Dec. 29, 1942. R. A. GIFT, JR 2,306,660

PROCESS FOR HANDLING MATERIALS

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Fig. 1

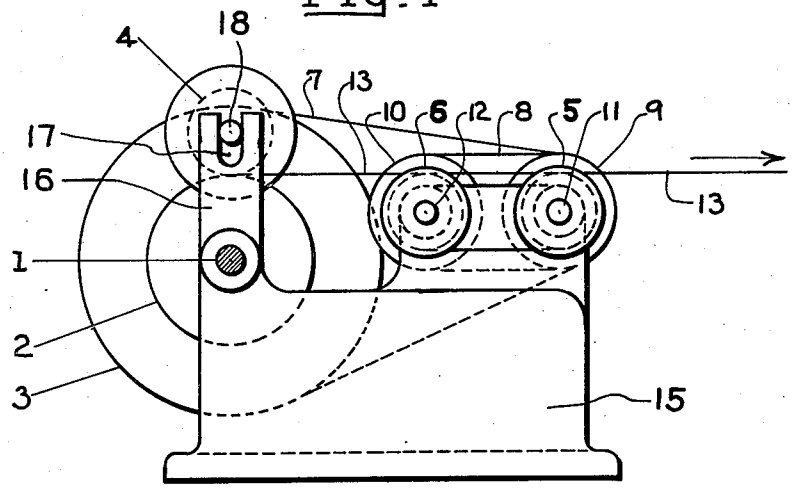
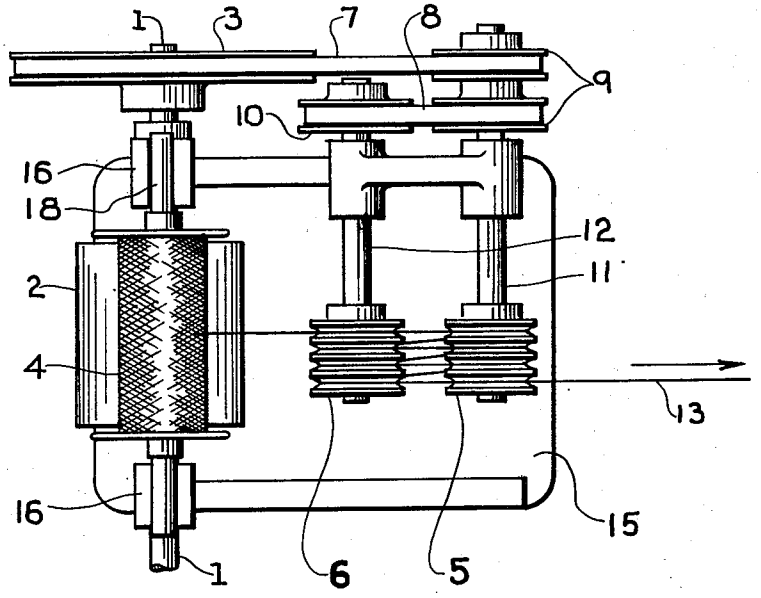


Fig. 2



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PROCESS FOR HANDLING MATERIALS

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5 Claims. (Cl. 242—45)

The present invention relates to handling filaments. More particularly it relates to handling elastic filaments and to the feeding of such filaments to using operations under substantially uniform tension. The preferred embodiments of the invention comprise a process and apparatus for handling elastic filaments which may be formed of uncovered rubber-like materials or rubber-like materials provided with any desired type of covering.

The majority of using operations for elastic filaments, both bare and covered, require that the filament be delivered to the using operation in a condition of substantially uniform tension. This has been the cause of considerable difficulty heretofore because of the fact that the elastic nature of such filaments makes it difficult to handle and transport the filaments without creating uneven tensions throughout the length of the filament. For example, it is essential from a practical standpoint that such elastic filaments be formed into some kind of winding to make it possible to handle and transport the filaments and also to feed them to using operations. One of the most common types of packages into which such filaments are wound for transporting, handling and feeding to using operations comprises a spool upon which the filament is wound. Regardless of how much care is exercised in initially winding the elastic filament upon the spool, the elastic filament will be subjected to varying tensions when removing it from the spool since the elastic nature of the filament causes the convolutions of the filament to crowd together and thereby embed some of the convolutions beneath others. When the embedded convolutions are reached during removal of the filament from the spool, they hang upon the spool and create an excessive tension in the filament being removed from the spool before sufficient force is built up to dislodge the embedded convolutions. This increase in tension is, of course, carried into the using operation and thereby causes the finished article to be nonuniform in character. The existence of even slight tension variations along the length of an elastic filament fed to a using operation, such as a knitting operation, causes the knitted product to be puckered over certain areas and unsightly as well as unfit for satisfactory service.

