Nov. 23, 1965 R. L. CARROLL 3,218,691

YARN TREATING DEVICE

Filed May 15, 1963

Fig. 1

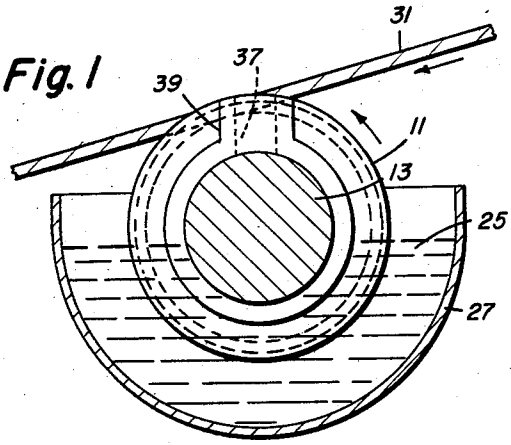
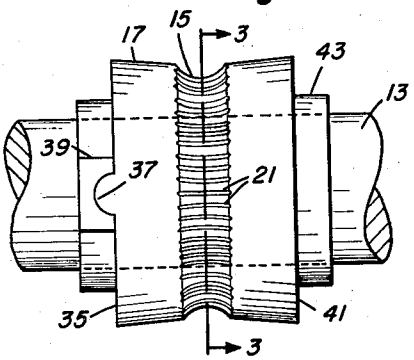


Fig. 2



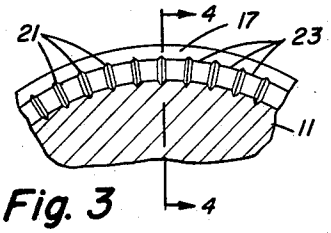


Fig. 3

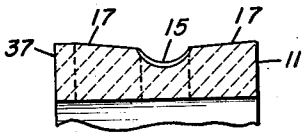


Fig. 4

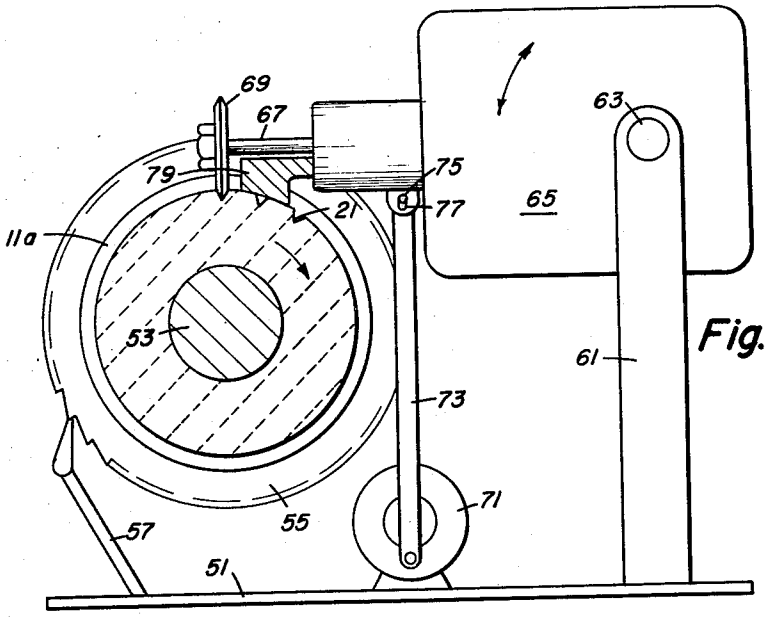


Fig. 5

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3,218,691

YARN TREATING DEVICE

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This invention relates to a device for treating yarn and more specially to a device for applying a finishing liquid such as a lubricant to the yarn during the processing of the yarn.

An object of the invention is the provision of a generally improved and more satisfactory applicator device for applying the lubricant or other desired liquid to the yarn.

A further object is the provision of an applicator device which will apply liquid to yarn in a reasonably uniform manner during a long period of time, avoiding the drawbacks of the prior art devices which have frequently applied the liquid in a seriously non-uniform manner, sometimes more and sometimes less.

These and other desirable objects may be attained in the manner disclosed as an illustrative embodiment of the invention in the following description and in the accompanying drawings forming a part hereof, in which:

FIG. 1 is a side elevation of an applicator according to a preferred form of the invention, showing the yarn passing over it, and showing schematically the container for the lubricant or other liquid which is applied to the yarn by the applicator;

FIG. 2 is a front elevation of the same;

FIG. 3 is a transverse vertical section through a fragment of the applicator, taken approximately on the line 3—3 of FIG. 2, on an enlarged scale;

FIG. 4 is a longitudinal vertical section through a fragment of the applicator; taken approximately on the line 4—4 of FIG. 3; and

FIG. 5 is a somewhat schematic side elevation of a preferred form of apparatus for manufacturing the applicator roller.

