

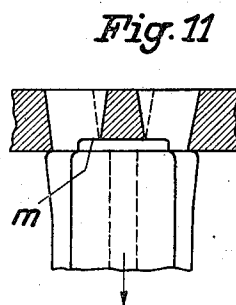
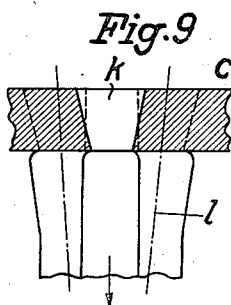
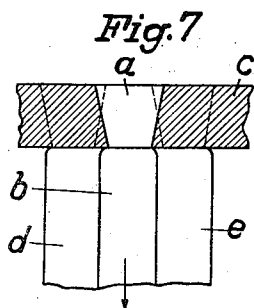
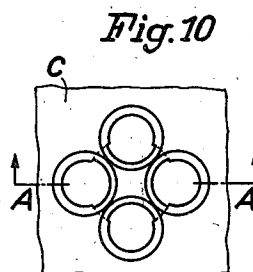
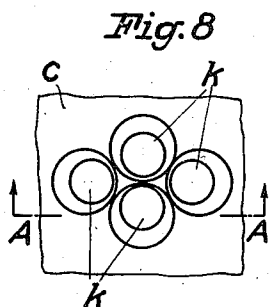
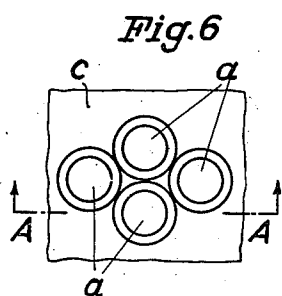
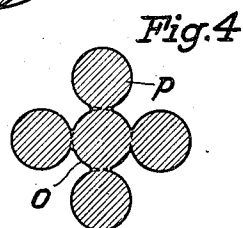
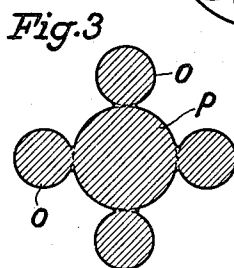
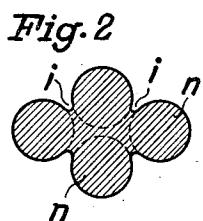
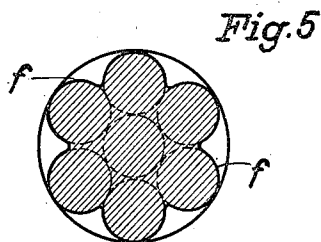
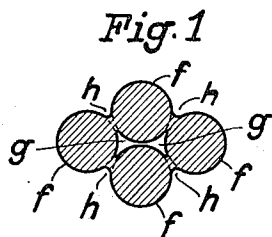
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2,149,425

RUBBER THREAD AND METHOD OF MAKING SAME

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## UNITED STATES PATENT OFFICE

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RUBBER THREAD AND METHOD OF  
MAKING SAME

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11 Claims. (Cl. 18—54)

This invention relates to rubber threads of the type used for making various elastic textile materials and the like.

It is an object of my invention to provide a new type of rubber thread which, while offering a secure grip to fibrous wrapping materials, is but little susceptible to wear and fissures.

A further object of my invention is to provide a method for producing rubber thread of this type in a simple, cheap and efficient manner.

Still other objects will become apparent in the course of the following description:

The most usual way of producing rubber thread as used in the manufacture of various elastic textile materials such as braces or elastic bands consists in cutting rubber sheet into suitable strips, the thread having a substantially square cross section. The comparatively sharp edges of such cross sections have been found to be important in that they are easily yielding to a slight pressure, thus offering a firm hold to fibrous wrapping materials. On the other hand fissures easily occur if the edges are too sharp, and such thread wears out rapidly.

According to the present invention I impart to the rubber thread a cross section having a plurality of indentations or recesses, the peripheral portions or projections remaining between such recesses having a circularly rounded outer face.

In many cases a rubber thread having such a cross section may also be defined as one composed of a plurality of round rubber filaments partly united or cemented to each other so as to produce a continuous or coherent cross section.

As the diameters of such individual circular filaments and, consequently, the radii of curvature of the peripheral projections of the composite rubber thread are comparatively small, these projections remain highly resilient and easily yielding so that fibrous wrappings will be held securely. On the other hand the edges of such rubber thread remain rounded and smooth enough to prevent the formation of fissures.

