Oct. 24, 1939. W. M. SPENCER 2,177,538

ARTICLE AND METHOD OF MAKING THE SAME

Filed June 2, 1937

Fig.1.

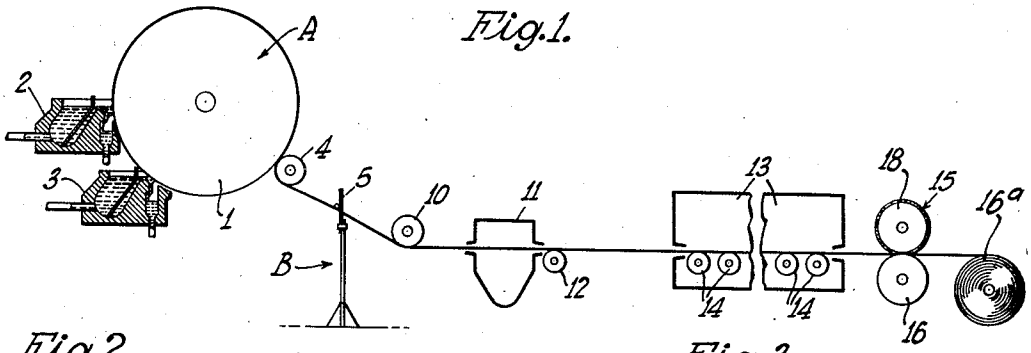


Fig.2.

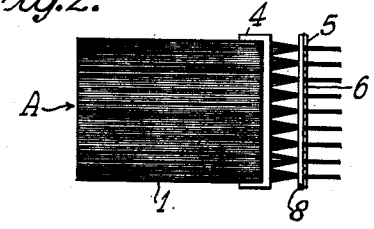


Fig.3.

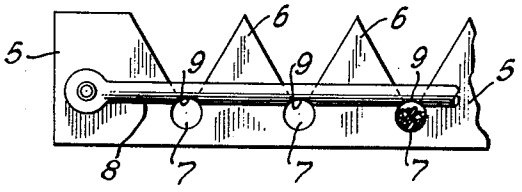


Fig.4.

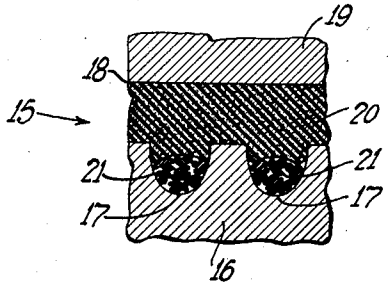


Fig.5.

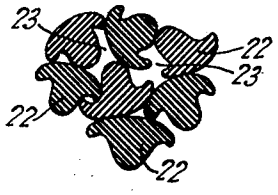


Fig.6.

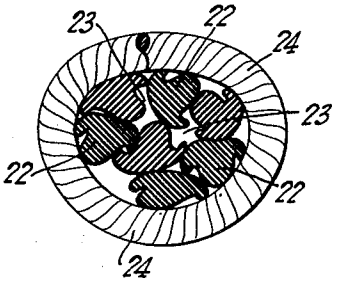
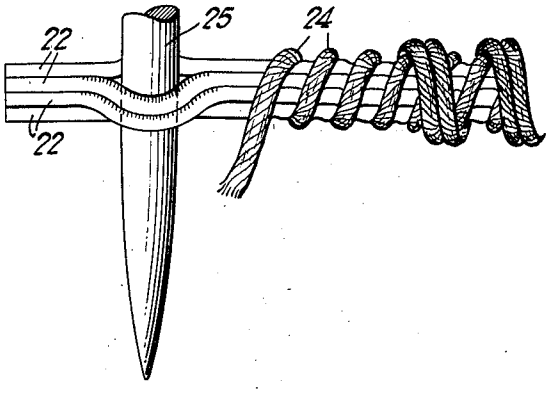


Fig.7.



