Feb. 6, 1940. A. H. BURKHOLDER 2,189,195

APPARATUS FOR DRYING OR OTHERWISE TREATING THREAD OR THE LIKE

Original Filed March 9, 1937 3 Sheets-Sheet 1

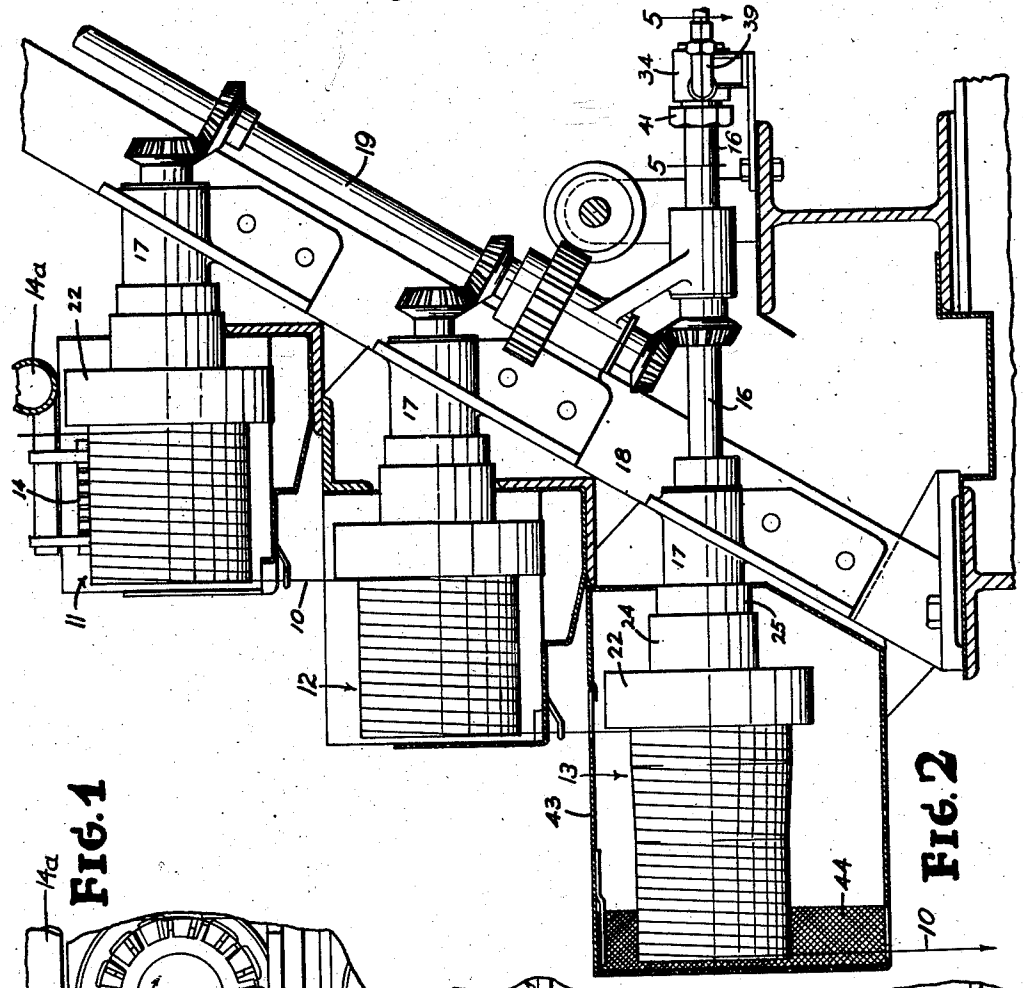


FIG. 2

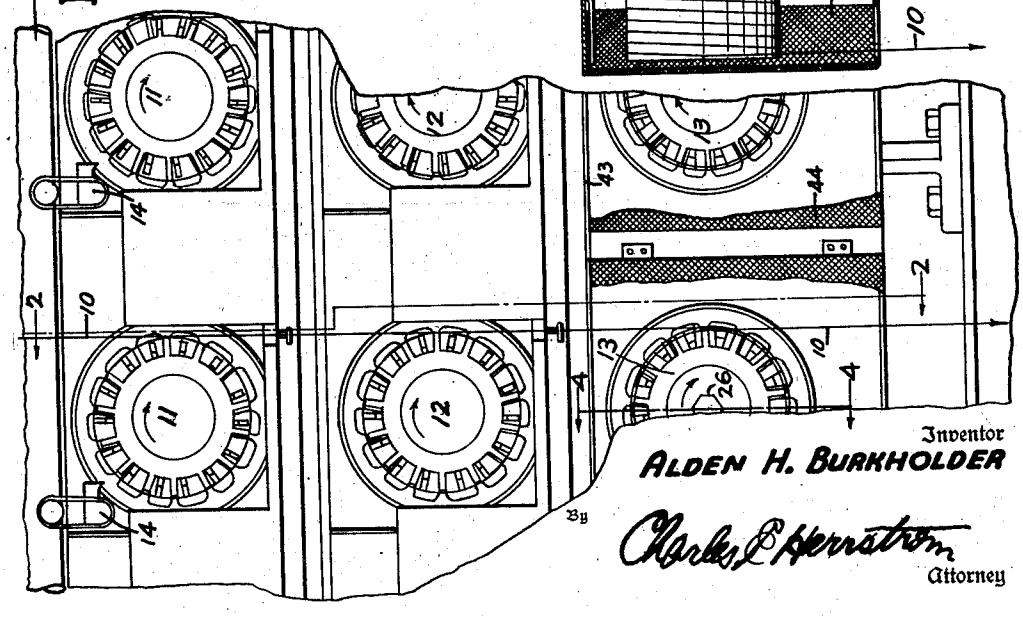


FIG. 1

