The present invention relates to apparatus for the manufacture of thread or the like. More particularly, it concerns an improvement in flared thread-advancing reels by virtue of which such devices are for the first time rendered practicable for the introduction into the thread or the like of a very high degree of stretch. The term "thread" as employed hereinafter in the specification and claims hereof is used in its generic sense to embrace all forms of single or multiple filament thread or threadlike articles, including cord, rope, tape, wire and the like.

In spite of the obvious advantages of employing flared thread-advancing reels in the stretching of thread, difficulties attend on the use of such reels in certain types of stretching operations. For example, where a very high degree of stretch is desired, a reel having a considerable flare must be employed; as a result, slippage of the thread turns as they attempt to traverse the periphery of the reel very frequently takes place. Entangling and even breaking of the thread are not uncommon on flared thread-advancing reels largely as a result of slippage of the thread. Furthermore, certain types of materials are inherently slippery or lacking in flexibility, making it difficult to stretch them by any previously known method.

The instant invention has for one of its objects to prevent the slippage of the thread turns, regardless of the character of the thread, upon flared thread-advancing reels.

To that end, the invention contemplates the incorporation in a self-threading reel, over at least a portion of the thread bearing surface of the elements going to make up the periphery thereof, of a large number of successively arranged steplike indentations. The function of each of these steplike indentations is to receive a single turn of thread at a time, thus assisting in the advance of thread along the flared periphery of the reel. Because the portion of the steplike indentation upon which each thread turn is carried is substantially cylindrical, the thread turns are prevented from slipping. Since slippage of the thread turns upon thread-advancing reels employing the teachings of the instant invention is thus rendered impossible, difficulties of the type heretofore experienced are largely, if not indeed entirely, eliminated.

Other advantages also characterize the invention, as will be apparent from the following description thereof.

One form of flared thread-advancing reel embodying the principles of the invention is illustrated in the accompanying drawings, in which like reference characters refer to like parts throughout. Figure 1 is a plan of a typical reel illustrating more or less diagrammatically the relation between the individual thread turns and the steplike indentations on the flared portion of the reel. Figure 2 is an end elevation of the reel of Figure 1 illustrating the arrangement of the bar members forming the periphery of said reel. Figure 3 is a sectional elevation on an enlarged scale from line 3—3 of Figure 2 showing the internal structure of the reel. Figure 4 is a partial sectional elevation from line 4—4 of Figure 3 with parts broken away.

The reel of Figures 1 to 3, inclusive, operates upon the same principle as the reel shown, described and claimed in copending Knebusch application Serial No. 652,089 (Patent 2,210,914), differing therefrom chiefly in that it has a flared periphery and is of cantilever construction.

Referring first to Figure 3, it will be noted that the reel includes two rigid cage members 10 and 11 each of which comprises a plurality of longitudinally extending bar members 12 and 13 respectively. When the reel is assembled, bar members 12 and 13 are alternately disposed with respect to each other, thereby forming the thread-bearing periphery of the reel. The latter, while generally circular in cross section, may for the purposes of the present invention be regarded as made up of two substantially cylindrical portions separated by a substantially frusto-conical portion. As illustrated in the accompanying drawings, the latter portion is so located that the larger end thereof is toward the unsupported end of the reel.

Reel member 10, hereinafter referred to as the concentric member, embodies a generally cylindrical body portion 14 mounted concentrically upon shaft 15 which body portion supports and imparts rigidity to bar members 12. Reel member 11, known as the eccentric member, is of rigid, cage-like construction, being made up of a plurality of bar members 13. The latter are provided at their forward ends with an internal reinforcing ring 16 and at their rear ends with an external reinforcing ring 17 by means of which eccentric member 11 is mounted by means of bolts 18 upon annular supporting member 18.

Annular supporting member 18 is freely rotatably mounted about shaft 15 with its axis b—b in spaced and inclined relation to the axis a—a of concentric member 10.

