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PROCESS OF MAKING YARN FROM CONTINUOUS RAYON AND STAPLE FIBER

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Fig.1.

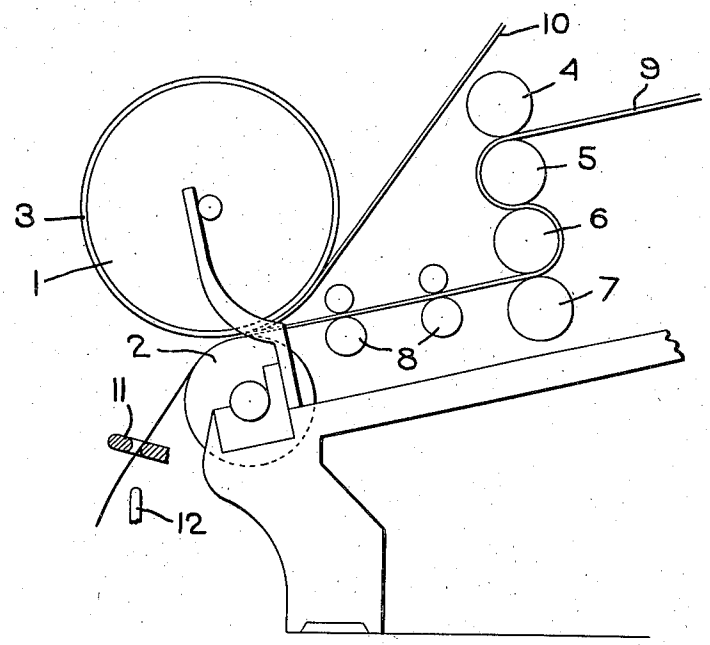
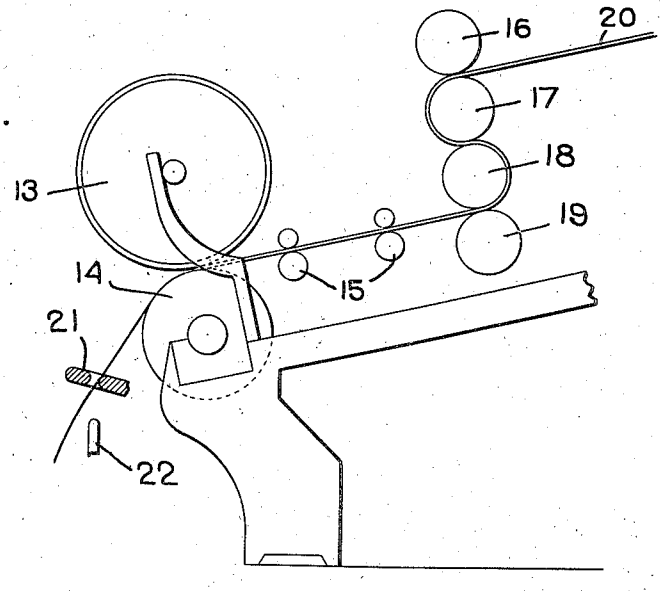



Fig.2.




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## PROCESS OF MAKING YARN FROM CONTINUOUS RAYON AND STAPLE FIBER

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9 Claims. (Cl. 118—69)

This invention relates to a process of producing a mixed or composite yarn from originally continuous filaments and from fibers originally in staple form.

Filaments of continuous length have long been used in the manufacture of yarn. Such continuous filaments occur naturally as the product of the silk worm and are now very extensively manufactured artificially from cellulose by various methods. While yarn has been made by processes in which the continuity of these continuous filaments is substantially retained in the finished yarn, such processes require great care and are relatively expensive. These continuous filaments, particularly in the case of the rayon or artificial silk, have also been manufactured into yarn by first being cut or broken into staple form and then passed through the usual processes employed in the manufacture of yarn from staple fiber. But in this latter case the loss due to wastage and the expense involved in passing such continuous filaments after being reduced to staple form through these preliminary processes is very considerable.