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APPARATUS FOR DRYING OR OTHERWISE TREATING THREAD OR THE LIKE

Original Filed March 9, 1937 3 Sheets-Sheet 2

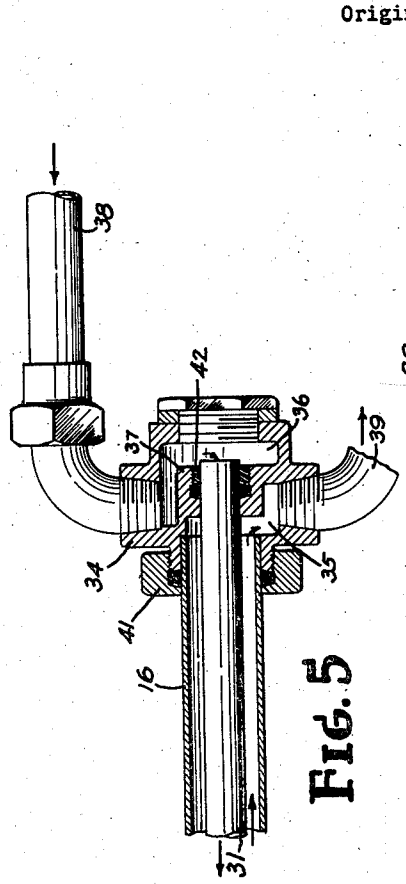


FIG. 5

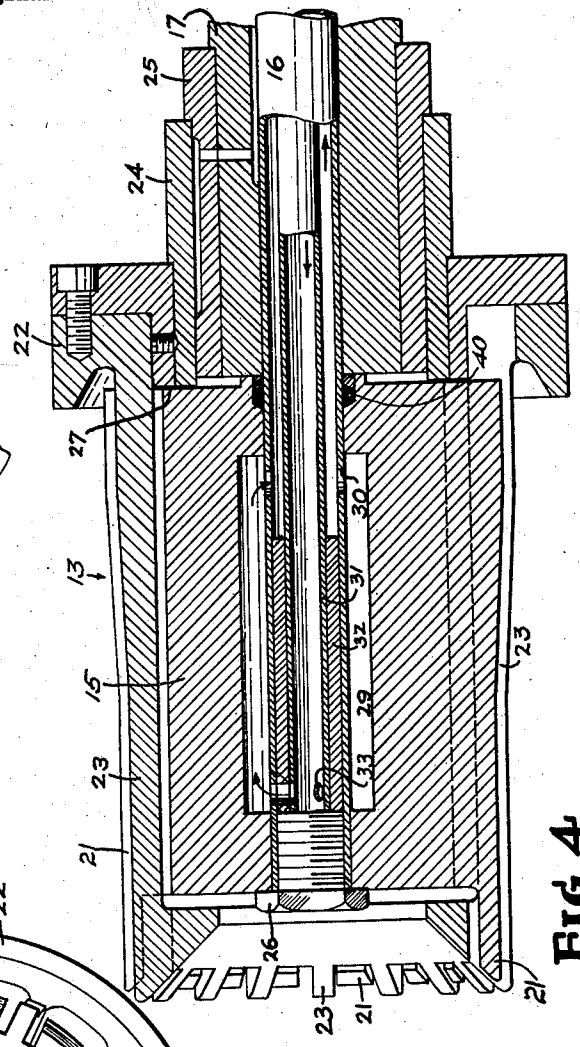


FIG. 4