It is an object of the present invention to provide a process of feeding elastic filaments to a using operation under a substantially uniform tension.

It is another object of the present invention to provide a process of unwinding elastic filaments without creating excessive tension variations along the length of the elastic filament.

It is also an object of the present invention to provide an apparatus for feeding elastic filaments to a using operation under substantially uniform tension.

It is a further object of the present invention to provide an apparatus for unwinding elastic filaments without creating uneven tension along the length of the elastic filament.

Other objects and advantages, if not specifically pointed out, will be apparent to those skilled in the art from the following detailed description of what are now considered the preferred embodiments of the invention.

The process of the invention in general comprises rotatably supporting a supply winding of elastic filament, rotating the supply winding by frictionally contacting the surface thereof by a member rotating in a direction to remove filament from the winding, the frictional contact preferably taking place substantially at the point where the elastic filament leaves the winding, applying tension to the elastic filament at a point close to where it leaves the winding, the magnitude of the tension so applied being such that the application of additional tension to the filament within the breaking strength of the filament produces only slight additional elongation of the filament, and thereafter feeding the filament under the existing tension or releasing the tension to the magnitude desired to a using operation such as a knitting machine, loom, braider or winder.

The apparatus of the present invention comprises, in general, means for supporting and rotating a supply winding of elastic filament by frictional contact with the surface of the winding, and means for frictionally contacting the unwound elastic filament at a point close to the supply winding and over a considerable area of the filament to apply tension to the filament.

The invention accordingly comprises the several steps and the relation of one or more such steps with respect to each of the others, and the apparatus embodying features of construction, combinations of elements and arrangement of parts which are adapted to effect such steps, all as exemplified in the following detailed disclosure, and the scope of the invention will be indicated in the claims.

For a fuller understanding of the nature and objects of the invention reference should be had to the following detailed description taken in connection with the accompanying drawing, in which:

Fig. 1 is a side elevational view of one embodiment of the apparatus of the present invention, and

Fig. 2 is a top plane view of the apparatus illustrated in Fig. 1.

The apparatus comprises a frame 15 having a shaft 1 suitably journaled for rotation in the frame. The shaft 1 is driven by any desired

prime mover which may be either an electric motor or some other prime mover which is of an independent nature, or the shaft 1 may be suitably geared to any desired moving part of the machine producing the using operation. A drum 2 is mounted on the shaft 1 for rotation therewith and may comprise a metal drum or a drum formed from vulcanized fibre, synthetic resins or the like, or may comprise a metallic drum provided with a continuous covering of rubber, vulcanized fibre, synthetic resins or the like. The frame 15 carries two bifurcated standards 16 providing vertically extending slots 17 which receive a floating shaft 18. The floating shaft 18 receives and carries a supply spool provided with a winding 4 of elastic filament. The surface of the winding 4 rests upon and is supported by the drum 2 and rotation of the drum 2 produces rotation of the supply winding 4 in a direction to unwind elastic filament from the winding 4.

The shaft 1 carries a pulley 3 for rotation therewith and a shaft 11 suitably journaled in a bearing on the frame 15 carries a double pulley 9, one section of which is connected with the pulley 3 by means of a belt 7. A third shaft 12, suitably journaled for rotation in a bearing carried by the frame 15 has a pulley 10 mounted for rotation therewith which is suitably connected with the second section of the pulley 9 by means of a belt 8. The shafts 11 and 12 carry drums 5 and 6, respectively, for rotation therewith. The drums 5 and 6 are provided with any desired number of corresponding grooves. The diameters of the pulleys 3, 9 and 10 are so selected as to make the peripheral velocity of the grooves on the drums 5 and 6 equal to several times the peripheral velocity of the drum 2, for example, three to seven times.