It is very desirable in the manufacture of yarn to produce a mixed or composite yarn composed both of fibers which were originally parts of continuous filaments, such as the rayon fibers, and fibers which were originally in natural staple form such as mohair, wool, cotton, etc., and this has only heretofore commercially and successfully been accomplished by first reducing the continuous filaments to staple form and then mixing these with the natural staple fibers and carrying out the usual processes performed in the manufacture of yarn from staple fiber.

While heretofore it has been proposed to form yarn entirely from continuous filaments by breaking the filaments in roving form as the result of a drafting operation, difficulties are presented due to the electrified condition of the filaments and fibers, the tendency of the filaments to slip in the grip of the rolls, the tendency of the filaments as they break to whip back or curl up, the loss of fibers broken at both ends between the rolls of the drafting frame, and the tendency to a "beardy" formation. The present invention makes use of the principle of reducing the continuous filaments to staple form by breaking them as by the action of a drafting frame but carries on this step while a ribbon of the continuous filaments is slightly twisted together with a roving of staple fibers so that as a result the staple fibers act as a carrier or support for the continuous filaments during the breaking operation. By this means a firm grip is secured upon the composite strand so as positively and regularly to effect the breakage of the continuous filaments; the whipping back or curling up of the continuous filaments as they break is substantially prevented; the disturbance of the broken fibers because of their electrical condition is substantially overcome, and the resultant yarn of mixed fibers is of a uniform, non-beardy, high character.

The nature and objects of the invention will more fully be understood from the accompanying description and drawing and will be particularly pointed out in the claims.

In the drawing:

Fig. 1 is a view in side elevation, chiefly diagrammatic, of a portion of an ordinary type of the drafting frame adapted for carrying out one step of the present invention.

Fig. 2 is a similar view of another frame which may be a spinning frame adapted for carrying out a further step in the preferred invention.

While the invention is adapted for making use of any form of continuous filaments suitable for textile purposes, it is particularly useful in connection with continuous artificial silk or rayon filaments. Such continuous filaments are extensively manufactured from re-constituted cellulose, as in the case of the viscose or cuprammonium processes, and also from cellulose acetate or other organic derivatives of cellulose, the cellulose acetate filaments being very largely employed.

The invention is also adapted for making use of any fibers suitable for textile purposes and already in staple form and preferably of such fibers that exist naturally in long staple form such as mohair, wool, linen, etc.

The yarn produced by this process is a mixed or composite yarn, one component being originally continuous filaments and the other component being originally staple fibers. The relative proportion of these components may vary within wide limits, although the best results have been secured when the component of the originally continuous filaments does not exceed 50%.

The process of the invention may be carried out by any suitable means but preferably ordinary drafting and spinning frames capable of maintaining a firm grip on the filaments and fibers and employed in yarn manufacture are used with very slight alteration, such as frames of the type employed in the Bradford system and illustrated in the drawing.

The frame illustrated in Fig. 1 may represent any of the drafting frames preceding the frame employed for the final drafting and spinning operation, as, for example, the finisher frame

which usually precedes the roving frame, which in turn precedes the spinning frame. This finisher frame is provided with the usual front or drafting rolls 1 and 2 with the bottom roll 2 of fluted steel and the top roll covered with a cork or similar surface 3. The finisher frame at the rear is provided with the usual series of back or gang rolls 4, 5, 6 and 7. The gang rolls as usual are adjustable bodily toward and from the front rolls and all the rolls are positively driven, the front rolls being driven at a higher peripheral speed than the back rolls to secure the usual drafting operation. Between the front and back rolls are usually located carrier rolls 8.

In carrying out the process by the use of such a frame, a roving 9 composed of the staple fiber and formed as a result of the usual processes employed in yarn manufacture passes through this finisher frame in the usual manner, that is, around the gang rolls as indicated, between the lower pair 6 and 7, thence through the carrier rolls and thence between the front or drafting rolls 2 and 3. The continuous filaments in the condition in which they are produced are parallel and usually untwisted in the form of what is known as a ribbon. Such a ribbon 10 composed of the required number of parallel filaments is led directly between the front or drafting rolls 1 and 2. The ribbon of filaments and roving of staple fibers, after they emerge from the front rolls 1 and 2, pass through the usual guide eye 11 and are wound on to a suitable bobbin or yarn carrier 12 in the usual manner, being given in this operation a slight twist so that the strand or ribbon of continuous filaments and the strand or roving of staple fibers are given a slight joint twist on the order of three to four turns per inch as they are wound onto the yarn carrier.

