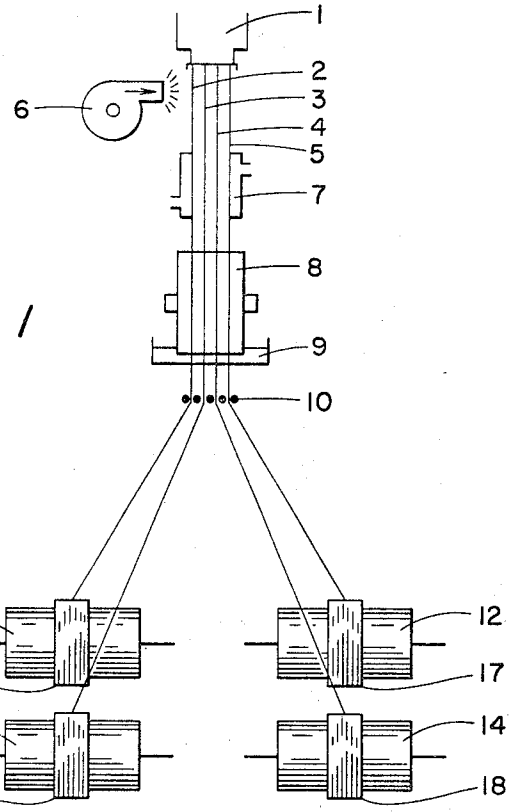
Jan. 14, 1969 G. T. DAVIES ET AL 3,421,926

DEVICE FOR APPLYING LIQUID TO TRAVELLING FILAMENTS

Filed Aug. 4, 1967 Sheet 1 of 2

FIGURE 1



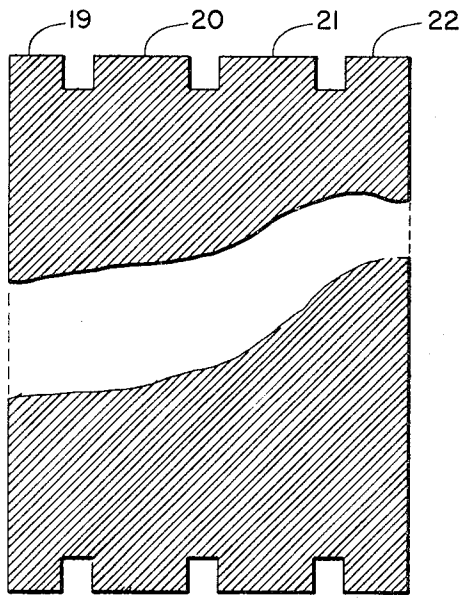


FIGURE 2

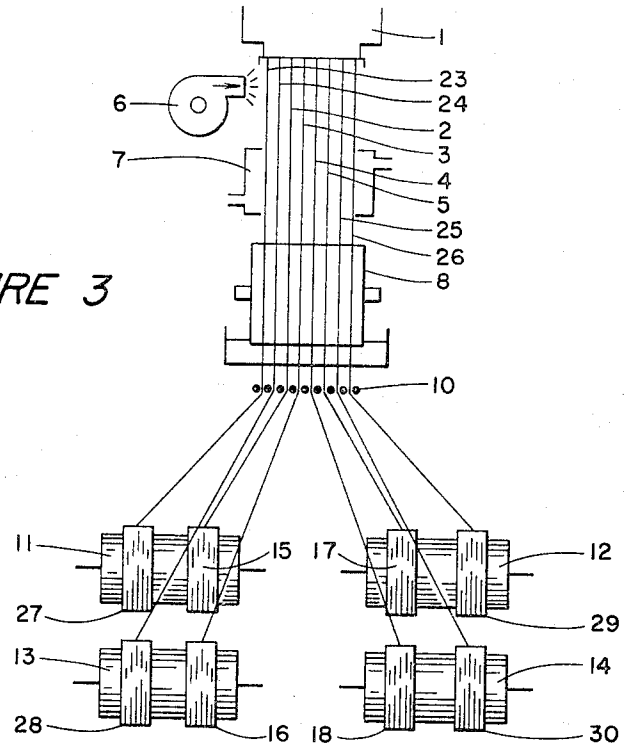
INVENTORS
GERALD THOMAS DAVIES
KENNETH GORDON BROWN
BY
Herbert L. Gatewood

