therefrom. Rubber is a good example of such a material and synthetic and substitute rubbers having rubbery elasticity may also serve this purpose. The cross-section of the sleeve 93 may be circular or oval as shown in Figure 7, but when oval, the long transverse dimension or axis is preferably disposed radially of the reel.

The tracks of cams 60 and 63 of this embodiment may correspond in every way to those shown in Figure 5. Regardless of which form of expansible and contractible bar is employed, however, the cam tracks shown in Figure 5 may be varied widely. For example, instead of effecting thread advance during approximately 150° rotation, as shown in Figure 5, the thread advance may be effected in a much shorter arc or it may occupy a much longer arc. Similarly, the radial contraction of the bar may be effected more or less quickly than shown and this is true also of the return stroke and radial expansion of the bar.

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-advancing reel comprising a plurality of generally parallel bars, alternate ones of the bars being reciprocable longitudinally and being expansible and contractible in a transverse direction extending generally radially of the reel, said alternate bars having, at least when in contracted condition, their centers disposed concentrically about a common axis of rotation, the other bars being rigid and having their centers disposed concentrically about said common axis of rotation generally parallel to their length, means for rotating the reel about its axis, means for selectively contracting and expanding said alternate bars in succession during rotation of the reel to protrude and retract respectively at

predetermined times their outer surfaces relative to the outer surfaces of the intervening bars, and means for moving said bars toward one end of the reel when they protrude relative to the other bars and toward the other end of the reel when they are retracted relative to the other bars.

2. A thread-advancing reel comprising a rotatable member having a plurality of axially extending lands alternating with grooves at the outer periphery of the member, a plurality of expansible and contractible longitudinally reciprocable bars disposed longitudinally in the grooves and mounted for rotation about the axis of rotation of the rotatable member, the expansible and contractible bars being mounted with their centers disposed concentrically about the axis of the reel and the surfaces of the lands being concentric with respect to said axis, means for selectively contracting and expanding said bars in succession during rotation of the reel to project and retract respectively at predetermined times their outer surfaces relative to the outer surfaces of the intervening lands, and means for sliding the bars toward one end of the reel when they project and toward the other end of the reel when they are retracted relative to the lands.

3. A thread-advancing reel in accordance with claim 2 in which the expanding and contracting means comprises a stationary cam and the sliding means comprises a stationary cam.

4. A thread-advancing reel comprising a plurality of longitudinally extending bars laterally spaced apart from each other, alternate ones of the bars being longitudinally reciprocable and being expansible and contractible in a transverse direction extending generally radially of the reel, said alternate bars having, at least when in contracted condition, their centers disposed concentrically about a common axis of rotation, the other bars being rigid and having their centers disposed concentrically about said common axis of rotation and providing in conjunction with the aforesaid alternate bars a reel circumference adapted to carry convolutions of thread, said expansible and contractible bars each comprising an inflatable member, means for rotating the reel about its axis, means for selectively inflating and deflating the inflatable member to cause said alternate bars in succession during rotation of the reel to protrude and retract respectively at predetermined times their outer surfaces relative to the outer surfaces of the intervening bars, and means for moving said reciprocable bars toward one end of the reel when they protrude relative to the other bars and toward the other end of the reel when they are retracted relative to the other bars.

5. A reel in accordance with claim 4 in which each inflatable member is disposed at the outer periphery of its respective bar and the outer surface of the inflatable member serves to carry the thread when expanded.

6. A thread-advancing reel comprising a rotatable member having a plurality of axially extending thread-supporting lands alternating with grooves at the outer periphery of the member, a stationary sleeve, an inlet port and a discharge port in such stationary sleeve, axially reciprocable shoes having ports, a bar on each of said shoes extending longitudinally in each of the grooves, an inflatable element on the surface of each of said bars, the ports in said shoes being arranged to communicate with the inflatable elements on said bars, and means for axially reciprocating the shoes and for rotating said shoes about the stationary sleeve to selectively connect the port in each shoe in succession with the inlet port and then in succession with the discharge port.

7. A thread-advancing reel comprising a rotatable drive shaft, a member having a plurality of axially extending lands alternating with grooves at the outer periphery of the member, said member being mounted on the shaft to be driven thereby, a rotatable supporting element, a plurality of bearings in the element having their centers disposed in a circle concentric with the axis of the element, a plurality of sleeves slidably mounted in the bearings, expansible bars carried by the sleeves and projecting into the grooves of the rotatable member, a cam for reciprocating the sleeves in the bearings, and cam means for expanding the bars.

