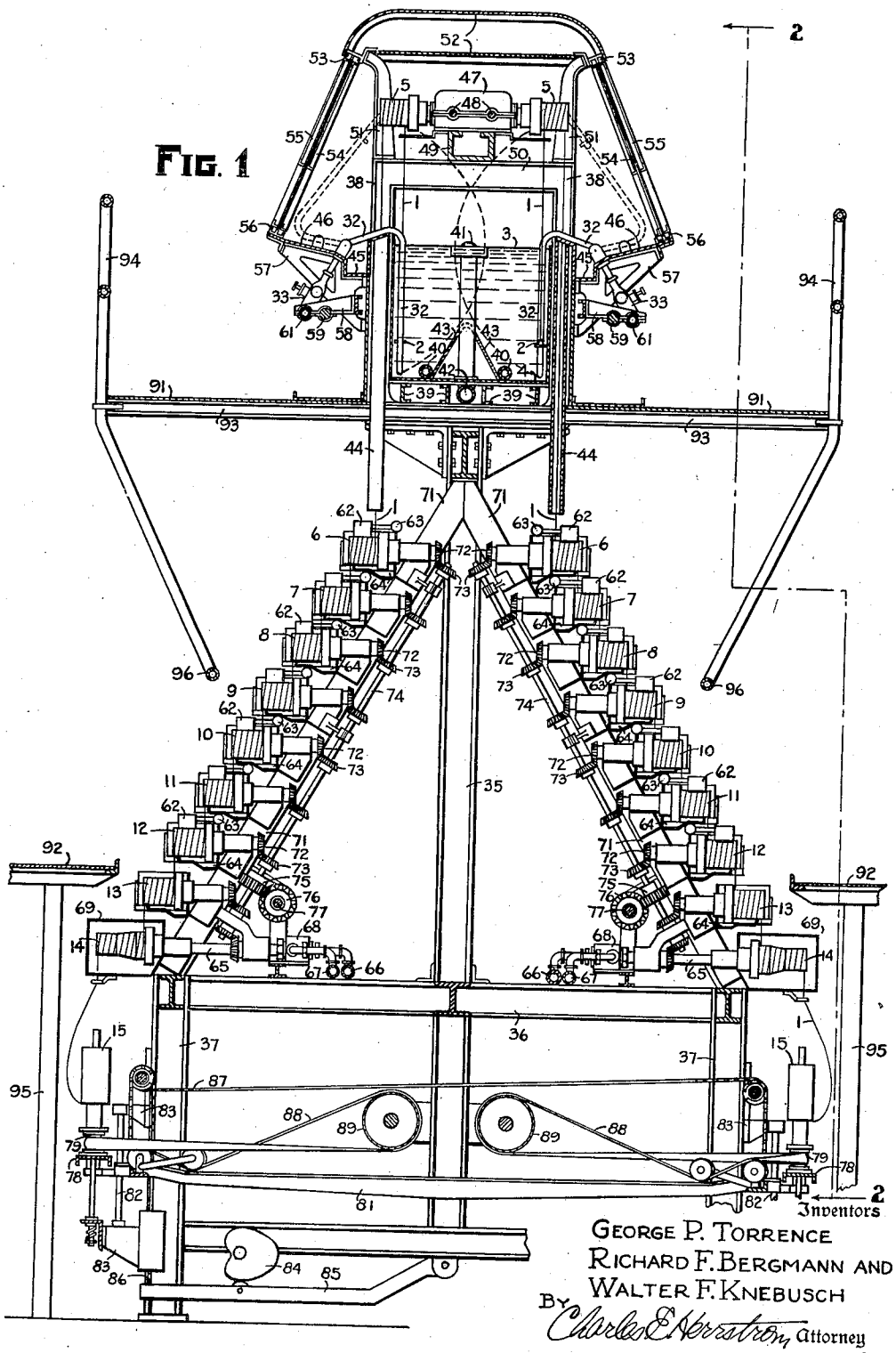
July 22, 1941. G. P. TORRENCE ET AL 2,249,797

APPARATUS FOR THE MANUFACTURE OF THREAD OR THE LIKE

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FIG. 1



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Filed Sept. 4, 1937 2 Sheets-Sheet 2

