Sept. 17, 1968 C. E. OXFORD, JR 3,401,670

APPARATUS FOR COATING TOW

Filed June 20, 1967

FIG. 1

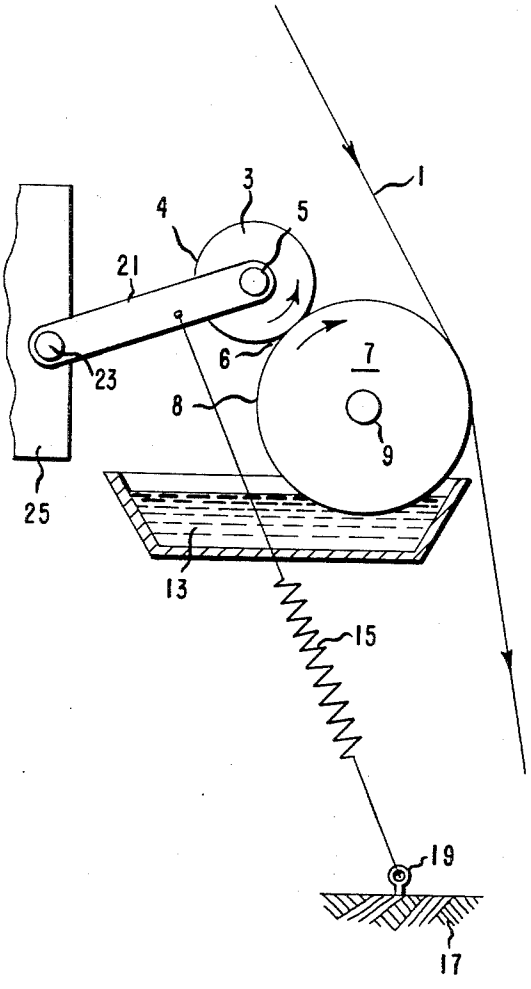
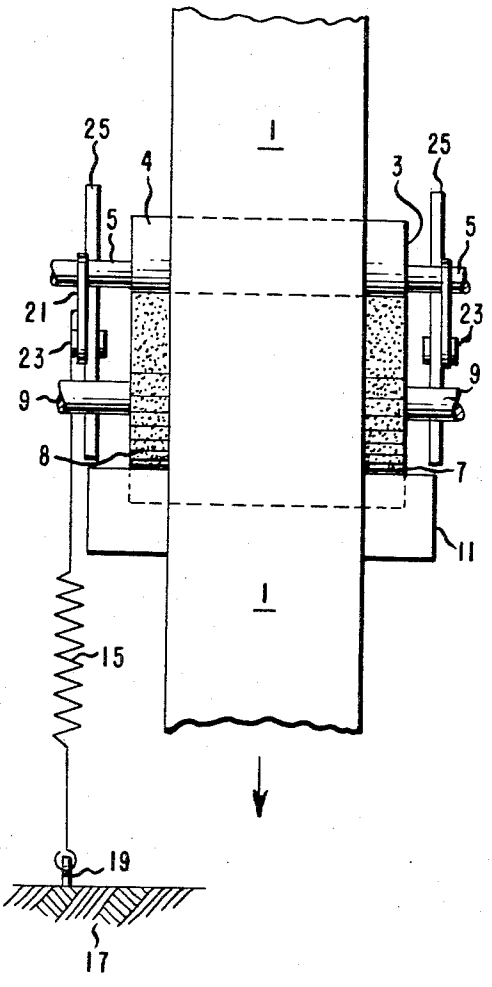


FIG. 2



INVENTOR

CLARENCE EDWARD OXFORD, JR.

BY E. Leigh Hunt

ATTORNEY

United States Patent Office 3,401,670 Patented Sept. 17, 1968

3,401,670

APPARATUS FOR COATING TOW

Clarence Edward Oxford, Jr., Kinston, N.C., assignor to E. I. du Pont de Nemours and Company, Wilmington, Del., a corporation of Delaware

Filed June 20, 1967, Ser. No. 647,402
2 Claims. (Cl. 118—212)

