April 13, 1937. F. C. HALE ET AL 2,077,320

MANUFACTURE OF STAPLE FIBER YARNS FROM CONTINUOUS FILAMENTS

Filed Aug. 30, 1934

Fig. 1.

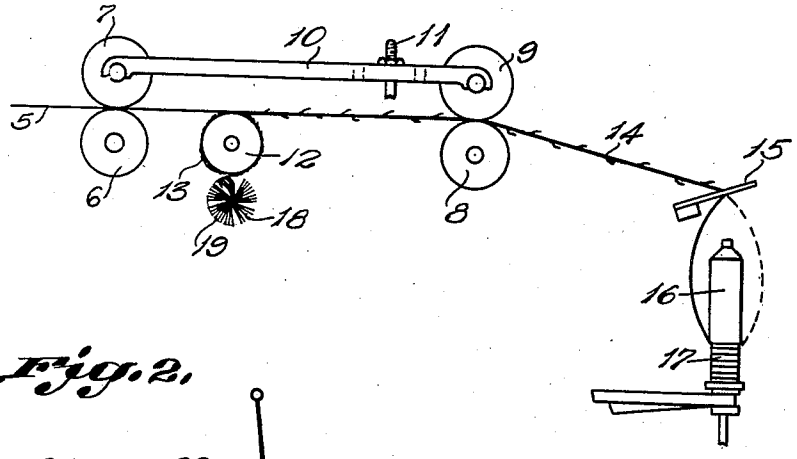


Fig. 2.

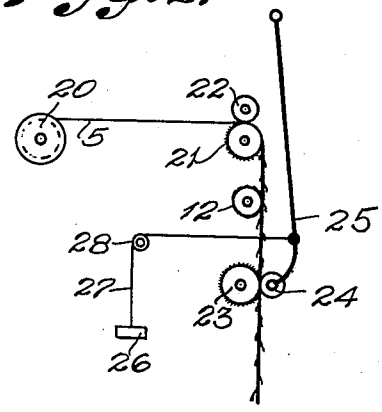


Fig. 3.

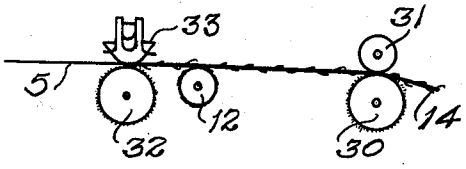
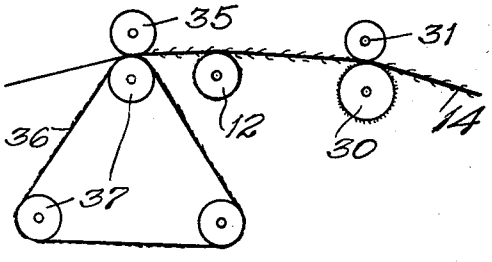


Fig. 4.



Inventors
F.C. Hale
W. Howarth
by
J Seltzer + C W Seltzer
Attorneys

Patented Apr. 13, 1937

2,077,320

UNITED STATES PATENT OFFICE

2,077,320

MANUFACTURE OF STAPLE FIBER YARNS FROM CONTINUOUS FILAMENTS

Frank Corbyn Hale and William Howarth, Spondon, near Derby, England, assignors to Celanese Corporation of America, a corporation of Delaware

Application August 30, 1934, Serial No. 742,092
In Great Britain September 5, 1933

6 Claims. (Cl. 19—1)

This invention relates to the production from yarns or bundles of continuous filaments of yarns having the appearance and characteristics of spun yarns made from staple fibers.