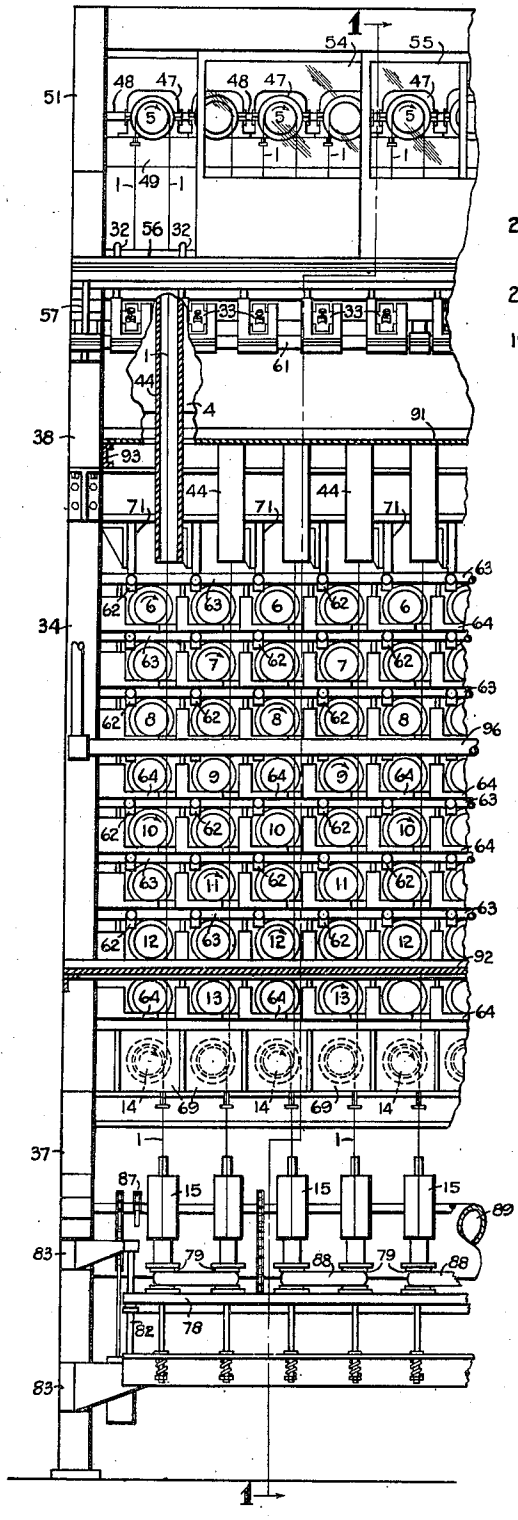


FIG. 2

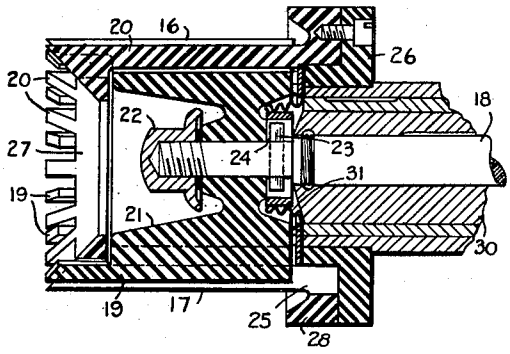


FIG. 3

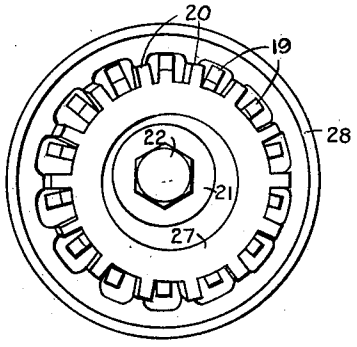


FIG. 4

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UNITED STATES PATENT OFFICE

2,249,797

APPARATUS FOR THE MANUFACTURE OF THREAD OR THE LIKE

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Application September 4, 1937, Serial No. 162,514

3 Claims. (Cl. 18—8)

This invention relates to apparatus for the manufacture of thread or the like, hereinafter referred to as "thread;" particularly, to improved apparatus for the manufacture of synthetic thread, such as artificial silk thread, by a continuous process.