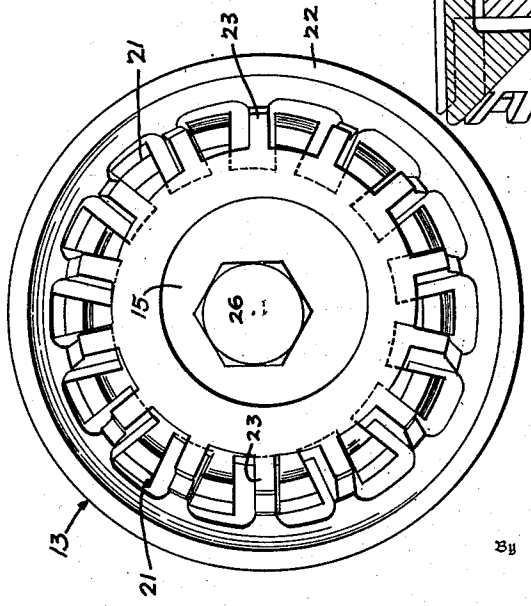


FIG. 3

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APPARATUS FOR DRYING OR OTHERWISE TREATING THREAD OR THE LIKE

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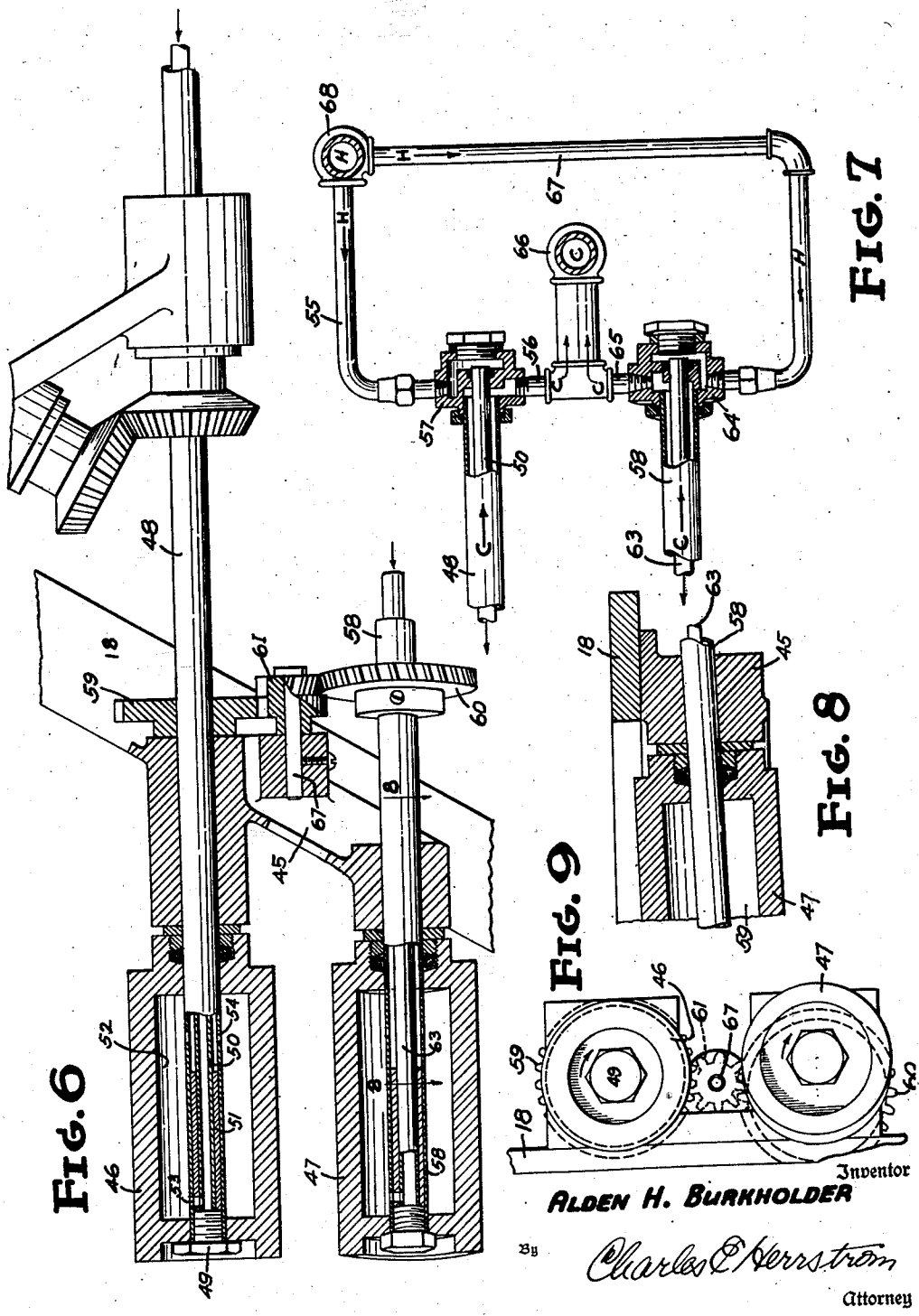


