

April 28, 1942.

R. F. BERGMANN

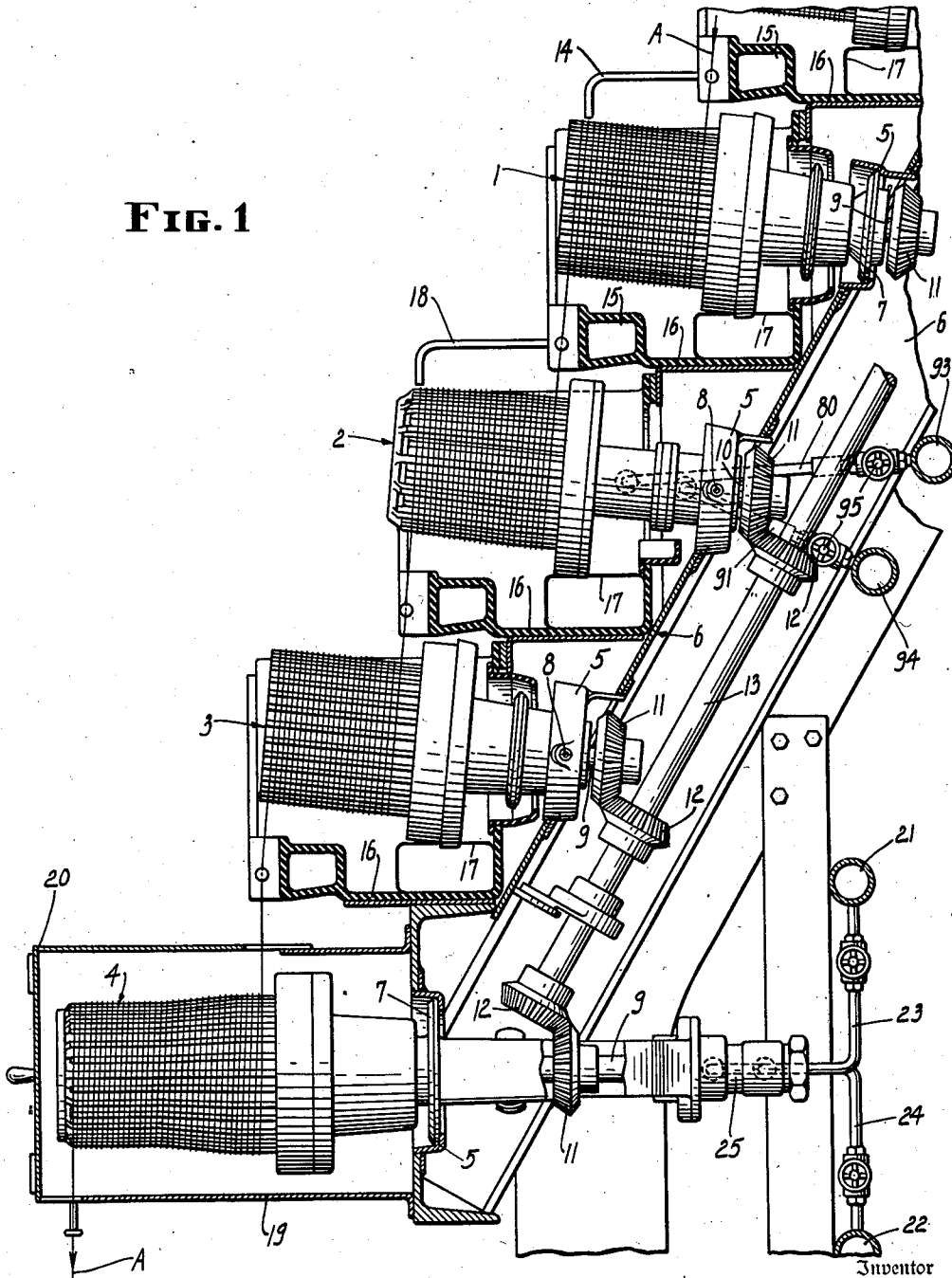
2,281,406

APPARATUS FOR TREATING THREAD OR THE LIKE

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3 Sheets-Sheet 1

FIG. 1



RICHARD F. BERGMANN

Charles Norstrom

Attorney

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R. F. BERGMANN

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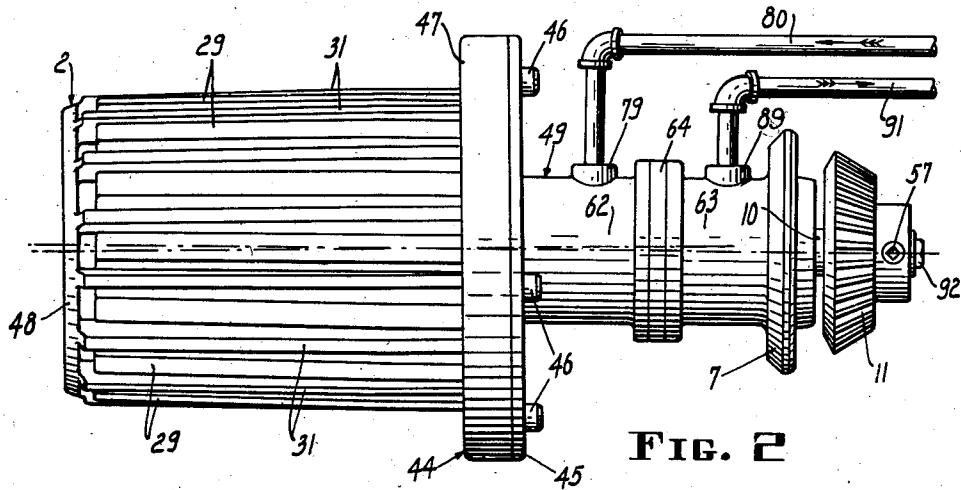


