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# ALIEN PROPERTY CUSTODIAN

## YARN AND METHOD OF MAKING SAME

Ehrhart Franz, Leipzig, Germany; vested in the Alien Property Custodian

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This invention concerns a manufacture of yarn from staple fibre, or from such fibre in mixture with other fibre. Staple fibre, i.e. fibre cut from rayon filament by way of contrast to natural textile fibre, consists in the present art of threads cut fairly uniformly to a definite length corresponding to that of natural cotton or wool fibre. The filament is thus, e.g. after having been exuded from the spinning bath, cut and loosened, e.g. it is floated in water and upset by obstacles opposing the free flow of the pieces in the water. The loosened staple fibre is then treated on carding machines and so forth, similarly to natural fibres, and finally spun into yarn. Attempts to work the staple fibre directly, i.e. without loosening and combing, have not met with success. But it has always been considered of importance that the filament be as uniform as possible in size, and also as to the length of the staple fibre.

In accordance with the instant invention, a yarn, which is greatly improved in many respects is obtained when we do not reduce the filament to staple of uniform size and length. But the filament is cut into pieces of different lengths, the choice in the mixture of varying lengths depending upon the particular nature and prior treatments of the artificial filament. The best possible ratios as to lengths and quantities of different lengths are preferably and most readily determined in an empirical way, by systematically preparing mixtures of varying ratios and proportions, and by a comparison of the resultant yarns in respect to their mechanical characteristics.

It is also of advantage to use filament varying in fineness, e.g. to make filaments of different fineness or size; and then again to determine empirically the best possible ratio of mixing. A careful analysis of commercial rayon has been carried out in this connection and has elicited, that there are considerable variations and fluctuations as to the size of filament. But the arbitrariness with which such variations and fluctuations occur, indicates that they are caused by accidental variations in the clear opening of the nozzle through which the filament is exuded; they cannot be attributed to a predetermined and planned schedule of variations in size. On the other hand my research has also shown, that a predetermined coordination as to fineness, e.g. a planned mixing in a fixed proportion of filament assorted as to size, is extremely useful in the manufacture of coarser yarn, yarn used for rug and carpet for instance. As a matter of fact crossbredswool cannot be successfully mixed with rayon, unless there is a scheduled mixing of fibre of different size.

Particular advantages will result, when a fixed mixing schedule is observed, which can be readily ascertained by test, and in which the mixing of the fibre is rationed in respect to the size as well as concerning the length of the filament; generally speaking, it is advisable to use longer pieces of finer, and shorter pieces of heavier fibre or filament.

The maxim of using greater lengths of thinner fibre is also known in the conversion of natural fibre. It was the natural outcome of the recognition, that uniformity in length and size must be observed in order to obtain a yarn of greater strength,—aside from a careful consideration of the convolutions per unit length in twisting and doubling. Thus diagrams evaluating the length and fineness or size of the fibre have come into general use in connection with natural fibre. But it has not been known before to assort the rayon fibre in this manner, to mix assorted fibres and thus to obtain superior results. This must evidently be attributed to a lack of analogy according to which we cannot, for instance, compare the scaleless rayon with a well scaled and crimped wool; fixed rules do not apply to one as well as the other though artificial crimping of rayon fibre confers more wool-like properties upon the rayon.

Assorted fibre may be dosed in the empirically evaluated preferred ratios of mixtures in various ways. Thus the endless rayon filament is not cut in uniform length as before, but the cut is arranged so that we immediately have a mixture of varying lengths of fibre, i.e. they vary in accordance with the predeterminedly preferred ratios of length. Variations of size may of course be simultaneously obtained by predetermined differentiations in the clear opening of different nozzles.

We may modify the operation by cutting from the endless filament bundles of different length, each bundle containing staple of like length, and may then mix with each other bundles, which differ from each other in respect to length.

A predetermined assorting in respect to length as well as to size may be brought about, by providing shorter bundles of finer filament, and longer bundles of heavier filament,—the staple of each bundle being, of course, uniform in length. Then the various bundles are mixed with each other in accordance with the predetermined schedule.

In order to effect a difference in length between the various filamentary pieces of a bundle, we may cut at an angle and/or along a curved path, such cuts alternating with cuts in a normal, transverse direction, or with cuts conversely slanted or curved. If in successive cuts the cutting means is for instance oppositely slanted, these cuts may be reversed in respect to each other in mirror fashion.

It should be mentioned, that such a predeterminedly mixed material may even go immediately into the combing process, i.e. the steps of loos-

ening and carding might be dispensed with, and considerable losses which are normally entailed in these steps of procedure, are thus eliminated. The same applies to the artificially crimped material mentioned hereinabove.

The advantages obtained by use of the instant invention, and its procedure will be better understood from the following comparison, which is however to be interpreted as an illustration rather than in limitation.

The chart below lists to the left the length and size of each staple fibre used, their size being given in Denier and their length in millimeter. To the right we have lots with different mixtures of these fibres, the percentages of the various fibre, I, II or III, mixed together in each lot being tabulated under the heading of the lot. (A, B, C or D)

| | Staple fibre | | Fibre mixtures | | | |
|---|---|---|---|---|---|---|
| | Denier | Length | Lot A | Lot B | Lot C | Lot D |
| | | *m/m* | *Per cent* | *Per cent* | *Per cent* | *Per cent* |
| I | 2.75 | 100 | 100 | 75 | 33 | 66 |
| II | 3.75 | 120 | ---------- | ---------- | 33 | ---------- |
| III | 6.00 | 150 | ---------- | 25 | 34 | 34 |

Yarns A, B, C and D were worked up in the ordinary worsted process. Even initially, before the spinning operation, Lots B and C proved vastly superior to Lot A, and this was more outspoken, in respect to Lot C than Lot B. In the spinning process Lot A again was greatly inferior, but in this instance Lot C was slightly better than Lot B. The material was spun at 3300 rpm, with 6.03 twist per centimeter, 52 meters of yarn per grain. The mechanical test then showed the following comparison:

| | A | C | D |
|---|---|---|---|
| Less than two-thirds of the average strength per cent | 10.0 | 4.3 | 7.2 |
| Breaking length km | 6.10 | 6.82 | 7.45 |
| Breaking strength gram | 112.2 | 132.5 | 144.9 |
| Elongation per cent | 6.2 | 6.2 | 7.0 |
| Unevenness do | 20.43 | 14.82 | 18.93 |
| Breaks do | 2.96 | 0.85 | 1.72 |
| Nubs per grain combed | 64 | 26 | 34 |

For a carpet material a mixture of yarns 25–35 diameter with yarn 3–5 diameter proved particularly suitable for spinning.

EHRHART FRANZ.