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54 Rubber thread covered with one or more windings having a controlled and limited elasticity, method and apparatus for its production.

57 In a rubber thread covered with one or more coils, one or more inelastic, semirigid or texturized yarns are inserted parallel to the elastic thread, in order to brake elongation of the elastic thread, so as to determine a maximum amount of admissible stretch, and to avoid yielding, strangulation and breakage of the rubber thread. The method and the apparatus designed to make such an elastic thread with controlled elasticity are also described.

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"RUBBER THREAD COVERED WITH ONE OR MORE WINDINGS HAVING A CONTROLLED AND LIMITED ELASTICITY, METHOD AND APPARATUS FOR ITS PRODUCTION"

The present invention relates to a rubber thread covered with one or more windings, receiving a controlled and limited elasticity by inserting one or more inelastic, semirigid or texturized yarns parallel to the elastic thread, as well as the method and the apparatus adapted to carry out production of such an elastic thread with controlled and limited elasticity. It has to be pointed out that the term rubber in
5 this context means any elastic thread of natural, artificial or synthetic origin.

It is known that in order to strengthen and protect the rubber thread from external agents, it is coil covered with one or more layers of inelastic yarn and the coils are wound on the rubber thread one in the right-hand direction and another in the left-
10 hand direction so as to equalize the thread, while for conferring more or less extensibility, coils are wound more or less compact.

However, if the covered elastic thread is being overstressed with such a stretch as to nearly reach break, said winding forms around the rubber thread many coiled loops, with the result that the more the thread is drawn and stressed, the more the loops are squeezed on the rubber thread, thus fostering its breakage by strangulation, so that in
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this way a control of the extensibility of coil covered elastic thread cannot be obtained.

Therefore, when such an elastic thread is used as elastic string for winding and tying sausages and dressed products in general, such a winding does not result accurate and uniform, and this is the reason why the elastic string still did not reach the large use that it could have for its qualities.

The present invention removes these drawbacks and solves this widely felt problem by inserting, during the operation of covering the thread with the coils of inelastic yarn, one or more inelastic, semirigid or texturized yarns parallel to the stretched rubber thread, so that once the rubber thread is released, it can be extended in use only by the amount determinated by the length of the inelastic or texturized yarns.

The apparatus allowing to carry out this controlled coupling of elastic thread and inelastic or texturized yarns, consists of a coiling machine, suitably modified by the addition of means for inserting one or more inelastic, semirigid or texturized yarns parallel to the elastic thread during the coiling operation, and of means for giving a predetermined stretch to the elastic thread during said coiling operation.

According to the present invention, in order to solve practically the above mentioned problem, a stretched inelastic, semirigid or texturized yarn is laid parallel to one or more tensioned rubber threads.

Texturization confers particular features to an inelastic yarn, namely an original predetermined fixed elongation and a recovery caused by said texturization, called also stretch or elasticization.

The inelastic, semirigid or texturized yarn may be laid parallel to the stretched rubber thread or threads in several ways, namely:

(a) before the coiling operation, i.e. covered by all windings which are being

superposed to it; (b) after the first coiling operation and more particularly before the last winding operation; or (c) an inelastic, semirigid or texturized yarn under each winding effected.

5 If the inelastic, semirigid or texturized yarn is laid as indicated at point (b) above, viz. before the last winding, a considerable advantage is gained, namely the inelastic, semirigid or texturized yarn is caught only by the last winding and therefore has more space to bend or curl, giving rise to many loops longer than those obtained with the system indicates at point (a) above. This greater freedom to bend and curl turns into lower friction and braking on return of the elastic thread in comparison with the
10 system indicated at point (a). The looser loops facilitate also the thread tensioning with time and energy saving.

The inelastic or texturized yarn may comprise several filaments, of different materials and colours, and this may make easier distinction of the various lots of the products or merely for decoration of the finished product.