Apparatus of the type comprehended by the present invention includes two oppositely inclined banks of thread-storage, thread-advancing devices on each of which devices a relatively long length of thread is continuously stored in a small space, each bank comprising one or more series of such thread-storage, thread-advancing devices arranged in processing sequence. The apparatus embodies a common coagulating trough disposed between said banks in which trough are formed all of the threads passing to said banks. The invention may be employed to particular advantage in connection with apparatus operating on the same general principle as the apparatus shown, described and claimed in prior application Serial No. 7,114, filed February 18, 1935, by Walter F. Knebusch and Alden H. Burkholder (Patent 2,225,642). From the standpoints of construction, operation, accessibility for manipulation of the thread, inspection, maintenance, repair, etc., the improved apparatus of the present invention provides numerous advantages over the apparatus of said prior application.

While the apparatus of the present invention is capable of use in connection with the manufacture of various kinds of thread, it will be described hereinafter as applied to the manufacture of viscose artificial silk thread.

In the drawings, in which is illustrated one form of apparatus embodying the invention, Figure 1 is a sectional elevation through said apparatus along line 1—1 of Figure 2. Figure 2 is a side elevation of the apparatus from line 2—2 of Figure 1, parts being broken away. Figure 3 is a sectional elevation on an enlarged scale from line 3—3 of Figure 4 of one form of thread-storage, thread-advancing device which may be employed in apparatus embodying the present invention. Figure 4 is a front elevation of said device. In the drawings, like reference characters refer to like parts throughout.

In the apparatus illustrated as embodying the present invention, each thread 1 is formed by extrusion of viscose from spinneret 2 into a coagulating bath 3 contained in trough 4. The thread is withdrawn from trough 4 by a suitable thread-storage, thread-advancing device 5 which advances it in a plurality of spaced, generally helical turns to a point beyond the edge of the trough, the thread then passing downward to the first thread-storage, thread-advancing device of a series of like devices disposed below said trough which devices in the drawings bear reference numerals 6 to 14, inclusive. On each of said devices the thread is stored in a plurality of spaced, generally helical turns which are automatically advanced axially of the device, the thread being meanwhile subjected to suitable processing treatment. After leaving the lowermost device of the series, the thread passes to suitable collecting means such as cap twister 15.

The thread-storage, thread-advancing devices are preferably thread-advancing reels supported from one end only having the unsupported ends thereof unobstructed by anything impeding the discharge of the thread therefrom, said reels being adapted upon rotation thereof to advance the thread from the supported to the unsupported ends thereof in a plurality of closely spaced, generally helical turns. In the illustrated apparatus, the reels are disposed in stepped arrangement with the unsupported ends of all reels extending in the same direction and with the unsupported end of each reel in apposite relation to the supported end of the next succeeding reel. Numerous advantages are provided by such arrangement, which, among other things, makes possible ready access to the reels for operating purposes, such as threading up of the reels, inspection, replacement, or repair of the reels, etc. Indeed, such an arrangement makes possible the threading up of the numerous reels with a minimum amount of time and labor and to a large extent is responsible for the commercial success of such apparatus.

The reel of Figures 3 and 4, which is typical of the kind of reel which may be employed to advantage in apparatus embodying the present invention, operates according to a theory and in a manner generally similar to the reel shown, described and claimed in copending application Serial No. 652,089, filed January 16, 1933, by Walter F. Knebusch (Patent 2,210,914). The illustrated reel comprises two rigid, generally cylindrical members 16 and 17. Member 16, which may be termed the concentric member, is mounted concentrically upon and for rotation with drive shaft 18. Member 17, which may be termed the eccentric member, is rotatably mounted with its axis slightly offset from and inclined to that of concentric member 16. The periphery of concentric member 16 comprises a plurality of bar members 19; that of eccentric

member 17, a plurality of bar members 20 equal in number to bar members 19 and alternately disposed with respect thereto.

Concentric member 16 may be of the form shown having the bar members 19 disposed on the periphery of a cylindrical body 21, in which case great rigidity is imparted to the bar members 19. While concentric member 16 may be mounted on the drive shaft 18 in any of various ways, it is shown as held against a shoulder formed on said drive shaft by cap nut 22 which is threaded onto the end of said drive shaft. In the embodiment illustrated, concentric member 16 is caused to rotate with drive shaft 18 by means of a pin 23 which passes through drive shaft 18 and extends into slot 24 formed in the hub of concentric member 16.