Jan. 14, 1969 G. T. DAVIES ET AL 3,421,926

DEVICE FOR APPLYING LIQUID TO TRAVELLING FILAMENTS

Filed Aug. 4, 1967 Sheet 2 of 2

FIGURE 3



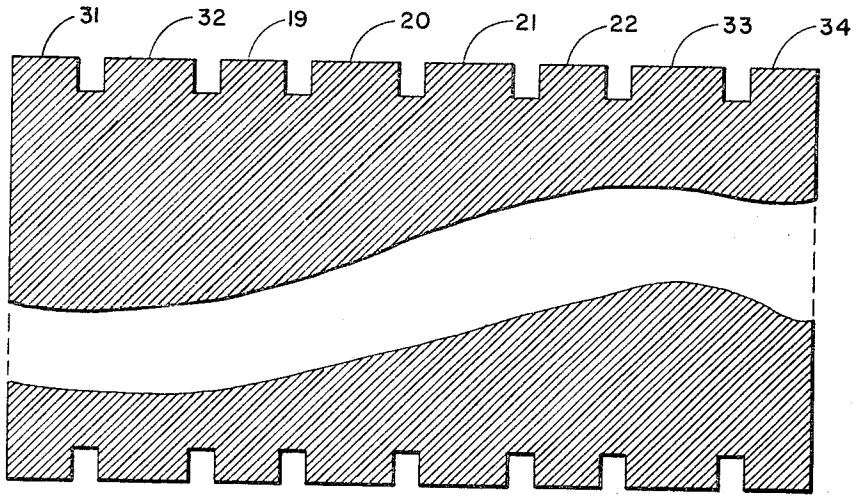


FIGURE 4

INVENTORS
GERALD THOMAS DAVIES
KENNETH GORDON BROWN
BY
Hibben & L. Gatewood

United States Patent Office 3,421,926
Patented Jan. 14, 1969

3,421,926

DEVICE FOR APPLYING LIQUID TO TRAVELLING FILAMENTS

Gerald Thomas Davies, Raglan, and Kenneth Gordon Brown, Abergavenny, England, assignors to British Nylon Spinners Limited, Pontypool, Monmouthshire, England, a corporation of Great Britain

Continuation-in-part of application Ser. No. 432,162, Feb. 12, 1965. This application Aug. 4, 1967, Ser. No. 658,460
U.S. Cl. 117—66 8 Claims
Int. Cl. B05c 1/04

ABSTRACT OF THE DISCLOSURE

An improved method of applying liquids to a plurality of travelling filaments wherein the filaments travel different distances to a wind-up mechanism, the improvement comprising applying a greater amount of finish to those filaments travelling the greatest distance from the point of application to the point of wind-up.

CROSS REFERENCE TO RELATED APPLICATIONS

This is a continuation-in-part of application Ser. No. 432,162, filed Feb. 12, 1965, now abandoned.

BACKGROUND OF THE INVENTION

This invention relates to a process of and device for applying liquid to travelling filaments.

Conventionally a liquid for purposes of lubricating or the like is applied to filaments by a rotating roll maintained in a wet condition by dipping in a bath of the liquid to be applied. The filaments take up the liquid on contact with the wet roll over which they are passed. Such rolls are made from various materials including glass and the amount of liquid taken up by the roll and indeed the amount of liquid applied to a given length of filament varies in the same sense as the speed of the roll when other conditions, for example, the rate of passage of the filaments over the roll remains constant. In other words, the thickness of the layer of liquid on the roll increases proportionately with an increase in roll speed, for instance, tripling the roll speed may double the thickness of the liquid on the roll. The latter, i.e. thickness of the liquid on the roll, it may be mentioned, is usually of the order of several thousandths of a centimeter.

Commercially liquids are applied to filaments for various purposes and especially to confer improved textile properties thereon. In the case of melt-spun filaments, e.g. filaments of polyhexamethylene adipamide, it is necessary to apply a liquid (known as a spinning finish) to the freshly spun filaments in order to facilitate the operations of winding up the filaments and drawing them in the solid state (sometimes referred to as "cold drawing"). Thus the filaments emerge from the spinneret in a viscous molten condition and are rapidly cooled as they pass through the surrounding atmosphere to the wind-up bobbin. On their way, commonly after they have been subjected to an atmosphere of steam, they pass over a rotating roll which is wet with the liquid spinning finish. The latter frequently comprises an aqueous emulsion of a lubricating oil. The textile properties of the filaments and the success with which they may be drawn depend on the presence of the correct amount of finish. It is accordingly essential that the weight of finish taken up per unit length of filament be of a high degree of uniformity. This is usually achieved by careful control of the temperature of the liquid finish, the speed of rotation of the wet roll and the speed of the passage of the filaments thereover, i.e. the speed of wind up of the filaments on

the wind up means provided, e.g. cylinders or cores. Thus in the case of freshly melt-spun filaments, the latter, as they come from the spinneret, are directed by appropriate thread guiding means on to the rotating roll, which is wet with finish, known as the finish roll, and thence to the guide of the traverse mechanism, which controls the way in which the filaments are wound on the cylinder.