15 If the inelastic or texturized yarns are laid in the manner indicate at point (c), namely one inelastic or texturized yarn of different colour and material under each winding effected, one obtains the advantage of having colour shades and higher resistance to tensile stress.

20 The present invention facilitates and attains regularity of tension of the elastic thread and therefore uniformity of the finished textile product, i.e. it allows to work with an elastic thread having a very wide recovery capacity or extensibility, as if said elastic thread would not exist, since the loom works on tension of the inelastic yarns.

25 Therefore the present invention is adapte to be used without difficulty either on the Raschel looms or on shuttle looms, as well as on circular knitting machines or any other binding machine.

Moreover the thread so formed according to the present invention, in addition to avoiding strangulation, prevents also yielding of the rubber threads, which would give rise to permanent deformation.

5 The thread, the one elastic and the other inelastic, being of different materials and characteristics, give rise to a thread taking joint advantage of the characteristics of each thread or yarn, said thread being versatile and finding use in making wearing apparel, i.e. opening up the road for using the soft elastic thread, in view of its controlled elasticity.

10 Objects, advantages and features of the improved thread as well as of the method and apparatus for its production, will become apparent and clear from the following detailed description of some embodiments, given as non limiting example only, and made with reference to the accompanying sheets of illustrative drawings, in which:

15 Fig. 1 is an elevational view of a portion of single rubber elastic thread in the relaxed condition, covered with coils of inelastic yarn and parallel coupled with an inelastic, semirigid or texturized yarn laid before the coiling operation;

Fig. 2 is an elevational view of the elastic thread of Fig. 1, but placed under stretching tension;

20 Fig. 3 is an elevational view of a portion of double rubber elastic thread in the relaxed condition, covered with coils of inelastic yarn and parallel coupled with an inelastic, semirigid or texturized yarn laid before the coiling operation;

Fig. 4 is an elevational view of the elastic thread of Fig. 3, but placed under stretching tension;

25 Fig. 5 is an elevational view of a portion of single rubber elastic thread in the relaxed condition, covered with coils of inelastic yarn and parallel coupled with an inelastic, semirigid or texturized yarn laid after the first and before the last coiling

operation;

Fig. 6 is an elevational view of the elastic thread of Fig. 5, but placed under stretching tension;

Fig. 7 is an elevational view of a portion of double rubber elastic thread in the relaxed condition, covered with coils of inelastic yarn and parallel coupled with an inelastic, semirigid or texturized yarn laid after the first and before the last coiling operation;

Fig. 8 is an elevational view of the elastic thread of Fig. 7, but placed under stretching tension; and

Fig. 9 is a schematic partially sectional front view of a coiling machine modified in order to carry out the apparatus adapted to couple to the elastic thread one or more inelastic, semirigid or texturized yarns so as to give it a controlled and limited elasticity.

With reference now to the figures the accompanying drawings, the characteristics of the present invention will appear clearly from the following description of the apparatus adapted to make it, which is illustrated diagrammatically but entirely in its essential elements in Fig. 9.

In order to cover an elastic thread with inelastic yarns such as natural fibers or other synthetic or artifical yarns, coiling machines are used, one of which is indeed shown in Fig. 9, with the modifications required for carrying out the method of producing said elastic thread or string with controlled and limited elasticity.

Coiling machines are generally arranged in banks and each unit consists of two superposed coil forming groups, one group making the coil or winding around an elastic thread in one direction of rotation, and the other group making the coil or winding in the opposite direction of rotation.

More particularly each group is supported by a rigid frame 1 on which a hollow shaft 2 is fixed and preferably screwed, on which by means of ball bearings a rotary holder 3 is mounted, that is being rotated through a driving belt 4 driven by a suitable motor (not shown). On the rotary holder 3 a bobbin 5 is then applied, bearing the feed of inelastic yarn for making the covering coils.

The assembly consisting of the hollow shaft 2, the rotary holder 3 and the bobbin 5 forms the spindle, and therefore for each elastic thread to be covered there are two superposed spindles, one rotating in the S-twist direction of rotation and the other in the opposite Z-twist direction of rotation, the order of the two directions being indifferent.