FIG. 6

FIG. 7

FIG. 8

FIG. 9

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UNITED STATES PATENT OFFICE

2,189,195

APPARATUS FOR DRYING OR OTHERWISE TREATING THREAD OR THE LIKE

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Application March 9, 1937, Serial No. 129,848
Renewed July 19, 1939

13 Claims. (Cl. 34—29)

This invention relates to thread treating apparatus and, more particularly, to thread-storage, thread-advancing devices adapted to dry thread or the like. While the invention may be employed in connection with the drying of any thread-like material, such as filaments, ribbons, bands, tapes, tubes and the like, all of which are hereinafter comprehended by the term "thread", the invention will be described with particular reference to the drying of multiple filament artificial silk thread produced by the viscose process. It will be understood that the invention may be applied to the drying of thread or the like made by any other process or processes, including the cuprammonium, nitrocellulose, and cellulose acetate processes.

The invention has particular utility in the continuous production of viscose artificial silk thread. In a continuous process, the thread may, after coagulation, be advanced successively over a plurality of thread-storage, thread-advancing devices upon each of which it is subjected to one or more of the necessary processing steps. After completion of the last liquid processing step, the thread contains a considerable amount of moisture which must be removed in order to finish the processing of the thread. In accordance with the present invention, the thread is dried at the same rate at which it is being produced and processed on the apparatus.

The invention contemplates the employment of a thread-storage, thread-advancing device of the type utilized in the several liquid processing steps, suitably modified, however, for use in the drying of artificial silk thread. The drying apparatus of the present invention does not, therefore, make necessary any material change in the construction of the complete thread-processing apparatus. In its preferred embodiment, the invention utilizes a unitary reel of the character disclosed in the copending application of Walter F. Knebusch, Serial No. 652,089, filed January 16, 1933, which application corresponds to British Patent No. 413,414. Other forms of thread-storage, thread-advancing devices may, however, be employed in lieu thereof.

