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ROLLS FOR USE IN SQUEEZING LIQUIDS FROM TEXTILES AND THE LIKE AND A METHOD OF PRODUCING SUCH ROLLS

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ROLLS FOR USE IN SQUEEZING LIQUIDS FROM TEXTILES AND THE LIKE AND A METHOD OF PRODUCING SUCH ROLLS

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6 Claims. (Cl. 29 — 129)

The present invention relates to rolls and more particularly to so-called soft rolls for use in squeezing liquids from textiles and the like, and to a method of producing such rolls.

In the manufacture, processing and finishing of textiles and the like, the textile web or strip is frequently subjected to treatments with various liquids. After such treatment, the liquid is removed from the web usually by passing the web between rolls and squeezing out the liquid. High specific pressures are used and, to avoid crushing or bruising the textile fibers, it is common to use one soft roll and one hard roll of material such as steel, ebonite, wood or the like.

The soft roll of such a squeeze roll unit should have a surface sufficiently soft and yielding that it will not damage the textile fibers but will enter the meshes between the fibers for thorough removal of moisture. However, this soft yielding portion should extend inward only a very short distance from the surface and the body of the soft roll should be relatively hard and dense so that even under high pressures, the soft roll is not deformed and makes substantially line contact with the hard roll.

For many years, the industry has endeavored to produce a soft roll meeting these requirements. Rolls have been made of various materials and in order to obtain a soft surface and high core strength, rolls have been made of steel and coated with rubber or other elastic material. All of these prior art soft rolls have met with only limited success for various reasons. Rubber covered steel rolls for example, cannot be operated at high specific pressures because the hard roll presses into and deforms the rubber surface thus making contact over a relatively large area and reducing the specific pressure. Further, rubber does not enter the meshes of a textile and, at high speeds, substantial amounts of liquid are carried through the rollers with the web. In addition, rubber covered rolls are difficult to produce and the rubber covering is easily damaged and torn.

One of the objects of the present invention is to produce a soft roll having a surface which will not injure textile fibers at high specific pressure.

Another object is to produce a soft roll which makes substantially line contact with a cooperating hard roll so that high specific pressures may be produced for squeezing liquid from a web.

Another object is to produce a roll having a surface which will enter the meshes of a textile web during squeezing.

Another object is to produce a soft roll having a soft, yielding surface and a hard dense core such that a cooperating hard roll of a squeeze roll unit will not substantially deform the soft roll even at high pressures.

Another object is to provide a soft roll which is durable and resistant to abrasion.

Another object is to provide a method of making soft rolls.

These and other objects and advantages reside in novel features of composition and construction and in steps and methods as will hereinafter be more fully set forth and pointed out in the appended claims.

In the drawing:
Figure 1 is an elevation with parts in section of a soft roll made according to the present invention;
Figure 2 is a section taken on line 2—2 of Figure 1;
Figure 3 is a section taken on line 3—3 of Figure 1; and
Figure 4 is an enlarged fragmentary perspective view of one disk used in the formation of the roll.

According to the present invention, the roll indicated generally at 10, is made up of a plurality of disks 12 and 14 arranged side by side on a steel core or shaft 16. The disks 12 and 14 are compressed tightly between a collar 18 on the shaft 16 and a ring 19 which is locked in position by any suitable means such as the split ring or washer 20 which engages a peripheral groove 22 in the shaft 16. In order to prevent rotation of the disks 12 and 14 on the shaft 16, each disk is provided with one or more inwardly extending projections 24 which engage in longitudinal slots or grooves 26 in the shaft 16.

The disks 12 are preferably made of a fleece of polyamide resins, especially super-polyamide resins known commercially as nylon and perlon. These resins are polyamide condensation products for hexamethylene-diamine and adipic acid. Very fine unspun individual polyamide fibers are used and these are fully stressed, that is, stretched to their maximum limit, before use.

The pre-stressed polyamide fibers are laid out in a sheet with the individual fibers in random orientation. The sheet is preferably very thin so that there is substantially only a single layer of fibers. This sheet of fibers is then impregnated with latex, several such sheets are superposed and the superposed sheets are pressed together and heated to vulcanize the latex. The disks 12 are then cut from the compressed, vulcanized sheets.

The disks 14 are made in substantially the same way as the disks 12 except that vegetable fibers such as ramie, cotton or sisal-hemp are used and up to about 30% of polyamide fibers are preferably mixed with the vegetable fibers. Generally I prefer to make the disks 14 containing the vegetable fibers somewhat thinner than the disks 12 which contain only polyamide fibers usually about 3/5 the thickness of the disks 12.

Each disk 12 and 14 is cut from a compressed and vulcanized sheet and the disks are preferably arranged on the shaft 16 with a different angular orientation to neutralize any linear characteristics due to more fibers lying in one direction than another. Disks 12 and 14 are placed on the shaft 16 alternately and the assembled disks are compressed. The pressure used in compressing the disks on the shaft should not be so great as to cause substantial flow of the polyamide but in order to obtain sufficient core strength and density, I prefer to use sufficient pressure that the finished roll has a Shore point of 92° or more. I have found that pressures of about 55 kg. per sq. cm. produce satisfactory rolls. The disks are then locked in compressed position by the ring 18 and the roll is ground or cut to shape.