In the operation of the filament-handling apparatus, a spool provided with a supply winding 4 is passed over the shaft 18 and the ends of the shaft are inserted in the slots 17 so as to rotatably support the spool with the winding 4 in contact with the surface of the drum 2. The winding 4 can be applied to the spool in known manner under a substantially uniform tension. Suitable winding machines for so applying the elastic filament are disclosed in United States patent applications, Serial No. 333,502, filed May 6, 1940, now Patent No. 2,265,036; Serial No. 403,265, filed July 21, 1941, and 384,514, filed March 21, 1941, and United States Patent No. 2,199,550.

The elastic filament is fed from the supply winding 4 and passed several times around the grooves in the drums 5 and 6 and is then passed to the using operation. The drums 5 and 6 are positioned as close to the drum 2 as permitted by the traverse of the filament as it unwinds from the winding 4. The process of the invention would best be served by placing the drum 6 so that it just clears the winding 4 at its maximum size, but practical considerations require that the drums 5 and 6 be spaced a sufficient distance from the winding 4 to permit free traverse of the elastic filament as it unwinds without appreciably increasing the tension on the filament as it approaches the ends of the winding 4. In view of the fact that the drums 5 and 6 are rotated at peripheral velocities which are several times the peripheral velocity of the drum 2 and the winding 4, the short length of the filament between the point at which the filament leaves the supply winding 4 and the first wrap of the filament around the drum 6 will be stretched several hundred per cent.

A stress-strain curve showing the modulus of elasticity of an elastic filament formed from rubber, latex, and rubber-like materials, shows that over the lower portion of the curve, the elastic filament undergoes considerable elongation for each additional unit of tension applied to it. As the upper portion of the curve is approached, but well before the ultimate strength of the filament is reached, the filament undergoes very slight elongation per additional unit of tension. With this in mind, the peripheral velocity of the drums 5 and 6 relative to the peripheral velocity of the drum 2 was selected so that the length of elastic filament extending between the supply winding 4 and the drums 5 and 6 is stretched to a point within the upper range of the modulus of elasticity curve so as to enable the stretched portion of the filament to withstand the application of considerable additional tension without undergoing an appreciable additional elongation. The actual tension applied to the filament over the extending length will, of course, vary with the material from which the filament is formed, but, for the majority of purposes where rubber thread formed either from latex or from milled rubber is used, an elongation of from 300 to 700 per cent will bring the stretch of the rubber within the desired portion of the modulus of elasticity curve

In view of the fact that, under normal conditions, the filament leaves the winding 4 within the area which is directly contacted by the supporting and rotating drum 2, there will be little tendency for any appreciable amount of tension to extend into the filament on the winding. In the event very small windings 4 are employed and an unusually high tension is exerted upon the filament as it leaves the winding, the shaft 1 may be provided with weights in any desired manner to clamp the elastic filament between the winding 4 and the drum 2 and thereby prevent extension of the stretched area into the winding.

As the winding 4 is rotated by the drum 2 the elastic filament 13 is unwound therefrom and whenever an embedded convolution of the filament is reached the high tension existing within the filament immediately after leaving the winding 4 will either be sufficient to dislodge the embedded convolution from the adjacent convolutions or the additional tension exerted on the filament by rotation of the drums 5 and 6 will quickly build up due to the fact that a small elongation of the filament produces a large increase in tension and the embedded filament will be quickly dislodged from the winding.

Any additional tension applied to the filament to dislodge an embedded convolution as previously described, will pass along with the filament into the drums 5 and 6. However, immediately upon the dislodgement of an embedded convolution, the tension within the filament will drop below that which existed before the embedded convolution was reached. This is caused by the fact that during the time the tension is increasing the winding 4 will rotate and when the filament releases from the winding the additional filament presented by the rotation of the winding during the time the tension was building up will be forwarded into the stretched area to lower the tension over the stretched area. In view of the fact that some slippage of the filament may occur from one wrap to another on the

drums 5 and 6, it can be seen that a high tension immediately followed by a low tension within the filament will bring about an equalization of the tensions within individual wraps on the drums 5 and 6, to substantially average tension which is approximately equal to the normal tension existing in the stretched length of the filament.