The rubber elastic thread E to be covered comes from a feeder consisting of several rollers 6 and combs 7, where the rubber thread E coming from a ribbon is divided into individual threads, each to be delivered to a coiling unit; this individual rubber thread E is wound with some turns on a first pulley 8, then inserted in the axial hole of the hollow shaft 2, then crosses the first spindle 5 and at its outlet receives the first covering R_1 of coils of inelastic yarns unwound from bobbin 5 of the first spindle 5.

Thereafter the rubber thread E, now provided with the first covering R_1 , passes through the second spindle Z, arranged at a suitable distance above the first spindle 5, and rotating in the opposite direction thereto. On coming out from the second spindle Z, the rubber thread E receives the second covering R_2 of coils of inelastic yarn unwound from bobbin 5 of the second spindle Z, and then it is wound with some turns on a second pulley 9, rotating at a speed which is slightly higher than that of the first pulley 8, so that this speed difference causes a certain elongation or tension of the elastic thread E during the covering operation.

What described up to now is generally the operation of a normal coiling machine. According to the present invention however, to the rubber thread E one or more inelastic, semirigid or texturized yarns $A_1 - A_2$ are coupled, coming from suitable feeding cones 10, 10' so that these inelastic yarns $A_1 - A_2$ parallel coupled to the stretched rubber thread E, are covered together with it by the covering coils R_1 and R_2 and the whole is finally wound on the take-up roller 11, where the composite thread so produced, being no more under tension, will be relaxed as much as the rubber thread E was stretched between the pulleys 8 and 9, giving rise to many little creases, curls Ap or loops A_n in the coupled inelastic, semirigid or texturized yarns $A_1 - A_2$.

By coupling only yarns A_1 , one obtains a thread of the above indicate type (a); by coupling only A_2 , one obtains a thread of the type (b), and coupling both yarns A_1 and A_2 one obtains a yarn of the type (c).

In this way one obtains a thread with advantages and novel features, consisting of the inelastic, semirigid or texturized yarn or yarns coupled to the stretched rubber thread, the whole covered by the coils of inelastic yarn and equalized, which in use will have a controlled and limited elongation or elasticity, without making the rubber thread dependent upon the winding.

Therefore one obtains a soft winding on the rubber thread and a predetermined fixed elongation of the inelastic, semirigid or texturized yarn or yarns, parallel coupled to the elastic rubber thread covered as above stated. With these characteristics it is possible to put the produced thread under maximum tension, without stressing too much the rubber thread or the coils, by fixing beforehand the desired elongation or stretch.

Clearly the number of yarns forming the produced composite thread may be varied.

Therefore the elastic rubber thread E may consist of one, two or more parallel

threads, and also the inelastic, semirigid or texturized yarn A may in turn consist of one, two or more parallel inelastic yarns, and also the number of yarns forming each of the coils R_1 and R_2 may be varied, and more particularly the coils R_1 and R_2 may each consist of the same or different number of inelastic yarns. Moreover the winding
5 may also be single and in this case the coiling machine would obviously have only one spindle.

Two first embodiments of threads made according to the above indicated system (a), i.e. coupling an inelastic, semirigid or texturized yarn A_1 laid before any coiling operation, are shown in Figs. 1-4 in the relaxed condition, where the elastic thread 4
10 causes creases and curls A_p of the inelastic, semirigid or texturized parallel coupled yarn A_1 , and in the tensioned condition of use, where the maximum elongation is determined by the maximum stretched length of the coupled inelastic, semirigid or texturized yarn A_1 .

Two other embodiments of threads made according to the above indicated system (b), i.e. coupling an inelastic, semirigid or texturized yarn A_2 laid before the last
15 coiling operation, are shown in Figs. 5-8 in the relaxed condition, where the elastic thread E causes loops A_n of the inelastic, semirigid or texturized parallel coupled yarn A_2 , and in the tensioned condition of use, where the maximum elongation is determined by the maximum stretched length of the coupled inelastic, semirigid or
20 texturized yarn A_2 .