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UNITED STATES PATENT OFFICE

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ARTICLE AND METHOD OF MAKING THE SAME

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Application June 2, 1937, Serial No. 145,993

15 Claims. (Cl. 57—152)

The invention relates in general to elastic materials and, in particular, to compound elastic rubber threads and covered elastic threads formed therewith and to correlated improvements in the process and apparatus for producing such threads.

Elastic fabrics, webs, tapes and garments fabricated from elastic threads have long been in commercial use. The elastic thread employed in weaving, knitting or otherwise forming elastic fabrics, garments or accessories usually comprises a rubber core filament which may have one or more layers of textile thread applied thereover while the core is maintained in a stretched or tensioned state. In the fabrication of articles from elastic textile materials sewing operations are invariably resorted to in the seaming or joining of parts. The chief difficulty with sewing elastic fabrics containing rubber filaments lies in the fact that the sewing needles pierce and rupture the filaments thus destroying the elasticity of the material. Moreover, the ruptured filaments, being initially under tension, contract leaving an open space in the fabric thus materially detracting from its appearance.

To overcome the above difficulties it has been proposed, in the manufacture of rubber threads, to apply the textile covering to two or three loosely associated rubber filaments. Such a thread has proven to be entirely unsatisfactory as it is practically impossible to cover two or more loosely associated rubber filaments without setting up a variation in the degree of tension in each of the filaments. If the tension in one filament is less or greater than that in another filament, the covered thread will be unbalanced and kink and thus be rendered useless. Moreover, the covering threads have to be applied on such cores under great tension to prevent slippage between the individual rubber filaments which greatly impairs the flexibility and elasticity of the covered thread as well as causing frequent breaks during the covering operation.

It has also been suggested to laminate two sheets of rubber in such a manner as to provide a relatively weak bond and subsequently to sever the sheet to form square rubber threads. This product has not enjoyed much success due to the limited number of cleavage lines afforded in the combined thread. Moreover, the individual filaments have a polygonal cross-sectional shape which results in a hard thread of solid rubber affording no latitude in compression during the covering operation.

The general object of the invention is to obviate the foregoing and other disadvantages.

A specific object of the invention is to provide an improved compound rubber thread which may be pierced by a sewing needle without deleterious effects.

Another object of the invention is to provide a compound rubber thread which may be materially compressed without substantial compression of the body portions of each of the constituent filaments.

A further object of the invention is to provide an improved covered rubber thread in which the creepage of the covering is substantially inhibited.

A further object of the invention is to provide a simple and economical apparatus for combining rubber filaments.

Other objects of the invention will in part be obvious and will in part appear hereinafter.

According to the invention the process comprises promiscuously arranging and combining a plurality of rubber filaments and in particular, substantially coextensive rubber filaments having irregular surfaces presenting a non-polygonal cross-sectional shape. The compound thread of the invention is characterized by having discontinuous longitudinal air spaces therein which afford a product having a greater degree of compression than a substantially solid rubber thread. The invention further contemplates the continuous process of forming and combining rubber filaments, the latter step being effected preferably while the filaments are in a tacky state. The invention also comprises the apparatus for combining rubber filaments as well as the compound thread having one or more layers of a textile material applied thereto.

The invention accordingly comprises the process having the several steps and the relation of one or more of such steps with respect to each of the others, the apparatus embodying features of construction, combinations and arrangement of parts adapted to effect such steps, and the article which possesses the characteristics, properties and relation of elements, all as exemplified in the detailed disclosure hereinafter set forth and the scope of the invention will be indicated in the claims.

For a fuller understanding of the nature and objects of the invention reference should be had to the following detailed description taken in connection with the accompanying drawing, in which:

Fig. 1 illustrates, in a diagrammatical view, one embodiment of apparatus of the invention;

Fig. 2 shows a top view of a portion of the apparatus of Fig. 1;

Fig. 3 is an enlarged side elevation of the filament combining device of the apparatus of Fig. 1;

Fig. 4 is an enlarged cross-section, in part, of the drawing unit of the invention;

Fig. 5 illustrates in cross-section one embodiment of the compound thread of the invention;

Fig. 6 shows, in cross-section, the thread of Fig. 4 with a textile covering applied thereon;

Fig. 7 illustrates one embodiment of the compound thread of the invention being pierced by a needle.