In the accompanying drawings, illustrating several embodiments of the invention, Figure 1 is a front elevation of a portion of a thread-processing apparatus embodying a preferred form of drying reel. Figure 2 is a section with parts in elevation on line 2—2 of Figure 1, the reels being shown more or less diagrammatically. Figure 3 is a front end elevation of the drying reel shown in Figures 1 and 2. Figure 4 is a central section, with parts in elevation, through the reel shown in Figure 3. Figure 5 is a sectional elevation on an enlarged scale along the line 5—5 of Figure 2. Figure 6 is a side elevation with parts in section of a different form of thread-storage, thread-advancing device in which the invention is incorporated. Figure 7 is a detail showing the means for supplying heating fluid to the device of Figure 6. Figure 8 is a section with parts in elevation on the line 8—8 of Figure 6. Figure 9 is a front end elevation of the device of Figure 6. Referring first to Figures 1 to 5, inclusive, thread 10 supplied from any suitable source is passed in descending sequence over a number of cantilever thread-storage, thread-advancing devices the last three of which are shown as reels 11, 12 and 13. These reels are conveniently disposed in stepped arrangement, as shown, so that the thread-receiving portion of one reel is below the thread-discharge portion of the reel next above. A complete thread processing apparatus includes a large number of vertical series of reels arranged side by side, each series handling a single thread. Each series may embrace as many as ten reels, but a larger or smaller number of reels may be employed, as desired.

Upon the reel 11 the thread may be subjected to a washing treatment by liquid showered upon the reel from distributor 14, the several distributors 14 being supplied with liquid from a conduit 14a. The washing performed upon reel 11 serves to eliminate chemicals which have been employed to treat the thread in the preceding processing steps. The thread next passes over reel 12, to which no liquid is shown as being supplied, for the purpose of allowing the excess liquid on the thread to drip therefrom, thereby to reduce the surface moisture as much as possible. The thread is dried upon reel 13, which is interiorly heated in the manner contemplated by the present invention.

Since the general construction and operation is the same for all of the reels shown, a description of reel 13 will suffice to explain the construction and operation of the other reels.

Reel 13, as shown in Figures 3 and 4, includes a rigid reel member 15 concentrically mounted upon a shaft 16 which is rotatably supported within a bracket 17 fastened to the frame 18 of the apparatus. Upon the exterior of the body portion of reel member 15 are integrally formed a plurality of longitudinally extending bar members 21. Shaft 16 is geared to shaft 19, which is mounted at an angle to the rear of the several

reels of each vertical series. To shaft 19 are also geared the shafts which drive the reels 11 and 12. By selecting the proper ratios for the gearing between the reel shafts and shaft 19, the reels may be rotated at the same or at different speeds.

Mounted in offset and inclined relation to concentric reel member 15 is a rigid reel member 22 having bar members 23 which lie between the bar members 21. Reel member 22 is secured to a bushing 24 which rotates upon a bearing member 25 carried upon the outer end of bracket 17. The outer surface of bracket 17 is eccentric with respect to the bore therethrough. Bearing member 25 is shaped to give the reel member 23 the desired inclined relationship to reel member 15, with the result that reel members 15 and 22 rotate about axes which are in fact in skew relation to each other. The reel members are retained in assembled relationship by the bolt 26 which secures the reel member 15 on shaft 16. Movement of the reel member 22 toward the free end of reel member 15 is prevented by contact with reel member 15 at the bearing surfaces 27.

The offset and inclined relation of the reel members results in advance of the thread in generally helical conformation.

Reels 11 and 12 need not be and therefore are not provided with means for supplying heat to the interior thereof, but reel 13, which embodies the present invention, is of course provided with such means. To heat reel 13 according to the principles of the present invention, the body portion of reel member 15 is provided with a longitudinal bore communicating with an internal enlarged chamber 29. To the same end, shaft 16, which in the case of reel 13 takes the form of a hollow shaft capable of serving as a conduit, extends throughout the length of the reel member 15 and serves to seal the ends of chamber 29.

The interior of shaft 16 communicates in some suitable way with the interior of the chamber 29, as, for example, through openings 30. Within the shaft 16 and extending longitudinally thereof is a coaxially mounted conduit 31 spaced from the shaft 16 by means of sleeve 32. Conduit 31 communicates with the chamber 29 through openings 33 extending through the walls of conduit 31, sleeve 32 and shaft 16. To cause a flow of fluid throughout the length of chamber 29, the openings 30 and 33 are disposed at opposite ends thereof. Escape of fluid from chamber 29 is prevented by packing gland 40.