ABSTRACT OF THE DISCLOSURE

An apparatus and process for uniformly applying a liquid in discrete metered quantities to moving continuous filaments or tow. The apparatus comprises a finish applicator roll having a hard, peripheral yarn-treating surface roughened to a controlled degree to form pits, the applicator roll is arranged to rotate in a fluid supply reservoir and is further arranged such that the filaments or tow to be coated can pass over a portion of its surface; a second roll of relatively inelastic material having a smooth surface is in loaded tangential contact with the applicator roll at a point between the fluid pickup and the yarn contact, the second roll being loaded to a degree such that substantially all the excess fluid is removed from the applicator roll and allowing only the liquid retained in the pits to reach the yarn. The process comprises the steps of transferring the finish to be applied from a fluid supply to a rotating finish applicator roll having a surface roughened to form pits; removing the excess finish from the applicator roll by means of a second roll in loaded tangential contact with the applicator roll thereby allowing only the fluid retained in the pits of the roughened surface of the applicator roll to pass through the nip, conveying the fluid retained in the pits of the applicator roll to the yarn to be coated which is guided over a portion of the surface of the applicator roll located at a point beyond the nip of the two rolls.

BACKGROUND OF THE INVENTION

(1) *Field of the invention*

This invention relates to an applicator for coating strands and more particularly to coating moving strands with a liquid treating composition. The invention is especially useful in applying small quantities of nonaquenous finishes uniformly to strands.

(2) *Description of the prior art*

In the production of synthetic filaments, it is the practice to apply a liquid treating composition to the filaments in order to facilitate subsequent processing. Such compositions comprise or contain lubricants, antistats, softeners, emulsifiers, wetting agents, and the like. For optimum processing, it is essential that the composition be applied uniformly and in relatively small amounts. The art has long recognized that this requirement can be efficaciously met by the use of aqueous emulsions of the desired concentration. However, the use of aqueous emulsions is not always desirable, for instance, when there is insufficient time for the water to evaporate or for subsequent hot processing where driving off the moisture would impose an intolerable heat load. Conventional applicators are not entirely suitable for use with undiluted, nonaqueous compositions particularly for the uniform application of very small amounts of the finish composition.

Armstrong, U.S. Patent 2,953,476 dated Dec. 8, 1953, discloses various combinations of finish rolls for the application of liquid to a textile material such as yarn. The yarn to be coated is passed through the nip of the rolls, one of which has been supplied with a film from a reservoir. No mention of a roll with a roughened surface is disclosed nor is any disclosure made which would lead one towards applicant's invention.

Hoffmann et al., U.S. Patent 2,331,980 dated Oct. 19, 1943, discloses a finish applicator that is designed to give uniform application of nonaquenous finishes to a yarn or tow. The gist of the Hoffmann et al. invention resides in the fact that the yarn contacting roll has a uniform film of the finish applied to it from a roll which rotates in a finish solution and is spaced a controlled distance therefrom. Therefore, the spacing of the rolls is critical in determining the quantity of finish applied to the moving yarn. The finish pickup roll disclosed in Hoffmann et al. does have a roughened surface, however, this is to insure an adequate pickup of finish solution in an over-supply and the film thickness is then regulated by the roll spacing. The roughened surface is not for the purpose as used in applicant's invention nor is any disclosure made which would lead one towards applicant's invention.

Johnson et al., U.S. Patent 2,084,960 dated June 22, 1937 discloses a finish applicator roll having a roughened surface. The roll rotates in the finish reservoir and the yarn passes over the roll thereby transferring the finish to the yarn. The disclosure of Johnson et al. does not lead on towards applicant's invention as the mechanism of Johnson's et al. invention differs from that of applicant's. The invention of Johnson et al. requires a finish solution of constant viscosity to uniformly apply finish to the moving yarn whereas applicant's invention uniformly applies finish to a yarn regardless of viscosity. Also, the Johnson et al. invention is practically suitable only for a relatively nonviscous finish solution thereby limiting it substantially to use of aqueous solutions of finishes. As will be described more completely the gist of applicant's invention resides in the fact that the only finish that is allowed to reach the yarn is effectively metered by allowing only the finish that is retained in the pits within the roughened surface of the roll to be conveyed to the yarn thereby allowing relatively viscous finishes to be applied uniformly and at any desired rate, no matter how minute.