Eccentric member 17 may be formed of a rigid cage-like member 25 mounted concentrically upon an annular supporting member 26. Said cage-like member 25 is shown as comprising the aforesaid bar members 20 which are provided at their outer ends with an internal annular reinforcing rib 27 and at their inner ends with an external annular reinforcing rib 28 by means of which cage-like member 25 is mounted upon said annular supporting member 26. Annular supporting member 26 is rotatably mounted on frame member 30 with its axis in the desired spaced and inclined relationship with respect to the axis of concentric member 16. Drive shaft 18 may be journalled as shown in frame member 30. Flexible sealing means 31 may be provided to prevent access of corrosive processing liquids to the bearing members.

Rotation of the reel drive shaft 18 causes concentric member 16 fixed thereto to rotate, whereupon contact of the bar members 19 of said concentric member with bar members 20 of eccentric member 17 causes said eccentric member to rotate at the same angular speed. During such rotation, the thread supplied to the reel is wound thereon, the spaced relationship of the axes of the two reel members causing the thread to transfer from the bar members of one generally cylindrical reel member to those of the other reel member. Concurrently, the inclined relationship of the generally cylindrical reel members causes the thread to advance longitudinally of the reel in a plurality of spaced, generally helical turns, the direction of inclination of the reel members being, of course, such that the thread is caused to advance in the desired direction lengthwise of the reel during the desired direction of rotation of the reel members. As previously indicated, it is desirable in the case of cantilever reels such as the one under discussion to advance the thread from the supported end of the reel toward the unsupported end thereof.

All of the reels shown in the illustrated embodiment of the invention are of the same general type and operate in the same manner.

Because of the above-described stepped arrangement of reels, the illustrated apparatus may conveniently comprise two oppositely inclined banks of reels. Thus the portion of the machine embodying said banks has the appearance of an inverted V when as in Figure 1, the machine is viewed endwise. The frame structure comprises inclined beams 34 and vertical beams 35 which are supported by the cross beams 36 and uprights 37. The upper portion of the apparatus comprises frame members 38 of cast construction, each being bolted in a suitable manner to the lower frame members of the apparatus.

As shown in Figure 2, the illustrated embodiment of the invention is constructed so that a plurality of thread producing units are disposed lengthwise of the machine along opposite sides of common coagulating trough 4. Each thread-producing unit comprises spinneret 2, its associated mass tube 32 and spinning pump 33, reels 5 to 14, inclusive, collecting device 15, and other associated apparatus. Corresponding parts of adjacent thread-producing units are disposed in corresponding positions lengthwise of the machine. The latter feature provides numerous benefits, among them economy of construction of the apparatus, advantages in driving the various portions of the apparatus, advantages in supplying processing medium thereto, operating advantages, etc.

Frame members 38, which are disposed at the ends of and at intervals along the machine, serve to support the various parts of the upper portion of the apparatus as a whole. This common coagulating trough 4 is contained within the vertical uprights and a lower crossbeam of said frame member 38, being supported therefrom by suitable beams 39. Trough 4 is provided with conduits 40, from which is supplied the coagulating liquid, and a plurality of drain conduits 41 which are spaced along the central axis of the trough and which communicate with a main drain conduit 42. Each drain conduit 41 has its intake at its upper end so that the desired level of liquid in the coagulating trough may be constantly maintained. The bottom of common coagulating trough 4 may be provided as shown with a re-entrant portion 43 which tends to prevent agitation, and hence non-uniformity, of the coagulating bath liquid and which also serves to reduce the volume of liquid required to fill the trough.

As shown in Figure 1, the coagulating trough 4 is provided with two working faces extending lengthwise of the trough from each of which working faces an operator may have access to the spinnerets, mass tubes, reels 5 and associated apparatus disposed on that side of the trough. Along each of the long sides of trough 4 are vertically extending channels 44 which may, as illustrated, be disposed between the trough 4 and the waste trough 45 of each working deck 46. Each of said channels 44 provides a passage for the thread 1 from one of the reels 5 to the corresponding succeeding reel 6. As illustrated, the design of the apparatus is such that the discharge point of the reel 5 is directly above the entrance to the channel 44 while the receiving point of the reel 6 is directly below the discharge end of channel 44. In starting a thread through the apparatus, it is thus merely necessary to drop the thread from the upper reel 5 through the channel 44 to the lower reel.

