Aug. 8, 1967 P. N. MILNE 3,334,478

MANUFACTURE OF ELASTIC YARNS

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FIG. 1.

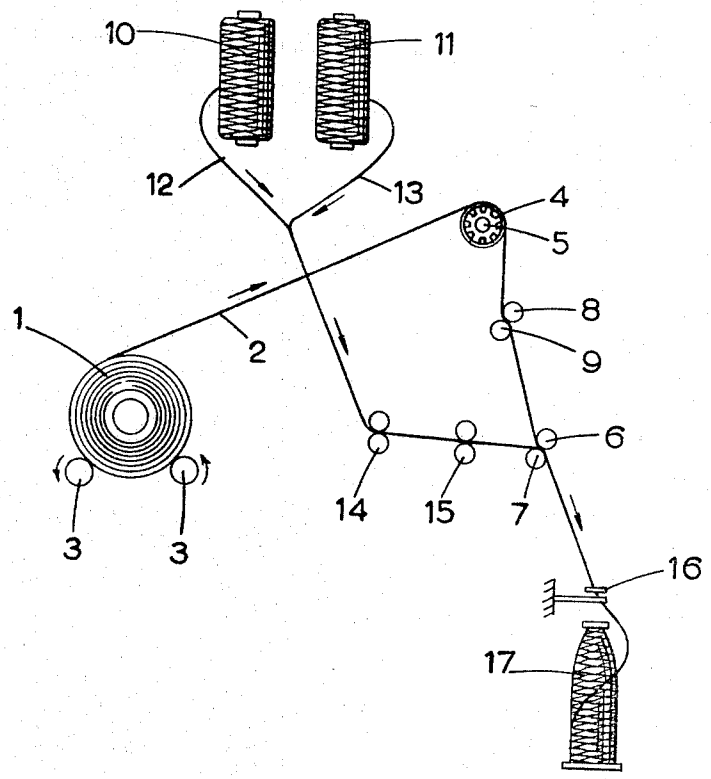

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FIG. 2.

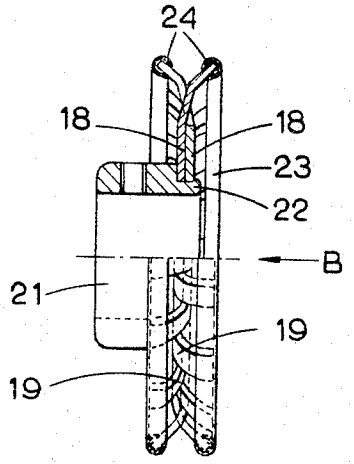


FIG. 3.

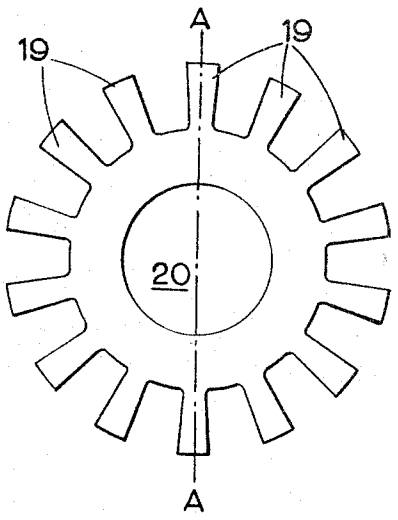


FIG. 4.

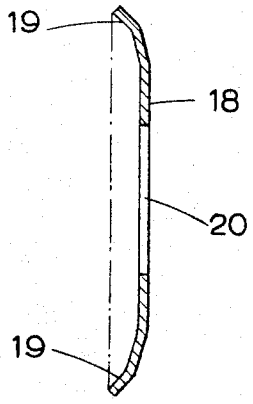
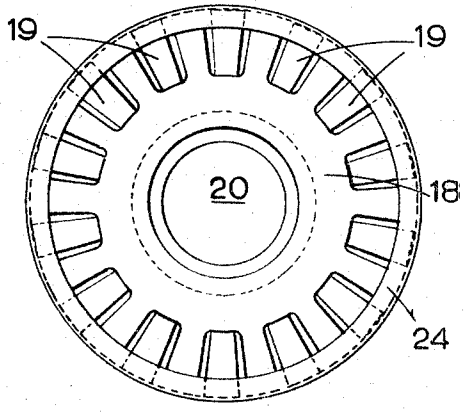


FIG. 5.



