

April 18, 1944.

T. JACKSON ET AL

2,346,759

TEXTILE PRODUCT

Filed May 21, 1941

FIG. 1

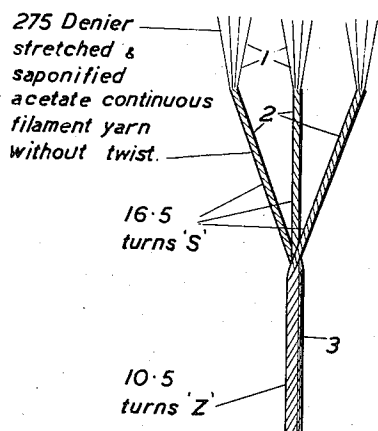


FIG. 2

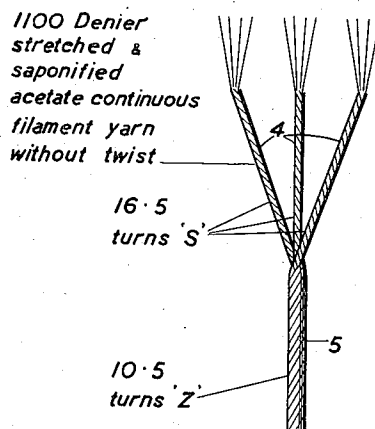
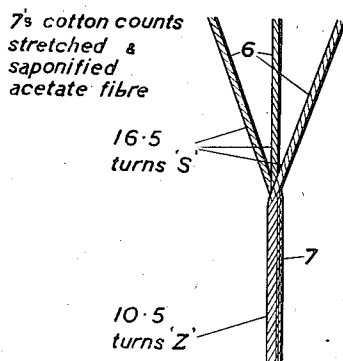


FIG. 3



T. JACKSON
D. FINLAYSON
T. B. FREARSON
INVENTORS

P. Selby & Co. Robinson
ATTORNEYS

UNITED STATES PATENT OFFICE

2,346,759

TEXTILE PRODUCT

Thomas Jackson, Donald Finlayson, and Thomas
Barnard Frearson, Spondon, near Derby, Eng-
land, assignors to Celanese Corporation of
America, a corporation of Delaware

Application May 21, 1941, Serial No. 394,438
In Great Britain June 6, 1940

8 Claims. (Cl. 57-140)

This invention relates to textile products and in particular to "cords" of the type used for the reinforcement of the covers of pneumatic tyres and other reinforced articles of rubber and similar materials.

According to the invention, a cord for the above mentioned purposes comprises a cabled assembly of cellulose acetate or other cellulose ester textile material that has been stretched and saponified. The saponification changes the cellulose ester to cellulose, but the combined treatments of stretching followed by saponification gives the filaments a higher strength, e. g. of 6 grams per denier upwards. Although the twisting involved in cabling the filamentary material brings about a reduction in strength, as is so commonly found in twisting operations, the final strength is very substantial, and certainly higher than that of cords made with other forms or types of cellulosic filaments. But perhaps even more important is the fact that cords of stretched and saponified cellulose ester filaments may be constructed so as to have an extraordinarily long flexing life. This most desirable property is obtained by the application of moderate degrees of twist in the building of the assembly and is therefore accompanied by high strength.

The basic material may be in continuous filament form, and yarns of such continuous filaments may be assembled in any suitable way to form the cabled structure of the cord, the usual reversal of singles and cabling twists employed to obtain "balance" in many different types of textile yarns being adopted, but as stated above, only a moderate amount of twist being employed, especially in the singles, to preserve the final strength. In comparison with the usual cotton cords of similar weight, the increase in flexing life is enormous, a fact that cannot readily be attributed to either of the more noticeable differences between the basic materials, i. e. continuity of filament as compared with staple fibre, and material difference in strength. Further, the flexing life is several times greater than cords of similar weight made of continuous filaments having a simple cellulosic basis, e. g. viscose (rayon) filaments.

The unexpected superiority of the stretched and saponified cellulose ester filaments is even more remarkable when, according to a further important feature of the invention, use is made of them in staple fibre form, the flexing life then being substantially greater than the already very high life of a continuous filament yarn of equivalent weight. The staple fibre cord may follow

the general construction of a cotton cord i. e. singles yarns of about 275 denier and appropriately twisted may be plied into an intermediate yarn, and several (say 3) of these intermediate yarns may be plied with reverse twist; but whereas a cord of, say 15 continuous filament 275 denier viscose yarns assembled in this manner shows an improvement in flexing life over a cotton cord, such improvement amounts to only a small fraction of the one obtained with staple fibre of stretched and saponified cellulose ester filaments.

With the continuous filament cord construction according to the invention, a flexing life of over 400,000 is obtained; the staple fibre cord construction further improves the life to 800,000 under the same conditions of tension. Both constructions enormously surpass in flexing life cords made from cotton and viscose; and this with the retention of higher strength, cord strengths of 2.0, 2.3, and 2.5 being obtainable.

The strength depends upon the amount of twist and the way in which it is applied in the stages leading to the final cabled product. Because of the very high flexing life made available by the invention, a balance can be made between flexing life and strength in accordance with the particular use to be made of any cord, by adjusting the twist, both in the final cabling and in the operations leading to the final cabling. For example, a reduction in the final cabling twist increases the strength at the expense of flexing life; at the same time, the extensibility of the cord is decreased.

