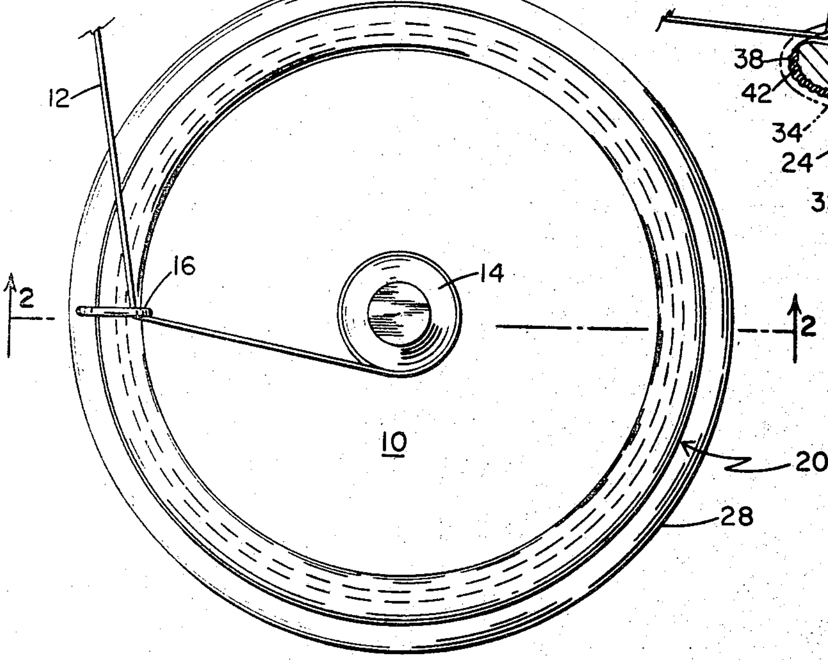
Dec. 17, 1968 K. C. CHILPAN 3,416,301

SPINNING RING WITH INDENTED SURFACE

Filed Jan. 31, 1967

FIG. 1



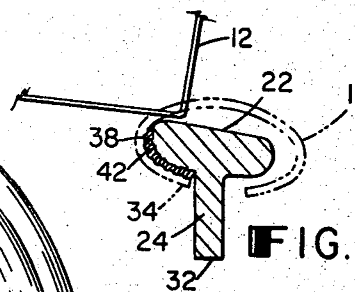


FIG. 4

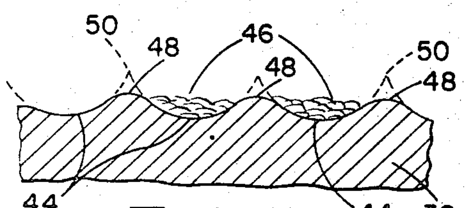


FIG. 5

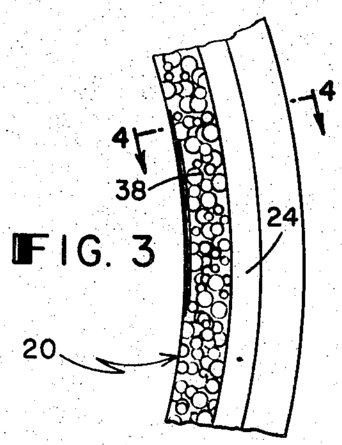


FIG. 3

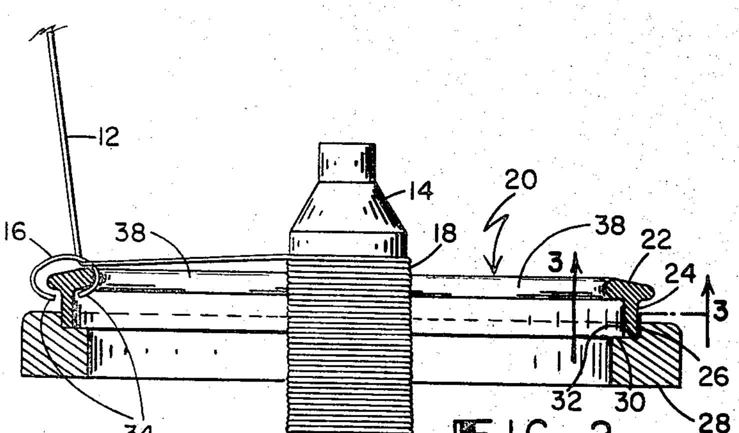


FIG. 2

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3,416,301
SPINNING RING WITH INDENTED SURFACE
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9 Claims. (Cl. 57—119)