In assembling a roll according to the present invention, ordinarily, a group of disks 12 and 14 are placed on the shaft and pressed by suitable means such as a hydraulic ram. Then another group of disks is placed on the shaft and pressed and this procedure is carried on until the roll is built up to the desired length. In each group, the disks closest to the ram are under the greatest pressure and those farthest from the ram are under the least pressure. The pressure of the disks in the roll as originally assembled is thus different throughout the length of the roll. Polyamide resins even when pre-stressed, tend to flow under pressure and, when the pressures in the disks is different, the tendency of the disks to flow or
expand radially will be different along the length of the roll. Unless this pressure difference is equalized or compensated, the disks under greatest pressure will flow or expand radially and carry most of the pressure load. Such a roll will break down at these high pressure areas probably due to internal heat and friction.

I have found that these pressure inequalities can be neutralized or compensated by running the finished roll under pressure against a hard roll for a period of time long enough to permit pressure flow of the polyamide fiber but not long enough to permit internal heat or friction to damage the roll. Ordinarily on to three hours is sufficient. The roll is then cut or ground to size. The process may be repeated until operation under pressure against a steel roll causes no change in the roll surface.

The vegetable fibers do not have the same tendency to flow under pressure (sometimes called cold flow) as the polyamide fibers and the vegetable fiber disks 14 located between the polyamide fiber disks 12 tend to reduce the pressure flow in the polyamide disks 12.

The outer surface of the roll consists of the ground or cut ends of the latex coated fibers and is both soft and resilient. This outer surface will enter into and fill the meshes of a textile web to remove entrapped moisture but will not bruise or crush the textile fiber themselves.

Just beneath the surface of the roll, the polyamide and vegetable fibers prevent the latex from flowing so that the roll has such high density and strength that the hard roll, even at very high pressures, does not penetrate the body of the soft roll or substantially distort the soft roll surface. Even when the hard roll is small, that is, has a diameter of 150 mm. or less, the body or core of the soft roll of the present invention is such that it makes substantially line contact with the hard roll so that high specific pressures may be obtained.

A series of comparative tests showed that the roll of the present invention extracts more liquid from cloth than known rolls and roll combinations. Tests were run in a machine of the type shown in British Patent No. 700,436 to compare the water extracting ability of the roll of the present invention with a conventional rubber roll. The tests were made on water saturated heavy twill using an upper steel squeeze roll 3¾ inches in diameter with the following results:

<table>
<thead>
<tr>
<th>Roll</th>
<th>Diam., inches</th>
<th>Load, lb./lin. ft.</th>
<th>Speed, yds./min.</th>
<th>Water Retention, percent on even dry weight</th>
</tr>
</thead>
<tbody>
<tr>
<td>Present Invention</td>
<td>4.7</td>
<td>330</td>
<td>40</td>
<td>44</td>
</tr>
<tr>
<td>Rubber</td>
<td>4¾</td>
<td>330</td>
<td>40</td>
<td>49</td>
</tr>
</tbody>
</table>

Different types of water saturated fabrics were run through the machine of the type shown in British Patent No. 700,436 using a 3¾ inch steel upper squeeze roll and 4.7 inch roll of the present invention and the results compared with other roll combinations in another mangle. In each case the load was 330 pounds per linear inch and the speed was 40 yards per minute. The results were as follows:

<table>
<thead>
<tr>
<th>Rolls</th>
<th>Water Retention, percent on even dry weight</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Heavy Twill</td>
</tr>
<tr>
<td>Present Invention</td>
<td>47.0</td>
</tr>
<tr>
<td>9&quot; brass and 19&quot; sycamore</td>
<td>46.0</td>
</tr>
<tr>
<td>6&quot; brass and 9&quot; sycamore-hard rubber</td>
<td>50.0</td>
</tr>
</tbody>
</table>

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From the foregoing it will be apparent that I have accomplished the objects of my invention and have provided a soft roll having a surface sufficiently soft, yielding and resilient to enter the meshes of a textile fabric without injuring the textile fibers yet sufficiently strong and dense that it is not distorted even at high pressures. The invention has been described particularly with reference to removing liquids from textile webs but it is apparent that the roll is of general application and may be used in the paper and other industries and may be used for pressing dyes, pigments or other materials into a web as well as squeezing liquids from a web.

This application is a continuation-in-part of my application Serial No. 267,112 filed January 18, 1952, now abandoned.

What is claimed and desired to be secured by United States Letters Patent is:

1. A roll comprising a plurality of flat, annular, axially compressed disks, a core extending through the central openings of said disks, said disks comprising latex impregnated fiber fleece, the fibers in each disk being substantially all in plane of the disk in random orientation and the latex being vulcanized.

2. A roll as defined in claim 1 in which the fiber fleece comprises polyamide fibers.

3. A roll as defined in claim 2 in which the polyamide fibers are unspun and stretched.

4. A roll as defined in claim 1 in which alternate disks contain vegetable fibers and the remainder comprise polyamide fibers.

5. A roll comprising a body of flat, annular latex impregnated disks of fiber fleece mounted on a mandrel and compressed to a hardness of 92* Shore, the fibers of the fleece lying substantially in the plane of the disks whereby the ends of the fibers of the fleece constitute the roll surface.

6. The method of making a roll which comprises forming sheets of fiber fleece in which substantially all of the fibers lie in a single plane, impregnating said fleece with latex, compressing said sheet, vulcanizing said latex, assembling said sheets in side by side relation, compressing said assembled sheets until the assembly has a hardness of at least 92* Shore, and cutting said compressed sheets into a roll.