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MANUFACTURE OF ELASTIC YARNS

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6 Claims. (Cl. 57—12)

This invention relates to the spinning of textile yarns and is concerned more particularly with the spinning of high-bulk composite elastic yarns consisting of an elastic filament constituting an elastic core about which is spun a sheath of drafted rovings of staple fibres.

A known method of spinning elastic high-bulk textile yarn consists in passing a straight elastic filament through a tensioning device, combining the filament with a non-elastic roving and twisting the filament and the roving on a spinning frame. Whilst undergoing such treatment, the elastic filament is maintained in a stretched condition. When the elastic filament is allowed to contract, the sheath fibres bulge outwardly to provide a high-bulk yarn. A disadvantage of this and other known methods of producing high-bulk elastic yarns is that they lack infinite control of the elastic filament so that non-uniform off-winding tensions of the elastic filament and drafting of the non-elastic roving occurs with the result that the composite yarn has imparted thereto irregularities in the elongation and other physical properties of the yarn which is undesirable.

It is an object of the invention to provide a method of spinning an elastic yarn in which the aforesaid disadvantages are obviated.

According to the present invention there is provided a method of spinning an elastic high-bulk yarn comprising the steps of providing an elastic filament wound under tension onto a package, causing said package to rotate at a predetermined speed, unwinding said filament from said package at a predetermined linear speed, feeding said filament onto a positively driven pulley to cause said filament to travel in an undulating path and to restrain it against slippage, advancing said filament under uniform tension through a drafting zone, drafting one or more rovings of inelastic fllaments, gathering said elastic filament and said drafted rovings in a final drafting zone and thereafter twisting said rovings about said elastic filament to form a sheath thereto.

The invention is illustrated by way of example in the accompanying drawings, in which:

FIGURE 1 is a diagrammatic representation of an apparatus for carrying out the invention.

FIGURE 2 is a part-sectional side view of a pulley employed in the apparatus diagrammatically illustrated in FIGURE 1.

FIGURE 3 is a front elevation of one of the parts from which the pulley illustrated in FIGURE 2 is constructed.

FIGURE 4 is a sectional view taken on the line A—A of FIGURE 3, and

FIGURE 5 is a front elevation looking in the direction of the arrow B in FIGURE 2.

Referring to the drawings, a cylindrical package **1** has wound thereon a continuous elastic filament **2**. The package **1** is disposed between a pair of drive rolls **3**, suitable brackets (not shown) being provided to hold the package **1** between the drive rolls **3**. The drive rolls **3** are adapted to be positively driven through suitable gearing and serve to unwind the elastic filament **2** from the package **1** at a predetermined linear speed. The elastic filament **2** is fed to a V-pulley **4** mounted on a shaft **5**, the rotational speed of which can be varied so as to afford a predetermined amount of elongation to the elastic filament **2** as it is fed to the nip of a pair of final draft rolls **6** and **7**. The elastic filament **2** is fed from the pulley **4** between the nip of a pair of rolls **8** and **9**. Packages **10** and **11** supply rovings of inelastic staple fibres **12** and **13** to a conventional drafting system comprising pairs of rolls **14** and **15**, as illustrated, or a series of drafting aprons or a combination of drafting rolls and aprons. The drafted inelastic staple fibre rovings **12** and **13** together with the elastic filament **2** are passed between the final draft rolls **6** and **7** and thence through a guide **16** to a conventional twist means (not shown) whereby the rovings **12** and **13** are wound around the elastic filament **2** to form a sheath. The composite yarn is then wound onto a bobbin **17**.

Rolls **8** and **9** are driven at a speed which is correlated with the speed of the rolls **6** and **7** to provide the desired amount of elongation of the filament **2** in the span between the rolls **8**, **9** and **6**, **7**. The rotational speed of the pulley **4** is correlated with the rotational speed of the rolls **8** and **9** to provide the desired amount of elongation of the elastic filament **2** in the span between the pulley **4** and the rolls **8** and **9**. The pulley **4** in effect provides a pre-tensioning of the elastic filament **2** to insure that this filament passes between the rolls **8** and **9** at a predetermined constant tension. Without the pulley **4**, the elastic filament **2** would pass between the rolls **8** and **9** under a tension which is in part a function of the tension with which the elastic filament is wound onto the bobbin **1**. Since this tension is not constant, it can readily be seen that, without the pulley **4**, the tension in the yarn entering the rolls **8** and **9** would vary to some extent. These variations would be carried to some extent beyond the rolls **8** and **9** and would thus result in a somewhat varying tension in the span between the rolls **8**, **9** and **6**, **7**, with the result that the end product would not be uniform in construction. The pulley **4** insures that the elastic yarn entering the rolls **8** and **9** is held at a substantially constant elongation or pretension so that the total elongation applied to the filament in the final draft zone (between rolls **8**, **9** and **6**, **7**) is constant.