ABSTRACT OF THE DISCLOSURE

An improved yarn spinning device having a spindle for winding up yarn, a traveler for receiving and redirecting the yarn, and a metal ring for guiding the traveler as it is moved about the spindle by the action of the yarn being wound on the spindle, the ring having a bearing surface for contacting the traveler. The improvement includes a bearing surface having a multiplicity of smooth-surfaced indentations for accumulating the natural elements that separate from the yarn during processing and adapting those elements to act as lubricants between the traveler and ring, those elements including waxes and finishes used in processing the yarn and fibers of the yarn alone and in combination with the waxes and finishes.

This invention relates to yarn spinning and twisting devices, and more particularly to an improved ring for guiding the traveler in such devices.

Many attempts have been made to increase the useful life of the rings and the travelers, including varying their shapes and increasing their hardness, as well as increasing the bearing surfaces of the traveler, changing the shape of its bearing surfaces and changing its weight. High hardness of the bearing surfaces of the traveler and ring is recognized as desirable to prolong their useful lives. But hardness alone does not prevent wearing. Indeed, if the web of the ring is made too brittle, as may be the case in attempting to achieve high bearing surface hardness, the web may break under the stress of a heavy traveler. Some suggested modifications to the ring and traveler have been expensive and are often complex. Presently, the first few weeks of traveler life must be devoted to "breaking in" including frequent traveler changes and wipings. After a few months of use the traveler reaches its optimum performance and in as little as six or seven months, the wear may become serious, requiring more frequent replacement of travelers and the use of heavier travelers. Poor performance begins when the bearing surface of the ring is worn as little as 0.003 inch and the ring is replaced when such wear reaches 0.004–0.005 inch. Applying normal lubricants to the bearing surfaces of the ring and traveler would improve their life, but this is not a workable solution, for such lubricants will soil the yarn and destroy its value and utility. Contamination of the yarn by such lubricants does not result only from contact of the yarn with the bearing surfaces, but may, as well, result from the spattering of the lubricant as it is tossed about by the spinning traveler. In addition, the oil film on the ring is transferred to the traveler and creates a sticky surface which facilitates the accumulation of lint on the traveler. This accumulation increases the drag of the traveler, resulting in heavier yarn tension and an increased wear rate of the traveler. The oil-fouled lint is also difficult to remove by conventional traveler cleaning means. Attempts to employ a soft or velvety surface applied to the bearing surface of the ring have proved unsuccessful for such a surface, while it does retain certain particles of the yarn, being on the metal ring wears quickly and its lubricating power is lost.

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Accordingly, it is an object of this invention to provide a resilient metal ring which has a high-hardness, low-friction bearing surface, a long useful life, requires a minimum of break-in time with each new traveler, and prolongs the useful life of travelers used with it, and which is capable of adapting natural elements in the yarns being processed, such as the waxes, finishes and crushed fiber residue of the yarn, to act as a lubricant on the bearing surfaces of the ring and traveler, and to provide such a ring which is simple and inexpensive to make, similar in size and shape to existing rings, and usable with existing apparatus and travelers.

These objects are accomplished in an improved yarn spinning device having a spindle for winding up yarn, a traveler for receiving and redirecting the yarn, and a metal ring for guiding the traveler as it is moved about the spindle by the action of the yarn being wound on the spindle, the ring having bearing surface for contacting the traveler. The improvement includes a bearing surface having a multiplicity of smooth-surfaced indentations for accumulating the natural elements that separate from the yarn during processing and adapting those elements to act as lubricants between the traveler and ring, those elements including waxes and finishes used in processing the yarn and fibers of the yarn alone and in combiantion with the waxes and finishes.

Other objects, features, and advantages will appear from the following description of a preferred embodiment of the invention, taken together with the attached drawings thereof, in which:

FIG. 1 is a plan view of a spinning device using a spindle, traveler and ring in accordance with this invention;

FIG. 2 is a sectional view of the ring and its support taken along line 2—2 of FIG. 1;

FIG. 3 is an enlarged view of a section of the ring taken along line 3—3 of FIG. 2, showing the bearing surface of the ring;

FIG. 4 is an enlarged sectional view taken along line 4—4 of FIG. 3 with the compressive layer somewhat exaggerated;

FIG. 5 is a magnified sectional view of a portion of the bearing surface of the ring.