8. A thread-advancing reel in accordance with claim 7 in which the bars comprise an elastic sleeve about a central rod, the elastic sleeve is secured at one end within the first-mentioned sleeve, and the rod carries a cam follower for cooperating with the cam means for expanding the bars.

9. A thread-advancing reel in accordance with claim 8 in which the rod is secured to the elastic sleeve adjacent one end thereof and projects through the other end of the elastic sleeve to the cam follower.

10. A thread-advancing reel in accordance with claim 8 in which a lazy-tong lever system is connected to the rod within the elastic sleeve adjacent its free end and rigid bearing plates are carried by the lever system within the elastic sleeve.

11. A thread-advancing reel comprising a rotatable drive shaft, a member having a plurality of axially extending lands alternating with grooves at the outer periphery of the member, said member being mounted on the shaft to be driven thereby, a rotatable supporting element, a plurality of bearings in the element having their centers disposed in a circle concentric with the axis of the element, a plurality of sleeves slidably mounted in the bearings, expansible bars carried by the sleeves and projecting into the grooves of the rotatable member, a stationary cam for reciprocating the sleeves in the bearings, and stationary cam means for expanding the bars.

12. A thread-advancing reel in accordance with claim 11 comprising a shroud about the driving elements at one end thereof and an annular labyrinthine seal between the shroud and the rotatable member.

13. A thread-advancing reel comprising a plurality of generally parallel bars, alternate ones of the bars being longitudinally reciprocable and being expansible and contractible in a transverse direction extending generally radially of the reel, said alternate bars having, at least when in contracted condition, their centers disposed concentrically about a common axis of rotation, the other bars being rigid and having their centers disposed concentrically about said common axis of rotation, said axis of rotation being generally parallel to the bars, means for rotating the reel about its axis, cam means for alternately contracting and expanding said alternate bars during rotation of the reel to alternately protrude and retract their outer surfaces relative to the outer surfaces of the intervening bars, and cam means for moving said bars toward one end of the reel when they project relative to the other

bars and toward the other end of the reel when they are retracted relative to the other bars.

14. A thread-advancing reel in accordance with claim 13 in which the bars comprise an elastic sleeve about a central rod, the elastic sleeve is secured at one end to the cam means for moving the bars, and the rod is reciprocated by the cam means for expanding the bars.

15. A thread-advancing reel in accordance with claim 13 in which the bars comprise an elastic sleeve about a central rod, the elastic sleeve is secured at one end to the cam means for moving the bars, and the rod is secured to the elastic sleeve adjacent one end thereof and projects through the other end of the elastic sleeve into engagement with the cam means for contracting and expanding the bars.

16. A thread-advancing reel in accordance with claim 13 in which the bars comprise an elastic sleeve about a central rod, a lazy-tong lever system is connected to the rod within the elastic sleeve adjacent its free end, and rigid bearing plates are carried by the lever system within the elastic sleeve.

17. A thread-advancing reel comprising a plurality of longitudinally extending bars laterally spaced apart from each other about a common axis of rotation and providing a reel circumference, alternate ones of the bars being longitudinally reciprocable and comprising an inflatable member which upon inflation and deflation is expansible and contractible in a transverse direction extending generally radially of the reel, means for rotating the reel about its axis, means for selectively inflating and deflating the inflatable members of said alternate bars in succession during rotation of the reel to protrude and retract respectively at predetermined times their outer surfaces relative to the outer surfaces of the intervening bars, means for moving said bars toward one end of the reel when they protrude relative to the other bars and toward the other end of the reel when they are retracted relative to the other bars, a sealing element for enclosing the moving means, and means for creating a fluid pressure above atmospheric within the element.

18. A thread-advancing reel comprising a plurality of longitudinally extending bars laterally spaced apart from each other about a common axis of rotation and providing a reel circumference, alternate ones of the bars being longitudinally reciprocable and being expansible and contractible in a transverse direction extending generally radially of the reel, means for rotating the reel about its axis, means for selectively contracting and expanding said alternate bars in succession during rotation of the reel to protrude and retract respectively at predetermined times their outer surfaces relative to the outer surfaces of the intervening bars, means for moving said bars toward one end of the reel when they protrude relative to the other bars and toward the other end of the reel when they are retracted relative to the other bars, a sealing element for enclosing the moving means, and means for creating a fluid pressure above atmospheric within the element.

19. A thread-advancing reel in accordance with claim 18 in which the bars comprise an elastic sleeve about a central rod, the elastic sleeve is secured at one end to said bar-moving means, and the rod is connected for reciprocation by said contacting and expanding means.

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