Referring to FIGURES 2 to 5 of the drawings, the pulley **4** comprises a pair of dished plates **18** each of which is formed with a plurality of equidistantly spaced radial tongues **19** which are inclined outwardly. The plates **18** each have a central aperture **20** for the reception of a boss **21** whereby the pulley is mounted on the shaft **5**. The plates **18** are assembled so that the tongues on one plate interengage the gaps between the tongues on the other plate, the plates being secured in the assembled position through the medium of a shoulder **22** on the boss **21**, the outer end **23** of which is punched over so that the plates are held in firm engagement with each other. After the plates **18** have been assembled, a hoop **24** is press-fitted onto the outer edge of each plate so as to provide a smooth finish thereto. By constructing the pulley in the manner described, the periphery of the base of the pulley groove will provide an undulating, e.g. corrugated, surface. When the elastic filament is in engagement with the pulley groove, it will follow an undulating path whereby a restraining action will be exerted on the filament and slippage thereof will be prevented, thus ensuring that the filament is fed uniformly to the final drafting zone and that the composite yarn will be free from irregularities in the elongation of the yarn.

The textile fibre from which the sheath is formed can be any natural fibre in staple or continuous filament form, such as cotton, or wool, or any synthetic fibre, such as, for example, nylon, rayon, polyacrylonitrile, or polyethylene terephthalate. The elastic filament constituting the core of the yarn is preferably formed from a long chain synthetic polymer composed of at least 80 percent of a segmented polyurethane of the kind known as "Spandex."

The present invention enables an elastic filament to be introduced to a drafting zone under predetermined and positively controlled conditions of elongation and modulus so as to produce a uniform and consistent yarn having the desired elastic properties. The controlled conditions can be varied from zero up to the ultimate stretch limit of the elastic filament.

Existing spinning machinery can readily be modified to adapt it to produce yarns in accordance with the invention and conveniently the apparatus can be constructed in the form of an attachment to an existing machine.

I claim:

1. A method of spinning an elastic high-bulk yarn comprising the steps of providing an elastic filament wound under tension on a package, causing said package to rotate at a predetermined speed, unwinding said filament from said package at a predetermined linear speed, feeding said filament onto a positively driven pulley to cause said filament to travel in an undulating path and to restrain it against slippage, advancing the filament from the pulley through a pretensioning zone to a final drafting zone, advancing said filament under uniform tension through the final drafting zone, drafting one or more rovings of inelastic filaments, gathering said elastic filament and said drafted rovings in the final drafting zone and thereafter twisting said rovings about said filament to form a sheath thereto.

2. A method according to claim 1, wherein the elastic filament is formed from a segmented elastomer.

3. Apparatus for spinning an elastic high-bulk yarn comprising a package wound with elastic filament and adapted to be rotatably driven to unwind said filament therefrom at a predetermined linear speed, a rotatably driven V-pulley adapted to receive said filament and to advance it without slippage through a pretensioning zone to the nip of a first pair of draft rollers, at least one package having wound thereon rovings of inelastic filaments, a drafting system for said inelastic rovings unwound from said package or packages, a second pair of draft rolls for receiving the elastic filament from said first pair of draft rolls, said elastic filament and said rovings being passed together between said second pair of draft rolls, a guide for said drafted elastic filament and rovings and means for twisting said rovings around said elastic filament, the speeds of the pulley and the first and second pairs of draft rolls being correlated with each other in such a manner that the elastic filament is pretensioned between the pulley and the first pair of rolls and passed from said first pair of rolls to said second pair of rolls under a uniform and constant tension.

4. Apparatus according to claim 3, wherein said pulley comprises a pair of dished plates each formed with a plurality of equidistantly spaced outwardly inclined radial tongues and a central aperture, said plates being so assembled that the tongues on one plate interengage the gaps between the tongues on the other plate, whereby the periphery of the base of the pulley V-groove will have an undulating elastic filament-contacting surface to restrain said filament against slippage.

5. Apparatus according to claim 4, wherein a boss is located within the central apertures in said plates, said plates being fixedly secured to said boss.

6. Apparatus according to claim 5, wherein a hoop is located on and secured to the outer edge of each of said plates to provide a smooth finish thereto.

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