A yarn or bundle (hereinafter referred to as "bundle") of continuous filaments may be converted into a yarn resembling yarn spun from staple fibers by passing the bundle through two or more pairs of breaking or severing rollers which draw out the filaments and repeatedly break them, thereby converting the bundle into a continuous product containing staple lengths of filament. The continuous product so produced may be spun into yarn either directly, e. g. by means of a ring spinning or cap spinning operation, or indirectly, the product being treated as a sliver or roving and being subjected to one or more subsequent drawing, twisting and winding operations. The length of the staple fibers produced in this manner is limited by the distance between the breaking rollers, no fiber substantially exceeding that distance in length, but since, in general, breakage may occur anywhere between the rollers, the length of the staple fibers up to this maximum length is indeterminate. Furthermore, in being drawn out to their breaking point the filaments are apt to suffer a loss in extensibility which is passed on to the spun yarns finally produced, and may even render them useless for some textile operations. It is an object of the present invention to produce from a continuous filament bundle a yarn containing staple fibers of which the length of the individual fibers may attain a greater degree of uniformity. A further object is to avoid subjecting the continuous filaments to tension sufficiently high in itself to produce breaking, so that the extensibility of the yarn ultimately produced does not suffer materially.

According to the present invention, a continuous filament bundle is converted into a product containing staple fibers by passing such bundle into engagement with means, such as a pair of rollers, adapted to grip the bundle and to draw it past means adapted to cause filaments in the bundle to be severed readily at a given point. In this manner the point at which the filaments are severed is localized, and the length of each staple fiber is caused to approximate to the distance between the point of severing and the nip of the rollers or point of grip. Conveniently, the continuous filament bundle may be passed through two pairs of rollers of which the second pair rotates faster than the first pair so as to put the individual filaments under tension, severing occurring between the two pairs of rollers. Since means are provided to cause the filaments to break readily, the tension applied by the two pairs of rollers is not so great as to cause breakage by itself and the filaments do not suffer any substantial loss in extensibility. The filaments are in fact cut or partly cut through, so that little tension is required, and consequently only low loading of the rollers is necesary to grip the filaments sufficiently.

A convenient means for causing the filaments to break readily at a given point comprises a roller having a fine abrasive surface such as carborundum over which the continuous filament bundle is drawn. When the end of a continuous filament is nipped by the rollers, it is drawn under tension over the abrasive roller and breaks at the point of contact, the abrasive nature of the roller encouraging such breaking action. The abrasive roller may be positively driven, or it may be free to rotate under the action of the filaments contacting with it. In this manner staple fibers of given length are broken off from the end of the individual filament and the new free end of the continuous filament proceeds until it, in turn, is nipped by the rollers when the operation is repeatd. At the same time all the other continuous filaments are undergoing similar treatment, and the continuous filament bundle is converted into a continuous product containing staple fibers. The rollers described in U. S. application S. No. 696,374 filed 2nd November, 1933 are suitable for employment as the rollers which draw the filaments in contact with the abrasive roller. Such rollers are characterized in that they are toothed and thus cause the filaments to follow a smooth sinuous path at their points of engagement by the rollers. The relatively long lengths of the filaments engaged by the rollers, due to the toothed nature of the rollers, enables the pressure of the rollers on the filaments to be reduced below that necessary with ordinary plain rollers, while maintaining an adequate grip on the filaments.

It is, of course, important that the points of severance of the filaments should be well distributed over the bundle so as to give it uniformity in appearance and strength. Such distribution is effected by the process according to the invention. If the bundle introduced into the nip of the rollers has been broken so that the filament ends are staggered, the rollers seize the staggered filament ends in turn. On the other hand, if the end of the bundle has been cut so that the filament ends are level, slight twist in the bundle

or the rough surface of the abrasive roller ensures that the filaments are brought more or less in turn into position to be cut. This initial distribution of the cutting points along a short length of the bundle is maintained throughout the entire length of the bundle, so that continuity of the resulting fibrous product is obtained.

A method of converting a continuous filament bundle into a continuous product containing staple fibers, to which the present invention may be applied, is described in the specification of U. S. application S. No. 726,264 filed 18th May, 1934. According to that specification a bundle of continuous filaments is passed in contact with a cutting surface (formed for example on a roller) moving in the same general direction as the filaments and at a speed different therefrom, the filaments being lightly pressed (as for example by a light roller) against the cutting surface which exerts a cutting action on filaments in the bundle. The cutting surface may take the form of a cutting roller on to which the bundle of filaments is lightly pressed by means of another roller.