In certain textile operations, it is desirable to apply what is broadly called a "finish" liquid to a yarn, using the word yarn in a broad sense as including all sorts of textile strands or filaments. The finish liquid, called merely finish for brevity, is usually a lubricant, but may also serve other purposes such as to give the yarn greater affinity for dyes. It is common practice to apply the finish by running the yarn in contact with and tangent to a rotating roller which dips in a bath of finish as it rotates. It is known, for example, to use a felt-covered applicator roller for this purpose, and other forms of applicator roller have also been tried. Great difficulty has been experienced in securing the desired uniform application of the finish per unit of length of the yarn, particularly when the viscosity of the finish varies somewhat.

The present invention provides an improved applicator roller by which the finish may be applied to the yarn more uniformly than has been possible in the past.

The construction of the present improved applicator roller is based upon the surprising discovery that more uniform application of the finish to the yarn can be accomplished if the applicator roller is provided around its circumference with a series or multiplicity of serrations or small grooves extending crosswise with respect to the direction of travel of the yarn, adjacent grooves or serrations being separated from each other, however, in a circumferential direction by a smooth surface of substantial extent in a circumferential direction. Moreover, it has been found that best results are obtained when the circumferential face of the applicator roller is slightly dished, having smooth inclined portions on either side of the central serrated portion, so that as the roller rotates with its bottom part in a bath of finish, the finish liquid on those parts of the roller which are above the axis of rotation will tend to flow laterally toward the center of the roller and thus tend to replenish the finish liquid which is picked up from the serrations by the passage of the yarn.

Referring now to the preferred form of applicator roller as seen especially in FIGS. 1–4, it comprises a roller or applicator member indicated in general at **11**, of a generally wheel-like or roller-like form, mounted on a horizontal shaft **13** which is driven preferably by a variable speed drive so that the shaft and the roller thereon may be driven faster or slower as required from time to time when a greater or less quantity of finish is to be applied to the yarn, per unit of length of yarn.

Viewing the applicator roller in radial axial cross section, as seen for example in FIG. 4, the roller has a circumferentially extending concave groove **15** around its middle. On each side of this groove the circumferential face of the roller is frusto-conical as at **17**, increasing in diameter toward the end faces of the roller. Each frusto-conical face **17** preferably makes an angle of about 5 degrees with the axis of rotation, that is, with the center of the shaft **13**.

The bottom of the concave groove **15** is serrated with a great multiplicity of small grooves or serrations **21** which, however, are spaced sufficiently far from each other in a circumferential direction so that there are substantial smooth portions or "lands" **23** between successive grooves **21**. It is desired to avoid sharp ridges between successive grooves, both for the purpose of decreasing wear or abrasion on the yarn passing over the applicator roller, and for the purpose of insuring that the yarn will not simultaneously contact with and pick up liquid finish from two successive grooves, but only from one groove at a time.

As above stated, the applicator roller rotates with the shaft **13**, and is so placed that the lower part of the roller dips into a liquid bath **25** (FIG. 1) in a suitable container **27**, indicated merely schematically in FIG. 1. The yarn **31** passes over the roller, tangent to and in firm contact with the concave circumferential groove **15**. The shaft **13** may be driven at such speed that the peripheral speed of the roller is equal to, greater than, or less than the speed of travel of the yarn **31**, depending upon the amount of finish which is to be applied to the yarn, slower speeds of rotation of the applicator roller serving to apply less finish per unit of length of the yarn, and higher speeds serving to apply more finish per unit of length.

Any suitable construction may be employed for fastening the applicator roller to the shaft **13** to insure that it will turn therewith. When the applicator roller is made of ceramic material, as it preferred and as further described below, it is convenient to provide one end face **35** of the roller with an integral protruding lug or rib **37** extending radially, which lug **37** is received in a radial groove in an arm **39** fixed to the shaft **13** in any suitable manner. The opposite end face **41** of the roller is engaged by a collar **43** on the shaft, serving to hold the roller firmly against the arm **39**, so that the integral lug **37** on the roller is in driving non-rotatable engagement with the arm **39** on the shaft. Of course other arrangements for fixing the roller to the shaft may be employed, the described arrangement being convenient but not a critical feature of the invention.

