Dec. 30, 1941. L. E. LOVETT 2,267,984

METHOD OF AND MEANS FOR MANUFACTURING MULTIPLE FILAMENT THREAD OR THE LIKE

Filed May 26, 1938 2 Sheets-Sheet 1

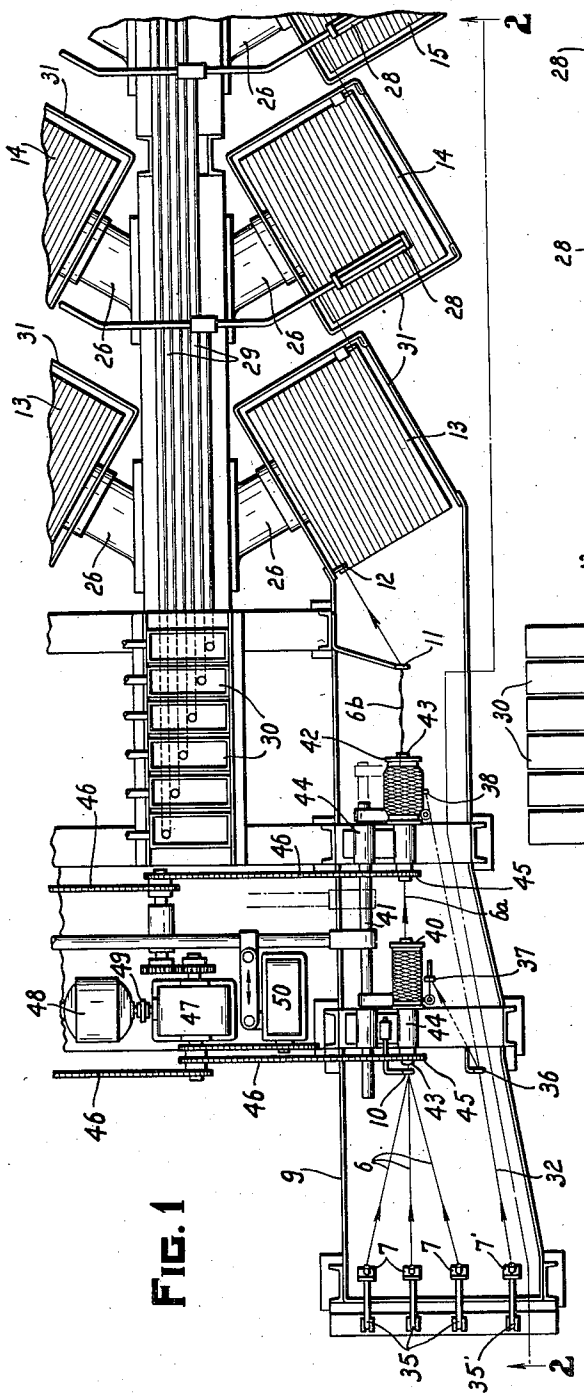


FIG. 1

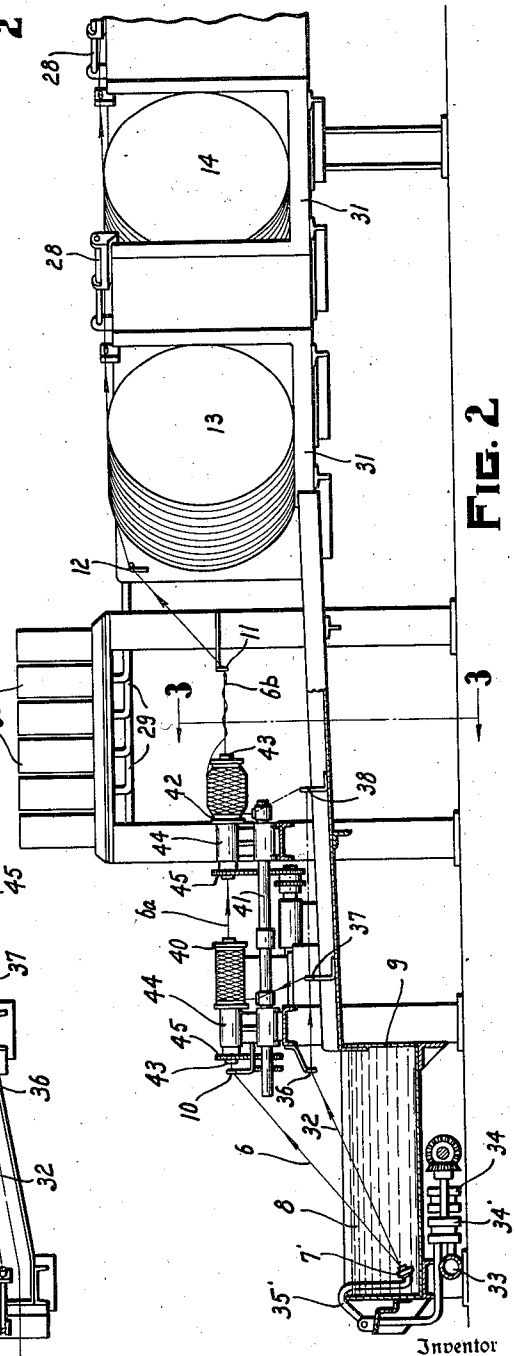