Reels 5 may be supported and driven in various ways. Thus in the apparatus shown, the reels 5 for opposite sides of the machine are supported and driven from a common gear box 47, a shaft 48 provided to drive the reels 5 for each side of the machine. As shown, the reels 5 are mounted at right angles to the axis of the shafts 48 from which they are driven. Gear box 47 is supported by a suitable longitudinally extending beam 49 which in turn is carried by cross members 50 of the spaced frame members 38.

Frame members 38 are provided with upward-

ly extending portions 51 to support the ventilating duct 52 and upper tracks 53 for the sliding doors 54 and 55, which may be provided, if desired, to enclose the space above the coagulating bath. The lower tracks 56 for the sliding doors of the apparatus are supported from the members 57 fixed to members 38, which members 57 also serve to support the working deck 46 and the brackets 58 which carry the drive shaft 59 and viscose supply line 61 for the spinning pumps 33 on each side of the apparatus. As shown in Figure 2, the sliding doors 54 and 55 on each side of the apparatus may be retracted to provide access for operating purposes to the spinnerets, reels 5, etc. Most of the time the entire upper portion of the machine is completely enclosed, thus making it possible to withdraw through duct 52 any fumes given off during the spinning operation.

In the illustrated embodiment of the invention, the reels 5 are employed as holding reels; i. e., reels providing an additional time to enable coagulation of the thread to proceed to substantial completion, such coagulation being facilitated by the fact that an appreciable amount of coagulating liquid is carried up to the reel by the thread passing thereto. After each thread passes through its corresponding channel 44 to succeeding reels 6 to 14, inclusive, it is subjected to the desired processing operations. While one or more processing treatments might be applied to the thread while stored on each reel, in the illustrated apparatus one liquid processing treatment is applied to the thread on each of reels 6 to 12, inclusive. Such treatments may include the application of additional coagulating liquid, desulphurizing, washing, bleaching, and oiling liquids, etc.

In the illustrated apparatus, the processing liquid applied to the thread on each of said reels is supplied from a suitable reagent distributor 62 which is supplied with liquid from conduit 63 extending longitudinally of the machine and serving corresponding reels on the same horizontal level. The liquid is collected in a suitable trough 64 disposed below the reel, said trough extending longitudinally of the machine and likewise serving corresponding reels in a horizontal series. Each trough may communicate with the sewer if it is desired to use the liquid collected therein only once, as might be the case with wash water, or the trough may communicate with suitable re-circulating and make-up means if the liquid is one which it is desired to re-use. For the purposes of convenience in illustration, the sources of supply for the various processing reagents, as well as the drainage systems therefor, are not shown.

On reel 13 no processing liquid is applied to the thread, but the excess liquid applied on the preceding step is allowed to drip from the thread before it passes to the drying stage; i. e., to reel 14. While various means may be employed for drying the thread on the reel, the drying reel illustrated is of the type shown, claimed and described in prior application Serial No. 129,848, filed March 9, 1937, by Alden H. Burkholder (Patent 2,189,195). Drying is accomplished by heating the reel, and consequently the thread thereon, by means of a heated liquid supplied through a suitable hollow drive shaft 65 for the reel to a chamber contained in the interior of the reel. The drying reels 14 for one side of the apparatus are shown as supplied with heated liquid from pipe 66 which extends longitudinally of the machine and serves a plurality of said drying reels disposed in the horizontal series. Pipes 66 and 67 may communicate with each hollow reel drive shaft 65 through a suitable fitting 68. If desired, a suitable enclosure 69 may be provided about each drying reel to aid in conserving the heat.

The number of reels on which the thread may be processed may, of course, be more or less than that shown, depending upon the number and kind of processing treatments which it is desired to apply to the thread.

In the apparatus illustrated, reels 6 to 14, inclusive, of each processing series are mounted on an inclined member 71 fixed to the frame of the machine. Each of said reels in a given descending series is driven by means of gears 72 and 73 from a drive shaft 74 disposed along the corresponding member 71. The drive shafts 74 for each bank are driven through gears 75 and 76 from a drive shaft 77 extending longitudinally of the machine driven by suitable means. Preferably the drive shafts 74 for both banks of reels are driven from a common power source in timed relation with the reels 5 and spinning pumps 33. Said driving means for the reels is but illustrative and various other types of driving mechanism may be substituted therefor.