Flanged collar 22, secured by means of set screw 23 to shaft 15, has formed at one end
thereof a conically shaped recess 21 into which is fitted a correspondingly shaped wedge member 24 the generally cylindrical portion 25 of which is driven tightly into a corresponding recess in the cylinrical body portion 14 of concentric member 10. Driving engagement between flanged collar 22 and concentric member 10 is insured by means of nut 26 threaded upon the end of shaft 15 and adapted to engage the forward end of body portion 14 of concentric member 10 thereby maintaining contact between the conical portion of wedge member 24 and its corresponding recess in said flanged collar 22. Flanged collar 22 is maintained in proper endwise relation by means of snap ring 23 and wedge member 24.

Over the exposed end of shaft 15 and nut 26 is fitted a hard rubber cap 27 which, together with washer 28, serves to prevent access of corrosive processing fluids to the bearings of the reel. A suitable flexible seal 20 of the type illustrated in Knebusch Patent No. 2,033,477, preferably of rubber or similar corrosion-resistant material, is provided to protect the shaft 15, flanged collar 22 and other internal metallic parts from the processing fluids. By forming the reel members 10 and 11 of suitable synthetic resin, as, for example, Bakelite, the reel as a whole may be used without susceptibility to chemical attack even under conditions in which chemicals of widely divergent characteristics are employed to treat the thread on the reel.

To provide positive driving engagement between concentric member 10 and eccentric member 11 and to preserve substantially uniform spacing between adjacent bar members thereof, a spur gear 31 is secured by means of screws 32 to flange 30 of collar 22. Teeth 33 of said spur gear 31 engage similar teeth 34 of an annular internal gear 35 mounted upon annular supporting member 18, to which such internal gear is secured by means of pins 36. Spur gear 31 and internal gear 35 are preferably made of some suitable combination of materials to obviate the necessity of lubrication and to insure quiet operation of the reel.

Rotation of shaft 15 from some suitable source of power (not shown) will actuate flanged collar 22, thereby driving concentric member 10 through wedge member 24. Simultaneously therewith, spur gear 31 on the flanged collar 22, by reason of its engagement with internal gear 35, operates to drive the freely rotatably mounted annular supporting member 18 which serves to support eccentric member 11. In this manner, eccentric member 11 is driven from positively driven concentric member 10. Bar members 12 and 13 are maintained in the meanwhile in suitably spaced arrangement out of contact with each other.

Radial displacement of the bar members of one reel member with respect to those of the other reel member as a result of which each turn of thread is supported first by one set of bar members and then by the other is made possible by mounting eccentric member 11 with its axis b—b spaced from but parallel to that of axis a—d of concentric member 10 (Figure 3). The inclined relationship between axes a—d and b—b (Figure 1) which causes the thread to advance longitudinally of the reel is effected by mounting annular supporting member 18 in suitably inclined position to the axis of shaft 15. On rotation of shaft 15, both factors taken together result in progression of the thread from one end of the reel to the other in the form of an advancing helix made up of a large number of spaced, generally helical turns. By virtue of these features, the reel is self-threading; i.e., if the thread 40 is lead to the supported end of the reel, it will be advanced in the form of a helix toward the unsupported end thereof.

As indicated, the reel has a periphery made up of a plurality of alternately disposed bar members 12 and 13. Each of the reel members 10 and 11 taken individually functions in similar manner, but increases in cross-sectional diameter from the supported to the unsupported end of the reel. By reason of the interdigitating relation of said reel members, the reel as a whole is likewise approximately circular in cross section. It has, however, a generally flared contour which permits stretching of the thread to occur as the thread advances toward the unsupported end of the reel. Suitable lead-on and take-off guides may be employed with the reel and one or more such reels may be employed in any convenient arrangement in practically any type of apparatus wherein it is desired to stretch thread.

As stated, the invention contemplates the employment of a large number of successive step-like indentations 39 formed upon the inclined portion of the thread before the direction of notch 37 by reference character C, the bar members f2 retract within the periphery defined by bar members 3, leaving the thread...
supported wholly by bar members 13 of eccentric member 11. In the zone C—D, each thread turn is wholly supported by eccentric bar members 13; consequently, each thread turn tends to assume a path perpendicular to axis b—b of eccentric member 11. Each thread turn, now turned slightly from its original direction, is again supported by the bar members of both reel members in the zone D—A, from which it moves into contact with the bar members 12 of the concentric member at a point slightly in advance of the point from which it left such member.

The pitch of the thread turns, therefore, is entirely dependent upon the degree of inclination between the axes a—a and b—b of the two reel members.