FIG. 2

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METHOD OF AND MEANS FOR MANUFACTURING MULTIPLE FILAMENT THREAD OR THE LIKE

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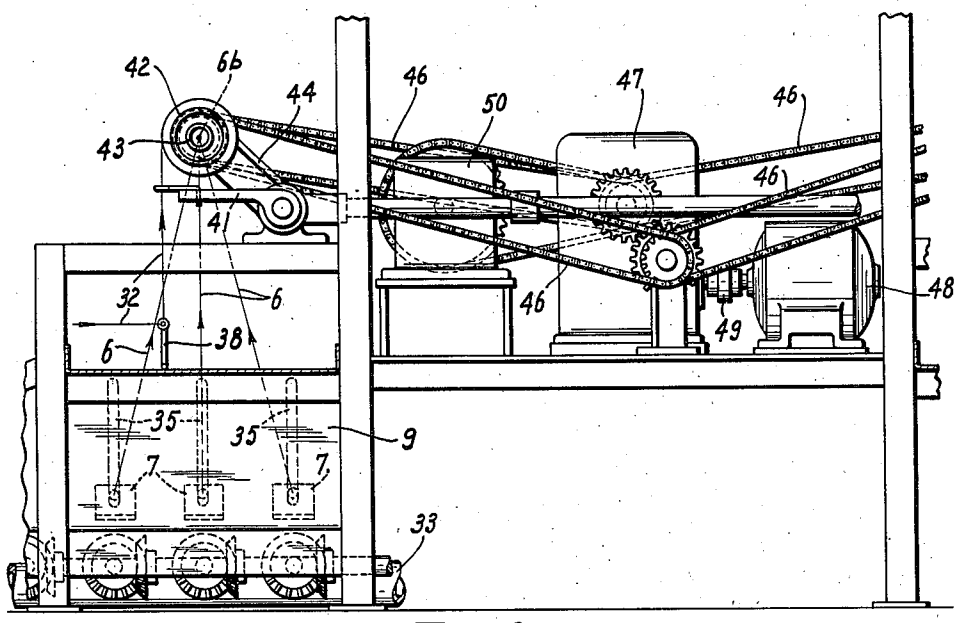