FIG. 2

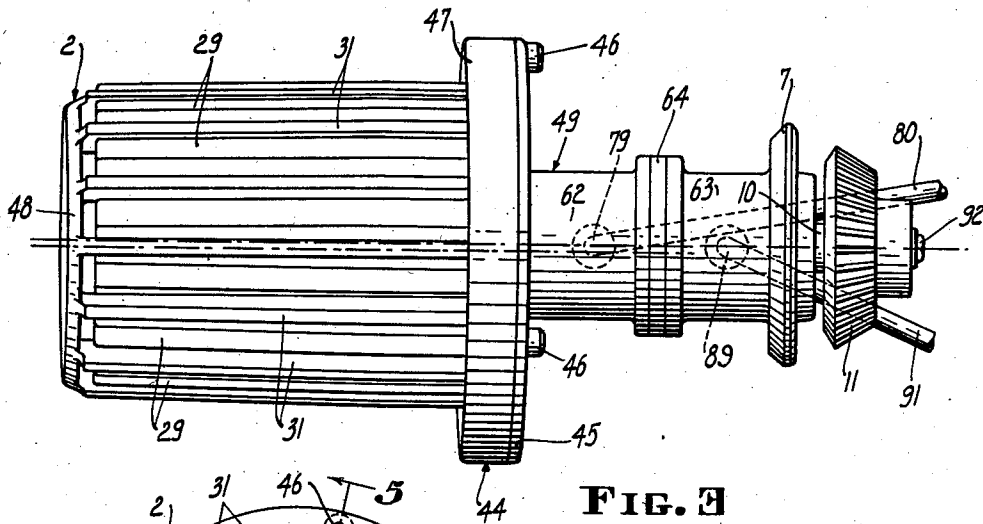


FIG. 3

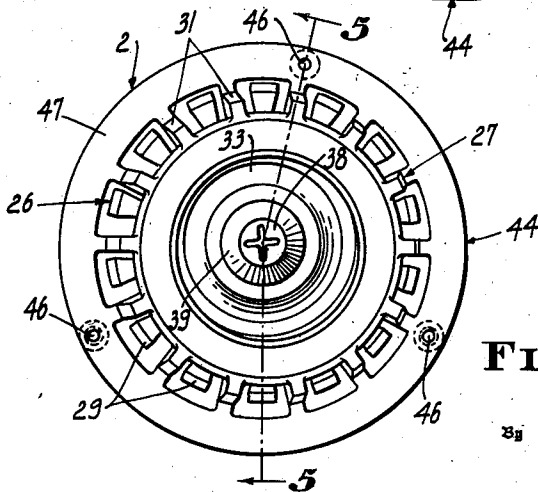


FIG. 4

Inventor

RICHARD F. BERGMANN

Charles E. Norstrom

Attorney

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R. F. BERGMANN

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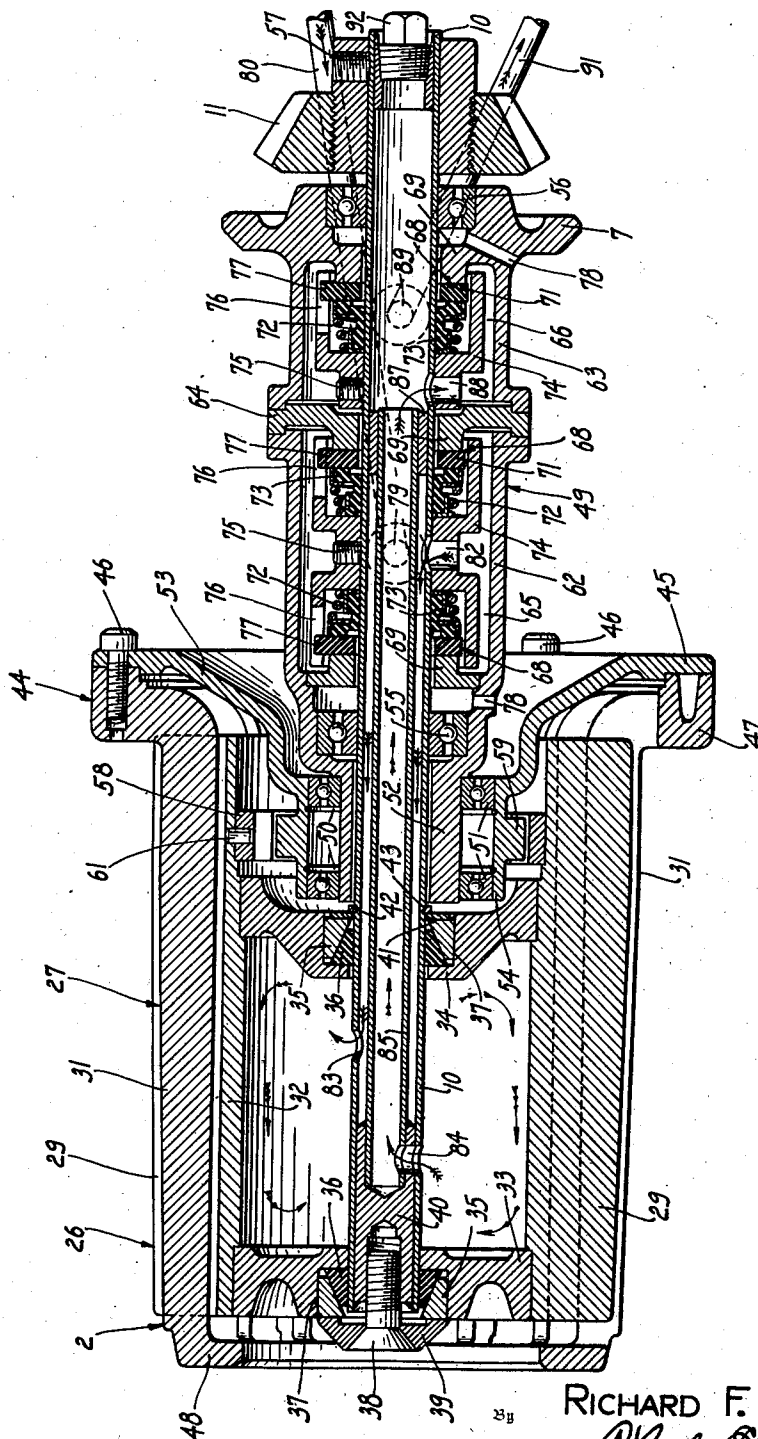


FIG. 3

Inventor

RICHARD F. BERGMANN

Charles F. Herrstrom
Attorney

UNITED STATES PATENT OFFICE

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APPARATUS FOR TREATING THREAD OR
THE LIKE

Richard F. Bergmann, Lakewood, Ohio, assignor
to Industrial Rayon Corporation, Cleveland,
Ohio, a corporation of Delaware

Application September 28, 1939, Serial No. 296,937

10 Claims. (Cl. 34-153)

This invention relates to apparatus for treating strip material such as thread or the like, hereinafter referred to as "thread," while it is being continuously but temporarily stored in a plurality of advancing, generally helical turns. More particularly, the invention relates to a thread-advancing thread store device capable of storing the thread in a plurality of generally helical turns having associated therewith means for supplying a treating medium, such as a temperature-changing fluid, to the interior of the device. In the preferred embodiments of the invention, such a thread-advancing thread store device takes the form of a thread-advancing reel.

For the purposes of illustration but in no sense of limitation, the invention will be described in connection with a thread-advancing reel operating on the principle of that shown, described and claimed in Knebusch Patent 2,210,914. Although any type of temperature-changing medium may be employed, the embodiment of the invention hereinafter described will be one adapted to be heated, for the purpose of drying thread or the like stored thereon, by means of a liquid heating medium circulated through the interior of the device. Further for purposes of illustration, such apparatus will be described in connection with a machine for the continuous processing of multiple filament viscose artificial silk thread of the type shown, claimed and described in Knebusch and Burkholder Patent 2,225,642.