The frame represented in Fig. 2 is the next drafting frame to which the composite strand thus formed is passed and this frame, for example, may be a roving frame of the usual type preceding the actual spinning operation or it may even be the final drafting and spinning frame. This frame has a similar construction to that shown in Fig. 1 comprising the front rolls 13 and 14, the carrier rolls 15, and the back or gang rolls 16, 17, 18 and 19. The composite strand 20 now made up of the continuous filaments and the staple fibers twisted together, passes through this frame in the usual manner and the resultant roving passes through the guide eye 21 and is wound or spun onto the bobbin or yarn carrier 22. The front rolls 13 and 14 as usual are run at a much higher peripheral speed than the back rolls so that a drafting operation takes place on the entire composite strand 20, the result of which is to break the continuous filaments of the ribbon into staple form, but as this breakage takes place while these filaments are enveloped by or twisted together with the component of natural fibers, the broken filaments are held against whipping back or curling up and are prevented as the result of the electrical action of the fibers from substantial disturbance from their normal position in the composite strand. Furthermore, the grip of the pairs of rolls at the front and back acting on the composite strand, that is, upon both the filaments and the fibers, insures a firm grip so that deleterious slippage is prevented. In fact, the normally staple fibers act as a carrier for the staple filaments formed by breakage from the continuous fibers. The resultant roving which then passes from the front rolls is made up entirely of staple fibers drafted and slightly twisted together, and a further twist is imparted in the usual manner as it is wound upon the yarn carrier 22.

If the roving has not been sufficiently attenuated to form the desired yarn, further drafting and final spinning may take place all in the usual manner because the roving is now entirely composed of staple fibers.

The distance between the front and back rolls of the frame shown in Fig. 2, commonly known as the "ratch", depends upon the length of the staple of the staple fiber component. Since the front and rear rolls must be separated a distance somewhat greater than the staple length of the staple fiber sufficient to prevent any material breakage of the staple fiber, and since the elongation of the continuous filament is on the order of 25% to 30% or less up to the breaking point, there need be little, if any, change made from the position required for drafting the said staple fiber alone. No change in the relative speed of the front and rear rolls of the frame, such as shown in Fig. 2 where the breakage of the continuous filaments takes place, from that usually employed in the drafting operation is necessary because the normal differential in order to attenuate the roving as required in the yarn manufacture is so far beyond anything required to elongate the continuous filaments to the breaking point that the minimum limit need not be considered. The elongation effected by the drafting operation is on the order of 600% to 700%, while the maximum elongation of rayon filaments to the breaking point is on the order of 25% to 30%.

In these drafting frames of the Bradford system the pressure between the rolls is adjustable and may be varied as desired. The grip or bite of the rolls upon the composite strand where the breakage of the continuous filaments takes place must be sufficient to prevent any undesirable slippage between the roll periphery and the strand and to insure breakage of the continuous filaments into the required staple length. The continuous filaments, being more or less intermingled with the staple fibers as the result of the twisting operation employed in forming the composite strand, are not all gripped with equal pressure by the rolls and consequently break unsymmetrically and in more or less uneven lengths, thus resulting in a condition similar to that of the staple fiber itself.

It is desirable that the denier of the continuous filament should not be greater than that of the corresponding size of the staple fiber. For example, when cellulose acetate filament is mixed with mohair, a 10 denier of the acetate filament which corresponds closely to the size of mohair fiber has produced highly satisfactory results.