A man skilled in the art will easily recognize the several applications and considerable advantages of such a controlled elasticity thread, and it is also to be understood that many variations, additions, modifications and/or substitutions of elements may be resorted to the invention, without departing however from its spirit
25 and object nor falling outside its scope of protection, as it is also defined in the appended claims.

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CLAIMS

1. Elastic rubber thread covered with one or more coils of inelastic yarn, characterized by the fact of comprising one or more elastic threads which are coupled, while being stretched with a predetermined elongation during the coiling operation,
5 with one or more inelastic, semirigid or texturized yarns laid parallel to said elastic threads, so that the assembly of coupled threads and yarns is enveloped by the coils, and once relaxed the rubber thread may then be extended in use only for the amount determined by the length of the inelastic yarn coupled thereto.

2. Rubber thread according to Claim 1, characterized by the fact that the coils,
10 when are multiple, may comprise an equal or different number of inelastic yarns and may be wound forming coils with opposite direction of rotation.

3. Rubber thread according to Claims 1 and/or 2, characterized by the fact that the inelastic, semirigid or texturized yarn or yarns are laid before any coiling around the elastic thread or threads, so as to be covered by all the coils.

15 4. Rubber thread according to Claims 1 and/or 2, characterized by the fact that the inelastic, semirigid or texturized yarn or yarns are laid after the first coiling and more particularly before the last coiling, with a greater creasing and curling freedom.

5. Rubber thread according to Claims 1 and/or 2, characterized by the fact that the inelastic, semirigid or texturized yarn or yarns are laid under each coiling or
20 winding effected.

6. Elastic rubber thread covered with one ore more coils, with controlled and limited elasticity, substantially as hereinbefore described and as illustrated in the figures of the accompanying drawings.

7. Method for the production of an elastic rubber thread covered with one or more
25 coils with controlled and limited elasticity, characterized by the fact of coupling to

the rubber thread or threads, held stretched by a predetermined amount during the coil winding operation, one or more inelastic, semirigid or texturized yarns laid parallel to said threads, and then relaxing the composite thread so obtained, in order that the coupled inelastic, semirigid or texturized yarn or yarns form many creases, curls or loops which are stretched in use and determine the amount of elongation admissible for the elastic thread or threads parallel thereto.

8. Method according to Claim 7, characterized by the fact that the predetermined elongation of the elastic threads during the coiling operation is effected by creating a difference between a lower thread feeding speed and a higher thread drawing speed at the end of the coiling operation.

9. Method according to Claims 7 and/or 8, characterized by the fact that the inelastic, semirigid or texturized yarn or yarns are laid before any coiling operation around the elastic thread or threads so as to be covered by all the coils.

10. Method according to Claims 7 and/or 8, characterized by the fact that the inelastic, semirigid or texturized yarn or yarns are laid after the first coiling operation and more particularly before the last coiling operation, with greater creasing and curling freedom.

11. Method according to Claims 7 and/or 8, characterized by the fact that the inelastic, semirigid or texturized yarn or yarns are laid under each coiling or winding effected.

12. Method for the production of an elastic rubber thread covered by one or more coils with controlled and limited elasticity, substantially as hereinbefore described and as illustrated in the accompanying drawings, for the above mentioned objects.

13. Apparatus for the production of an elastic rubber thread covered by one or more coils with controlled and limited elasticity, characterized by the fact of

consisting of a coiling machine comprising one or more superposed spindles, winding coils of inelastic yarns on one or more elastic threads, means being added to said machine for coupling to the elastic threads one or more inelastic, semirigid or texturized yarns parallel to said threads, and means for placing the elastic threads
5 under controlled elongation or stretch during the coil winding operation.