The more important advantages of the invention will be brought out hereinafter in connection with the following description. In the accompanying drawings, Figure 1 is a sectional elevation of a portion of a machine for continuously processing thread in which is employed the apparatus of the present invention. Figure 2 is a plan on an enlarged scale of a thread-advancing reel comprising the preferred embodiment of the invention. Figure 3 is a side elevation thereof on the same scale as Figure 2. Figure 4 is a corresponding end elevation on the same scale. Figure 5 is a longitudinal sectional elevation of the thread-advancing reel on a still larger scale on line 5-5 of Figure 4. In the drawings, like reference characters refer to like parts throughout.

In the machine shown in Figure 1, thread A supplied from a suitable source, such as a spinneret, passes in sequence to each of a series of thread-advancing reels of which four are shown, bearing reference characters 1 to 4, inclusive.

Each takes the form of a thread-advancing reel of cantilever construction; i. e., a reel having one end unsupported. Each is so constructed that during rotation thereof the thread A advances in a relatively large number of closely spaced generally helical turns toward the unsupported end of the reel.

The reels are preferably disposed as shown in a descending series with the unsupported ends of all reels extending in the same direction; i. e., toward the operating face of the apparatus. The unsupported or discharge end of each preceding reel is disposed in apposite relation to the supported or receiving end of each succeeding reel, an arrangement which provides numerous advantages from the standpoints of accessibility and visibility to the operators. Any number of such descending series may be disposed lengthwise of the apparatus.

The means shown as employed for supporting each of the reels 1 to 4, inclusive, include a cup member 5 mounted on the supporting frame 6 of the machine. In said cup member 5 fits a flanged member 7 which forms part of or is suitably fixed to the frame member on which the reel is rotatably mounted. Flanged member 7 is held in place in cup member 5 by one or more set screws 8. Each of the reels 1 to 4, inclusive, is driven by a gear 11 mounted on drive shaft 9 or 10, as the case may be. Each gear 11 meshes with a gear 12 mounted on an inclined drive shaft 13. Each inclined drive shaft 13 serves to drive all of the reels in the same descending series.

In Figure 1, the thread on reel 1 is being subjected to the action of a processing liquid supplied from distributor 14. The reel 1 is inclined to the horizontal in order that the liquid applied thereto may travel lengthwise of the reel toward the supported end thereof, thus subjecting all of the thread on the reel to the action of the liquid. Reagent distributor 14 communicates with a supply conduit 15 shown as forming an integral part of a trough 16 disposed beneath the preceding reel.

One of said troughs 16 is shown as disposed beneath each of the reels to which liquid is applied or which serves to advance wet thread. Each of said troughs 16 extends lengthwise of the apparatus in a manner permitting it to serve a number of corresponding reels in adjacent descending series, wherefore conduits 15 likewise extend along the apparatus and serve the reagent distributors for a number of reels disposed in corresponding positions lengthwise of the apparatus.

Troughs 16 communicate through openings 17 with piping leading to a sewer or, if desired, to recirculation and make-up means.

In the illustrated apparatus, reel 2 represents the reel with which the present invention is more immediately concerned. It is shown as adapted to be heated by hot water, steam or other fluid circulated therethrough by means hereinafter to be described. The reel may conveniently be tapered, as shown, to provide for shrinkage of the thread during the drying operation. A small stream of rewetting liquid is applied from reagent distributor 18 to the last few turns of thread on the reel, said distributor being supplied from conduit 15 forming part of the trough disposed below reel 1. The thread passes from the unsupported end of reel 2 to reel 3, on which no processing medium is applied to the thread but on which the excess liquid is permitted to drip therefrom.

Reel 3 is similar to reel 1 and any preceding reels on which processing liquids have been applied to the thread; however, inasmuch as no processing liquid is applied to the thread on reel 3, it requires no reagent distributor such as reagent distributor 18 of reel 1. By the time it reaches the end of reel 3, the thread has had its moisture content reduced, by dripping, to a predetermined amount, thus facilitating subsequent drying of the thread. From reel 3 the thread passes to reel 4, on which it is given its second and, in the illustrated apparatus, final drying.

Reel 4, which is tapered to provide for the shrinkage of the thread, is enclosed in a housing 19 provided with a door 20 which permits access to the reel. The thread passes out of said housing 19 to a collecting device such as a cap-twister (not shown). The drive shaft 9 of reel 4 is hollow to permit the circulation through the reel of heated fluid supplied by means of conduit 21 and removed by means of conduit 22. Tubes 23 and 24 serve to connect supply and discharge conduits 21 and 22 to a suitable fitting 25 so constructed as to keep the entering and leaving streams of fluid segregated from each other.

