This invention relates to the manufacture from continuous filaments of yarns which have the appearance and character of spun yarn made from staple fibres.

In U.S. application Serial No. 696,375 filed November 2, 1933 methods are described of converting continuous filament threads directly into spun yarns by passing such continuous filament threads successively through at least two pairs of rollers which rotate at successively higher peripheral speeds and so stretch the continuous filaments beyond their breaking point. The fibrinous material so produced is, according to this specification, twisted into a final yarn (e.g. by ring or cap spinning devices) as it proceeds from the breaking rollers. In order to produce effective results the drawing rollers must grip the filaments quite definitely in order to avoid slippage and consequent non-breakage of the filaments.

The pressure applied to the yarns for this purpose, if it is of sufficient magnitude to prevent slippage is apt to cut all the filaments at the roller instead of gripping them, or to bruise the filaments, giving rise to weakness in the yarn produced. If a smaller force is used, while some of the filaments would be broken, others of the filaments may be shielded from the nippling effect of the rollers by their fellows and so pass unbroken through the rollers. It is an object of the present invention to enable pressure of the drawing rollers to be reduced without permitting unbroken filaments to pass through the rollers.

According to the present invention, each pair of rollers comprises one roller of substantially unyielding material, the surface of which is covered with protruberances which localize the pressure applied between the rollers, such localization taking effect along the length of the rollers as well as along the length of the filaments passing between them. The disposition of the protruberances on the surface of the rollers should be such that at any point along the length of the rollers through which the yarn is to pass, localized pressure is applied at some time. In this manner the different filaments of the thread of continuous filaments have a localized pressure applied to them at different times, and are successively gripped and broken.

The invention is applicable in the production of staple fibre yarns from continuous or substantially continuous filaments of any desired kind, particularly artificial filaments. While the invention may be applied to continuous artificial filaments of reconstituted cellulose such as viscose or cuprammonium filaments, it is especially convenient with continuous filaments of cellulose acetate or other organic derivatives of cellulose. Examples of other organic derivatives of cellulose are other cellulose esters such as cellulose formate, propionate or butyrate and cellulose ethers such as ethyl or benzyl cellulose.

By way of example a form 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 side elevation and Figure 2 a front elevation of an apparatus embodying the rollers according to the invention, while Figure 3 is an enlarged sectional view through the surface of one of the rollers.

Referring to Figures 1 and 2, a thread 3 consisting of continuous filaments is drawn from a package or is fed substantially without tension as described in U.S. application Serial No. 714,559 filed March 8, 1934 corresponding to British application No. 9309/33 filed March 28, 1933, and proceeds successively between the two pairs of rollers 4, 5 and 7. The upper rollers 5 and 7 are pressed on to the lower rollers 4 and 6 by means of a bar 8 and a rod 9 loaded with a spring or weight (not shown). The position of the rod 9 along the bar 8 is adjustable so as to adjust the proportions of weight carried by the rollers 5 and 1 respectively.

The lower rollers 4 and 6 of each pair are made of steel or like hard material and are surfaced with a pattern of grooves as indicated in Figure 2, so as to leave upstanding lozenge-shaped domes or protruberances between the grooves. Any sharpness which may occur at the edges of the protruberances is removed by smoothing, e.g. by means of sand blasting, the reduction in height of the protruberances resulting from such smoothing being taken into account in determining the depth of the helical grooves. The resultant form is indicated in the enlarged sectional view of Figure 3. The upper rollers 5 and 7 are covered with a jacket of leather, cork, rubber or like relatively soft material 12, and the protruberances on the lower rollers 4, 6 press into the relatively soft surfaces 12 and gripping of the filaments of the thread is thereby assured. Upstanding protruberances of shapes other than lozenge-shape may be employed and the patterns, whether of lozenges or other shapes may be of any desired degree of coarseness or fineness.

In order to avoid excessive local wear the thread 3 between the pairs of rollers 4, 5 and 6, 7 is passed through a tube 10 of the kind described in U.S. application Serial No. 712,148 filed Feb.
January 20, 1934, corresponding to British application No. 8765/33 filed March 23, 1933 which is mounted on a bar 14 adapted to traverse the tube endwise of the rollers 4, 5, 6, 7. The tube 10 confines the filaments and maintains them in a compact state after they have been broken. It may conveniently be made of non-conducting material, so as to reduce the electrification of the fibres and subsequent difficulties in spinning. The length of traverse is substantially equal to the length of that part of the rollers 5, 7 which is covered by the jacket 12 as shown in Figure 2. The thread 3 proceeds from the rollers 5, 7 in the form of a continuous product of staple fibres which passes to the guide 14 of a ring spinning device by means of which it is twisted and wound on a package 16.

Since the breakage by stretching between the drawing rollers 4, 5, and 6, 7 necessitates the stretching of the filaments beyond their maximum extensibility, the extensibility of the yarn ultimately produced may be reduced to an undesirable extent. This reduction in extensibility may be overcome at least partially by the methods described in U.S. application Serial No. 696,184 filed November 1, 1933.

What I claim and desire to secure by Letters Patent is:-

1. An apparatus for the production of staple fibre yarns from continuous filaments, comprising successive pairs of rollers for breaking the filaments, each pair consisting of one roller having a surface of yielding material and one roller having an unyielding surface covered with protuberances which localize the pressure applied between the rollers, said protuberances being discontinuous both longitudinally and circumferentially of the roller.

2. An apparatus for the production of staple fibre yarns from continuous filaments, comprising successive pairs of rollers for breaking the continuous filaments, each pair consisting of one roller having a surface of yielding material and one roller having an unyielding surface covered with protuberances which localize pressure applied between the rollers, said protuberances being discontinuous both longitudinally and circumferentially of the roller and a guide tube disposed between the pairs of rollers and adapted to confine the filaments passing between the pairs of rollers.

3. An apparatus for the production of staple fibre yarns from continuous filaments, comprising successive pairs of breaking rollers, each pair consisting of one roller having a surface of yielding material and one roller having a surface of unyielding material covered with protuberances which localize pressure applied between the rollers, said protuberances being discontinuous both longitudinally and circumferentially of the roller, and means disposed between the pairs of rollers for traversing the filaments to and fro along the rollers so as to minimize wear on the roller surfaces.

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