When an applicator roller having the shape above described is used in a textile mill to apply finish to the yarn, the finish is carried up by the peripheral face of the rotating roller as the face leaves the surface of the liquid bath, and fills the various serrations **21**. Of course there will also be a film of finish on the smooth lands **23** between

the serrations, and on the smooth frusto-conical surfaces **17** of the roller. But the finish will mainly be in the serrations or grooves **21**, which will thus serve somewhat as measuring devices for holding measured quantities of finish. As rotation continues and a given portion of the roller reaches approximately the top of its travel, the slight inclination of the frusto-conical faces **17** will cause the film of finish on these frusto-conical faces to tend to flow toward the middle of the length of the roller, into the concave groove **15** and thence into the serrations **21** extending crosswise in the large concave groove, insuring that each measuring serration will be full of the finish liquid, by the time the serration gets to the point of contact with the yarn **31**. Although the exact nature of the flow of the finish liquid cannot be determined and described in detail, nevertheless it may be stated unequivocally, as a result of many experiments and observations, that this construction of applicator roller does give superior results as compared with applicator rollers of the prior art, and produces reasonably uniform application of finish liquid notwithstanding slight variations in viscosity of the finish, which variations have been very detrimental to uniform application of the finish with applicator rollers of the prior art.

Preferably the applicator roller of the present invention is made of a hard dense material which is resistant to abrasion and has long wearing qualities, as well as being relatively non-absorptive of the finish liquid and easy to clean. For ease and rapidity of manufacture of the applicator rollers, it is much preferred to make them of ceramic material, because the shaping of the rollers, including the formation of the serrations **21**, can be made while the ceramic material is in an unhardened or green state, after which the ceramic material can be fired to harden it. By working on the relatively soft ceramic material, the serrations can be formed easily to the desired accuracy of size and spacing, with great rapidity, whereas it would be relatively slow and prohibitively expensive to form the desired shapes from an initially hard material such as metal.

Referring now to FIG. 5, there is shown rather schematically a preferred form of apparatus for manufacturing the applicator rollers of the present invention. On a suitable base **51** there is a standard (not shown) for supporting a rotatable shaft **53** fixed to an indexing disk **55** which is indexed in a rotary direction by conventional indexing mechanism schematically indicated at **57**. The ceramic body **11***a*, in the soft green or unhardened state, is placed on the shaft **53** and suitably secured to rotate with the shaft. Previous to this, the ceramic body has already been shaped, in a mold or on a lathe or by a combination of molding and turning on a lathe, so as to have the desired final shape except for the matter of the serrations **21**. Of course the size of the roller in the green or unfired state must be slightly larger than the intended final or completed size, to allow for shrinkage in the final firing operation, as well understood in the ceramic art.

On a standard **61** rising from the base **51**, there is pivoted on a horizontal pivot **63** an electric motor **65**, the armature shaft **67** of which carries a suitable cutter **69** having a continuously beveled peripheral edge as shown in FIG. 5, made of any desired cutting material harder than the hardness of the ceramic body **11***a* at that particular time. Conveniently the cutter **69** may be a hardened ceramic wheel, although it can be a metal cutter. The profile of the periphery of the wheel corresponds to the profile of the grooves or serrations **21** which are to be formed in the applicator roller.

Also mounted for rotation on the base **51** is an eccentric cam or crank arrangement indicated schematically at **71**, connected by a link **73** to the motor at a point offset from the motor pivot **63**. At one end of the link **73**, such as the upper end, there is a pivot pin **75** working in a vertical slot **77** so as to provide a slight loss motion connection. A guide portion or foot **79** fixed to a part of the motor mechanism (preferably adjustably) has a lower face of sufficient area to contact with the applicator roller being manufactured so as to support the weight of the motor assembly against downward tilting, without digging into or deforming the ceramic material in its green or unhardened state. This foot **79** serves as a guide or limit stop for determining the depth of the serration or groove formed by rotation of the cutting wheel **69**.

Assuming that the motor **65** is running so that the cutting wheel **69** is rotating, the eccentric or crank device **71** is operated so that the cutting wheel **69** is brought down onto the portion of the applicator roller in the circumferential concave groove **15**, and serves to grind one of the serrations **21** transversely of the circumferential groove **15**. On account of the pin and slot loss motion connection **75**, **77**, the operation of the crank or eccentric mechanism **71** does not draw the cutting wheel **69** forcibly down against the applicator roller which is being constructed, but simply allows the force of gravity to press the cutting wheel **69** down to cut farther and farther into the applicator roller until the pressure foot **79** comes into contact with the periphery of the applicator roller, thereby limiting the depth of the serration **21** which is being formed. The eccentric or crank mechanism **71** is then operated through half a revolution, thus tilting the motor and cutter assembly upwardly on the pivot **63**, raising the cutter clear of the applicator roller. Then the indexing mechanism **57** is operated through one indexing cycle, to turn the applicator roller to the position for forming the next serration **21**, whereupon the crank or eccentric mechanism **71** is operated through half a revolution to lower the link once more, allowing gravity to press the cutting wheel **69** downwardly to grind the next serration **21** in the semi-soft ceramic material, to a depth again determined by the contact of the presser foot **79** with the periphery of the applicator roller. Upon completion of the grinding of this serration, the up and down tilting mechanism or crank mechanism **71** is again operated to raise the cutter, the indexing mechanism **57** is operated through one more cycle, and the operation is repeated as before, to form the next groove or serration. The cycles are repeated over and over again until all of the desired serrations have been formed all the way around the periphery of the main circumferential groove **15**.