The process of drying the thread a plurality of times, with a rewetting step between drying operations, forms no part of the present invention, being shown, described and claimed in copending application Serial No. 297,074, filed September 29, 1939. However, the reel 2 with which the present invention is concerned is very important in carrying out this process, since it makes it possible to employ a reel which is of little, if any, greater overall length than the preceding processing reels, such, for example, as reel 1. This makes it practicable to substitute the reel of the present invention for various other reels in the apparatus, including all of the liquid processing reels, without making any changes whatsoever in the apparatus as a whole.

Like reels 1, 3 and 4, reel 2 operates on the principle of the reel disclosed in Knebusch Patent 2,210,914. It comprises two wholly rigid reel members, each having a periphery of substantially circular cross section made up of a plurality of longitudinally extending bar members which interleave with the bar members of the other reel member. The reel members rotate about axes displaced from and inclined to each other in such manner as to continuously advance the thread in a large number of closely spaced, generally helical turns. The construction of reel 2 is shown to best advantage in Figures 2 to 5, inclusive.

As is apparent from these figures, the reel 2

comprises two wholly rigid reel members 26 and 27. Member 26, which may be termed the concentric member, is mounted concentrically upon and for rotation with drive shaft 10, having its periphery made up of a series of spaced, longitudinally extending bar members 29. Member 27, which may be termed the eccentric member, is rotatably mounted with its axis inclined to but in a plane slightly offset from the axis of rotation of reel member 26, having a periphery including a series of spaced, longitudinally extending bar members 31 alternately disposed with respect to bar members 29 of reel member 26.

Concentric reel member 26 may conveniently be fabricated as shown with bar members 29 formed integrally with a hollow body portion 32. Front and rear closure members 33 and 34, respectively, form fluid-tight junctions with the interior surface of hollow body portion 32, being pressed, welded, or otherwise held in place. Cooperating annular sealing members 35 and 36 of wedge-shaped cross section are disposed in recesses 37 in members 33 and 34 to prevent the escape of fluid past shaft 10. It has been found desirable to make the outer annular sealing member 35 of metal and the inner annular sealing member 36 which bears against the shaft of some flexible material such as rubber or possibly of one of the synthetic materials capable of withstanding heat. A bolt 38 holding a washer 39 against the outer sealing member at the unsupported end of the reel is threaded into a plug 40 which is welded in the unsupported end of hollow drive shaft 10. A washer 41 located on shaft 10, as by snap ring 42 disposed in a groove 43 in the outer surface of drive shaft 10, bears against the outer annular sealing member 35 at the inner end of concentric reel member 26, serving thereby to locate reel member 26 endwise on shaft 10. As bolt 38 is tightened, it forces the wedge-shaped annular members 35 and 36 together at each end of reel member 26, thus effectively sealing it against the escape of fluid past the shaft 10.

In the construction illustrated in the drawings, eccentric member 27 is formed of a rigid cage-like member 44 concentrically mounted upon a rotatable supporting member 45, as by bolts 46. Member 44 embodies bar members 31 fixed at their supported ends to an external annular rib 47 and at their unsupported ends to a reinforcing member 48. This construction serves to impart rigidity to eccentric member 27, which is supported only from supporting member 45. The latter member is mounted on frame member 49, as by spaced antifriction bearings 51, for rotation about an axis disposed in the desired offset and inclined relationship to the axis of rotation of concentric member 26.

Antifriction bearings 51 are pressed on boss portion 52 of frame member 49. Boss portion 52 has an external generally cylindrical surface the axis of which is disposed in the desired offset and inclined relation to the axis of rotation of drive shaft 10, which is also the axis of rotation of concentric reel member 26. Snap rings 50 are provided to locate the outer races of the bearings 51 in the bore of supporting member 45, thereby aiding in locating eccentric reel member 27 lengthwise of the frame member 49.

Supporting member 45 is formed so that the projecting boss 52 of frame member 49 is disposed within the limits of the reel proper. The rear closure member 34 of concentric reel member 26 is within the hollow body portion 32 at a substantial distance from the inner end of concentric

reel member 26; consequently, boss 52 may be disposed within the reel member 26 and hence within the reel itself. The supporting member 45 is provided with a concave web 53 fixed to a sleeve-like portion 54 in which are disposed bearings 51 which support the reel member 27 upon frame member 49. The construction is therefore such that, although fluid supply and removal means are associated with frame member 49, the overall length of the reel and its supporting member is only slightly, if any, greater than that of the liquid processing reels.