The cap twisting devices to which the threads pass after leaving drying reels 14 may be actuated by any suitable means. In the illustrated apparatus, the lifting rails 78 on opposite sides of the apparatus, which rails support the bobbin-supporting whirls 79 for a plurality of cap twisters 15, are connected by transverse beams 81. The lifting rails 78 and transverse beams 81 are guided vertically by means of guide rods 82 fixed to the frame of the machine by suitable brackets 83. The desired vertical reciprocatory motion may be imparted to the lifting rails by the conventional apparatus illustrated comprising a cam 84 and cam lever 85, chains 86 and 87, etc. The whirls of adjacent pairs of cap twisters on each side of the machine may be rotated by means of belt 88 driven by a rapidly rotating drum 89. The driving connections, not shown, for the drums 89 and cam 84 may be of any suitable design. It is apparent that various other types of collecting or twisting apparatus may be employed instead.

The illustrated embodiment of the invention is, moreover, provided with upper and lower platforms 91 and 92 from which operators may have access to different portions of the machine. Upper platforms 91 may, as shown, be supported by cross beams 93 bolted to the frame of the machine and may be provided with suitable guard rails 94. Lower platforms 92 may be supported by any suitable means as by stanchions 95, sufficient headroom being preferably provided between the floor and lower platforms 92 and between platforms 91 and 92 to permit the operators to stand upright. Hand rails 96 which, in the illustrated embodiment are supported from the cross beams 93 for the upper platforms, may be provided for the operators working on platforms 92.

The illustrated apparatus therefore comprises two banks of reels inclined as a whole toward each other, the faces of the banks at which the operators work in the thread-processing operations being oppositely disposed, and, associated therewith, a common coagulating trough disposed intermediately of the banks in which coagulating trough is formed the thread for both

banks. The trough also is provided with working faces on opposite sides thereof from which an operator may have access to the trough, so that the machine as a whole has two working faces on opposite sides thereof. As will be hereinafter pointed out, such an arrangement possesses numerous advantages.

Thus the operators on upper platform **91** have access to the thread-forming means and associated apparatus, such as spinnerets, spinning pumps, reels **5**, etc. Those standing on lower platforms **92** have access to the reels in the inclined banks, while the operators below platform **92** have access to the lower portion of the apparatus including the collecting or twisting mechanism. This makes for an advantageous subdivision of labor since each operator need perform only a relatively few specialized tasks at which he is particularly skilled. Each operator can, therefore, perform his specialized duty more rapidly than would otherwise be the case; consequently, a smaller number of operators than would otherwise be possible can tend a large number of thread-producing units. Moreover, a relatively more unskilled grade of labor can be employed with a consequent reduction in wage costs. Furthermore, the design of the apparatus is such that no excessive movement of the operators about the apparatus is required in their performance of their duties, with consequent saving of operators' time.

If, as indicated, platform **92** is disposed above the drying reel, advantages result from the fact that in such a case the operators working on lower platform **92** handle only wet thread, while operators standing on the floor below said lower platform handle only the dry thread. Since the operators working at the liquid processing reels in time develop a roughened condition of the skin on the hands due to exposure to processing liquids, it is extremely desirable that they should not handle the dry thread, since snagging and breakage of the filaments of the dry thread would soon result. Since, however, the operators standing on the floor work only with the dry thread, they do not develop such a roughened condition of the hands and consequently even though they actually come into contact with the thread more than do other operators, they do not damage the thread. In this respect the illustrated apparatus makes possible an improved quality of the thread, since the finished thread is more nearly free of broken filaments, knots, etc., than would otherwise be the case.

The present invention also provides numerous other advantages. Thus the overall width of the machine is considerably reduced over that which would be required if, for instance, a separate coagulating trough were provided for each bank, and particularly if such separate coagulating troughs were separated and a working platform were to be mounted between the troughs. This is extremely important in view of the fact that in a commercial plant for the manufacture of artificial silk thread in commercial quantities a large number of such machines will be employed. Thus a saving of several feet in the width of each machine results in a very considerable saving in plant space and plant cost.