Butler et al., U.S. Patent 2,083,635 dated June 15, 1937, discloses an applicator consisting of two rolls. A driven roll is submerged partially in the finish and is in rolling contact with an idler roll. The amount of finish that is applied to the yarn is regulated in part, by the weight of the idler roll and the pressure it exerts at the nip. The yarn may contact either the driven roll or the idler roll. The film of liquid that is allowed to contact the yarn in either case is on the surface of the applicator roll and not in pits as the rolls are smooth. Therefore the function of the Butler et al. invention substantially differs from that of applicant and the uniformity of application is highly sensitive to roll pressure and liquid viscosity.

British Patent 713,276 published Aug. 11, 1954, discloses a finish roll in which at least the peripheral surface is made of hard wearing particles and an abrasive material bonded together. The mechanism of the invention disclosed in British patent differs from that of applicant's in that the alleged invention allows the finish roll to support a continuous film while having a roll exhibiting the hard wearing properties of the abrasive material from which it is constructed.

SUMMARY OF THE INVENTION

The invention is a textile finish applicator and also a process for applying finish uniformly to a moving yarn

or tow of filaments. The finish applicator comprises two rolls in contact under pressure wherein at least one of the rolls has a roughened surface forming pits wherein the degree of roughness controls the amount of finish applied to the synthetic filaments passing over the applicator roll. The important features of the invention are that the rolls are made of a hard material and loaded to such a degree that the excess finish is removed from the applicator roll and only that retained in the pits of the applicator roll is allowed to reach the yarn. Because of this feature the viscosity of the finish has little effect on the quantity of liquid reaching the yarn and the finish is uniformly supplied to the moving yarn. The quantity of finish applied can thus be regulated effectively by controlling the surface roughness and hence the number and size of the pits in the appliactor roll.

BRIEF DESCRIPTION OF THE DRAWINGS AND THE PREFERRED EMBODIMENT

This invention provides an improved applicator for the uniform application of small amounts of nonaqueous yarn-treating compositions.

Other provisions and advantages of the present invention will be apparent from the following detailed description of a preferred embodiment, reference being made to the accompanying drawings wherein,

FIGURE 1 is a somewhat schematic side view of an embodiment of the apparatus; and

FIGURE 2 is a somewhat schematic front view of the apparatus of FIGURE 1.

Referring to the drawings, particularly FIGURE 1, a supply of continuous, synthetic filaments **1** brushes roll face **8** of supply rolls **7** in a small but noticeable angle of contact. Supply roll **7** is partially immersed in liquid treating composition **13** contained in trough **11**. Supply roll **7** is driven by suitable connection of a power supply, not shown, to shaft **9**. In rotating through the surface of composition **13**, the roll face **8** becomes coated with the liquid composition and carries it to the nip point between supply roll **7** and regulator roll **3**. Regulator roll **3**, which may be a driven roll or an idler roll, is maintained in tangential contact with supply roll **7** by suitable mounting of shaft **5**. The suitable mounting may consist of an arm **21** swing-mounted on shaft **23** affixed to a solid support such as the machine frame as indicated by **25** and force-loaded by spring **15** anchored to a solid support as at **17** through eye **19**. The face **8** of supply roll **7** comprises a rough surface and by virtue of the tangential contact, the degree of roughness and hence the number and size of the pits determines the amount of the liquid composition passing through the nip point from the supply pool indicated at **6**. The liquid treating composition passing the nip point in the depressions in roll face **8** is carried to the filament contact point where it passes to the filaments.

As will be apparent, the regulator roll may also function to carry the composition to the filaments by an alternate arrangement wherein the filaments contact roll **3** rather than roll **8**. In such an arrangement, roll **3** will have a roughened face. The rolls may be of any suitable material such as, for example, glass, plastic, ceramic or metal and the yarn-contacting surface may be roughened in any suitable manner such as sand-blasting, etching, or the like. Preferably the roll used to apply the composition is made from stanless steel and has a sand-blasted surface.