In accordance with one embodiment of the present invention, the continuous fibrous product obtained by the above method is brought into contact with the severing means, e. g. an abrasive roller, in order that filaments not already severed may be severed or broken at the abrasive roller.

The continuous product thus formed may be treated as a sliver or roving, and spun into a finished yarn in a separate operation, with one or more intermediate drafting steps if desired, or alternatively, if it is sufficiently fine, the continuous product may be spun directly into a finished yarn, e. g. by means of a ring spinning or cap spinning device.

The invention is capable of application to continuous filaments in general, that is either to natural continuous materials such as silk or to continuous artificial filaments such as filaments of reconstituted cellulose or of cellulose derivatives. Examples of continuous artificial filaments of reconstituted cellulose are viscose and cuprammonium filaments, while examples of filaments of cellulose derivatives are the cellulose esters, e. g. cellulose acetate, formate, propionate or butyrate and the cellulose ethers, e. g. ethyl or benzyl cellulose. Mixed filament bundles, consisting of filaments of different materials, e. g. any of those given above, may also be employed.

By way of example, some forms of apparatus according to the invention will now be described in greater detail with reference to the accompanying drawing, in which:

Figure 1 is a diagrammatic side elevation of one form of apparatus for carrying out the invention, and

Figures 2–4 show three forms of the apparatus described in U. S. application S. No. 726,264 filed 18th May, 1934, to which the present invention has been applied.

Referring to Figure 1, a bundle of continuous filaments **5** is fed through two pairs of rollers **6**, **7**, **8**, **9**, the rollers **7**, **9** being loaded by means of a bridge **10** and a loading bar **11**. The second pair of rollers **8**, **9** rotate at a higher peripheral speed than the rollers **6**, **7**, and draw the bundle **5** in tension against a freely mounted roller **12** having a surface **13** roughened with carborundum, glass paper or the like. By being drawn in contact with the roller **12**, filaments of the bundle **5** are caused to break on the roller, and proceed through the rollers **8**, **9** in the form of a continuous product **14** containing staple fibers. The product **14** passes to the guide **15** of a cap spinning device **16** by means of which it is directly twisted into a yarn and wound on the bobbin **17**.

As each filament is broken on the roller **12**, the free end, which still forms part of a continuous filament of the bundle **5**, proceeds to the rollers **8**, **9** where it is nipped and the filament again drawn at tension over the roller **12** so that it is broken again. As a result the length of the staple fibers, contained in the product **14** is substantially uniform, and equal to the distance between the roller **12** and the rollers **8**, **9**. In order to avoid the gathering of fluff on the surface of the roller **12**, a rotating brush **18** is provided which brushes against the surface of the roller **12** and removes any such contamination. The roller **12** being freely mounted is rotated in a clock-wise direction by the contact of the bundle **5**, and the brush **18** is also rotated in a clock-wise direction, the bristles **19** of the brush **18** being very light so that they do not prevent clock-wise rotation of the roller **12**. The rollers **6**, **7**, **8**, **9** may be of the form described in U. S. application S. No. 696,374, or one of each or either pair may be roughened in the manner described in U. S. application S. No. 726,264.

In Figure 2, the continuous filament bundle **5** is drawn from a bobbin **20** and passes between two rollers **21**, **22**, the roller **21** having a roughened surface, while the roller **22** lightly presses the bundle **5** on it. As described in U. S. application S. No. 726,264, the bundle **5** then proceeds through a pair of nip rollers **23**, **24**, the roller **24** being mounted on a lever **25** and lightly pressed into contact with the roller **23** by means of a weight **26** and a cord **27** attached to the lever **25** and running over a pulley **28**. According to the present invention, there is also included in this apparatus a freely mounted roller **12** covered with carborundum, sand paper or other sharp edged material by means of which filaments in the bundle which is drawn in tension between the rollers **21**, **22** and the rollers **23**, **24** are severed by the sharp edged particles on the surface of the roller **12**. Many of the continuous filaments of the bundle **5** will be severed by being drawn in slipping contact with the roughened roller **21**, the rollers **23**, **24** exerting enough pull to cause the filaments to slip over the roller **21**. The roller **12** is provided by way of an auxiliary device whereby filaments resisting the severing action of the roller **21** are nevertheless severed.