The unit A of the apparatus diagrammatically shown in Fig. 1 may be of the type shown and described in my co-pending application Ser. No. 123,225 filed Jan. 30, 1937 and which may comprise a movable filament-forming member 1 having a plurality of filament collecting projections on the surface thereof which are adapted to collect a rubber containing fluid such as latex or the like from the containers 2 and 3. The latex collected on the projections is coagulated, preferably by means of heat, to form somewhat tacky coherent filaments which are stripped from the filament forming member 1 by the roller 4 from whence they are led to a combining means B such as a comb 5 having a V-shaped tines 6 terminating in circular or rounded orifices 7 wherein the combining step is effected without exerting any substantial pressure or only slight pressure on the filaments. The orifices 7 may be positioned slightly above the plane formed tangentially between the lower surfaces of the rollers 4 and 10 thus providing a slight combining pressure within the orifices. A guide-bar 8 is hingedly mounted on the comb 5 and is provided with notches 9 at spaced points above the orifices 7. The guide-bar 8 serves merely to guide the converging threads into the combining zone and does not exert any pressure on the filaments. As shown in Fig. 2, the filaments are stripped from the member 1 in parallel relationship and then groups of filaments are caused to converge and pass through the combining comb. By reason of their inherent tackiness the filaments adhere to each other in a substantially parallel relationship and in such a manner as to form a relatively weak bond which has sufficient strength to maintain the filaments as a unit during conventional covering operations but which will easily break when the compound thread is pierced by a sewing needle.

The comb 5 may be composed of any suitable material, preferably one having a low coefficient of friction such, for example, as polished Celluloid, glass, synthetic resin, metal etc., and, in particular, the edges of the orifices 7 are smooth.

The compound thread is led from the comb 5 under a guide roller 10, through a dusting chamber 11 over a guide roller 12, through a heated chamber 13 containing a plurality of supporting rollers 14 and wherein partial or complete vulcanization of the rubber may be effected. The compound threads are drawn through the apparatus by means of a drawing unit 15 and finally wound upon a swift or reel 16a.

The diameter of the orifices 7 will be dependent upon the desired size of the compound thread to be formed as well as upon the size and number of filaments to be employed. For example to form a compound thread having a mean diameter of .035 inches it has been found convenient to pass seven filaments having a mean diameter of .007 inches through an orifice having a diameter of .04 inch.

As shown in Fig. 4 the drawing unit 15 comprises a metallic (preferably brass) roller 16 having a plurality of compound thread receiving grooves 17 formed in the surface thereof and a second cooperating roller 18 formed of a core 19 having applied thereto a yieldable and resilient covering 20 of any suitable material such as sponge rubber, felt, cork or the like, sponge rubber being highly preferred. During operation of the apparatus the cooperating pressure between the rollers 16 and 18 is adjusted in such a manner as to cause the covering 20 to enter the grooves 17 thereby frictionally gripping the threads 21 without compacting or permanently deforming the same while drawing the threads through the apparatus.

In Fig. 5 there is shown a compound thread of the invention which is composed of seven filaments 22 each having irregular surfaces presenting a non-polygonal cross-sectional shape. Due to the promiscuous arrangement and the irregular shape of the filaments a porous or sponge-like compound thread is produced having discontinuous longitudinal air spaces 23 between the filaments. As shown in the drawing, the irregular surfaces of the filaments and the projections thereon serve to space the filaments from each other in such a manner that the bonded areas between the filaments is very small compared to what it would be if filaments having a polygonal cross-sectional shape were employed. The filaments are bonded together at irregularly transversely spaced points which comprise only a small proportion of the peripheral surfaces of the filaments. The irregularity of the spacing of the points of contact of the filaments transversely of the compound thread is due to the irregular shapes of the individual filaments.