FIG. 3

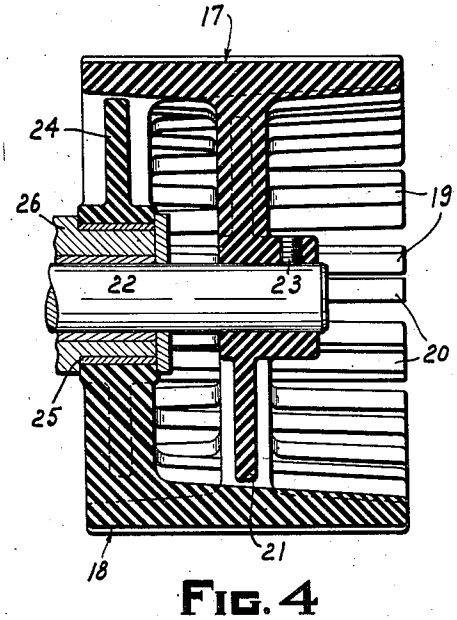


FIG. 4

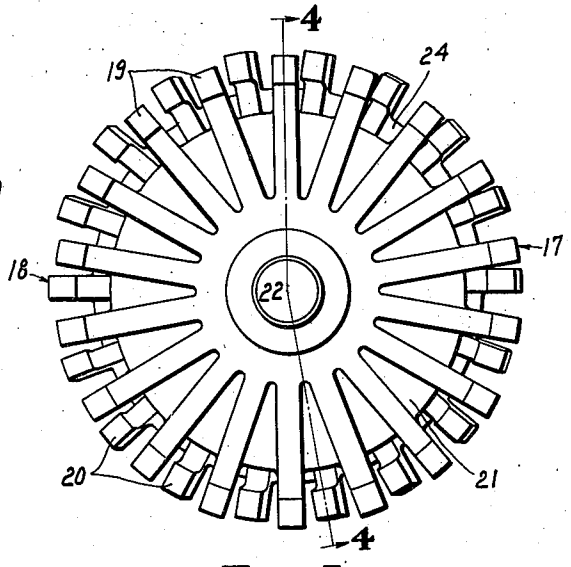


FIG. 5

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METHOD OF AND MEANS FOR MANUFACTURING MULTIPLE FILAMENT THREAD OR THE LIKE

Louis E. Lovett, Cleveland Heights, Ohio, assignor to Industrial Rayon Corporation, Cleveland, Ohio, a corporation of Delaware

Application May 26, 1938, Serial No. 210,174

5 Claims. (Cl. 18—8)

This invention relates to a method of and means for manufacturing thread or the like; more particularly, to a method of and means for manufacturing according to the so-called continuous process thread or thread-like articles made up of a large number of filaments.

Among other things, the invention involves the doubling of a thread or thread-like article characterized by a large number of filaments with one or more single- or multiple-filament threads in order to form a composite thread which may be more conveniently subjected to the necessary processing operations. One of the advantages of employing a composite thread of this kind is that the filaments are bound together throughout the subsequent processing operations in such manner as to prevent separation thereof and the difficulties attendant upon such separation.

In the production of artificial silk thread by the so-called continuous process it is not infrequently desirable to double a freshly spun multiple-filament thread with a single- or multiple-filament thread, this being equally true whether the product is to constitute a thread of the ordinary multiple-filament type or is of the nature of a thread bundle adapted to be cut into fibers of staple length. In order to simplify matters, the invention will be illustrated and described as applied to the manufacture of a thread bundle adapted to be reduced to the form of fibers of staple length. The apparatus shown in the accompanying drawings represents one of numerous embodiments of the invention which may be employed for the latter purpose.

In the accompanying drawings, Figure 1 is a plan of a staple fiber machine embodying and operating upon the principles of the invention. Figure 2 shows a side elevation of the machine partly in section as indicated by the line 2—2 in Figure 1. Figure 3 is a vertical section of the machine along line 3—3 of Figure 2. Figure 4 shows a section along the line 4—4 of Figure 5 of a typical form of thread-advancing thread store device which may be used to advantage in a machine employing the invention. Figure 5 is an end elevation of the device of Figure 4.

