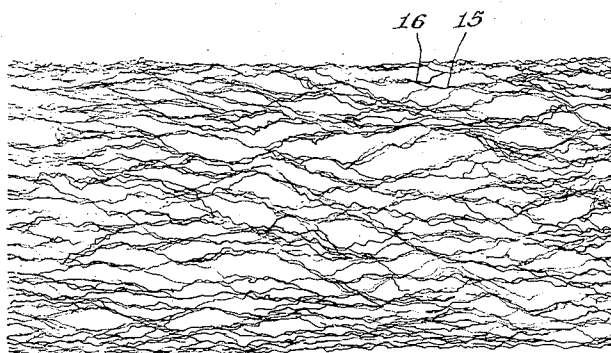
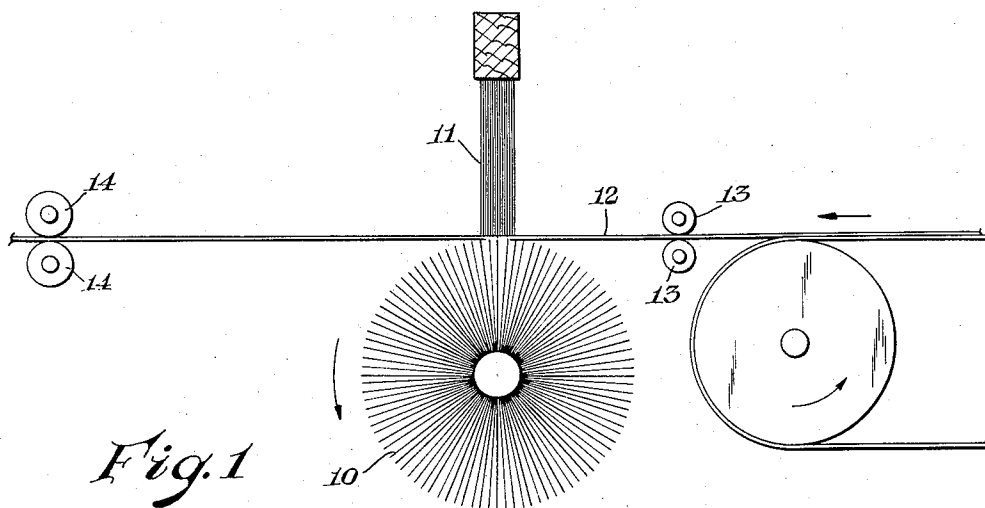


Sept. 30, 1958

J. E. COSTA ET AL
FIBROUS ARTICLE AND METHOD OF PREPARING
THE SAME FROM POLYMERIC FILMS
Filed May 27, 1954

2,853,741



BY

INVENTORS
John E. Costa
Lloyd E. Lefevre
Edgar W. Le Boeuf
Griswold & Surdick
ATTORNEYS

1

2,853,741

FIBROUS ARTICLE AND METHOD OF PREPARING THE SAME FROM POLYMERIC FILMS

John E. Costa and Edgar W. Le Boeuf, Midland, and Lloyd E. Lefevre, Bay City, Mich., assignors to The Dow Chemical Company, Midland, Mich., a corporation of Delaware

Application May 27, 1954, Serial No. 432,826

3 Claims. (Cl. 18—47.5)

This invention relates to a new fibrous product and to a process for producing the same. More particularly, it relates to such products made from polymeric materials.

The production of continuous tows has long been a necessary step in the production of yarn for the textile industry. One of the oldest and most common methods employed to produce such tows has been to card a mass of staple fibers so that the individual fibers are brought into approximately parallel relationship, followed by twisting and drawing the resulting sliver. There are many time-consuming steps in such a method. The tow is held together by the intermeshing of the individual fibers, by the crimp in the fibers, and by surface characteristics of the individual fibers. The strength of the yarn is dependent to a large extent on the resistance these short fibers have to sliding past each other. Yarns made from staple fibers have a characteristic resiliency and hand which is highly desirable for articles of wearing apparel. Still another method produces a yarn by extruding or spinning a plurality of continuous fibers, crimping, twisting, and drawing the tow into a yarn. That method is mostly associated with synthetic fibers that have smooth surfaces and even when crimped tend to slide easily past one another. Up to now that method has been useless for producing yarns for wearing apparel because it has been impossible to achieve a desirable hand, such as that found in yarns made from staple fibers, in yarns spun from continuous fibers. In order to obtain the proper hand it has been necessary to staple the continuous filaments and then carry out all of the usual steps of converting the staple fibers into a continuous tow. Such a method is impractical and costly in operation. It would be desirable to have a method of producing a tow of continuous fibers which could be twisted directly into a yarn having a desirable hand.

It is the principal object of this invention to provide a continuous fibrous or filamentary article from synthetic polymers which may be twisted directly into a yarn having the hand of a yarn made from staple fibers.

It is a further object to provide a process for producing such a fibrous article.

The above and related objects are accomplished by a process whereby an unilaterally oriented film of synthetic polymer is shredded into a continuous tow of fibers, such shredding being only partially complete, so that the individual fibers are physically connected to each other at random intervals. The tow made by this process may be twisted into a yarn without further processing, eliminating several of the operational steps usually required when yarn is prepared from staple fibers. The fibers, being linked to other fibers, show exceptional resistance to slippage against one another. Yarns produced in accordance with this invention have the same hand as yarns prepared from staple fibers.