There is shown in FIG. 1 a spinning device **10** for winding yarn **12** on spindle **14** by means of a hardened steel traveler **16**. Spindle **14** is rotated about its central, vertical axis by a suitable source of power not here shown. Yarn **12** is fed to traveler **16** from the output of a yarn processing machine, not shown.

As spindle **14** turns, yarn **12** is wound on it in layers **18**, FIG. 2, and the action of yarn **12** as it is wound moves traveler **16** about metal ring **20**.

Ring **20** has a horizontal flange **22** and a vertical web **24**; web **24** abuts shoulder **26** of holder **28** when the ring is mounted therein. And ledge **30** of holder **28** supports base **32** of web **24**. The horns **34** of traveler **16** retain the traveler on ring **20** by guiding on bearing surface **38** on the lower and edge portions of flange **22**.

Bearing surface **38** has a compressive layer **42** extending from the surface to a depth of approximately 0.002–0.008 inch, FIGS. 3 and 4. Compressive layer **42** is formed by shot peening the ring with steel balls having a hardness value of approximately 60 on the Rockwell "C" scale (Rc), the shot peening compressively stressing the ring and densifying its crystalline structure in the layer **42** extending inwardly from surface **38**, which results in the layer having a compressive residual stress of approximately 148,000 pounds per square inch and a hardness of approximately 58 Rc.

The shot peening of bearing surface **38** provides, in addition to the high hardness compressive layer, a surmild mechanical treatment may, for instance, consist of striking, rubbing, brushing, or vibrating. Such treatment during the electrical treatment will not only fold out but also spread the material out.

At this point in the flow sheet of FIGURE 1 the sheet material is in a spread-out condition wherein the individual fibrils, making up the material, are parallel to the longitudinally axis of the sheet material. In many cases, and for many applications, this is a desirable configuration. However, for certain textile products the yarn used in the manufacture therein should not be lean and smooth but rather should have a high percentage of loose fibrils along the surface of the web or sheet as the case may be. For instance, in the case of blankets, carpets, and fabrics made from woolen yarns, it is essential to use a bulky yarn which is not produced under the process described in the above-identified patent.

My invention resides in forming a pile fabric from this polymeric sheet material as it emerges from the folding-out step.

With reference to FIGURES 2 and 3, after the sheet material **10** has been folded out as described hereinabove, it passes between a pair of generally cylindrical rollers **12** and **13**, which are rotatably mounted in frame plates **14** and **16** respectively. These frame plates **14** and **16** extend vertically from a base plate **18** which is mounted on wheels **20**. This unit is able to be wheeled into a position to receive the film **10** directly from the folding-out step described in FIGURE 1 in the event that it is desirable to make the whole process continuous. The sheet or web **10** passes from the rollers **12** and **13** to a roller **54** (see FIGURE 6) which is also rotatably mounted in plates **14** and **16**.

With reference to FIGURE 6, a plurality of rollers **54** are shaped to form a crown **56** at their centers. As a result, the fibrils in the central portion of film **10** passing over the crown **56** will break while those in the edge portion of the film passing over the edge of the roller will not. This action of crowned rollers **54** (FIGURE 2) causes the fibrils in the center portion of sheet **10** to break. This web is particularly useful in making yarn and as such it is twisted by conventional yarn twisting means as it is wound onto a spool **58**.

As shown in FIGURES 2 and 3, rollers **13**, **54** (only one roller is shown; however, it would be within the skill of the art to connect a plurality of crowned rollers into the mechanism) and **29** are connected to a suitable driving mechanism **30**. This mechanism comprises an endless belt or chain **32** which passes over a pulley or sprocket **34** which is fixed to roller **54**, then over a sprocket **36** which is fixed to roller **13**, then over a sprocket **38** which is fixed to roller **29**, then over an idler sprocket **40**, then over a drive sprocket **42**, which is driven by any suitable power source such as electric motor **44**, and finally back over sprocket **34**. The rollers **12**, **13**, **54**, **28**, and **29** are rotated in the directions shown by the arrows.

