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2,217,826

RAYON FOR REINFORCING RUBBER PRODUCTS

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Fig. 1.

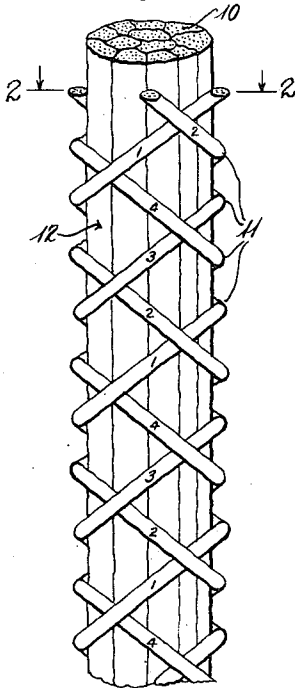


Fig. 3.

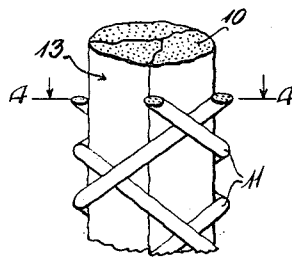


Fig. 4.

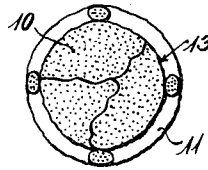


Fig. 5.

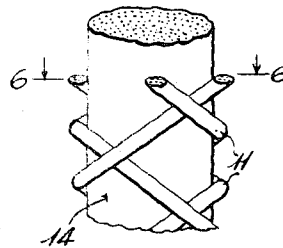


Fig. 6.

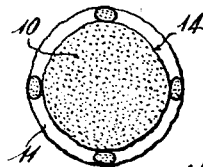
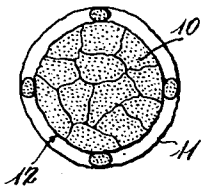


Fig. 2.



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UNITED STATES PATENT OFFICE

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RAYON FOR REINFORCING RUBBER
PRODUCTS

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Application December 2, 1939, Serial No. 307,331

8 Claims. (Cl. 56—26)

The present invention relates to the prepara-
tion and construction of rayon in strand form and
more particularly to the provision of an improved
rayon cord especially adapted for reinforcing
rubber products such as cord tires and the like.

of fact, if the cord is completely untwisted and
the strength of the elemental filaments be re-
measured, it will be found that the filaments
per se have lost some of their original strength
due to the several twisting operations.

At the present time, thread of artificial origin,
and in particular, rayon, is replacing cotton to
an increasing extent as a reinforcement for all
types of vehicle tires. In order for such a sub-
stitution to become practical in the rubber in-
dustry, the physical and chemical properties of
rayon had to be materially improved and through
extensive research, these conditions have now
been made possible. Of course, rayon has always
had the favorable quality of being more heat
resistant than a natural cellulose product. The
tensile strength, extensibility, durability, aging,
etc., were not initially satisfactory and did not
compare favorably with cotton. By improving the
stretching operations during the extrusion and
primary treating steps, freshly spun rayon has
acquired a tremendous increase in strength both
in wet and dry tenacity and, which is another im-
portant factor, the elongation differential has de-
creased materially.

The fact that twist influences the strength of
rayon cords is evidenced by the Parker Patent No.
2,132,492. That patent is directed primarily to a
twist that is low when compared to the twist dis-
closed by the prior art. Various ranges of twists
are given for the thread, strand (intermediate)
and cable (final), but the maximum at any stage
does not comprehend substantially more than ten
turns per inch. The patent discloses graphs
plotting the strength of the cord against the
turns per inch. It is obvious therefrom that an
appreciable decrease in strength of the cord oc-
curs as the turns per inch increase. The said
decrease accelerates rapidly after the turns are
over five per inch. Theoretically, in the range of
from one to five turns per inch the strength
decreases slightly as shown in the graph (Fig. 1).
However, in actual practice, it has been deter-
mined that a slight twist may not appreciably im-
pair the strength of the final cord or cable.

One of the major considerations and problems
still confronting the industry is that of preserv-
ing the initial strength of the individual fila-
ments comprising the thread and by the same
token maintaining the strength of the individual
threads making up the ply or cord.

As indicated above, prior to the present inven-
tion, in order to properly handle the thread and
utilize the cord in reinforcing composite articles,
a substantial twist had to be employed because an
untwisted strand would tend to fall apart and be-
come mutilated or impractical to manipulate.

In order to handle the strand elements or con-
stituents thereof as unitary bodies, it has been
necessary to impart a twist to the various ele-
ments prior to, or during the formation of the
cord or cable. Customarily tire cords are formed
in three separate twisting operations, the basic
threads which are termed yarn comprise a plu-
rality of small filaments twisted together. A plu-
rality of yarns are twisted together or "plied"
to form a structure known as a ply or intermedi-
ate strand and plies thus formed are twisted with
other plies to form a cord or cable. It has been
determined that the properties of the cable are
dependent in part upon the degree of twist at each
stage in the formation thereof. Preferably the
yarn has a very low degree of twist. However, it
has been definitely determined that any twist
imparted either to the filaments constituting the
thread, or to the threads or plies constituting
the cord, lowers the effective strength of the
cord. In other words, if the strength of a finally
constructed cord is measured, it will be less than
the combined strengths of the individual fila-
ments measured prior to twisting. As a matter

It is the object of the present invention to pro-
vide a cord or cable composed of one or more un-
twisted threads held together as a unitary struc-
ture by means of an exterior support.

