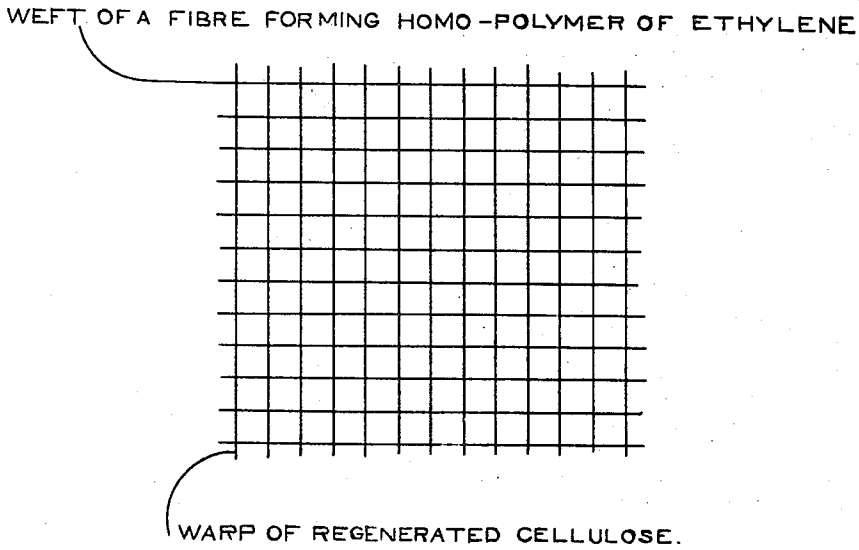
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METHOD OF TIRE BUILDING AND MATERIAL USED THEREIN

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METHOD OF TIRE BUILDING AND MATERIAL USED THEREIN

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This invention relates to textile reinforcement and especially to automobile tyres and other articles having a basis of rubber or a rubber substitute and provided with a textile reinforcement.

It is common practice to provide pneumatic tyres with textile reinforcement in the form of cords, for example of cotton or artificial silk. Usually the tyre-body is provided with an even number of layers of cords, all the cords in a particular layer being substantially parallel and the cords of one layer crossing those of the next. To facilitate handling of the layers of cord, it is common for the cords of each layer to be interwoven with relatively weak and widely spaced weft yarns to form a so-called tyre fabric. In the finished tyre these weft yarns are redundant. Their presence hampers the building up of the tyre in the optimum form and they may produce wear in the cords.

Various methods of avoiding the difficulty referred to above have been proposed. Thus, for example, it has been proposed to form the weft of unvulcanized rubber threads. The elastic properties of these threads, however, introduce serious difficulties in weaving the tyre fabric and avoiding subsequent distortion thereof. An alternative suggestion is to form the weft of plastic material having a basis of vulcanised natural rubber. The great extensibility and relative weakness of such threads, however, also introduces difficulties in weaving the tyre fabric and in its subsequent manipulation. It has therefore been proposed to form the weft of threads having a basis of unvulcanised natural rubber and to employ a non-elastic substance, for example gelatine, either as a size applied to the weft threads before weaving or as a constituent of the composition from which the threads are formed, with a view to temporarily suppressing the elasticity of the rubber. The substance employed to suppress the elasticity is removed after the tyre fabric has been woven and before the building up of the tyre-body. When such methods are adopted, however, the fact that the rubber-like elasticity of the weft threads is restored before the building up of the tyre-body introduces difficulties in manipulation.

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A method representing an improvement on the methods referred to above is described in United States Patent No. 2,147,736 according to which the weft is formed of an organic derivative of cellulose which, at the temperature of vulcanisation, melts, disintegrates, or loses its strength.

In the tyre fabrics or like textile re-inforcing structures of the present invention, the weft is composed of fibre-forming material which does not exhibit rubber-like elasticity at ordinary temperature and which is adapted when heated, e. g. during vulcanisation of the tyre, to merge with the rubber or rubber-substitute forming the basis of the tyre-body.

The drawing shows a diagrammatic view of a type of woven tyre fabric.

The weft threads of the fabrics of the invention may melt at the temperature of vulcanisation and form solid solutions with the rubber of the tyre-body, or they may, at that temperature, develop sufficient tack to merge with the rubber without melting. The weft threads should possess sufficient strength to undergo the weaving operation and to keep the cords forming the warp of the fabric in position during the subsequent manipulation involved in incorporating the fabric in the tyre-body.

The use in the tyre fabrics of the invention of a weft which merges with the rubber on vulcanisation makes possible the use of high tenacity cords of smaller cross-sectional area than could be used if allowance had to be made for the weakening effect on such cords of constant rubbing contact with weft yarns during the use of the tyre. Thus the invention is important in enabling the advantages of high tenacity cords to be realised to the full. Moreover the disappearance of the weft during vulcanisation facilitates adhesion of the rubber to the cords.

Suitable materials from which to form the weft threads are linear polymers which are hy-

drocarbons and do not exhibit rubber-like elasticity at ordinary temperatures. The preferred material from which to form the weft threads is polythene. Another hydrocarbon polymer that can be used is polystyrene.

Rubber derivatives can also be used as a basis for the weft threads. Examples of rubber derivatives are chlorinated rubber, rubber hydrochloride, hydrogenated rubber, oxidised rubber, and cyclic rubbers obtained for example by reacting upon rubber with polyvalent metallic halides or with sulphur-containing oxy-acids or the chlorides of such acids. Among the most suitable rubber derivatives for the purpose are the derivatives obtainable by reacting upon rubber (or other polymerised dienes, e. g. poly-butadiene and co-polymers of butadiene with styrene) with para-phenol sulphonic acid, para-toluene sulphonyl chloride and like sulphonic acids and sulphonyl chlorides, or with sulphuric acid.