In view of the fact that the steplike indentations 39 are formed on each of the bar members in such manner that the lands 37 are substantially parallel to the axis of the reel member of which said bar members form a part and, as stated, are of a width slightly less than the distance between the thread turns, each turn of thread in the zone D—A is picked up by a land 37 of one of the steplike indentations 39 on bar member 12 next succeeding that which previously supported it. Thus each thread turn is supported on a separate land 37 immediately adjacent to a riser 38, so that thread slippage is entirely prevented. A positive thread advance in the direction of the flare is thereby insured, this for the reason that the thread is not able to slip while on the lands 37, which, as already noted, are generally cylindrical in shape.

In adapting the invention to the production of a material which possesses considerable stiffness; e. g., wire, it will be advisable to employ a metal reel rather than a reel such as that illustrated in the drawings constructed of Bake-lite or other non-metallic material. The tendency of material such as wire to maintain the normal pitch of the helix upon the lead-on portion of the reel. As each turn of the advancing helix reaches the first steplike indentation 39 of the flared portion of the reel, the tendency of the thread to maintain the pitch characteristic of the first portion of the helix is partly restrained by riser 38 with the result that the diameter of the thread turn in contact with such riser tends to increase slightly. This action assists the positive advance of the material along the periphery of the reel, since the material being fed to the reel at the lead-on end thereof forces each turn to move outward in contact with the riser of each succeeding steplike indentation.

Any desired degree of flare and any suitable arrangement of the step-like indentations 39 may be employed commensurate with the type and character of the material to be stretched on the reel. Certain artificial silk threads, for example, will satisfactorily take 60% or more stretch, while others can stand only a lesser amount of stretch without breaking. With the employment of the present invention, the reel in effect becomes a plurality of small reels equivalent in length to the length of each step, each of which is adapted to advance a single turn of thread and eliminate the possibility of slippage.

The instant invention is adaptable to many types of thread-advancing reels and is not restricted to the reel shown in the drawings. The width of the lands 37 and the height of the risers 38 may be varied within reasonable limits, depending upon the pitch of the thread turns, the degree of flexibility of adjustment of the reel, and the over-all amount of flare in the frusto-conical portion of the reel.

It is intended that the patent shall cover, by suitable expression in the appended claims, whatever features of patentable novelty reside in the invention.

What is claimed is:

1. A unitary thread-advancing reel adapted to stretch thread by positively advancing it in regularly spaced, generally helical turns of gradually increasing diameter which embodies a plurality of substantially parallel longitudinally extending bar members, and which includes upon at least a portion of the thread-bearing surface thereof means for preventing slippage of the thread comprising a large number of successively arranged substantially identical steps each of which accommodates only a single turn of thread at a time, said steps having the lands thereof in substantial parallelism with the axis of the reel.

2. A unitary thread-advancing reel adapted to stretch thread by positively advancing it in regularly spaced, generally helical turns of gradually increasing diameter which embodies a plurality of substantially parallel longitudinally extending bar members, and which includes upon at least a portion of the thread-bearing surface thereof means for preventing slippage of the thread comprising a large number of steplike indentations individually accommodating only a single turn of thread at a time characterized by alternately disposed lands and risers, each of said risers extending generally radially of the axis of the reel.

3. A stretching reel capable of advancing thread in the form of a helix of gradually increasing diameter but of substantially constant pitch comprising a plurality of interdigitating, longitudinally extending bar members upon each of which is formed a large number of steplike indentations comprising alternately arranged lands and risers, each of said risers extending generally radially of the axis of the reel and each of said lands extending in a direction substantially paralleling the axis of the reel but for a distance not more than the spacing between successive turns of thread in said helix.

4. A stretching reel capable of advancing thread in the form of a helix of gradually increasing diameter but of substantially constant pitch comprising a plurality of interdigitating, longitudinally extending bar members upon each of which is formed a large number of steplike indentations comprising alternately arranged lands and risers, each of said risers extending generally radially of the axis of the reel and each of said lands extending in a direction substantially paralleling the axis of the reel but for a distance not more than the spacing between successive turns of thread in said helix.

5. A cantilever reel of the type defined in claim 4 which is adapted to advance the thread from the supported to the unsupported end thereof.

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