The films are conveniently prepared from an aqueous latex of the synthetic polymer. Any polymers whose latexes will form a continuous, self-supporting, orientable film may be employed in making the fibrous articles of

2

this invention. As typical examples of such polymers may be mentioned the copolymers of vinylidene chloride with other copolymerizable monomers such as acrylonitrile, vinylchloride, and vinylacetate, in which the vinylidene chloride is present in the major proportion. Useful films may also be cast from a solution of a polymer although many disadvantages, such as the high cost and flammability of many solvents, and the difficulty in preparing concentrated polymer solutions, usually make this procedure less attractive than that using a latex. Other useful films may be formed by melt extrusion of polymeric bodies.

The preparation of latexes capable of forming films is old in the art. Typically the polymerizable materials are mixed into an aqueous phase containing a polymerization catalyst and an emulsifier for the polymerizable materials. Polymerization is initiated by warming the mixture and allowing it to proceed with agitation until substantially complete.

Before casting the latex into a film it may be necessary to blend therein a thickener. As is well known in the art, some latexes will form films without a thickener, whereas others require one and simple preliminary experiments will determine if one is necessary.

The films are easily prepared from latexes or solutions by casting the latex or solution onto a flat surface and drying the resulting deposit.

With those films that are made from crystalline polymers, it is necessary to heat the films to a temperature at which the crystallites will melt followed by supercooling the film, and then to stretch the film in one direction to obtain the desired unilateral orientation. After orientation the films may be shredded at any time. Films of non-crystalline polymers may be oriented by stretching them in a heated condition, and the orientation may become set in the film by sudden chilling.

The operation of the method and the article produced thereby will be better understood from the annexed drawings and the following description. In the drawings:

Fig. 1 shows in diagrammatic side-elevation a preferred embodiment of an apparatus for operating the method, and

Fig. 2 is a magnified view of a portion of the fibrous article prepared by the method of this invention.

An especially useful device for shredding the films is shown in diagrammatic cross section in Fig. 1 of the accompanying drawing. In that device the unilaterally oriented film is fed through the nip between a driven revolving brush 10 and a stationary brush 11 positioned so that its bristles barely engage those of the rotary brush 10. The revolving brush 10 rotates in the direction of travel of the film 12. The pressure between the two brushes that is necessary to produce the partial shredding will depend on several factors, such as the thickness of the film, the degree of orientation, and the stiffness of the brushes. Simple preliminary experiments will readily disclose the proper adjustment of the brushes to provide the necessary shredding action. The rate of travel of the film 12 may be controlled by running the film 12 through a pair of driven pinch rolls 13 before being brushed. A windup roll or other similar collecting device (not shown) may follow the brushes (10, 11) and tension rolls 14, to collect the partially shredded film. It should be understood that the invention is not limited to any particular apparatus, and that the above description represents only a preferred embodiment of a device for carrying out the method of the invention. However, methods such as turning and slicing, which produce continuous unconnected fibers are not suitable for use in the invention.

The product which is formed in accordance with the method of this invention is a fibrous article consisting of

3

4

a coherent sheet of long fibers physically connected to each other at random intervals by short links which are an integral part of each of the long fibers. The form of the article is more apparent from the highly magnified sketch of a portion of a fibrous article as shown in Fig. 2. From this sketch it can be seen that the long fibers 15 are connected at random intervals at linkage points 16. It can also be seen that the links 16 are a part of both of the long fibers 15 which they connect and are not welded, glued, tied, or in any other manner tacked onto the long fibers 15. The latter methods would be time-consuming, expensive, and impractical, and the product produced by such methods would not enjoy the advantages inherent in the product of this invention consisting of a single integral network.

By way of illustration, a film-forming aqueous latex of a polymer consisting of 97 percent vinylidene chloride and 3 percent acrylonitrile was cast into a continuous film, which, when dried, was about 0.5 mil thick. The dried film was heated to about 180° C. and unilaterally stretched to seven times its original length. The oriented film was then passed through the nip of a revolving brush and a stationary brush and the pressure between the brushes adjusted so that a fibrous article substantially as described in this specification was formed. The continuous tow thus produced was twisted into a yarn, and articles made therefrom had a hand typical of similar articles made from staple fiber yarns, but the individual yarns of

the invention were much stronger than staple fiber yarns of the same composition and denier.

We claim:

1. The method of producing an interconnected fibrous article from a film of a normally crystalline polymer comprising the steps of supercooling said film, orienting said supercooled film unilaterally, and shredding said oriented film an amount sufficient to break the film into a coherent longitudinally fibrillated fibrous web, the fibroid segments forming said web being in random association but insufficient to separate the fiber segments forming said web from one another.

2. The method as claimed in claim 1 wherein the film is one cast from an aqueous latex of a polymer.

3. The method as claimed in claim 1 wherein the shredding consists of passing the film between a revolving brush and a stationary brush whose bristles engage slightly with those of the revolving brush.

References Cited in the file of this patent

UNITED STATES PATENTS

2,238,422	Marcin	Apr. 15, 1941
2,464,746	Gering	Mar. 15, 1946
2,459,804	Francis	Jan. 25, 1949
2,516,295	Borton et al.	July 25, 1950
2,578,523	Llewellyn	Dec. 11, 1951
2,728,950	Annesser	Jan. 3, 1956