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2,930,080

ROLLER GUIDE

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Fig. 1

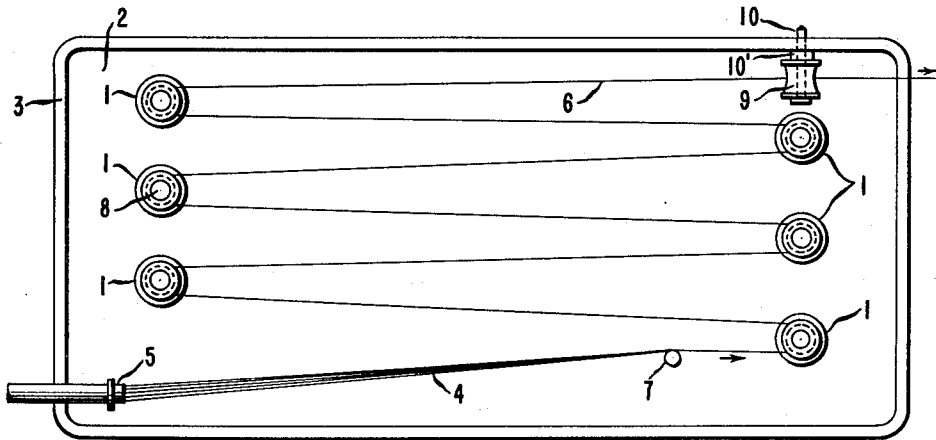


Fig. 2

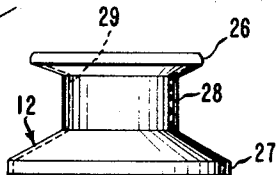
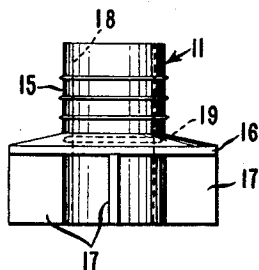
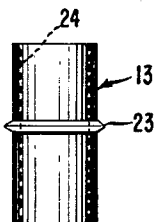
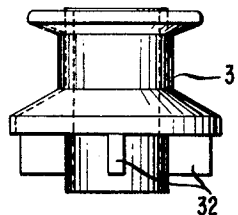


Fig. 3



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ROLLER GUIDE

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5 Claims. (Cl. 18—8)

This invention relates to improved processing of synthetic yarns; it particularly concerns rollers used as guides for freshly coagulated cellulosic yarns formed by the viscose process.

In the viscose process for manufacturing regenerated cellulosic yarns, a solution of cellulose xanthate is extruded into an aqueous acid bath that coagulates the separate filaments formed by each extruded stream of solution. Rates of extrusion and windup have increased throughout the rayon industry, necessitating a longer path in the bath for adequate coagulation and regeneration of the newly formed yarn. A common expedient that eliminates any necessity for increasing the bath volume materially is to increase the total path by zig-zagging the yarn back and forth from one to another of a succession of freely rotatable pulley-like roller guides over which the yarn passes in substantially non-slipping contact. Multiple roller guides are helpful also in providing incremental stretching of the yarn in the bath, which is conducive to higher quality of production. Suitable designs and arrangements of the guides are well-known; some examples appear in Patents 1,878,455, 2,083,251, and 2,273,240. Patent 2,083,251 illustrates use of vanes on such guides as a means for regulating tension imposed upon the yarn as it rotates the guides. Control of placement and size of such vanes aids regulation of stretch in the yarn. The roller guides usually are made of glass or ceramic materials or of wood, metals, or certain acid-resistant thermosetting plastics, and they are mounted for free rotation on fixed axial pins or rods made of any such composition.