The compound thread of the invention may be easily compressed or deformed without affecting the compression value of the bodies of the individual filaments 22 to any appreciable extent. This salient feature is illustrated in Fig. 6 which shows a textile covering 24 applied to the compound thread shown in Fig. 5. It may be seen that while the compound thread as a whole is compressed the body portions of the filaments are not materially compressed. The compressibility of the compound thread aids in preventing the displacement or creepage of the textile covering thereby insuring a uniform product. Moreover, the degree of compression necessary to prevent creepage of the covering on the compound thread of the invention is not sufficient to affect the flexibility or elasticity of the final product.

Fig. 7 shows the result obtained when a needle 25 is caused to pierce the compound thread of the invention. The textile covering has been removed from the pierced zone to more fully illustrate the manner in which the needle separates the filaments rather than penetrating the individual filaments or causing a rupture of the same. This desirable result is attributed to the many cleavage lines afforded by the spaced and promiscuous arrangement of the irregular filaments and to the relatively small bonding areas between the filaments.

In starting the apparatus the unit A is set in motion in the manner described in my aforementioned application and the filaments thus formed are divided into groups of the desired number and laid into the orifices 7 of the comb 5 while the guide bar 8 is in a raised vertical

position. After the threading operation the bar 8 is lowered to the position shown in Fig. 3 and it is maintained in such position during operation of the apparatus.

The covered compound thread of the invention is free of the twist which invariably results when two or more individual filaments are covered without being bonded together. Inasmuch as the filaments are combined in the absence of any substantial compacting pressure and while under substantially no longitudinal tension, no torque or unequal forces are set up within the compound thread thereby substantially eliminating any twisting or curling of the final product. This is particularly true when the filaments are combined continuously with their formation in the manner hereinbefore described.

While the use of seven filaments has been described, any suitable number of two or more may be effectively employed, it being advantageous to use numbers of four or more as the lines of cleavage increase with the number of filaments combined. While it is preferable to combine the filaments while in a tacky state as aforesaid they may be combined by the use of a suitable rubber containing adhesive or fluid and preferably the same type of fluid from which the filaments are initially produced. Any suitable rubber containing fluid may be employed in the formation of the filaments such as latex or any other suitable fluid of the type disclosed in my copending application hereinbefore mentioned.

While the drawing illustrates only one example of a filament having a non-polygonal cross-sectional shape it is within the purview of this invention to employ other suitably shaped filaments presenting a non-polygonal cross-sectional shape and preferably filaments having one or more longitudinal fins or ribs projecting from the body portion thereof. Several examples of suitable filaments having non-polygonal cross-sectional shapes and which may be employed in the formation of the compound thread of this invention are disclosed in my co-pending application Ser. No. 99,342 filed September 4, 1936. It is also within the purview of this invention to provide a compound thread composed of a plurality of filaments some of which may have a polygonal cross-sectional shape and some having a non-polygonal cross-sectional shape, the irregular or ribbed portions of the non-polygonal cross-sectionally shaped filaments serving to space the filaments from each other to produce a porous, compressible compound thread.

It is to be understood that the expressions "promiscuous" or "promiscuously" are used only with respect to the relationship between the filaments taken on a cross-section of the compound thread as the filaments are longitudinally arranged in a substantially parallel relationship to each other, i. e., the individual filaments become somewhat twisted about their own axis during the combining operation thus providing discontinuous longitudinal air spaces having irregular cross-sections. Further, by reason of the axial twisting of the filaments the air spaces vary in length because they are terminated at irregular intervals lengthwise of the compound thread. The individual filaments may be arranged in the same plane and bonded in this relationship to form a substantially flat or tape like compound thread which, upon being covered with a textile material, will be coiled or rolled upon itself to produce discontinuous longitudinal air spaces in the covered compound thread.