Since the shaft 16 and conduit 31 rotate together, means must be provided to establish communication between each of them and the exterior piping without interfering with their rotation. To this end, they extend into a coupling block 34 mounted upon the frame of the apparatus, as shown in Figure 5. Coupling block 34 is divided by a partition 37 into two interior chambers 35 and 36. Chamber 36 is preferably in communication with a fluid supply pipe 38 and chamber 35 is connected to a pipe 39 for the discharge of the fluid. Shaft 16, which communicates with the chamber 35, is sealed by the packing gland 41 against leakage from coupling block 34. Conduit 31 is sealed by packing gland 42 against leakage past partition 37. The fluid may conveniently be hot water, although it is apparent that in special cases steam, heated air or any other temperature-changing fluid may be utilized, if desired.

The selection of the heating fluid will ordinarily depend upon the temperature to which it is desired that the reel member 15 shall be heated and the rapidity with which the heat is to be removed therefrom. In order to increase the amount of contact with the thread, bar members 21 may be flared in transverse cross section so as to be wider at their outer surfaces than elsewhere, as shown, for example, in Figure 3. It is desirable that the reel member 15 be made of a metal having a high coefficient of heat conductivity, such, for example, as aluminum, and it is furthermore desirable that the reel member be a one-piece casting or forging. To maintain the reel at as nearly as possible a constant temperature and to prevent excessive dissipation of heat, it is preferably enclosed with a housing 43. It is important, however, that this housing be open to the atmosphere as, for example, through the screen 44 in the door at the forward end of the housing, this in order to facilitate the escape of air which has become saturated with moisture.

In operation, the reel is heated by passing fluid through the shaft 16 before the thread is caused to advance thereover. Heating of reel member 15 will necessarily result in heating of reel member 22 due to the proximity of the reel members to each other. After the reel has arrived at the desired temperature, the thread may be applied thereto and caused to advance thereover in generally helical form. In advancing over reel 13, the thread will be heated by direct contact with the bar members 21 and 23 and this direct contact will result in a rapid removal of the moisture. As here shown, the shrinkage of the thread which results from the removal of its moisture is accommodated by a tapering of the bar members toward the unsupported end of the device in the direction of the advance of the thread.

The cantilever thread-storage, thread-advancing device of Figures 6 to 9, inclusive, includes two rotatable cylinders 46 and 47, supported from one end thereof by member 45. These rotatable cylinders are separated from each other and their axes are disposed in inclined relation in order to cause helical advance of the thread. Although both cylinders may, as shown, be positively driven, it is sometimes sufficient to drive only one of them in a positive manner. It will be understood that the two rotatable cylinders 46 and 47 together may occupy substantially the same position in the complete thread-processing apparatus that is occupied by reel 13 in Figures 1 and 2.

Rotatable cylinder 46 is keyed to a hollow driving shaft 48, being retained on the shaft by bolt 49. Within this hollow shaft and extending longitudinally thereof is a conduit 50 adapted to rotate with shaft 48. Conduit 50 and shaft 48 are spaced from each other by a sleeve 51, which prevents direct communication between them. Conduit 50 communicates with a cavity 52 within rotatable cylinder 46 through one or more openings 53. At the end of cavity 52 opposite opening 53, the interior of hollow shaft 48 communicates with cavity 52 through openings 54.

To establish connection with supply pipe 55 and discharge pipe 56 for the heating fluid; e. g., hot water, a coupling block 57 is employed similar to that employed with reel 13.

The interior construction of rotatable cylinder 47 and its mounting is in all respects similar to the construction and mounting of rotatable

cylinder 46, except that shaft 58 for rotatable cylinder 47 passes angularly through member 45, as is shown in Figure 8, to give the desired inclined relation between the axes of rotatable cylinders 46 and 47. Shaft 58 is driven from shaft 48 of the rotatable member 46, the driving connection being effected by gear 59 secured to shaft 48, a gear 60 affixed to shaft 58, and an intermediate idler gear 61. Idler gear 61 is rotatably mounted upon a shaft 67 carried by casting 45. The axis of idler gear 61 is parallel to the axis of shaft 48; consequently, the teeth upon gear 59 and the teeth upon the portion of gear 61 with which gear 59 meshes may be spur teeth. Inasmuch as the axis of shaft 58 is at an angle with respect to the axis of shaft 67, the teeth upon gear 60 and the teeth upon gear 61 with which gear 60 meshes may conveniently be of helical form.