Furthermore, since the reels **5** which serve to withdraw the threads from the spinnerets may, as shown, be supported from a longitudinally extending beam **49** carried by the cross beams **50** of the spaced frame members **38**, the space above the coagulating bath may be virtually entirely, if not completely, unobstructed. This arrangement is extremely advantageous for operating purposes; in addition, it provides other advantages. Thus if the reels **5** were supported from frame members extending vertically through the center of the trough, it would be necessary to make the trough wider than is required according to the present invention, since when the mass tubes **32** on opposite sides of the trough are swung up out of the trough, as for replacement of spinnerets, etc., they would interfere with such supporting means.

However, in the illustrated embodiment and as shown by the dotted lines in Figure 1 when the mass tubes **32** on opposite sides of the trough are swung up out of the trough, there is no interference with the supporting means for the reels **5**. Consequently, a greater depth of immersion of the spinnerets, which obviously is desirable, and a considerably narrower trough than would otherwise be required are made possible by the present invention. As is apparent from the preceding remarks, such a saving in width of the trough is reflected as a saving in overall width of the machine, which is important since it results in a large reduction of floor space required by the large number of machines which must be employed in a commercial plant.

It is evident that the above-described embodiment of the invention is illustrative only and that various changes and modifications may be made therein without departing from the spirit of the invention. In the appended claims, the term "thread" is not restricted solely to thread per se, but is intended to define all continuous length materials which can be manufactured or handled by apparatus embraced by the claims. 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. Apparatus for the manufacture of thread comprising an elongated trough having a working face along each of the two longitudinally extending sides thereof; a plurality of thread-forming means supported in said trough from each working face thereof, whereby each of said thread-forming means is accessible from at least one of said working faces; a longitudinally extending member disposed centrally above and supported at spaced points along said trough in such manner as to leave the space between said trough and said longitudinally extending member substantially unobstructed; a plurality of thread-storage, thread-advancing devices of cantilever construction supported above said trough by and on each side of said longitudinally extending member, each of said thread-storage, thread-advancing devices being so mounted that although its supported end is located directly above said trough its unsupported end extends toward one of the working faces of and beyond the lateral limits of the trough, whereby each of said devices is enabled to withdraw a thread from said thread-forming means and advance it in a large number of generally helical turns to a point beyond the lateral limits of the trough; and, disposed below said trough on each side of a vertical plane passing through the longitudinal center line of said trough, a plurality of parallel downwardly extending series of thread-storage, thread-advancing devices to which the threads pass from the thread-storage, thread-advancing devices above the trough on the corre-

sponding side thereof, whereby one of the working faces of said trough and a plurality of parallel series of thread-storage, thread-advancing devices below said trough are accessible for operating purposes on each side of the apparatus.

2. Apparatus for the manufacture of thread comprising an elongated trough having a working face along each of the two longitudinally extending sides thereof; a plurality of thread-forming means supported in said trough from each working face thereof, whereby each of said thread-forming means is accessible from at least one of said working faces; a longitudinally extending member disposed centrally above and supported at spaced points along said trough in such manner as to leave the space between said trough and said longitudinally extending member substantially unobstructed; a plurality of thread-storage, thread-advancing devices of cantilever construction supported above said trough by and on each side of said longitudinally extending member, each of said thread-storage, thread-advancing devices being so mounted that although its supported end is disposed directly above said trough its unsupported end extends toward the working face of said trough on the corresponding side of said longitudinally extending member; a plurality of downwardly extending channels disposed on each side of said trough each of which channels is adapted to permit the passage therethrough of thread leaving the unsupported end of one of said thread-storage, thread-advancing devices; and, disposed below said trough on each side of a vertical plane passing through the longitudinal center line of said trough, a plurality of parallel downwardly extending series of thread-storage, thread-advancing devices to which the threads pass through said channels on the corresponding side of said trough from said thread-storage, thread-advancing devices above the trough on the corresponding side thereof, whereby one of the working faces of said trough and a plurality of parallel series of thread-storage, thread-advancing devices below said trough are accessible for operating purposes on each side of the apparatus.

3. Apparatus of the character described in claim 1 incorporating means enclosing the space above said trough together with the thread-storage, thread-advancing devices disposed above said trough, said enclosing means being provided with closures providing access to said trough along each of the two working faces thereof.

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