Groups of filaments constituting untwisted multifilamentous yarn may be melt-spun from one or more spinnerets, the groups of filaments being wound up on separate cylinders, or spaced apart upon one cylinder so as to form separate coils (sometimes referred to as "cakes" or "biscuits") or packages of yarn. Now, in the course of development of melt-spinning machines, it has been found advantageous in many cases to group together in close propinquity a plurality of wind up cylinders or cores for each melt-spinning machine, that is to say, for each melt-spinning head (which can be regarded as a constituent melt-spinning unit of a melt-spinning machine comprising a number thereof arranged in a row). On each group of cylinders are wound up packages of yarn comprising filaments coming from one melt-spinning head which may have one spinneret or several spinnerets. Frequently the cylinders are disposed vertically one above the other, and also side by side to suit the convenience of spatial requirements. The respective groups of filaments are thus directed by appropriate guiding means, e.g. thread guides, to the various cylinders on which they are to be wound up. It is clear that the paths pursued by the various groups of filaments will differ. Some groups of filaments may pass over different systems of thread guides from those used by other groups. These guides may slightly increase or decrease the amount of finish or water on the filaments. Thus it comes about that groups of filaments, which have been melt-spun from a given melt-spinning head and which have all taken up the same weight per unit filament length of spinning finish on passing over the finish roll, are found to show variations in the amount they have by the time they reach their respective cylinders. Such is undesirable, however, because it adversely affects subsequent drawing operations as well as the dyeing of fabrics produced from such filamentary material. Moreover, variations in the amount of finish applied to the filamentary strands adversely exects package builds. It is well known, of course, that for some purposes too much finish presents as much a problem as does too little an amount of finish on the yarn. A particular example of such behavior, that is the variation in the amount of finish, is found in the pair of cylinders or bobbins, one positioned vertically above the other, described and illustrated in United States Patent 2,647,697. As disclosed in such last mentioned patent, after both yarns have passed through the traverse guide, the yarn destined for the lower bobbin or core parts from the yarn which is wound on the upper bobbin, passes around a portion of the drive roller and is then wound on the lower bobbin. In this case the yarn on the upper bobbin steals finish from that on the lower bobbin, thus acting very similar to a blotter.

SUMMARY

It has now been found possible to compensate for the above variations in spinning finish by providing the groups of filaments (or multifilament yarns) coming from a given melt-spinning head with a set of separate finish rolls of the same diameter which are mounted on a common driving shaft but differ slightly in width, the latter corresponding proportionally to the amounts of finish which it is desired to apply to the groups of filaments of yarns initially. The invention is based on the unexpected discovery that the amount of finish applied to a group of

filaments or a twistless multifilament yarn from a wet roll is very nearly proportional to the width of the roll, notwithstanding a variation over a fairly wide range of values in the width of the roll, in the number of filaments and/or in their total denier. (In fact the amount of finish taken up is nearly independent of the number of filaments.) This discovery may perhaps be explained by the fact that a group or bunch of filaments passing over a roll spreads out to a greater or less extend so as to form a ribbon, and finish flows on the peripheral area or surface of the roll under the influence of capillarity to the point where it is taken up, i.e. to the filaments. Be this as it may, the fact remains that if the finish per unit length of filament is plotted on a graph against the "catchment area" (which is proportional to the width of the roll) a straight line results over a wide range of values. Clearly the roll must not be so narrow that it is impractical to guide the filaments so that they run steadily over its peripheral surface. Experiments show that one-quarter centimeter can be regarded in general as the minimum useful width. Likewise it is useless to make the rolls so wide that the filaments passing over the middle portion thereof are unable to take up finish coming from the extreme edges of the roll. Moreover, the invention is based on the discovery that yarn can be provided with almost exactly the same amount of spinning finish although such yarn has had applied thereto differing amounts of spinning finish.

The set of rolls of the present invention which are characterized by their widths being adjusted so as to compensate for variation in the spinning (or other) finish content of the multifilament yarn wound up on neighboring bobbins or cylinders may be fabricated by any conventional method. Thus, a set of two rolls may be made by taking a wide roll and separating it into two rolls by cutting a peripheral slot therein, providing a peripheral projection thereon or locally modifying the surface of the roll to provide a peripheral non-wettable strip. A set of two rolls may also be made by securing two cylindrical sleeves a short distance apart, on a shaft.