14. Apparatus according to Claim 13, characterized by the fact that said means for coupling the inelastic, semirigid or texturized yarns parallel to the elastic threads, comprise one or more feeding bobbins for the inelastic yarns and guide and drive means for said inelastic, semirigid or texturized yarns up to the insertion in the axial
10 hole of one or more spindles for winding the coils.

15. Apparatus according to Claim 13, characterized by the fact that said means for placing the elastic threads under controlled elongation or stretch during the coil winding operation, comprise two pulleys for winding the threads, of which one is arranged before inlet of threads in the spindles and rotating at a lower speed, and the
15 other is arranged at the outlet of threads from the spindles and before winding on the take-up roller and rotates at a speed slightly higher than the first pulley, so as to carry out said controlled elongation or stretch in the elastic threads.

16. Apparatus for the production of an elastic rubber thread covered by one or more coils with controlled and limited elasticity, substantially as hereinbefore
20 described and as illustrated in the accompanying drawings, for the above mentioned objects.

Fig. 4

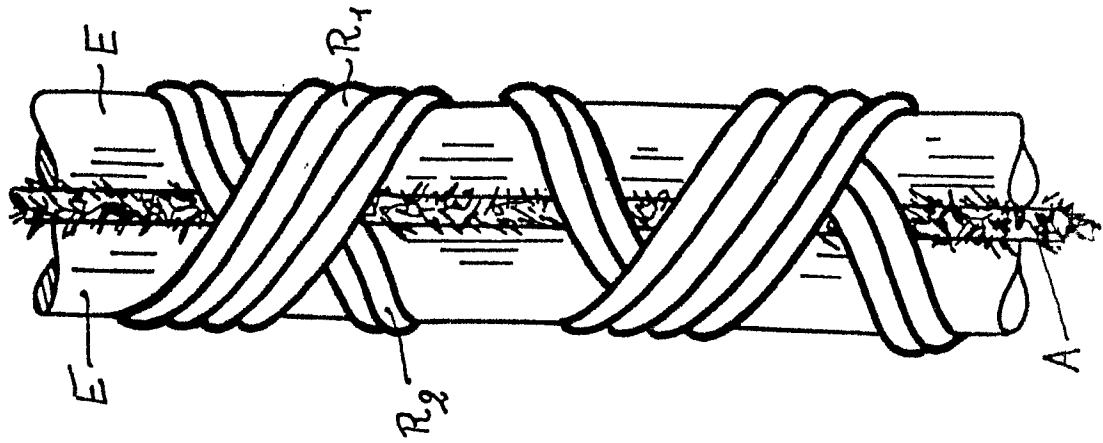


Fig. 2

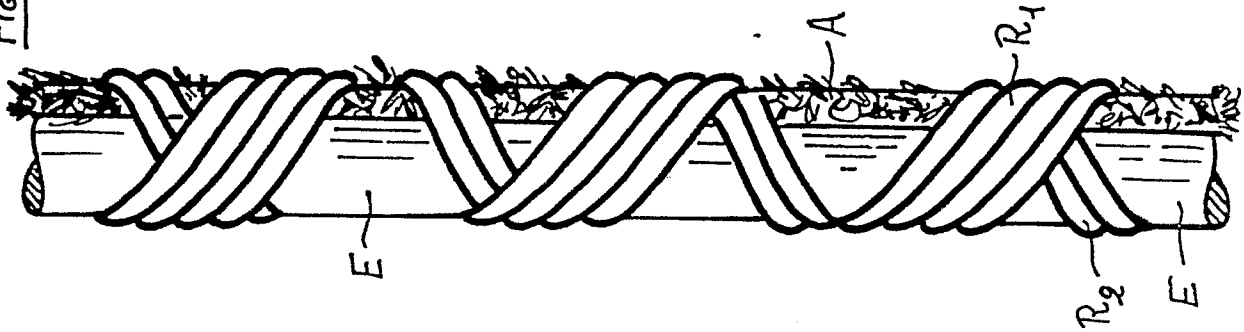


Fig. 1

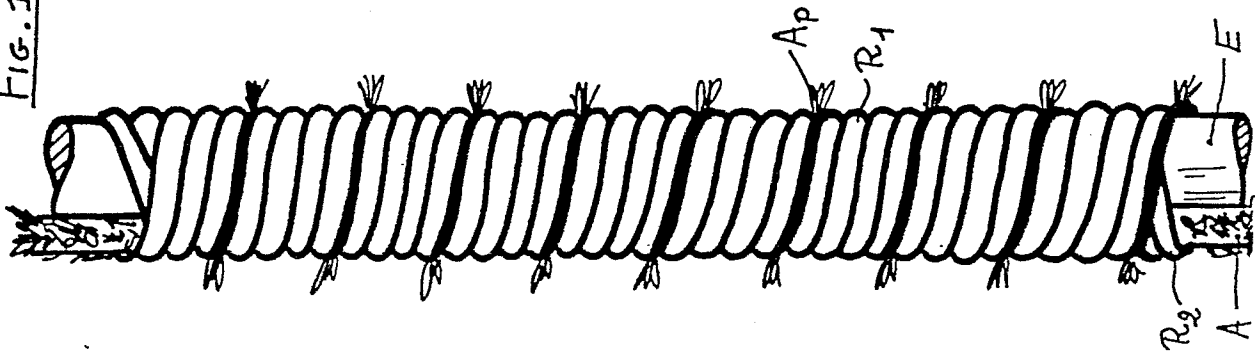


Fig. 3

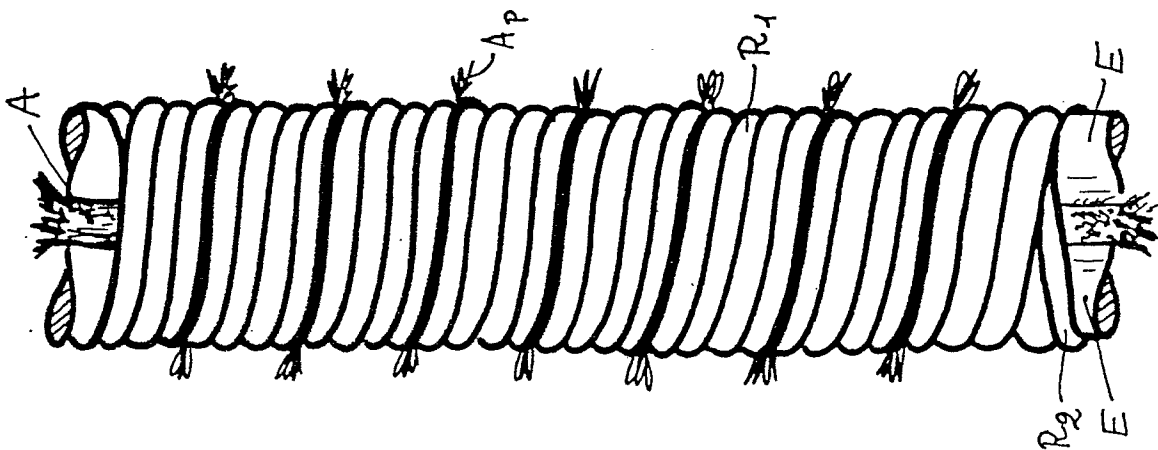


FIG. 6

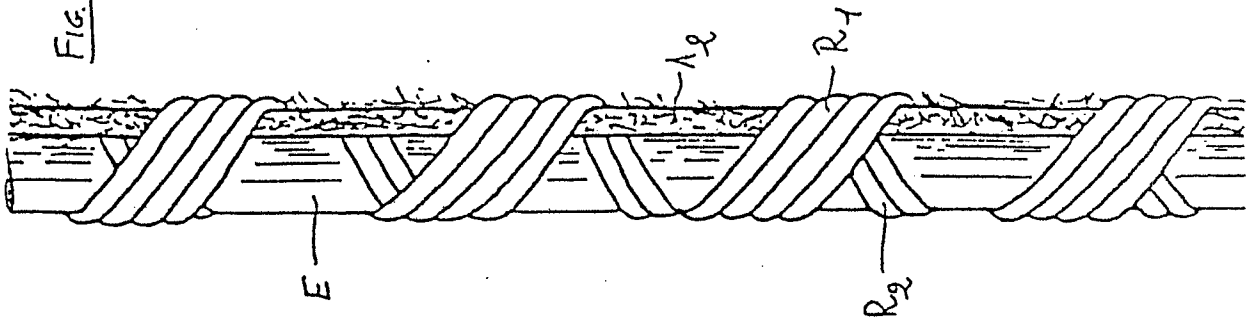


FIG. 8

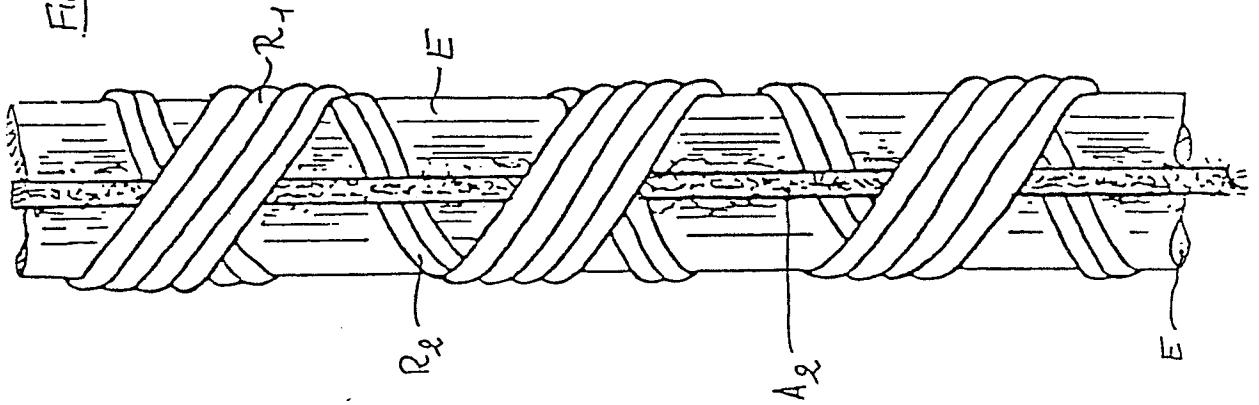


FIG. 5

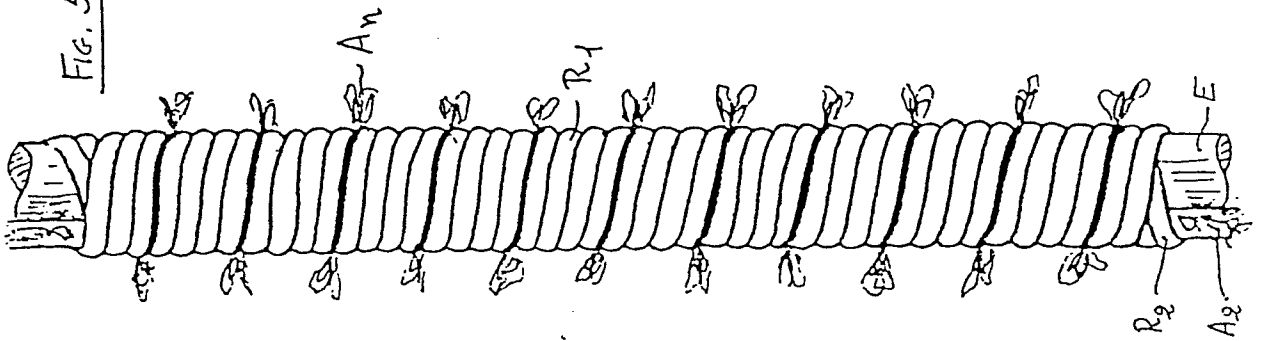


FIG. 7