Of course the operations of the tilting mechanism **71** and indexing mechanism **57** are normally performed successively and cyclically by conventional automatic controls, so that they do not have to be operated by hand. The result is the production of the desired serrations in the semi-soft ceramic material, with great accuracy and in a very economical manner, after which the applicator roller is removed from the apparatus just described, and is fired in the manner well understood in the ceramic art, to harden it to its final hard and usable form.

The size of the applicator roller, as well as the size of the serrations and the width of the smooth surfaces or lands between successive serrations, may be varied as desired, depending upon the character and viscosity of the finish which is to be applied to the yarn, and the characteristics of the yarn itself. It is preferred, however, to have the width of the land (in a circumferential direction with regard to the roller) from one to two times the width (in the same direction) of the serration. A very satisfactory proportion is to have the land about one and a half times the width of the serration. The serrations are preferably V-shaped in cross section, as seen in FIG. 3, and when speaking of the width of the serration this means, of course, the width of the top of the V, since the serration has zero width at the bottom. While other cross sectional shapes of serration could be used while retaining some of the advantages of the present invention, the V-shaped cross section is preferred because it pro-

motes better capillary action to retain the finish in the serration until it is picked up by the yarn.

As a typical example of dimensions which have been found satisfactory, but not as a limitation, the following dimensions of a roller according to the present invention may be mentioned. The roller has an outside diameter (at the larger ends of the frusto-conical surfaces **17**) of $1\frac{31}{64}$ inches, and an inside diameter of 0.752 of an inch, to receive the shaft **13**. The thickness of the roller in an axial direction is one inch, and each frusto-conical portion **17** has an axial width of about ⅜ of an inch, so that the circumferential groove **15** has a width (in an axial direction) of about ¼ of an inch, and the concavity thereof (viewed from the direction of FIG. 2) has a radius of about ¼ of an inch. The root diameter of the bottom of the circumferential groove **15**, from the land surface on one side of the roller to the land surface on the diametrically opposite side of the roller, is about 1.268 of an inch. The center to center spacing of the grooves **21**, in a circumferential distance around the roller, is about 0.040 of an inch, the circumferential width of each groove at its top being about 0.016 of an inch, and the circumferential width of each land between adjacent grooves being about 0.024 of an inch. These typical dimensions are highly satisfactory in use, and the lands are large enough so that there are no sharp edges between adjacent grooves, thus avoiding undesired abrasion of the yarn.

It is seen from the foregoing disclosure that the objects and purposes of the invention are well fulfilled. It is to be understood that the foregoing disclosure is given by way of illustrative example only, rather than by way of limitation, and that without departing from the invention, the details may be varied within the scope of the appended claims.

What is claimed is:

1. An applicator roller adapted to rotate partially submerged in a liquid bath of finish for applying the finish to a textile yarn in tangential contact with the upper part of said roller as it rotates, said applicator roller comprising a body of substantially circular outline with respect to an axis of rotation, said roller having a periphery formed of two frusto-conical sections with their smaller ends faced toward each other and with a shallow circumferential groove of arcuate cross-section between the two frusto-conical sections, the surface of said groove being interrupted by a multiplicity of relatively small serrations extending crosswise of the groove and sufficiently small to retain finish therein by capillary action until the finish in each serration successively makes contact with a yarn lying in said shallow groove in tangential relation to the roller.

2. A construction as defined in claim **1**, wherein each of said frusto-conical sections has a surface at an angle of approximately five degrees to the axis of rotation of the roller.

3. A construction as defined in claim **1**, wherein each of said serrations is separated from the next adjacent serration by a smooth land having a width, circumferentially of the roller, sufficient to eliminate any sharp edge between adjacent serrations.

4. A construction as defined in claim **1**, wherein each of said serrations is separated from the next adjacent serration by a smooth land having a width, circumferentially of the roller, at least as great as the width, in the same circumferential direction, of the serration.

5. A construction as defined in claim **1**, in which said roller is made of hard ceramic material.

6. An applicator roller adapted to rotate partially submerged in a liquid bath of finish for applying the finish to a textile yarn in tangential contact with the upper part of said roller as it rotates, said applicator roller comprising a body of substantially circular outline with respect to an axis of rotation, said roller having a shallow groove extending circumferentially around the roller, the surface of said groove being interrupted by a multiplicity of relatively small serrations extending crosswise of the groove and sufficiently small to retain finish therein by capillary action until the finish in each serration successively makes contact with a yarn lying in said shallow groove in tangential relation to the roller.

7. A construction as defined in claim **6**, wherein said shallow groove is of arcuate cross-section.

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