Accordingly the invention comprises an improvement for applying a spinning finish to a twistless continuous filament yarn, wherein a lesser amount of spinning finish is applied to the yarn intended to travel a lesser distance to a wind up means than on yarn intended to be wound on a lower core, that is, yarn travelling a greater distance from the point of finish application whereby the yarns on the respective cores carry substantially the same amount of finish and of a device for practice of the invention. Such device consists of a means for applying a liquid to a plurality of travelling twistless continuous filament yarns, including a containing means for said liquid, a plurality of rotating rolls of the same diameter dipping therein and mounted on a common driving shaft, a wind up means for each of the travelling yarns, the wind up means being grouped together in close propinquity, and appropriate guiding means adapted to direct each yarn so that it passes over and in contact with the middle portion of one of the rotating rolls and thence to its wind up means, some or all of said rolls being characterized by differing widths which are proportional to the slightly differing amounts of liquid per unit length of yarn needed in order to ensure that each yarn carries the same amount of liquid per unit length on reaching its wind up means.

As already mentioned the liquid needing applying to the yarn may consist of a spinning finish comprising an aqueous emulsion of a lubricating oil, for example (the parts quoted being part by weight):

(A)

	Parts
White mineral oil	50
Nonylphenol ethylene oxide condensate	25
Diethanolammonium distearyl phosphate	25
Water	900

(B)

White mineral oil	67
Nonylphenol ethylene oxide condensate	33
Water	900

The containing means for the spinning finish or other liquid may consist of a bath or tray. The wind-up means for each yarn may comprise a cylinder and cam-operated traverse guide or any other conventional arrangement.

The rolls may be fabricated of various materials, for example stainless steel, Tufnol, polished glass, porcelain and other ceramics, especially a triple-fired ceramic. It is advantageous that a material be chosen for the roll having a surface which is readily wetted by the liquid it is desired to apply to the yarn. The rolls may, if desired, possess a small degree of convexity or concavity.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

Several embodiments of the invention will now be described with reference to the accompanying diagrammatic drawings, in which the following examples which are intended to illustrate, not limit, the invention.

In FIGURE 1 thereof, there is disclosed a melt-spinning head with spinneret **1** from which is extruded four twistless continuous filament yarns **2**, **3**, **4**, and **5**. The yarns are quenched by means of air from air blower **6**, passed through steam chamber **7**, after which a spin finish is applied thereto by means of a set of finish rolls **8** which rotates in a bath **9** of liquid finish. The yarns are forwarded to conventional wind-up cylinders **11**, **12**, **13**, and **14** via appropriate guide **10** and are wound into coils (or biscuits) of yarn **15**, **16**, **17** and **18**.

The set of finish rolls **8** is shown on an enlarged scale and in broken section in FIGURE 2 of the drawing. The four finish rolls **19**, **20**, **21**, and **22** are mounted on a common driving shaft such having been manufactured by taking a wide roll and separating it into the above-mentioned four rolls by cutting peripheral slots therein, as indicated in the drawing, thereby providing peripheral projections thereon. In FIGURE 3 there are provided four additional twistless continuous filament yarns **23**, **24**, **25** and **26** from which are formed four additional coils (or biscuits) of yarn **27**, **28**, **29** and **30** in a conventional fashion. As is indicated in the drawing, two biscuits of yarn are formed on each wind-up cylinder.

There is shown in FIGURE 4 a schematic illustration of eight finish rolls similar to the set of finish rolls **8** in FIGURE 3 but in addition to containing finish rolls **19**, **20**, **21** and **22** such now also includes finish rolls **31**, **32**, **33** and **34**. As previously discussed, the set of finish rolls may be provided by taking a wide roll and separating into a plurality of rolls by cutting peripheral slots therein, providing peripheral projections thereon, or locally modifying the surface of the roll to provide a peripheral non-wettable strip. In yet another fashion, the set of finish rolls can be provided, if desired, by securing cylindrical sleeves a short distance apart on a shaft.

EXAMPLE 1

FIGURE 1 shows four twistless continuous filament yarns **2**, **3**, **4** and **5** being melt-spun from the melt-spinning head **1**. Each yarn contains 13 filaments and has a total denier of 119. The yarns consist of polyhexamethylene adipamide. On leaving the spinneret, the yarns are cooled by the air blower **6**, treated with steam in the steam chamber **7**, passed over the set of finish rolls **8** which are maintained in a wet condition by the bath of liquid finish **9** in which they dip. The set of rolls has a diameter of 20 cms. and rotates ten times per minute. They are fabricated of triple-fired ceramic. The composition of the liquid finish has already been quoted under A. The four yarns **2**, **3**, **4**

and 5 are passed through the guides 10 and thence to the cylinders 11, 13, 14 and 12 respectively, on which they are wound up in the form of the biscuits 15, 16, 18 and 17 by means of conventional traverse mechanisms (not shown in the drawings) at a speed of 1200 metres per minute.