Figures 3 and 4 also illustrate the application of the roller **12** of the present invention to forms of apparatus described in U. S. application S. No. 726,264. In Figure 3 the continuous filament bundle **5** is drawn by means of rollers **30**, **31** between a roughened roller **32** and a pressing member **33**, the pressing member **33** pressing the bundle lightly into contact with the roller **32** and thus effecting severance of filaments in the bundle. In order further to assist the severance of the filaments, the roller **12** is provided between the rollers **30**, **31** and the rollers **32**, **33**.

In Figure 4, the continuous filament bundle is drawn by rollers **30**, **31** between a roller **35** and a roughened band **36**, surfaced with sand paper, carborundum or the like and running round guide rollers **37**. In this case also, the auxiliary roller **12** is provided, so that filaments not severed by slipping between the roller **35** and the band **36** are severed by the roller **12**. In each case the product issues from the second pair of rollers **31**, **32** or (in Figure 2) the rollers **23**, **24**, in the form of product **14** containing

staple fibers, which may either be spun directly into a yarn as described with reference to Figure 1 or may be submitted to further drawing and spinning operations.

What we claim and desire to secure by Letters Patent is:—

1. Apparatus for the conversion of a continuoust filament bundle directly into a continuous product containing staple fibers, comprising successive sets of rollers between which the bundle is caused to pass, means for rotating said rollers at such a speed that between the bundle and one set of rollers at least there is slipping engagement, and a roller having an abrasive surface adapted to cause filaments in the bundle to be severed readily thereon, said roller being disposed in contact with the bundle between said pairs of rollers.

2. In the continuous production of staple fiber yarns by converting a bundle of continuous filaments into a continuous product containing staple fibers, causing such bundle to pass through two points and to travel faster at the second point than at the first so as to break the filaments into staple fibers, and localizing at a given point between the two first-mentioned points the position at which the filaments are broken, so as to increase the uniformity of length of the staple fibers in the product so produced.

3. In the production from a bundle of continuous filaments of a continuous product containing staple fibers by causing said bundle to pass through two points and to travel faster at the second point than at the first so as to break the filaments into staple fibres, the use of a roller having an abrasive surface adapted to localize the position at which the filaments are broken so as to increase the uniformity of length of the staple fibers in the product so produced.

4. Apparatus for the conversion of a bundle of continuous filaments directly into a continuous product containing staple fibers, comprising two sets of rollers adapted to engage the filaments, means for driving said sets of rollers, the second set being driven faster than the first set so as to break the filaments between them, and abrasive means disposed between said sets of rollers adapted to cause the filaments in the bundle to be severed readily at a given point.

5. Apparatus for the conversion of a bundle of continuous filaments directly into a continuous product containing staple fibers, comprising two sets of rollers adapted to engage the filaments, means for driving said sets of rollers, the second set being driven faster than the first set so as to break the filaments between them, and a roller having an abrasive surface adapted to contact with the filaments between said sets of rollers and to cause the filaments in the bundle to be severed readily at a given point.

6. Apparatus for the conversion of a bundle of continuous filaments directly into a continuous product containing staple fibers, comprising two sets of rollers adapted to engage the filaments, means for driving said sets of rollers, the second set being driven faster than the first set so as to break the filaments between them, a roller having an abrasive surface adapted to contact with the filaments between said sets of rollers and to cause the filaments in the bundle to be severed readily at a given point, and a rotatable brush adapted to contact with said abrasive roller to prevent the adhesion of the ends of the continuous filaments thereto.

FRANK CORBYN HALE.
WILLIAM HOWARTH.