It is important that the single filaments constituting the new rubber thread be either homogeneously united or securely cemented to each other as experience has shown that rubber yarns composed of not interconnected filaments are comparatively weak, as on tension the individual filaments are elongated to different extents.

In the drawing Figs. 1 to 5 are cross sections through various modifications of the rubber thread according to the invention.

Figs. 6, 8, and 10 are front views of three different types of extruding nozzles designed for

producing the new type of rubber thread by an extruding process.

Figs. 7, 9, and 11 are sections taken along the lines A—A, of the nozzles shown in Figs. 6, 8, and 10, respectively.

The rubber thread shown in Fig. 1 is composed of four rounded filaments *f* united at their interfaces so as to produce a single coherent cross section having recesses or indentations *h*. The outer or peripheral portions of the thread thus formed has radii of curvature identical with the radius of the single filaments.

The thread is partly hollow in view of the empty portion *g* of the cross section, and this feature is also advantageous as it reduces the weight of rubber for a given length of thread and also increases the pliability and softness of the product.

As shown in Fig. 2 this feature is, however, not indispensable, as the four filaments can be united to form a thread with an uninterrupted solid cross section.

The star-shaped cross section shown in Fig. 3 is composed of a central filament *p* united with four circumferential filaments *o* of a smaller diameter. This arrangement of filaments is particularly advantageous in that comparatively little rubber is wanted to produce a rubber thread of a given diameter.

Fig. 4 shows a star-shaped arrangement of five united filaments which are all of the same diameter.

The cross section shown in Fig. 5 is composed of seven filaments, but as it does not differ much from the circumscribed circle, which is moreover touched by the peripheral projections, it offers the special advantage that it is particularly little susceptible of causing disturbances in the uniformity of the lustre of fabrics produced with such rubber thread. Nevertheless the projecting portions of the cross section, due to the comparatively small radii of curvature, are easily yielding and very resilient, thus offering to fibrous wrappings a secure hold which would be entirely missing with a plain round rubber thread of a similar total diameter.

In producing the rubber thread according to my invention I have found it particularly advantageous to resort to extruding processes. I may produce the single filaments by extruding an unvulcanized rubber composition through nozzles of substantially circular cross section, unite them to form the desired cross section, while they are still sticky, and vulcanize the thread thus obtained.

The rubber composition may be of any conven-

tional type which includes a certain amount of rubber solvent so as to render the mass sufficiently sticky. Alternatively, I may extrude latex or similar rubber dispersions having a suitable consistency so that the filaments immediately or soon after leaving the nozzles are sufficiently strong to retain their shape, so that they may be led together and caused to unite or coalesce closely in front of the nozzles.

10 Instead of producing the composite rubber thread according to the invention in an unvulcanized state and vulcanizing it only thereafter I may also produce and vulcanize the individual rubber filaments separately and unite them or cement them to each other by means of a rubber solution or a rubber dispersion. As will be obvious to those skilled in the art, the individual filaments or the thread composed thereof need not be subjected to a separate vulcanizing step if the extruding composition consists of one of the well-known types of vulcanized latex.

20 A nozzle plate suitable for producing rubber thread of the type indicated in Fig. 1 is shown in Figs. 6 and 7. In the nozzle plate *c* four conic nozzles *a* are arranged close to each other, so that the filaments *b, d, e* which slightly swell or expand in front of the outlet of the nozzles, are getting in touch with each other and coalesce at their interfaces. Whether or not empty spaces or cavities (*g* in Fig. 1) are formed depends on the distance of the individual nozzles from each other.

The nozzles shown in Figs. 8 and 9 substantially correspond to those shown in Figs. 6 and 7, except that the axes *l* of the nozzles *k* are not in parallel to each other, but inclined so as to meet in front of the nozzle plate. This arrangement greatly facilitates the leading together and uniting of the individual filaments.

40 This modification enhances the mutual touching and coalescing of the individual filaments after having left the nozzles.

In order to produce particularly deep grooves in the composite rubber thread suitable recesses may be provided at the outlet face of the nozzle plate. This is illustrated in Figs. 10 and 11, where part of the front portion of the bridges between the individual nozzles has been cut away. With a nozzle plate of this type the expansion of the individual filaments, takes place mainly in the direction towards the centre of the thread to be formed, the filaments partly expand in a centripetal direction before they wholly emerge from the nozzles, thus producing a thread having a cross section similar to that shown in Fig. 2.