By properly proportioning gears 59 and 60 with respect to the portions of gear 61 with which they mesh, rotatable cylinder 46 and rotatable cylinder 47 will have the same peripheral velocity.

Shaft 58 and its coaxially mounted inner conduit 63 may enter a coupling block 64 similar in construction to coupling block 57. Coupling block 64 is, in the illustrated embodiment of the invention, upside down with respect to coupling block 57 so that the discharge pipes 56 and 65 therefrom conveniently may be connected to a common discharge conduit 66. The hot water supply pipe 67 may receive water from the same conduit 68 which supplies pipe 55. In this manner water from the same source will be supplied to the interiors of rotatable cylinders 46 and 47, so as to maintain them at the same temperature.

In each of the embodiments of the invention hereinabove disclosed, supply and discharge of the heating fluid is caused to take place through the supported end of the thread-storage, thread-advancing device. In this manner, the unsupported ends of the rotatable cylinders or reel members, as the case may be, remain unobstructed, thus facilitating access thereto by the operator. Furthermore, by supplying heating the fluid in the manner described, no interference results with the rotation of the cylinders or reel members necessary to enable them to perform their thread-advancing function.

It will be understood that the structures hereinabove described are intended to be illustrative rather than limitative of the invention. It will be apparent to those skilled in the art that the invention is susceptible of numerous modifications. Departures may be made from the constructions illustrated without in any way departing from the spirit of the invention. 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. Thread drying apparatus comprising, in combination, a cantilever thread-storage, thread-advancing reel having one end thereof wholly unobstructed embodying at least one rotatable thread-advancing member which is supported from one end only thereof, said rotatable thread-advancing member having an imperforate body portion provided with an internal cavity, and, associated with said rotatable thread-advancing member, means for simultaneously supplying heating fluid to and removing it from said cavity through the supported end of said rotatable thread-advancing member.

2. Thread drying apparatus comprising, in combination, a cantilever thread-storage, thread-advancing reel having one end thereof wholly unobstructed embodying at least one rotatable thread-advancing member which is supported from one end only thereof, said rotatable thread-advancing member having an imperforate body portion provided with an internal cavity, and, associated with said rotatable thread-advancing member, supply and discharge conduits communicating with said cavity for circulating heating fluid from the supported end of said rotatable thread-advancing member, said supply conduit communicating with said cavity toward the unsupported end and said discharge conduit toward the supported end of said rotatable thread-advancing member.

3. Thread drying apparatus comprising, in combination, a cantilever thread-storage, thread-advancing reel having one end thereof wholly unobstructed embodying at least one rotatable thread-advancing member which is supported from one end only thereof, said rotatable thread-advancing member having an imperforate body portion provided with an internal cavity, and, entering the supported end of said rotatable thread-advancing member, two conduits disposed one within the other for circulating heating fluid through said cavity from the supported end of said rotatable thread-advancing member.

4. Thread drying apparatus comprising a rotatable thread-storage, thread-advancing reel including two interdigitating sets of longitudinally extending bar members; a closed, imperforate hollow body disposed within said bar members; and, disposed one within the other, substantially coaxial supply and discharge conduits for supplying heating fluid to and removing it from said hollow body.

5. Thread drying apparatus comprising a rotatable thread-storage, thread-advancing reel embodying two rotatable reel members each of which comprises a plurality of spaced, longitudinally extending bar members, the bar members of said reel members being alternately disposed; a closed, imperforate hollow body to which are fixed the bar members of one of said reel members, said body being contained within the periphery of the other reel member; and means for supplying heating fluid to and removing it from said hollow body.

6. Thread drying apparatus comprising a rotatable thread-storage, thread-advancing reel comprising two rotatable reel members, each of which comprises a plurality of spaced, longitudinally extending bar members, the bar members of said reel members being alternately disposed; a closed, imperforate hollow body to which are fixed the bar members of one of said reel members, said body being contained within the periphery of the other reel member; and supply and discharge conduits disposed one within the other for circulating heating fluid through said hollow body.