Since certain changes may be made in carrying out the above process and in the product, and modifications effected in the apparatus for practicing the principle thereof, without departing from the scope of the invention, it is intended that all matter contained in the above description or shown in the accompanying drawing shall be interpreted as illustrative and not in a limiting sense.

It is also to be understood that the following claims are intended to cover all of the generic and specific features of the invention herein described, and all statements of the scope of the invention which, as a matter of language, might be said to fall therebetween.

Having described my invention, what I claim as new and desire to secure by Letters Patent is:

1. As an article of manufacture, a compound rubber thread comprising a plurality of rubber filaments each having a longitudinally positioned fin projecting from the body portion thereof, said filaments being bonded together at spaced points of contact to provide a compressible thread.

2. An article of manufacture comprising a plurality of substantially coextensive rubber filaments, some of which are characterized by having irregular peripheries presenting non-polygonal cross-sectional shapes, the filaments being bonded together at portions only of their peripheries to form a compressible compound rubber thread.

3. As an article of manufacture, a compound rubber thread comprising a plurality of substantially coextensive combined rubber filaments promiscuously arranged to provide discontinuous longitudinal air spaces within the thread.

4. As an article of manufacture, a compound rubber thread composed of a plurality of substantially coextensive bonded rubber filaments having irregular surfaces presenting non-polygonal cross-sectional shapes, the bond between the filaments being relatively weak to facilitate separation of the filaments when pierced by a needle.

5. As an article of manufacture, a compound thread composed of a plurality of rubber filaments having irregular surfaces presenting non-polygonal cross-sectional shapes bonded in contact at irregularly transversely spaced points, the bond between the filaments having sufficient strength to maintain the filaments as a unit during conventional covering operations but which bond will easily break when the compound thread is pierced by a sewing needle.

6. A process of producing a porous compound rubber thread, which comprises promiscuously arranging and combining a plurality of rubber filaments to form a thread having discontinuous longitudinal air spaces therein.

7. A process of producing a compound rubber thread, which comprises assembling a plurality of rubber filaments having irregular surfaces so that they contact each other at irregularly transversely spaced points, and bonding said filaments together at said points of contact.

8. A process of producing a porous compressible compound rubber thread, which comprises bonding without compacting a plurality of tacky rubber filaments having irregular surfaces presenting non-polygonal cross-sectional shapes in contact at irregularly transversely spaced points.

9. As an article of manufacture, a compound thread of the type set forth in claim 1 having a textile covering thereon, the covering being under a tension sufficient to compress the compound

thread but insufficient to materially compress the body portions of the individual filaments.

10. As an article of manufacture, a compound thread of the type set forth in claim 2 having a textile covering thereon, the covering being under a tension sufficient to compress the compound thread but insufficient to appreciably compress the body portions of the individual filaments.

11. As an article of manufacture, a compound thread of the type set forth in claim 3 having a textile covering threon, the covering being under a tension sufficient to decrease the volume of the air spaces within the compound thread but insufficient to compress the body portions of the individual filaments to any appreciable extent.

12. As an article of manufacture, a compound thread of the type set forth in claim 4 having a textile covering thereon, the covering being under a tension sufficient to compress the compound thread but insufficient to compress the body portions of the individual filaments.

13. A process of producing covered compound rubber threads, which comprises covering a compound rubber thread of the type set forth in claim 1 by winding a textile material about the thread under a tension sufficient to compress the compound thread and maintain it in compressed state but insufficient to compress the body portions of the individual filaments.

14. A composite thread comprising a plurality of substantially coextensive rubber filaments having irregular surfaces which contact at irregularly transversely spaced points, said filaments being bonded together at said points.

15. A composite rubber thread comprising a plurality of rubber filaments having ribbed surfaces which contact at random positions, said filaments being bonded together at said positions.

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