Roller guides in the coagulating bath are subject to deposition of sludge, not only at the juncture with the supporting pin and on the yarn-bearing guide surface but also on the vane surfaces of the roller, where sludge interferes greatly with desired uniformity of roller rotation and, hence, of tension imposed upon the yarn. If allowed to build up, such deposits result in undesirable variation in yarn quality. The sludge is made up of sulfur, sulfides, and other by-products of bath operation. The bath commonly contains sulfuric acid, soluble metal sulfates, and other inorganic salts; various organic compounds, such as reducing sugars, may be present also. The benefits of adding to the bath (or to the viscose) various modifiers, such as those mentioned in Patents 2,535,045, 2,535,046, and 2,536,014, are not fully realized when, as may be expected, the modifiers contribute to a heavy buildup of sludge. Recent use of higher bath temperatures, such as 50° C. and above, has intensified the problem of sludge formation. Perhaps the most desirable compositions for these guides until the present invention were phenol-formaldehyde resins, such as that known as "Bakelite"; however, even they require changing every eight hours, or so, usually once each work shift. As each spinning position, of which a rayon plant

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may have several hundred, requires a half dozen or more roller guides, it is clear that frequent changing is laborious and expensive. Natural rubber is unsatisfactory for the roller guides because of its susceptibility to attack by sulfides in the bath.

A primary object of the present invention is provision of a sludge-free roller guide. An object is production of a composite roller guide with non-sludging vanes. Other objects of this invention, together with means and methods for attaining the various objects, will be apparent from the following description and the accompanying diagrams.

Figure 1 is a plan view of apparatus including a roller guide of this invention in use. Figure 2 is an exploded view of the guide of Figure 1 in elevation. Figure 3 is an elevation of another embodiment of roller guide according to the present invention.

In general, the objects of the present invention are accomplished by means of a roller guide having a flexible body, as described hereinafter, made of synthetic elastomer. The invention comprehends composite guides in which the surface bearing against the supporting pin or the yarn-bearing surface (or both) is composed of another substance (or substances) of lesser flexibility.

The roller guides of this invention may have substantially any conventional form or other configuration suitable for guiding material moving in substantially non-slipping surface contact. The bodies of the guides, besides being made of suitable elastomeric composition, should fall within a moderate hardness range, measured on a scale that reflects flexibility fairly well. For the present purposes hardness is measured by a standard indentation test, using an instrument known as a "durometer." This method of measurement, for which the American Society for Testing Materials has established specifications (ASTM: D676-49T), involves pressing a spring-loaded pin surrounded by a cup-shaped projection against an article whose hardness is to be measured and then observing the resulting deflection on a suitable scale.

Suitable to form the body are polymers of butadiene or of butadiene and styrene, reaction products of polysulfide salts and polyhalides, polymers formed from halogenated unsaturated hydrocarbons, isobutylene polymers, and polymeric vinyl halides. The body also may contain other functional groups not overly reactive with the bath ingredients. Copolymers or interpolymers of the above substances with various others may be suitable. Relatively inert plasticizers, fillers, or other additives may be present, as well. The synthetic elastomers can be shaped conveniently into the desired configuration, as by machining of an extruded rod or by casting or molding and suitable surface finishing.

Figure 1 shows in plan a representative installation of roller guides 1 submerged in bath 2 in tank 3 and receiving filaments 4 from spinneret 5 terminating spinning line 6 also submerged in the bath. Pin guide 7 is located in the path from spinneret to first roller guide to converge the filaments into a compact bundle. Each of the half dozen roller guides is mounted on a similar axle pin 8, those at opposite ends of the tank being inclined outwardly from one another at an slight angle to the vertical to prevent each of the roller guides from rising sufficiently during rotation, as the filament bundle progresses around them in succession, to leave either the bath or the supporting pin. Exit guide 9, about which the filaments pass just before leaving the bath is mounted for rotation on horizontal pin 10 extending through bushing 10' into the tank wall near one corner.