In the apparatus illustrated in the drawings, one or more multiple-filament threads 6 are supplied by some suitable source such as the spinnerets 7 from which viscose is extruded into coagulating bath 8 contained in trough 9. Ordinarily, the thread bundle 6a resulting from the consolidation of the threads 6 is passed through a series of guides 10, 11 and 12, being led thereby to a series of thread-advancing thread store devices of which a plurality may be arranged in any desired processing sequence and upon each of which the thread bundle may be continuously but temporarily stored in a large number of closely spaced, generally helical turns. Such thread-advancing thread store devices may take any of several suitable forms, one of which is the reel illustrated in Figures 4 and 5.

Reels of the latter type are advantageously employed in the practice of the invention because their construction permits their being supported from one end only, leaving their unsupported ends unobstructed by anything impeding the continuous discharge of the thread bundle. The reel of Figures 4 and 5, which will be but briefly described herein, is generally of the type shown, described and claimed in Patent 2,210,914, granted August 13, 1940, to Walter F. Knebusch. It embodies two rigid, generally cylindrical cage members 17 and 18 made up of a number of longitudinally extending bar members 19 and 20 which are interleaved with each other.

The bar members 19 of the reel member 17 are supported by a spider 21 which is mounted concentrically of and fixed to drive shaft 22 by the set screw 23. The member 17 is, therefore, known as the concentric reel member. The bar members 20 of reel member 18 are supported by a spider 24 which is rotatably mounted upon a bearing 25 in offset and inclined relation to concentric member 17, such bearing 25 being carried by the frame member 26 in which the drive shaft 22 is journalled. Member 18 is referred to hereinafter as the eccentric reel member.

Concentric reel member 17, being fixed to the drive shaft 22, is rotated therewith from a suitable power source (not shown). Due to the fact that the bar members 19 of the concentric reel member 17 interdigitate with the bar members 20 of the eccentric reel member 18, the latter is caused to rotate by bar-to-bar contact between the two reel members. The offset relationship of bar members 20 with respect to bar members 19 causes the thread bundle to be supported first by one set of bar members and then by the other. At the same time, the inclined relationship between the respective reel members results in advance of the thread bundle in a series of closely spaced, generally helical turns from the thread-receiving end of the reel to the thread discharge end thereof.

Referring again to Figures 1 and 2, during the period of travel of the thread bundle upon reels 13, 14 and 15, one or more processing operations, as desired, may be performed upon it.

Thus reel 13, for example, may be utilized as a holding reel for the purpose of permitting coagulation of the several component threads to proceed substantially to completion. Thereafter, the thread bundle is advanced along reels 14 and 15 and in sequence along each of any subsequent reels, the number being such as to permit the completion of the several processing steps required by the particular method of manufacture being followed. A suitable processing medium may be applied to the thread bundle while it is temporarily stored upon each of reels 14, 15 and so on by means of a suitable distributor 28 which may be supplied with processing liquor from supply conduits 29 connected to supply tanks 30. Collecting troughs 31 are provided to catch the spent processing liquid.

Ordinarily, in the processing of thread bundles upon such thread-advancing reels, there is a tendency for the filaments of adjacent turns to become entangled. This results in breakage of filaments, causing knots or bunches of ends usually referred to as "slubs." These slubs, which are carried along by the thread bundle, catch on the guides or break off and clog the drain outlets from the collecting troughs. These and other difficulties are, however, eliminated by the present invention, by which as a result of the operations hereinafter described the spreading and consequent entanglement of filaments in adjacent turns is largely prevented.

The preferred mode of carrying out the invention, which obviously may be practiced in a number of different ways and by means of various forms of apparatus, is illustrated as involving the forming and the doubling with the thread bundle 6*a* of a separate thread 32 which conveniently is, but need not necessarily be, a thread of lower denier and of a lesser number of filaments than the thread bundle 6*a*. Viscose supplied by a common conduit 33 serving similar units of several machines is pumped by means of pumps 34 through the mass tubes 35 to form the separate threads 6 which are combined to form the thread bundle 6*a*. Simultaneously, the thread 32 is produced by a similar but separate thread-forming unit including the pump 34', mass tubes 35' and spinneret 7'.