As mentioned above, reel 2 is similar to the other reels shown in Figure 1 in that its frame member 49 is provided with a flanged portion 7 adapted to fit closely in and be held, as by set screws 8, in a cup member 5 fixed to the frame 6 of the machine as a whole. Drive shaft 10 on which concentric member 26 is rigidly and concentrically mounted passes through frame member 49, being journaled therein by spaced bearings 55 and 56. Driving gear 11 is rigidly mounted on the projecting end of said drive shaft, as by set screw 57. Consequently, reel 2 may, if necessary, be interchanged with any of the reels of the machine other than reel 4.

In the reel illustrated in Figures 2 to 5, inclusive, an annular internally toothed member 58 mounted in the portion of hollow body portion 32 surrounding bearings 51 meshes with external teeth 59 formed on the sleeve-like portion 54 of supporting member 45. Pins 61 are employed to prevent rotation of gear 58 in body portion 32. Thus means are provided for driving the eccentric member from the concentric member at the same speed without contact of the bar members of the two reel members.

If desired, annular gear 58 may be made of material which, in conjunction with metal teeth 59, provides good wearing qualities. Thus supporting member 45, and hence teeth 59, may be formed of iron or steel, while annular gear 58 may be formed of Bakelite-impregnated fabric or the like. Such a combination gives extraordinarily good wearing qualities even in the complete absence of lubrication. If some such means are employed, contact of the bar members of the reel members can be entirely avoided, which is advantageous in view of the fact that the bar members of the reel members are preferably made of metal having good heat conductivity, such as aluminum, which would otherwise wear readily.

As indicated above, reel 2 is heated internally by the circulation of suitable heating fluid through the hollow body portion 32 of concentric reel member 26. As is apparent from Figure 5, frame member 49 is hollow, being built up of two hollow parts 62 and 63 separated by a member 64 which in effect forms a partition; so that the frame member 49 includes two compartments 65 and 66 through which the drive shaft 10 passes. Suitable sealing means 68 are provided to prevent the escape of fluid from the interior of said compartments past the drive shaft, either from one compartment into the other or from the ends of frame member 49.

The sealing means shown individually comprise a smooth-faced stationary portion 69 against which bears a rotatable member 71 which is urged thereagainst by a spring 72. Member 71 may be formed of carbon or some material such as synthetic rubber. Spring 72 is compressed between the edge of a flexible annular sealing member 73 bearing against said member 71 and a

support 74 rigidly fixed to the drive shaft 10, as by a set screw 75. Each of said supports 74 is provided with one or more slots 76 in which are disposed projections 77 formed on rotatable bearing members 71 so that said rotatable members are rotated by said supports 74. Sealing member 73 encloses drive shaft 10, thereby preventing the escape of fluid between drive shaft 10 and bearing member 71, while the tight contact between the rotating bearing member 71 and stationary member 69 prevents the escape of fluid at this point.

In the embodiment of the invention illustrated in Figure 5, support 74 in compartment 65 serves two sealing means 68, one of which prevents the escape of fluid from the end of the frame member 49 and the other of which prevents the escape of fluid into the other compartment 66. The support 74 in compartment 66 similarly serves the single sealing means 68 therein. Openings 78 may be provided in the vicinity of bearings 55 and 56 to provide a drain for any liquid which might seep past the sealing means. As a result of the expansive action of the springs 72, said sealing means aid in properly locating drive shaft 10 and concentric member 26. If desired, compartment 66 may be made the larger and contain two sealing means while compartment 65 may contain a single sealing means; alternatively, both compartments may contain two sealing means.

Compartment 65 is provided with an opening 79 through which heating fluid is supplied from a tube 80 connected to frame member 49. The heating fluid passes through a port 82 in said drive shaft 10 and thence longitudinally through said drive shaft to a port 83 through which it passes into the interior of the hollow body portion 32 of concentric reel member 26. The heating fluid passes out of said hollow body portion 32 through opening 84 in said drive shaft 10. The latter opening communicates with the interior of an inner tube 85 rigidly fixed in said drive shaft. The fluid leaving inner tube 85 passes out through port 88 into the rear compartment 66, which it leaves through opening 89 connected to discharge tube 91. Since openings 79 and 89 in the embodiment of Figure 5 are located in the far walls of compartments 65 and 66, they are shown in dotted lines.

The plug 40 at the unsupported end of drive shaft 10 serves to separate the inner tube 85 and the drive shaft 10. It also operates to prevent fluid from passing directly from the drive shaft to the tube and vice versa. A similar plug 87 at the rear portion of said drive shaft 10 between the opening 82 through which the fluid enters said drive shaft and the opening 88 through which the fluid leaves said drive shaft prevents intermixing of the entering and discharging fluid. The end of hollow drive shaft 10 remote from the reel is closed by plug 92 threaded therein.