In Figure 2, the parts of a composite roller guide of this invention appear disassembled. Shown in elevation or side view, they consist of body 11 flanked by cover 12 and sleeve 13. When assembled, the cover fits over the body, and the sleeve fits inside the body. The body has cylindrical portion 15 (ribbed circumferentially) with flange 16 near one end; vanes 17 extend radially outward from that end of the cylindrical portion and along the near face of the flange. Bore 18 through the cylindrical portion of the body has a diameter just large enough to receive the sleeve inside it; the bore has circumferential indentation 19 into which circumferential protrusion 23 of the sleeve fits to hold body and sleeve together. Bore 24 of the sleeve is smooth and adequate in diameter to receive the supporting axle pin. The cover resembles an asymmetrical pulley, having small flange 26 and large flange 27 on opposite sides of groove 28. Bore 29 of the pulley is sufficiently large to fit snugly over the ribbed cylindrical portion of the body, when assembled over the longer end, with the outside of the larger flange of the cover against the non-vaned face of the body flange.

Figure 3 shows another roller guide suitable, as is that of Figure 2, as a component of the apparatus of Figure 1. Guide 31 of this last figure conforms generally in outline to the guide of Figure 2 when assembled, although modified vanes 32 are shorter in both axial and radial extent than those of the previous guide. Dashed lines indicate the extent of body, cover, and sleeve by analogy with Figure 2; however, either or both lines of demarcation may be imaginary, as when the guide is formed integrally (as it may be) of the elastomeric material prescribed for the guide body.

In general, unitary guides are useful at tensions customary in production of rayon having textile denier, while composite guides are preferable at higher tensions, such as those normally employed in formation of tire cord. The cover of the composite roller guide preferably is made of glass or ceramic, which is resistant to abrasion by the yarn, and the sleeve may be made of a hard resin or other material having good bearing properties; other compositions may be used instead, but whatever material is selected for the cover or the bushing-like sleeve will be characterized by a hardness superior to that of the body portion, of course. The vanes of either the unitary or composite modification should be thick enough not to deform excessively under the prevailing tension. The invention is exemplified below by roller guides in which the elastomeric composition is polyvinyl chloride. All parts are given by weight.

Viscose spinning solution containing 6.25% cellulose, 5.75% sodium hydroxide and 0.05% cyclohexylamine is extruded through a spinneret having 90 orifices of 0.0030 inch diameter into a bath containing 9.4% sulfuric acid, 17.5% sodium sulfate, and 9.5% zinc sulfate. The bath temperature is maintained at 60° C. Converged to form a yarn, the extruded filaments pass over six successive rollers like those of Figure 3 suitably located to provide a total path length of 130 inches in the bath, the apparatus elements being arranged as in Figure 1. At emergence from the bath the yarn is subject to a tension of 0.55 gram per denier, which is attributable largely to increments imposed at the successive rollers. After leaving the bath the yarn passes over a rotating feed wheel and then is collected in a rotating bucket to form a cake, which is subsequently washed, desulfured, bleached, and finished in conventional manner. The yarn, which is finally collected on a cone, is found to have a total denier of 150, a dry tenacity of 3 grams per denier, an elongation of 21% and a silk factor of 67. Comparative results of this procedure for conventional roller guides and for those of the invention appear in the following table. The indicated hardness of the roller guides was measured by a Type "A" Shore Durometer.

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Table

Composition of Roller Guides	Hardness of Guides	Time Until Initial Sludge Deposition	Normal Replacement Time	Break-down Time
Bakelite.....	over 100.	1 hour.....	8 hours.....	2 days.
Polyvinyl chloride.....	60.....	6 days.....	6 days.....	no known limit.

In a similar arrangement for spinning rayon tire cord of 1650 denier per spinneret, composite roller guides (like those of Figure 2) were substituted for the unitary rollers, which themselves deformed under the proportionately higher total tension. Even higher tension was applied satisfactorily to these roller guides of this invention; they were composed of polyvinyl chloride having a Shore "A" Durometer hardness of 75. Instead of the customary weekly replacement of "Bakelite" roller guides previously used in manufacture of such heavy denier, these guides with glass cover and elastomeric body permitted an increase to six weeks before sludging became at all troublesome.