A further object of this invention is to produce
a number of untwisted rayon threads and bind
the same in a cord construction by means of a
braided cover.

The invention additionally contemplates the
manufacture of a rayon cord having a strength
equal to the sum of the strengths of the indi-
vidual filaments.

Another object of the invention contemplates
the provision of a cord having a core consisting of
untwisted filaments.

Other objects and advantages will be apparent
when considered in connection with the accom-
panying drawings wherein

Fig. 1 is an enlarged perspective view of one
form of cord constructed in accordance with the
invention;

Fig. 2 is a cross-sectional view taken on line
2—2 of Fig. 1;

Fig. 3 shows a cord having a modified core

construction formed of three untwisted threads;

Fig. 4 is a cross-sectional view taken on line 4-4 of Fig. 3;

Fig. 5 is a second modification of the structure illustrated in Fig. 1, showing an untwisted core consisting of one large thread; and

Fig. 6 is a cross-sectional view taken on line 6-6 of Fig. 5.

Referring now to the drawing, the rayon cords shown therein are constructed of a multiplicity of untwisted filaments 10 bound together by means of a braided exterior or support 11. The braided exterior consists of four threads indicated separately by the numerals 1, 2, 3 and 4 (see Figs. 1 and 2).

A cord having the strength desired for reinforcing tires normally has a denier in the neighborhood of at least 4000, the usual 275-5-3 construction being 4125 denier. In each of the figures a core is shown consisting of 1440 filaments and having a total denier of 3300. The cord illustrated in Fig. 1 consists of twelve untwisted threads 12 of 275 denier each of which is composed of 120 untwisted filaments. These threads 12 collectively make up a substantially cylindrical core. In Fig. 3, three large untwisted threads 13 having 480 filaments of 1100 denier each is disclosed. Fig. 5 shows a core made up of one large thread 14, of 3300 denier.

In fabricating the cord, the individual threads may be slightly twisted, for example, one turn per inch and several of these threads may also be slightly twisted about each other prior to their disposition in a braiding machine, although neither twisting step is necessary. The threads are laid together to form a substantially cylindrical core and placed in a tubular braider. The number of threads braided around the core is optional depending upon the ultimate denier desired. In the drawing, four threads of 100 denier each are employed, which causes the exterior to be greater than 400 denier. This is due to the fact that these braids are in helical form rather than longitudinally disposed as in the case of the filaments of the core. The increase in denier depends, of course, on the angularity of the helices. It can be seen from the above that the total denier of the cord is slightly greater than 3700. The thread of which the braided exterior is composed, usually has a twist of from 3 to 5 turns per inch, although the twist may be higher inasmuch as the braid per se has no effect on the final strength of the cord. For the purposes of exemplifying this invention the braid is disclosed as being made of rayon but other textile materials, such as cotton, may be employed.

In order to arrive at the maximum allowable denier for the braided exterior, the cords, constructed in accordance with past practice, i. e., twisted constructions, must be taken into consideration. The usual prior cords have been tested and found to have from 15% to 30% less strength than the combined strengths of the individual filaments. Therefore, a cord constructed

in accordance with the present invention can have a denier of from 15% to 30% less than twisted cords and still have the same strength. The denier of the braided support may accordingly range from 15% to 30% of the total denier without the latter becoming more than the denier of prior cords while still having equivalent strength. As shown in the present specific description the braided exterior is only approximately 11% of the total denier.

It can be readily seen that the present cord construction offers a number of advantages over the prior art, in that, lighter weight cords of superior strength may be used in the manufacture of composite articles such as rubber tires, belts, etc., wherein the strength of the reinforcing elements is of the utmost importance. Moreover, the untwisted filaments are not biased against each other and therefore excessive wear and strain is avoided.

It is to be understood that the invention is not to be restricted to any specific construction other than one in which rayon cords are bound together by means of a braided or otherwise suitably plaited exterior, or one in which the exterior consists of a spiral strand element, such as one or more strands wound spirally in the same or opposite directions.

What is claimed is:

1. A composite cord comprising a rayon core consisting of a multiplicity of substantially untwisted filaments held together as a unitary structure by means of a sheath.

2. A composite cord comprising a rayon core consisting of a multiplicity of substantially untwisted filaments held together as a unitary structure by means of a plaited outer support.

3. A composite cord comprising a rayon core consisting of several untwisted threads, each thread being composed of a multiplicity of untwisted filaments and held in compact cylindrical form by means of a braided cover.

4. A cord for tires and the like comprising a rayon core of at least 3300 denier and composed of several substantially untwisted threads held together by means of a braided outer support.

5. A cord as defined in claim 4 in which the braided outer support has a denier of less than 15% of the total denier of the cord.

6. A rayon cord for tires and the like comprising a core of untwisted filaments and a braided cover, the ratio of the denier of said core to the denier of the cover being at least 8:1.

7. A reinforced rubber article having embedded therein a rayon cord consisting of untwisted rayon filaments held together with a braided rayon cover.

8. A composite cord comprising a rayon core consisting of a multiplicity of substantially untwisted filaments and a braided outer support, said core having a strength equal to the combined strengths of the individual filaments.

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