Among other things, the preferred embodiment of the invention provides two alternately used spin spools 40 and 42 to one of which, depending upon which of the two is currently being employed in the doubling operation, the freshly spun thread 32 is passed through guides 36 and 37 or 36 and 38 and upon which it is wound by means of reciprocating arm 41. In order to facilitate the withdrawal and use in the doubling operation of the thread 32, the filled spin spool is rotated by means of reversible motor 48 at the proper speed and in the proper direction to cause the thread 32 previously wound thereon to unwind therefrom, the unwinding of the thread 32 being effected in such manner as to permit it to be doubled with the thread bundle 6*a*. Meanwhile, the empty spin spool is rotated in the opposite direction in such manner as to cause the freshly spun thread 32 to be wound thereon in the form of a package.

Spin spools 40 and 42 are rotatably mounted upon hollow drive shafts 43 through which the thread bundle 6*a* is led, such hollow drive shafts being supported from a vertical frame member by bearing brackets 44. Sprockets 45 for driving shafts 43 are fixed thereto and connected by means of chains 46 to change speed device 47 (Figure 3) which is driven through coupling 49 from motor 48, which serves also to furnish the necessary motive power to actuate the traverse guide arm 41 through the cam box 50. When the thread package on the filled spool is exhausted, the respective directions of rotation of spools 40 and 42 are reversed, the leading end of the freshly spun thread 32 being simultaneously removed from guide 37 and passed through the guide 38 thence conducted by traverse arm 41 to the empty spin spool.

The thread bundle 6*a*, directed by means of guide 10 to the hollow shafts 43 and thence to guides 11 and 12, is doubled with thread 32 from the filled spool immediately after emerging from the shaft supporting said spool, thus forming composite thread bundle 6*b*. The composite bundle 6*b* thus formed is directed through the guides 11 and 12 to the first thread-advancing reel 13 and thence to the remaining reels in the sequence. The thread 32 does not interfere with the processing of the composite thread bundle 6*b*; rather, the doubling operation tends to confine within the composite thread bundle 6*b* any broken filaments which may inadvertently occur and, in consequence thereof, to prevent over-riding of adjacent turns.

Due to the fact that the doubling action effected by the rotation of the filled spin spool involves a withdrawal of thread 32 from the filled spin spool at a rate greater than the spinning speed of the threads 6, it is necessary to operate the pump 34' which supplies the viscose to the spinneret 7' forming the thread 32 at a speed somewhat greater than that of the pumps 34 of the thread-forming units forming the separate threads 6. The simultaneous compensation and decompensation of the spin spools 40 and 42 necessary to maintain the linear speed of the thread 32 constant is accomplished through suitable gearing combinations by means of the change speed device 47. The change in the direction of rotation of the spin spools is accomplished by reversing the direction of rotation of motor 48.

If desired, a plurality of packages of thread 32 previously formed in the conventional manner on another machine may be supplied and so positioned with respect to guide 10 as to cause thread 32 to be continuously doubled with the thread bundle 6*a*. Such a procedure is, however, not so desirable as that contemplated by the method previously described in which the thread 32 is formed simultaneously with the formation of the thread bundle 6*a* itself, since, as is readily apparent, it is necessary to break the thread bundle 6*a* in order to replace the empty spool when the supply of thread 32 is exhausted. This frequent breaking of the thread bundle 6*a* to replenish the supply of thread 32, while not otherwise objectionable in the manufacture of staple fiber, will necessitate the repeated threading-up of the machine as a whole.

In apparatus of the kind to which the invention relates, the employment of thread-advancing reels involves the concomitant desideratum of keeping the turns spaced as closely as possible in order to insure effective processing of the thread bundle on each of the several reels. To accomplish the desired result it is necessary to space the turns relatively closely together. Consequently, unless restricted in some way, the inherent tendency of the filaments to separate in the course of the processing treatment and impart a flat ribbon-like appearance to the thread bundle causes over-riding of the filaments of ad-

jacent turns, giving rise to knots and slubs, as previously indicated.