Use may be made of wet doubling (either English or Scotch systems) or steaming in each or any of the twisting operations. Greater benefits are, however, obtained by the application of textile lubricants. For example, a lubricant such as coconut oil may be applied as a 2½% solution in kerosene or petrol, and if desired a small proportion (1%) of tricresyl phosphate may be added, the yarns being passed over a wick saturated with the mixture, to leave about 3% of residual lubricant on the yarns.

The stretched cellulose acetate or other cellulose ester filaments may be shrunk before saponification, the strength then being reduced, e. g. to the order of 4.5 grams per denier, and the extension being higher than that of the unshrunk filaments. The shrunk filaments may be used in continuous filament form or in the form of staple fibre, as indicated above.

The stretching employed in the production of the basic filaments enables the filament denier

to be controlled, and, if desired, very fine filaments can be used, say less than 0.1 filament denier upwards. In general, however, filaments of about 0.5 or 1.0 or so filament denier are very satisfactory, giving the 400,000 and 800,000 flexing lives for continuous filament and staple fibre cords respectively, already mentioned.

The staple fibre length is capable of variation. For example, lengths of the order of cotton fibres ($1\frac{1}{8}$ inches) may be used, or longer fibres of $2\frac{1}{2}$, 3, 5, or 10 inches may be used. Composite cords containing continuous filament yarns and staple fibre yarns may be built up by the methods according to the invention. Likewise, cotton cords may be used in the yarns according to the invention.

The total denier of the cords varies according to requirements, 3000-4500 denier being typical weights. Using a 3, 4, or 5-fold construction for the final cabling, the elements (continuous filament or staple) there assembled should be approximately 800-1100-1500 denier, and their twist should be of the order of 19, $16\frac{1}{2}$, or 14 turns per inch. The final denier is dependent on the amount of the cabling twist, which should be about $10\frac{1}{2}$ -9 turns per inch. Thus, a nominal 3-fold 1100 denier cord has a denier of about 3600 with 9 turns per inch of twist and about 3800 with $10\frac{1}{2}$ turns, both of which yield a very satisfactory flexing life. The singles twist similarly affects the final denier. In the case of staple fibre yarns, the first plying may be used to build up a heavy end of which 3, 4, or 5 may be used for the final cabling. Thus 4 ends of 20's cotton counts may be used with 10 turns Z twist, and the first plying may be effected twist-on-twist, say 14 turns Z a final cabling of 12 turns S imparting the necessary coherence, balance, and flexing life. The singles are, however, preferably composed of heavier ends of say, 3 or $3\frac{1}{2}$, 5, 7, or 10's cotton counts, only a few of which are needed for cabling into the final cord. By the use of heavy singles, the whole manufacturing operation is simplified. With care in selecting a roving of uniform character, a uniform heavy singles yarn can be made at far less cost than several fine yarns totalling the same weight, and the careful winding and doubling operation needed with fine yarns is eliminated. More important, however, the quality of the final product is much improved, especially with regard to its ability to withstand the repeated flexing to which it is subjected when serving as the reinforcement of the rubber article.

Three constructions of cord according to the invention are diagrammatically shown in the drawing.

In Fig. 1, four ends 1 of 275 denier stretched and saponified acetate continuous filament yarn without twist are folded with 16.5 turns S twist into the intermediate ends 2, which are then cabled with 10.5 turns Z twist to form the cord 3.

In Fig. 2, three ends 4 of 1100 denier stretched and saponified acetate continuous filament yarn assembled without twist are individually twisted

16.5 turns S and are then cabled with 10.5 turns Z twist to form the cord 5.

In Fig. 3, three ends 6 of 7's cotton counts stretched and saponified acetate staple fibre with 16.5 turns S twist are cabled with 10.5 turns Z twist to form the cord 7.

Having described our invention, what we desire to secure by Letters Patent is:

1. An improved cord for tyres and the like comprising a cabled assembly including high tenacity staple fibre yarns having a basis of cellulose ester filaments which have been stretched and saponified.

2. An improved cord for tyres and the like comprising a cabled assembly of high tenacity staple fibre yarns having a basis of cellulose acetate filaments which have been stretched and saponified.

3. An improved cord for tyres and the like comprising a cabled assembly of high tenacity staple fibre yarns having a basis of cellulose ester filaments which have been stretched and saponified said yarns having an individual moderate degree of twist in one direction and a cabling twist of moderate degree in the opposite direction.

4. An improved cord for tyres and the like comprising a cabled assembly of high tenacity staple fibre yarns having a basis of cellulose acetate filaments which have been stretched and saponified said yarns having an individual moderate degree of twist in one direction and a cabling twist of moderate degree in the opposite direction.

5. An improved cord for tires and the like comprising a cabled assembly of heavy-singles staple fibre yarns, said yarns having a basis of cellulose ester filaments which have been highly stretched and saponified.

6. An improved cord for tires and the like comprising a cabled assembly of heavy-singles staple fibre yarns, said yarns having a basis of cellulose acetate filaments which have been highly stretched and saponified.

7. An improved cord for tires and the like comprising a cabled assembly of heavy-singles staple fibre yarns, said yarns having a basis of cellulose ester filaments which have been highly stretched and saponified said heavy-singles staple fibre yarns having an individual moderate degree of twist in one direction and a cabling twist of moderate degree in the opposite direction.

8. An improved cord for tires and the like comprising a cabled assembly of heavy-singles staple fibre yarns, said yarns having a basis of cellulose acetate filaments which have been highly stretched and saponified said heavy-singles staple fibre yarns having an individual moderate degree of twist in one direction and a cabling twist of moderate degree in the opposite direction.

THOMAS JACKSON.
DONALD FINLAYSON.
THOMAS BARNARD FREARSON.