It will thus be seen that when the composite strand composed of a ribbon or strand of the continuous filaments and a roving of the staple fibers slightly twisted together passes through the step of the process illustrated in Fig. 2, there is applied successively and continuously to this strand between points separated by a distance somewhat greater than the staple length of the staple fibers a longitudinal strain sufficient to break the continuous filaments extending between said points and that the staple fibers act as a carrier for the continuous filaments as they break into staple length and are drafted along therewith.

Having thus described the invention, what is

claimed as new, and desired to be secured by Letters Patent is:

1. The process of forming yarn from both continuous filaments and staple fibers which comprises slightly twisting together a ribbon of the continuous filaments and a roving of the staple fibers and drafting the composite strand thus formed while maintaining a ratch greater than the staple length of the staple fibers and a draft strain sufficient to break the continuous filaments, and thereafter spinning the drafted composite roving with all its fibers thus in staple form into yarn.

2. The process of forming yarn from both continuous filaments and staple fibers which comprises slightly twisting together a ribbon of the continuous filaments and a roving of the staple fibers, successively and continuously applying to the composite strand thus formed between points separated by a distance somewhat greater than the staple length of the staple fibers a longitudinal strain sufficient to break the continuous filaments extending between said points, and thereafter spinning the composite roving with all its fibers thus in staple form into yarn.

3. The process of forming yarn from both continuous filaments and staple fibers which comprises slightly twisting together a ribbon of the continuous filaments and a roving of the staple fibers, drafting the composite strand thus formed to secure an elongation thereof substantially greater than that elongation of the continuous filaments which is possible without breakage, and thereafter spinning the drafted composite roving with all its fibers thus in staple form into yarn.

4. The process of forming yarn from both continuous rayon filaments and natural staple fibers which comprises slightly twisting together a ribbon of the continuous filaments and a roving of the staple fibers and drafting the composite strand thus formed while maintaining a ratch greater than the staple length of the staple fibers and a draft strain sufficient to break the continuous filaments, and thereafter spinning the drafted composite roving with all its fibers thus in staple form into yarn.

5. The process of forming yarn from both continuous rayon filaments and natural staple fibers which comprises slightly twisting together a ribbon of the continuous filaments and a roving of the staple fibers, drafting the composite strand thus formed to secure an elongation thereof substantially greater than that elongation of the continuous filaments which is possible without breakage, and thereafter spinning the drafted composite roving with all its fibers thus in staple form into yarn.

6. The process of forming yarn from both continuous cellulose acetate filaments and staple fibers which comprises slightly twisting together a ribbon of the continuous filaments and a roving of the staple fibers and drafting the composite strand thus formed while maintaining a ratch greater than the staple length of the staple fibers and a draft strain sufficient to break the continuous filaments, and thereafter spinning the drafted composite roving with all its fibers thus in staple form into yarn.

7. The process of forming yarn from both continuous cellulose acetate filaments and staple animal fibers which comprises slightly twisting together a ribbon of the continuous filaments and a roving of the staple fibers and drafting the composite strand thus formed while maintaining a ratch greater than the staple length of the staple fibers and a draft strain sufficient to break the continuous filaments, and thereafter spinning the drafted composite roving with all its fibers thus in staple form into yarn.

8. The process of forming yarn from both continuous cellulose acetate filaments and natural staple fibers which comprises slightly twisting together a ribbon of the continuous filaments and a roving of the staple fibers, successively and continuously applying to the composite strand thus formed between points separated by a distance somewhat greater than the staple length of the staple fibers a longitudinal strain sufficient to break the continuous filaments extending between said points, and thereafter spinning the composite roving with all its fibers thus in staple form into yarn.

9. The process of forming yarn from both continuous filaments and staple fibers which comprises slightly twisting together a ribbon of the continuous filaments and a roving of the staple fibers and then passing the composite strand thus formed through successive pairs of rolls driven at different peripheral speeds, the bites of which are separated a distance greater than the length of the staple of the staple fiber, the differential in speed between said pairs of rolls being sufficient to stretch the continuous filaments past the breaking point but not sufficient to separate the strand, and the grip of the rolls of each pair on the strand being sufficient to prevent substantial slippage between their peripheries and the strand.

LEROY W. BOOTH.