Thus the heating fluid enters the hollow body portion 32 of the concentric reel member 26 near the end of the reel at which the thread starts thereon, passing out of the reel near the unsupported end thereof. The reel is therefore heated most at the end thereof where the thread is wettest, which is often advantageous. However, the heating fluid may be caused to enter the hollow body portion near the unsupported end thereof and leave at the other end.

As shown in Figure 1, the supply tube 80 is connected to a supply conduit 93 which extends lengthwise of the apparatus and serves a plurality of reels 2 disposed in adjacent series length-

wise of the machine. Similarly, discharge tube 91 communicates with a discharge conduit 94 extending lengthwise of the apparatus and serving a plurality of corresponding reels 2. Regulating valves 95 may be provided as shown to control the flow of heating fluid through each reel 2. The heating fluid may be hot water, steam, or other suitable liquid or vapor which may be heated by any suitable means (not shown) and circulated through the system. Such heating fluid is preferably reheated and recirculated, since this makes for economy.

The present invention thus provides a thread-advancing reel embodying means for heating the thread from the interior thereof which does not require that the heating medium be supplied to the interior of the reel from the end of the drive shaft thereof but in which, on the contrary, such heating medium may be supplied from a point intermediate the ends of the drive shaft and the frame member on which the reel is supported. Consequently, a thread-advancing reel embodying the present invention may be employed in place of other thread-advancing reels on a machine for the continuous processing of thread without changing the construction of the machine or the like. As has already been explained, this is advantageous in the repetitive drying of thread in a continuous process.

It is apparent that various modifications may be made in the thread-advancing thread store device illustrated in the drawings and that thread-advancing thread store devices embodying the invention may be employed for uses other than that described, all without departing from the spirit of the invention. For example, while the thread-advancing thread store device of the invention is described herein as heated for the drying of thread, it is apparent that the fluid passed therethrough need not serve to heat the device, but may be employed to cool it. Likewise, the invention is not restricted to the winding of thread per se, but is capable of employment with various kinds of strip material. The term "thread" in the appended claims is intended to include such materials.

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 thread-advancing thread store device comprising a frame member; a first set of spaced, longitudinally extending bar members; means supporting said first set of bar members in rotatable relation to said frame member; a second set of spaced, longitudinally extending bar members alternating with the bar members of said first set but mounted for rotation about an axis in inclined relation to the axis of rotation of said first set, said second set of bar members surrounding a portion of said frame members; supporting means characterized by a concave web portion extending inward of the device as a whole rigidly connected to said second set of bar members at one end thereof, said supporting means being disposed about said frame member; and, disposed within the periphery of and at a substantial distance from the ends of said second set of bar members, bearing means rotatably supporting the supporting means for said second set of bar members from said frame member.

2. Apparatus of the character described in claim 1 in which said bearing means comprise spaced antifriction bearings disposed at a sub-

stantial distance from each end of said second set of bar members, the inner and outer races of said antifriction bearings being respectively mounted on said frame member and in said supporting means.

3. Apparatus for treating thread comprising a frame member; a rotatable hollow shaft passing through said frame member; means disposed at one end of said frame member for rotating said hollow shaft; a thread-advancing thread store device rotatably mounted at the other end of said frame member for rotation by said hollow shaft, said thread-advancing thread store device having a closed hollow interior communicating with the interior of said hollow shaft; means associated with said hollow shaft for circulating fluid through said interior of said thread-advancing thread store device by the supply and removal of fluid through the interior of said hollow shaft; and means associated with said frame member between said thread-advancing thread store device and said means for rotating said hollow shaft for supplying fluid to and removing it from the interior of said hollow shaft.

4. Apparatus for treating thread comprising a frame member; means for supporting said frame member from one end only thereof; a rotatable hollow shaft passing through said frame member and projecting from the supported end of said frame member; means disposed at the projecting end of said hollow shaft for rotating said hollow shaft; a thread-advancing thread store device rotatably mounted at the other end of said frame member for rotation by said hollow shaft, said thread-advancing thread store device having a closed hollow interior communicating with the interior of said hollow shaft; means associated with said hollow shaft for circulating fluid through said interior of said thread-advancing thread store device by the supply and removal of fluid through the interior of said hollow shaft; and means associated with said frame member between said supporting means and said thread-advancing thread store device for supplying fluid to and removing it from the interior of said hollow shaft.