Although as many wraps of the filament as desired may be made about the drums 5 and 6, it has been found that when the drums 5 and 6 have a diameter, measured at the grooves of 2½ inches, three 180 degree wraps of elastic filament on each of the drums will prevent slippage between the grooved drums and the winding 2.

From the drums 5 and 6 the filament 13 is passed to any desired using operation while maintained at substantially the same tension as exists between the winding 4 and the drums 5 and 6 or at any desired increased or decreased tension. The tension on the filament as it passes to the using operation will generally be lowered to fifty to two hundred per cent elongation which tension is substantially uniformly held throughout the operation.

The process and apparatus of the present invention make it possible to handle and transport elastic filament while in the form of a durable and convenient package and, at the same time, make it possible to unwind the elastic filament from the package and furnish it to any desired using operation under a substantially uniform tension. This has greatly enhanced the general quality of articles made from elastic filaments, such as sock tops, girdles, surgical stockings and bathing suits, as well as many other articles. The process and apparatus have also reduced the number of imperfect articles produced which has increased the economy of manufacture and constituted to the advancement of the art.

The process and apparatus of the present invention may be employed to handle filament formed of any material which renders the finished product elastic in nature.

Since certain changes in carrying out the above process and in the constructions set forth, which embody the invention, may be made without departing from its scope, it is intended that all matter contained in the above description or shown in the accompanying drawing shall be interpreted as illustrative and not in a limiting sense.

The invention having been described, what is claimed is:

1. The process of handling elastic filaments comprising positively rotating a supply roll of the filament in a direction to unwind the filament therefrom at a constant rate by frictional contact with the surface of the filament winding on the supply roll, applying tension to the filament, as it leaves the supply roll and at no greater distance from the supply roll than is required by the traverse of the filament in leaving the supply roll and of sufficient magnitude to elongate the filament to a point where the application of additional tension within the breaking strength of the filament produces only slight elongation of the filament, to dislodge embedded convolutions from the supply roll, and thereafter feeding the filament to a using operation.

2. The process of feeding elastic filaments comprising positively rotating a supply roll of the filament by frictional contact with the surface of the winding on the supply roll to positively rotate the supply roll in a direction to unwind the filament therefrom at a constant rate, applying tension to the filament, a short distance after it leaves the supply roll, of sufficient magnitude to stretch the filament to a point where additional tension within the breaking strength of the filament will produce only a slight elongation of the filament, to dislodge embedded convolutions from the supply roll, reducing the tension on the filament to the amount required for a using operation, and passing the filament to a using operation.

3. The process of feeding elastic filaments comprising rotating a supply roll of the filament by frictional contact with the surface of the winding on the roll in a direction to unwind the filament from the roll at a constant rate, the frictional contact being applied substantially at the point where the filament leaves the supply winding, applying tension to the filament, a short distance from where it leaves the supply winding, of sufficient magnitude to elongate the filament to a point where the application of additional tension within the breaking strength of the filametn produces only slight elongation of the filament to dislodge embedded convolutions from the supply roll, relaxing the tension to the amount desired for a using operation and passing the filament to a using operation.

4. The process of feeding elastic filaments comprising rotating a supply roll of the elastic filament by frictional contact with the surface of the winding on the supply roll in a direction to unwind filaments from the winding at a constant rate, the frictional contact being applied substantially at the point where the filament leaves the winding, applying tension to the filament, at a point close to where the filament leaves the supply winding, by frictionally contacting the filament over a considerable area, the magnitude of the tension applied to the filament being such that the application of additional tension to the filament within its breaking strength produces only slight elongation of the filament to thereby dislodge embedded convolutions from the winding by only slightly increasing the elongation of the filament as it leaves the supply winding, which increased elongation is followed by a decrease in the elongation when the embedded convolutions disengage from the winding, permitting the increased and decreased elongations to substantially equalize each other throughout the area over which friction is applied to the filament to tension it, and thereafter passing the filament to a using operation.

5. The process of feeding elastic filaments comprising positively rotating a supply winding of the elastic filament in a direction to unwind filament therefrom, applying tension to the filament, at no greater distance from the supply roll than is required by the traverse of the filament in leaving the supply roll and of such magnitude that the application of additional tension to the filament within the breaking strength of the filament produces only slight additional elongation thereof, for the purpose of dislodging embedded convolutions of the filament from the winding, and thereafter passing the filament to a using operation.

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