The pair of cylinders 11 and 13 are positioned, one vertically above the other, as described in United States Patent 2,647,697. The same applied to the pair of cylinders 12 and 14.

FIGURE 2 shows the set of four finish rolls 19, 20, 21 and 22 over which the four yarns 2, 3, 4 and 5 respectively pass. The rolls are of two different widths. Thus rolls 19 and 22 which supply finish to the yarns 2 and 5 proceeding to the upper cylinders 11 and 12 are both 0.66 cm. wide. On the other hand, rolls 20 and 21 are 0.94 cm. wide; these rolls supply finish to yarns 3 and 4 which are wound up on the lower cylinders 13 and 14. All the four yarns after being wound up carry almost exactly 1% of spinning finish, namely the required amount. In fact the standard deviation calculated from 12 results is only 0.117.

When a plain finish roll (or a set of rolls of equal size) instead of the set of finish rolls according to the invention, is employed at 8, the yarns on the upper cylinders carry more finish than the yarn on the lower cylinders, the standard deviation being 0.140.

EXAMPLE 2

Example 1 is repeated except that instead of four yarns, eight yarns 23, 24, 2, 3, 4, 5, 25 and 26 are melt-spun, being wound up on the some four cylinders, but two cakes of yarn are wound on each cylinders. Thus, yarns 23 and 2 are wound up as cakes 27 and 15 on cylinders 11. The eight yarns are passed respectively over eight finish rolls 31, 32, 19, 20, 21, 22, 33 and 34 each of which has a width of 0.66 or 0.94 cm. The yarns proceeding to the upper cylinders, namely Nos. 23, 2, 5 and 26 are passed over the narrower rolls 31, 19, 22 and 34, while the yarns for the lower cylinders (24, 3, 4 and 25) are passed over the wider rolls 32, 20, 21 and 33. In this way a very even distribution of finish is effected, the standard deviation being only 0.077. When one common roll is employed for all the yarns the standard deviation is 0.193.

What we claim is:

1. In a process for winding a plurality of travelling twistless continuous filament yarns which comprises surface driving a core on an upper section of a rotating drive roll; surface driving a second core on a lower section of said rotating drive roll; passing a plurality of said filaments through a guide mechanism and then through the nip formed by the said upper wind-up core and said drive roll; separating a portion of said filaments from said plurality; passing this portion to said upper core and winding it thereon; passing the remainder of said plurality through the nip formed by said lower wind-up core and said drive roll; and winding said remainder on said lower core; the improvement comprising applying a lesser amount of spinning finish to the yarn intended to be wound on the upper core than on that yarn intended to be wound on the lower core whereby the yarns on the respective cores carry substantially the same amount of finish.

2. Process according to claim 1 wherein the amount of finish applied to the yarn intended to be wound on the lower core exceeds that applied to the yarn intended to be wound on the upper core by about 40%.

3. Process according to claim 2 wherein the standard deviation of the amount of finish on the yarn is less than about 0.120.

4. Process according to claim 3 wherein the amount of finish on the yarn on the cores is at least about 1%.

5. In a process of applying a liquid to a plurality of yarns being wound onto a plurality of cores wherein some of said yarns travel over paths of greater distances from the point of application than do other of said yarns, said paths including appropriate application means, drive means, wind-up means, guide means, the improvement comprising applying a greater amount of liquid to those filament yarns travelling the greater distances to insure that each yarn carries the same amount of liquid per unit length on reaching its wind-up means.

6. Process according to claim 5 wherein the greater amount of finish is applied by using applicator rolls of greater width.

7. Process according to claim 6 wherein the surface of the rolls consists of a ceramic material.

8. Process according to claim 7 wherein the width of the rolls is from about one-quarter inch to about one-half inch.

References Cited

UNITED STATES PATENTS

2,188,442	1/1940	Mills et al.	118—234 X
2,331,207	10/1943	Lodge	118—262 X
2,647,697	8/1953	Pollock	242—35.5
3,053,222	9/1962	Brierley et al.	118—220 X

RALPH S. KENDALL, *Primary Examiner.*

T. E. BOKAN, *Assistant Examiner.*

U.S. Cl. X.R.

8—151.2; 28—59, 75; 68—202; 117—111; 118—216