To insure maximum efficiency and satisfactory treatment of the thread bundle, it is desirable that the processing medium be brought into intimate contact with the filaments thereof. As has already been stated, the doubling operation contemplated by the instant invention when employed in the manner described prevents the tendency of the filaments to separate from being carried to the point where over-riding, snarling or tangling of the filaments results. Nevertheless it does not hinder the thorough processing of the thread bundle, which is not so compacted by means of thread **32** as to impair the thoroughness of the processing operation.

In the processing of a multiple-filament thread bundle of relatively large denier such, for example, as that used in the manufacture of staple fiber, a great many filaments are inevitably broken in the course of the operation of forming the thread bundle. The expedient of doubling a thread bundle of this type with one or more single- or multiple-filament threads to form a composite thread bundle among other things serves by consolidation of the filaments to enclose within the composite thread bundle any broken filaments, thereby virtually completely eliminating the difficulties previously experienced. In lesser degree the same holds true in the case of products of lower denier; for example, ordinary multiple-filament artificial silk threads.

One of the particularly important results of the employment of the present invention in continuous processing apparatus using thread-advancing reels lies in the fact that in permitting a closer spacing of thread turns it makes possible the use of reels which are considerably shorter in length and smaller in diameter than would otherwise be necessary. This feature, in addition to conserving floor space and cutting the cost of the facilities for housing the equipment, accounts for a considerable saving in the expense of fabrication of the reels and construction of continuous processing machinery. In that it makes it possible for operators to attend to their tasks without having to walk farther than necessary it mages it possible to employ their time to the maximum advantage.

Obviously, numerous changes in the apparatus shown and described may be made without in any way departing from the spirit of the invention. For example, the apparatus may readily be modified to permit of its use in the production of a variety of thread-like products other than multiple filament viscose artificial silk thread, all of which are comprehended by the term "thread" as hereinafter employed. While as indicated in the drawings the preferred form of machine employed in the practice of the invention is double-sided, other arrangements are equally possible. The apparatus as a whole may, if desired, be arranged to provide a plurality of similar horizontal tiers one above the other, a feature making possible a further saving in floor space.

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 production of a multiple filament artificial silk thread bundle comprising means containing a coagulant; means for simultaneously forming in said coagulant a plurality of artificial silk threads at least one of which is a multiple filament thread characterized by a large number of filaments; a rotor for taking up said multiple filament thread; rotary means for collecting the remaining thread or threads; means operating concurrently with said collecting means for wrapping about said multiple filament thread one or more threads of like origin which have previously been collected on similar collecting means; and means for synchronizing the operation of said wrapping and collecting means so that the supply of wrapping thread is depleted on one of said collecting means at the same over-all rate at which it is collected on the other.

2. Apparatus as in claim 1 in which the collecting system comprises two like spools each of which is rotated at a speed such that the wrapping thread is taken up by and withdrawn from said spool at a constant linear speed.

3. Apparatus as in claim 1 in which the part of the collecting system from which the wrapping thread is being withdrawn at any given time comprises a hollow spool through which the multiple filament thread is passed.

4. Apparatus as in claim 1 in which the collecting system comprises two aligned spools through both of which the multiple filament thread passes in traveling from the forming means to the rotor by which it is taken up.

5. The method of uninterruptedly producing a multiple filament artificial silk thread bundle comprising the steps of simultaneously forming in a common coagulant a plurality of artificial silk threads at least one of which is a multiple filament thread characterized by a large number of filaments; taking up said multiple filament thread on a rotor; collecting the remaining thread or threads with the aid of rotary collecting means; concurrently with said collecting operation, wrapping about said multiple-filament thread one or more threads of like origin which have been previously collected with the aid of similar rotary collecting means; and synchronizing the wrapping and collecting operations so that the supply of wrapping thread is depleted on one of said rotary collecting means at the same over-all rate at which is is collected on the other, whereby a uniform thread bundle of substantially continuous length is formed.

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