7. Thread drying apparatus comprising a rotatable thread-storage, thread-advancing reel embodying two rotatable reel members each of which comprises a plurality of spaced, longitudinally extending bar members, the bar members of said reel members being alternately disposed; a closed, imperforate hollow body to which are fixed the bar members of one of said reel members, said body being contained within the pe-

riphery of the other reel member; and means for supplying heating fluid to and removing it from said hollow body, said means providing a flow of heating fluid in said body in a direction opposite to the direction of advance of the thread on the reel.

8. Thread treating apparatus comprising a cantilever thread-storage, thread-advancing reel embodying two rotatable reel members, each of which comprises a plurality of spaced longitudinally extending bar members, the bar members of said reel members being alternately disposed; a closed, imperforate hollow body to which are fixed the bar members of one of said reel members, said body being contained within the periphery defined by the bar members of the other reel member; means for supporting said reel members from one end only thereof, the other end of the structure formed by said reel members being unsupported and unobstructed; and means for supplying a temperature-changing fluid to and removing it from said hollow body through the supported end of the reel.

9. Thread treating apparatus comprising a cantilever thread-storage, thread-advancing reel embodying two rotatable reel members each of which comprises a plurality of spaced, longitudinally extending bar members, the bar members of said reel members being alternately disposed; a closed, imperforate hollow body to which are fixed the bar members of one of said reel members, said body being contained within the periphery defined by the bar members of the other reel member; means for supporting said reel members from one end only thereof, the other end of the structure formed by said reel members being unsupported and unobstructed; and means for supplying a temperature-changing fluid to and removing it from said hollow body through the supported end of the reel, said means comprising supply and discharge conduits disposed one within the other substantially coaxially of the reel.

10. Thread treating apparatus comprising a cantilever thread-storage, thread-advancing reel embodying two rotatable reel members each of which comprises a plurality of spaced, longitudinally extending bar members, the bar members of said reel members being alternately disposed; a closed, imperforate hollow body to which are fixed the bar members of one of said reel members, said body being contained within the periphery defined by the bar members of the other reel member; means for supporting said reel members from one end only thereof, the other end of the structure formed by said reel members being unsupported and unobstructed; and means for supplying a temperature-changing fluid to and removing it from said hollow body, said means supplying said temperature-changing fluid to said hollow body toward the unsupported end and removing it from said hollow body toward the supported end of the reel.

11. Thread-treating apparatus comprising a cantilever thread-storage thread-advancing reel embodying two rotatable reel members each of which comprises a plurality of spaced, longitudinally extending bar members, the bar members of said reel members being alternately disposed; a closed, imperforate hollow body disposed within the periphery defined by the bar members of said reel members; means for supporting said reel members from one end only thereof, the other end of the structure formed by said reel members being unsupported and unobstructed; and means for supplying temperature-changing fluid to and removing it from said hollow body through the supported end of said reel.

12. Thread-treating apparatus comprising a cantilever thread-storage thread-advancing reel embodying two rotatable reel members each of which comprises a plurality of spaced, longitudinally extending bar members, the bar members of said reel members being alternately disposed; a closed, imperforate hollow body disposed within the periphery defined by the bar members of said reel members; means for supporting said reel members from one end only thereof, the other end of the structure formed by said reel members being unsupported and unobstructed; and means for supplying temperature-changing fluid to and removing it from said hollow body through the supported end of the reel, said means comprising supply and discharge conduits disposed one within the other substantially coaxially of the reel.

13. Thread-treating apparatus comprising a cantilever thread-storage thread-advancing reel embodying two rotatable reel members each of which comprises a plurality of spaced, longitudinally extending bar members, the bar members of said reel members being alternately disposed; a closed, imperforate hollow body disposed within the periphery defined by the bar members of said reel members; means for supporting said reel members from one end only thereof, the other end of the structure formed by said reel members being unsupported and unobstructed; and means for supplying temperature-changing fluid to and removing it from said hollow body through the supported end of the reel, said means comprising conduits disposed one within the other substantially coaxially of the reel in such manner that the inner conduit communicates with the interior of said hollow body toward the unsupported end of the reel and the outer conduit communicates with the interior of said hollow body toward the supported end of the reel.

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