Materials from which weft threads having the desired properties can be formed are also to be found among celulose ethers containing radicles of higher aliphatic mono-hydric alcohols, i. e. alcohols containing 5 or more carbon atoms for example, amyl cellulose, amyl ethyl cellulose, hexyl cellulose and hexyl ethyl celluose.

A further aternative is to employ for the weft, threads of natural rubber which have been lightly vulcanised, for example by means of sulphur chloride in the cold while highly stretched, the degree of vulcanisation being sufficient to prevent the contraction of the threads at ordinary temperatures, so rendering them substantially free from rubber-like elasticity at such temperatures, but insufficient to prevent them merging with the rubber stock at the temperature of vulcanisation of the tyre body.

Various textile materials can be employed as the basis of the warp cords in the tyre fabrics of the invention. Among such materials are cotton, regenerated cellulose, polyhexamethyleneadipamide and like linear condensation polymers and polyvinylidene chloride. The textile material employed must be strong, water-resistant, capable of being united to the rubber of the tyre-body and able to withstand the temperatures encountered in vulcanisation and in the running of the tyre without undesirable loss of tenacity.

It is preferred to employ as the material for the warp, cords composed of high tenacity fibres (preferably continuous filaments) of regenerated cellulose such as are obtained by stretching cellulose acetate yarns in steam or hot water, or an organic stretch-assisting agent, to many times their original length and saponifying the resulting high tenacity cellulose acetate yarns. Between the stretching and saponification stages the yarns may if desired be shrunk, e. g. by the action of methylene dichloride or other shrinking agent, to increase the extension. By such methods regenerated cellulose yarns of tenacities ranging from 2 or 3 grams per denier or less up to 6 or more grams per denier can be obtained. It is of special advantage in the production of such tyre cords to employ a cellulose acetate of high viscosity i. e. a cellulose acetate of which a 6% solution in acetone at 25° C. has a viscosity at least 40% and preferably from 40 to 100 or even 200% of that of glycerine at the same temperature. The use of such high viscosity cellulose acetates enable cords to be produced which are of high tenacity even when wet.

Suitable constructions for the warp cords will be found for example in United States Patents

Numbers 2,346,759 and 2,324,583. The cords may contain a lubricant as described in United States Patent No. 2,201,992. Tricresyl phosphate may be employed with considerable advantage for this purpose.

Before incorporation in the tyre-body the cords may be given a treatment adapted to facilitate adhesion between the tyre cords and the rubber of the tyre-body. This treatment may, for example, comprise the application to the cords of rubber latex or other dispersion of rubber or a rubber-like substance, or of a solution of rubber or a rubber-like substance, or of dispersions or solutions containing in addition to the rubber or rubber-like substance, a synthetic resin, for example a thermosetting condensation product of formaldehyde or a like acting aldehyde with a phenol. When such a treatment is given to the cords it will usually be most convenient to apply the treating agent to the tyre fabric as a whole. Naturally, when this is done, care must be taken that the nature of the treatment is not such as to destroy or unduly weaken the weft of the tyre fabric, or to prevent it from merging with the rubber during vulcanisation.

The following example illustrates the invention:

Example

A tyre-cord is made by doubling together 3 ends of 733 denier regenerated cellulose yarn of tenacity above 5 grams per denier, this yarn being made by complete saponification of a high tenacity yarn made by stretching dry-spun cellulose acetate yarn in steam to about 10 times its original length.

A tyre-fabric is woven using this cord as the warp, and a 350 denier polythene thread obtained by cold-drawing a thread of heavier denier to about 500% of its original length, as the weft.

The fabric is impregnated at ordinary temperature with a solution of rubber in toluene, said solution having a viscosity of about 10 centistokes at 25° C., and is dried at a temperature of 60 to 70° C. in a current of hot air. It is then coated on the calender with a vulcanisable natural-rubber mix and cut into suitably shaped lengths for building up the tyre-carcase. A pneumatic tyre is then built up, its carcase being formed of layers of the impregnated fabric. The tyre is vulcanised under the usual conditions and during this operation the weft threads lose their identity and merge with the rubber.

The invention has been described with particular reference to the construction of tyre fabrics for pneumatic tyres having a basis of rubber. The fabrics of the invention can also be employed however in the construction of pneumatic tyres of rubber substitutes, e. g. poly-butadiene, polychloroprene, co-polymers of butadiene or isoprene with mono-olefinic compounds such as styrene and isobutylene, and other polymers and co-polymers of dienes. The principle of the invention can also be applied in the construction of reinforcing fabrics for other articles having a basis of rubber or a rubber-substitute and requiring a weft-less cord reinforcement, e. g. in driving belts or conveyor belts of rubber, balata or a rubber substitute.

Having described the invention, what it is desired to secure by Letters Patent is:

1. A tire fabric for pneumatic tires, said fabric having a weft composed of a fibre-forming homopolymer of ethylene and a warp of continuous filament yarns of regenerated cellulose having a tenacity of at least 2 grams per denier.

2. Process for the manufacture of pneumatic tires, wherein the tire carcass is built up of layers comprising a tire fabric coated with a vulcanizable natural rubber mix, said tire fabric having a weft of a fibre-forming homopolymer of ethylene and a warp of continuous filament yarns of regenerated cellulose having a tenacity of at least 2 grams per denier.

CLAUDE BONARD.

Administrator of the Estate of the Said Henry Dreyfus.

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