Replacement of the body of the composite guide is a simple operation that can be performed manually in a few seconds; in this way a clean body or one with vanes of different size can be substituted without necessity for substitute covers and sleeves. If desired, either the cover or the sleeve may be formed integrally with the body of the guide. The improvement utility-wise of unitary roller guides of this invention over conventional guides of like design is apparent, and the composite guides of this invention are even more useful, as indicated.

Roller guides made of any of the above materials having a durometer hardness from about 30 to about 90 may be expected to prove suitable in ordinary acid baths. Harder guides are much more subject to sludge deposition, and softer guides do not retain their shape well under appreciable load. In rayon manufacture, at the tension level normal for textile yarn the lower part of the stated hardness range is preferred, while the upper portion of the range is useful at higher tension. Selection of satisfactory guides on the basis of the above criteria is relatively simple.

The indicated normal replacement times for the rollers exemplified above are largely arbitrary, as sludge deposition was not a compelling factor in either instance. The improvement in useful life before necessity of cleaning the guides often is on the order of a hundred-fold, and the advantages of such an increase are immediately apparent. Other materials than rayon may be processed with similarly successful results over movable guides or like supports through acid baths where sludge deposition is a problem. The invention is useable, therefore, in similar processing of film, fabric, wire, and other materials.

This application is a continuation-in-part of application Serial No. 418,760, filed March 25, 1954.

The claimed invention:

1. A roller guide comprising a body portion bored axially to receive a support and composed of a synthetic elastomer with a durometer hardness of between about 30 and about 90, a smooth, close-fitting glass cover for the body which is grooved on the peripheral surface to guide material moving in contact with it, a close-fitting interior sleeve of the body composed of a phenolformaldehyde resin and characterized by a hardness greater than that of the body.

2. In a tank adapted for use as a receptacle for a coagulating bath wherein rollers are used as guides for freshly coagulated cellulosic yarns formed by the viscose process, the improvement comprising a roller guide comprising a body portion bored axially to receive a support, a close-fitting cover portion exterior to the body portion

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to guide material moving in contact therewith, the body portion being composed of a synthetic elastomer with a durometer hardness between about 30 and about 90.

3. In a tank adapted for use as a receptacle for a coagulating bath wherein rollers are used as guides for freshly coagulated cellulosic yarns formed by the viscose process, the improvement comprising a roller guide comprising a body portion bored axially to receive a support, a detachable close-fitting cover portion exterior to the body portion and grooved on the peripheral side to guide material moving in contact therewith, the body portion being composed of a synthetic elastomer with a durometer hardness between about 30 and about 90, said cover portion characterized by a hardness greater than that of the body, and the body portion having vanes extending axially and radially from the body.

4. In a tank adapted for use as a receptacle for a coagulating bath wherein are rollers used as guides for freshly coagulated cellulosic yarns formed by the viscose process, the improvement comprising a roller guide comprising a body portion bored axially to receive a support, a cover portion exterior to the body portion, and grooved on the peripheral surface to guide material moving in contact therewith, and a close-fitting inner sleeve for the body portion, said body portion being composed of a synthetic elastomer with a durometer hardness be-

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tween about 30 and about 90, and having vanes extending axially and radially from the body and said cover and inner sleeve portions characterized by a hardness greater than that of the body.

5. A tank adapted for use as a receptacle for a coagulating bath having rollers affixed therein as guides for freshly coagulated cellulosic yarns formed by the viscose process said roller guides comprising a body portion bored axially to receive a support, a close-fitting cover portion exterior to the body portion to guide material moving in contact therewith, the body portion being composed of a synthetic elastomer with a durometer hardness between about 30 and about 90.

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