55 In the front portion of nozzles of this type a certain amount of pressure will be exerted on the individual jets of rubber in a direction towards the axis of the rubber thread to be formed, but in view of the portions cut away no counterpressure is exerted in the opposite radial directions. The total effect of such an arrangement may consequently be defined as one forcing the individual rubber filaments towards each other during or immediately after their formation.

65 It will be understood, however, that the nozzles which I may use in carrying out my invention need not necessarily be conic and not even circular in cross section. In certain cases, for instance in the production of threads having a comparatively large diameter, filaments of a cross section other than circular may be led together and united or cemented to each other.

70 In the above description as well as in the claims affixed thereto, the term "rubber thread" should

be understood in its proper sense so as to exclude rubber band or rubber strip with a width considerably in excess of its thickness, as such cross-sections are not suitable for being wrapped up with fibrous material in accordance with the object of my invention, and projections and recesses as described would not exert the intended influence.

I claim:

1. As a new article of manufacture a rubber thread composed of a central rubber filament and of peripheral rubber filaments united with said central filament but otherwise separated from each other so as to form a star-shaped arrangement.

2. The method of making rubber thread comprising extruding simultaneously along a corresponding number of orifices with axes converging in the direction of extrusion a plurality of rubber filaments, causing such filaments to emerge from the orifices in close vicinity to each other so as to coalesce partly and to form projections of the thread separated from each other by recesses, and assisting said coalescing effect by permitting the filaments to expand partly in a centripetal direction before they wholly emerge from the extruding orifices.

3. As a new article of manufacture, a rubber thread being composed of a homogeneously united filaments and having a cross-section of the form of a body provided with projections of substantially circular circumference formed by a part of said filaments, said projections forming recesses between each other extending in the direction of the longitudinal axis of the thread.

4. As a new article of manufacture, a rubber thread being composed of individual filaments cemented to each other, said rubber thread having a cross-section of the form of a body provided with projections of substantially circular circumference formed by a part of said filaments, and said projections forming recesses between each other extending in the direction of the longitudinal axis of the thread.

5. As a new article of manufacture, a rubber thread being composed of individual filaments united by vulcanized rubber, said rubber thread having a cross-section of the form of a body provided with projections of substantially circular circumference formed by a part of said filaments, and said projections forming recesses between each other extending in the direction of the longitudinal axis of the thread.

6. As a new article of manufacture, a rubber thread being composed of homogeneously united filaments, each of said filaments having a substantially round cross-section, said rubber thread having a cross-section of the form of a body provided with projections of substantially circular circumference formed by a part of said filaments, and said projections forming recesses between each other extending in the direction of the longitudinal axis of the thread.

7. As a new article of manufacture, a hollow rubber thread composed of partly united filaments and having a cross-section of the form of a hollow body provided with projections of substantially circular circumference forming recesses between each other, said recesses extending in the direction of the longitudinal axis of the thread.

8. As a new article of manufacture, a rubber thread being composed of a central rubber filament and a plurality of rubber filaments surrounding said central filament, a part of the cir-

5 circumference of each of said surrounding filaments being united with said central filament, the other part of the circumference of each of said surrounding filaments being free to form a star-like cross-section of the rubber thread.

10 9. A method of making rubber threads comprising the steps of extruding a plastic sticky rubber mass through a plurality of adjacent orifices forming a plurality of rubber filaments, and partly uniting with each other said non-coagulated filaments by their expansion under the pressure of the extrusion in front of said orifices immediately after their formation to form a rubber thread having a cross-section of the shape of a body provided with projections of substantially circular circumference forming recesses between each other.

15 10. A method of making rubber threads comprising the steps of extruding a plastic sticky rubber mass through a plurality of adjacent orifices forming a plurality of rubber filaments, partly uniting with each other said non-coagu-

lated filaments by their expansion under the pressure of the extrusion in front of said orifices immediately after their formation to form a rubber thread having a cross-section of the shape of a body provided with projections of substantially circular circumference forming recesses between each other, and vulcanizing the rubber thread thus formed.

11. A method of making rubber threads comprising the steps of extruding a plastic sticky rubber mass through a plurality of adjacent orifices having converging axes and forming a plurality of rubber filaments, and partly uniting with each other said non-coagulated filaments by their expansion under the pressure of the extrusion in front of said orifices immediately after their formation to form a rubber thread having a cross-section of the shape of a body provided with projections of substantially circular circumference forming recesses between each other.

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