With reference to FIGURE 4, roller **22** is provided with a plurality of grooves **24** and a plurality of needles **26** or other similar sharp, pointed implements, which project radially from the center of the grooves **24**. These needles may be secured in the grooves **24** in any suitable manner. As the sheet **10** passes over the roller **22**, portions of it are channelled into the grooves **24** and become impaled upon the needles which penetrate through the sheet material and cause a portion of the individual fibrils to be severed. The degree of breakage would be determined by the number of grooves in the roller and the number of pins in the grooves; however, no more than one-half of the fibers passing over the roller should be broken in order to retain sufficient web strength. In the preferred embodiment we show only one roller but it would be within the skill of the art to adapt a plurality of rollers over which the film could be passed. The film after passing over the pin-studded roller **22** is received by a pair of pick-up rollers **28** and **29** which are also rotatably mounted in the frame plates **14** and **16**. These rollers feed the bulky sheet material to a suitable take-up mandrel (not shown).

FIGURE 5 illustrates another embodiment of my invention. In this embodiment a roller **46** contains a plurality of grooves **48** around the perimeter thereof. These grooves are cut at an angle of 45° to the horizontal axis **50** of the roller **46**. This roller **46** is attached to frames **14** and **16** in place of roller **22**. A plurality of knife blades **52** are positioned around the circumference of roller **53** rotatably mounted between the vertical frames **14** and **16** a predetermined distance from roller **46**. The sheet **10** is passed between the roller and the blade. The blade **52** is rotated in close enough proximity to the roller **46** so that portions of the film **10** pass over the crown of the grooves **48** and are cut by the rotating blades **52**. Because of the angle of inclination of these grooves a discontinuous chopping of the individual fibrils results without cutting entirely across the sheet itself. The strength of the sheet itself is not significantly affected. This fabric possesses a tremendous advantage over a normal pile fabric because the pile fibers form an integral part of the sheet and are firmly anchored to the surface of the sheet.

In order to illustrate with greater particularity and clarity the operation of my process, the following examples are offered as illustrative of the operation thereof. The specific materials and conditions given in the examples are presented as being typical and should not be construed to limit my invention unduly.

EXAMPLE I

A 60-inch wide fibrillated web of 0.8 mil polyethylene, having a density of 0.95 gram/cc. and a melt index of 0.3 (ASTM D 1238–5DT, Condition E), is threaded through the machine described in FIGURE 2. A chopper roller **53** is provided with 12 tempered spring steel blades **52** around its circumference. The blades **52** coact with a 12-inch diameter grooved roller **46**, made of mild steel and coated to a thickness of 60 mils with 80 durometer rubber. Each groove **48** in roller **46** defines an ellipse in a plane making a 45° angle with the roller axis. These grooves are ⅛-inch wide, ⅛-inch deep, and spaced so that their centers are ¼-inch apart, and having all their edges and corners chamfered and rounded on a 1⁄16-inch radius. Bulk film is fed to roller **12** at the rate of 20 feet per minute while the machine is being adjusted to insure clean, uniform cuts. After adjustment, the rate is increased to 150 feet per minute and about 2000 feet of the material is fed through the machine.

Air filters 2½ feet square are produced from some of this material by laminating **21** layers of this bulked film together, each layer being laid at right angles to the adjacent layers **21** and being stitched together in both directions across the film at 6-inch intervals with cotton string and subsequently edged with an aluminum channel having a ⅛-inch flange.

In another application ten 8-foot sections of this bulked fibrilated web are stitched together on 4-inch centers both lengthwise and crosswise and the edges bound to make an exceptionally warm, lightweight blanket.

Example II

The rollers **46** and **53** are replaced with a 12-inch diameter pin-studded roller **22** similar to that shown in FIGURE 4. The grooves **24** are ½-inch center-to-center with a sharp 60° included angle peak between the grooves. In each groove **36** equally spaced cylindrical pins **26** are positioned wherein each pin is 3⁄32-inch in diameter and has a flat, sharp edged top portion located 3⁄32-inch below the peaks. Web material similar to that used in Example I is threaded through the machine and the machine is started and run at an initial rate of about 15 feet per minute output while adjustments of the film tension over the pin-studded roller **22** are made. After adjustment, the rate is increased to 150 feet per minute to produce approximately