5. Apparatus for treating thread comprising a hollow frame member which includes two compartments disposed longitudinally thereof; a hollow drive shaft journaled in and projecting from both ends of said frame member, said hollow drive shaft having openings therein communicating with said compartments; a thread-advancing thread store device including a hollow member rigidly mounted on one of the projecting ends of said hollow drive shaft, said thread-advancing thread store device communicating with the interior of said hollow drive shaft; a tubular member disposed in said hollow drive shaft in spaced relation thereto, said tubular member communicating through an opening in said hollow drive shaft with the interior of said hollow member and communicating with another opening in said hollow drive shaft with the compartment farthest removed from said thread-advancing thread store device; conduit means connected to said compartments intermediate the ends of said frame member for conducting fluid to and removing it from said compartments, whereby said fluid is circulated through said thread-advancing thread store device; and, mounted on the projecting end of said drive shaft remote from said thread-advancing thread store device, means for rotating said drive shaft.

6. Apparatus of the character described in

claim 5 including means for mounting said frame member from one end thereof only, said conduit means being disposed between said mounting means and said thread-advancing thread store device.

7. A thread-advancing thread store device comprising a frame member; a first set of spaced, longitudinally extending bar members; means supporting said first set of bar members in rotatable relation to said frame member; a second set of spaced, longitudinally extending bar members alternating with the bar members of said first set but mounted for rotation about an axis in inclined relation to the axis of rotation of said first set, said second set of bar members surrounding a portion of said frame member; supporting means connected to said second set of bar members characterized by an annular portion surrounding said frame member extending inward of said second set of bar members; bearing means supporting said annular portion of said supporting member from said frame member; external teeth associated with the annular portion of said supporting member, said teeth being disposed within the periphery defined by said sets of bar members; and, engaging said external teeth, internal teeth associated with said first set of bar members.

8. A thread-advancing thread store device comprising a frame member having a projecting end; a first set of spaced, longitudinally extending bar members; means for supporting said first set of bar members in rotatable relation to said frame member in such manner that one of the ends of said first set of bar members is unobstructed by supporting means; a second set of spaced, longitudinally extending bar members alternating with the bar members of said first set but mounted for rotation about an axis in inclined relation to the axis of rotation of said first set, said second set of bar members surrounding a portion of said frame member; bearing means mounted upon said frame member at a substantial distance from the ends of the device as a whole; and, mounted upon said bearing means, supporting means characterized by a concave web portion extending inward of said second set of bar members, said supporting means being connected to said second set of bar members at one end only thereof.

9. Apparatus for treating thread comprising a hollow frame member which includes two compartments, disposed longitudinally thereof; a thread-advancing thread store device having a closed hollow interior rotatably mounted at one end of said frame member; a rotatable hollow shaft journaled in and extending through said frame member with one of its ends projecting into said thread-advancing thread store device, said shaft embracing a rigidly disposed tubular

member extending longitudinally thereof; means disposed at the ends of the space between said shaft and said tubular member forming a fluid-tight seal preventing intercommunication between said space and the bore of said tubular member; a plurality of openings in said shaft certain of which provide communication through said space between one of said compartments and the hollow interior of said thread-advancing thread store device while others connect the other of said compartments with the interior of said thread-advancing thread store device through the bore of said tubular member; sealing means for preventing escape of fluid past said shaft disposed at the ends and between the compartments of said frame member; and conduit means connected to each of said compartments at a point intermediate the ends of said frame member, one of said conduit means serving to supply and the other to remove fluid from the interior of said thread-advancing thread store device.

10. Apparatus for treating thread comprising a hollow frame member which includes two compartments disposed longitudinally thereof; a fluid conduit communicating with each of said compartments intermediate the ends of said frame member; a hollow shaft journaled in and projecting from the ends of said frame member, said shaft embracing a rigidly disposed tubular member extending longitudinally thereof; means disposed at the ends of the space between said shaft and said tubular member forming a fluid-tight seal preventing intercommunication between said space and the bore of said tubular member; a first thread-advancing member disposed about the projecting end of said shaft, said thread-advancing member including a closed hollow body portion rigidly mounted on and surrounding the end of said shaft; a plurality of openings in said shaft certain of which provide communication through said space between one of the compartments in said frame member and the hollow interior of said first thread-advancing member while others connect the other of said compartments with the interior of said first thread-advancing member through the bore of said tubular member; a second thread-advancing member surrounding said frame member in operative relation to said first thread-advancing member, said second thread-advancing member including a supporting member extending inwardly of and rotatably supporting said second thread-advancing member on said frame member at a point a substantial distance from each of the ends of said second thread-advancing member; and, disposed at the other end of said shaft, means for rotating said drive shaft.

RICHARD F. BERGMANN.