As will be apparent from the above description, the degree of roughness of the roll face can be used to control the amount of the liquid composition supplied to the yarn and is particularly advantageously used to apply small amounts, for example, less than 0.25%, by weight, based on the weight of the filaments. Since the speed of the filaments will be appreciably greater than the surface speed of the regulator roll, it is desirable that there be no protrusions above the original surface since otherwise the filaments may be damaged. The face of the sand-blasted roll may be treated with a fine abrasive or by an electrolytic polishing process to remove any burrs or the like. If desired, the roughened roll may be subjected to a metal plating process such as chrome plating to produce a smooth, long-wearing surface with a controlled degree of roughness. If desired, both rolls may have a roughened face which may be of the same or a different degree of roughness. The surface roughness of the supply roll may be measured by a Profilometer, a device sold by Micrometrical Manufacturing Company, Ann Arbor, Mich. The Profilometer gives a root mean square (RMS) measurement.

A roughness value of 70–90 RMS is satisfactory for the application of from about 0.08–0.25%, by weight, of a textile treating finish or the like to the moving filaments. When the roll diameter is 17.5 cm. and it rotates at 7 revolutions per minute, 0.19%, by weight, oil is applied to filaments advancing at 250 meters per minute.

When using this invention it is essential that one of the rolls, preferably the regulator roll, be loaded so as to maintain forceful contact at the nip. This insures removal of substantially all of the finish from the applicator roll outer surface thereby allowing only the liquid contained in the pits to be conveyed to the yarn. The regulator roll may be spring loaded or loaded by use of air or hydraulic pressure means. Using stainless steel rolls with a face width of about 0.3 meter, a spring-loading force between 10 to 20 kilograms has been found suitable for the desired tangential contact.

It is essential that the rolls be relatively inelastic and a sufficient force be applied between the rolls to effectively remove substantially all of the finish from the peripheral surface of the roughened roll thereby allowing only the finish retained in the depressions or pits of the roughened surface to pass through the nip and reach the filaments to be treated. Such an arrangement insures a constant and uniform metering of the finish solution irregardless of viscosity of the finish. If the rolls are relatively elastic difficulty is encountered in the metering mechanism as much of the finish will be removed from the depressions at the nip of the rolls and the process will undesirably become extremely sensitive to variations in roll pressure.

While the finish applicator of this invention is particularly well suited to applying small amounts of nonaqueous treating composition to synthetic filaments just prior to a packaging operation, it may also be used to good advantage at other points in yarn-handling process. For instance, the device may be used prior to a drawing step, prior to or following a heat-treating step, or prior to or following relaxation, crimping or the like.

The process and apparatus of this invention is useful in treating textile strands, yarns, tows, threads, filaments, and the like with a liquid treating composition.

Although I have described my invention with a certain degree of particularity, it is understood that the present discolsure has been made only by way of example only and that numerous changes in the details of construction and the combination and arrangement of parts may be restored to without departing from the spirit and the scope of the invention as hereinafter claimed.

What is claimed is.

1. In an apparatus for applying a liquid treating composition to an advancing filamentary textile strand, the apparatus being of the type including strand guide means, an applicator roll having a hard peripheral surface roughened to form numerous pits and adapted to convey a viscous liquid to yarn passing thereover, and means for supplying liquid to the applicator roll; the improvement which comprises a second hard-surfaced roll rotatably mounted and disposed to be in loaded tangential contact with the applicator roll at a position on the applicator roll intermediate the position of yarn contact and liquid supply means, said applicator roll peripheral surface having a

surface roughness within the range of about 50 to 100 RMS; and biasing means for maintaining the rolls in loaded tangential contact at a force of at least 0.30 kilogram per centimeter of tangential roll contact to remove substantially all the liquid from the applicator roll except for the liquid within the pits; said strand guide means being disposed to define a path therebetween with said path bending around said applicator roll to an extent in excess of a line of tangency to hold said strand against said roll and to allow said strand to advance at a greater speed than said roll surface.

2. The apparatus as in claim 1 wherein the applicator roll and the second roll are made of stainless steel, the applicator roll having a sand-blasted surface.

References Cited

UNITED STATES PATENTS

1,661,174	3/1928	Francis	118—262 XR
1,914,488	6/1933	Cüsters	118—262 XR
2,053,730	9/1936	Minkow	118—262 XR
2,243,604	5/1941	Parkinson	118—262
2,338,138	1/1944	Sillars	118—262
2,396,946	3/1946	Grupe	118—212 XR
2,605,684	8/1952	Nangels et al.	118—262 XR
3,244,143	4/1966	Ewing	118—262

CHARLES A. WILLMUTH, *Primary Examiner.*

R. I. SMITH, *Assistant Examiner.*