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FABRIC AND METHOD OF MAKING SAME

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17 Claims. (Cl. 154—2)

This invention relates to a woven fabric comprising heavy warp threads and fine weft threads that are made such that they become ineffective upon the application of heat and to the use of such a fabric in rubber articles such as tires.

An object of the invention is the economic and expeditious production of a cord tire or similar article requiring a fabric having ineffective weft threads in the finished product. Other objects of the invention will appear from the following detailed description.

In the manufacture of tires and other rubber articles there is desired a cord or rope fabric in which there is little or no drag of the weft on the warp. When the weft exerts an action upon the warp, the warp does not lie in a straight line but must flex to a certain extent over and under the weft threads. Also in the use of the article there is a continual flexing action in which the weft threads cut into the warp threads thus weakening same. The result of the bending of the cord or rope warp is to weaken the article allowing it to stretch, while the result of the cutting action of the weft on the warp is to lessen the durability of the finished article.

By this invention there is produced a fabric that is tough and holds its weave shape exceptionally well yet when incorporated with the rubber and subjected to vulcanizing temperatures its weft threads become inoperative allowing the cords of the warp to lie straight and in future flexing of the article there is no cutting action by the weft threads on the warp threads. This fabric will withstand the processing steps in the manufacture of rubber articles, wherein the fabric imbedded therein is cut to shape and fitted into the rubber and otherwise handled, while remaining a tight durable fabric in which there will be no separation or overlapping of the cord or ropes forming the warp. For this purpose, a strong durable weft is required which, however, is reduced or disintegrated to an ineffectual noninjurious weft in the finished article.

According to this invention the weft of the fabric is formed of yarns or filaments of organic derivative of cellulose that contain suitable quantities of suitable solvents for the organic derivatives of cellulose that act as solvents only at elevated temperatures preferably at the temperature of vulcanization of rubber. There is thus produced a fabric that may be embedded in the rubber, that is firm and that may be handled and worked without a separation of the warp cords. Although the fabric is firm while being worked into an article after heat treatment of the article the weft threads are substantially destroyed leaving the properly placed cords of the warp properly imbedded in the rubber and unaffected by the treatment that destroyed the weft threads.

According to a modified form of the invention the weft of the fabric is formed of a fine denier yarn of organic esters of cellulose having a small number of twists per inch. The yarn is preferably of about 100 denier or below and has a twist of about 0.5 to 2 turns per inch. This fabric may be worked with rubber to build such articles as automobiles tires etc. that are vulcanized by the application of heat and pressure. In the application of heat for the vulcanization of the article, this low denier yarn becomes sufficiently soft to be easily stretched so that the warp yarns will lie straight. In the use of the article, the elastic limit of the weft yarns will soon be overcome and it will stretch in the article to such an extent so as to lose completely its cutting power on the rope warp.

The warp of the fabric may be formed of any desired type of material such as cotton, wool, silk, hemp, etc. This invention however is especially applicable to tire making wherein the fabric used contains a warp of heavy cotton cords or rope. The warp however may be yarns, threads, cords or ropes. Articles other than tires made of rubber or similar plastics that contain imbedded fabric as a strengthening medium and are cured, vulcanized or set by the application of heat may be formed efficiently employing this invention, such as, for example, water hose, gasoline pump hose, water bags and containers and like objects.

The weft of the fabric is yarns or filaments of organic esters or ethers of cellulose. Examples of organic esters of cellulose are cellulose acetate, cellulose formate, cellulose propionate and cellulose butyrate while examples of organic ethers of cellulose are ethyl cellulose, methyl cellulose, butyl cellulose and benzyl cellulose.

The yarns or filaments of organic esters or ethers of cellulose contain from 5 to 30% by weight of latent solvents for the particular derivative of cellulose employed which latent solvent preferably has no solvent action thereon at normal temperatures but which become solvents at elevated temperatures. Examples of such latent solvents for cellulose acetate are dimethyl phthalate, monoethyl-para-toluene sulfanimide, monomethyl-xylene sulfonamide, dibutyl tartrate, phthalic acid di-ester of hypothetical methylene glycol monomethyl ether and similar

solvents. These compounds are preferably relatively nonvolatile and have no action on the cellulose acetate at normal temperatures but at temperatures of about 125° C. or above they are actual solvents therefor. It is preferable to use a sufficient amount of the latent solvent that it may totally dissolve the organic derivative of cellulose at the elevated temperatures and not act as a mere swelling agent.

The latent solvent may be applied to the yarns or filaments as a coating during any winding operation in the spinning, twisting or other processing step in which the yarns or filaments are being wound. The latent solvent may be incorporated with the yarn or filaments by swelling the filaments with swelling agents prior to application of the solvent. Examples of swelling agents for cellulose acetate are the thiocyanates of ammonium, sodium, potassium and calcium, zinc chloride, dilute phenol, dilute acetone, pyridine, the ethers and esters of glycol and ethyl ether of ethylene glycol. The latent solvent may be applied to the yarns or filaments from solution or emulsions of same. Thus a 10% of monoethyl-para-toluene sulfonamide in benzol may be applied to yarns or filaments by means of wicks, furnishing rollers, discs etc. that dip into the solution and over which the yarns or filaments are drawn.

In place of applying the latent solvent to the formed filaments the same may be added to the spinning solution from which the filaments are to be spun by either a dry evaporative method or by a wet spinning process. By this method large amounts of the latent solvent may be added to the organic derivative of cellulose without imparting a greasy feeling to the resulting yarn.

In place of applying the latent solvent to the yarn or filaments as such it may be applied to the woven fabric. This may be done by spraying, dipping or padding the fabric with a solution or emulsion of the latent solvent. The latent solvent has no effect on the warp of the fabric, it however coats and is absorbed by the warp thus requiring a greater quantity thereof than in treating the weft yarns separately.

The fabric may be woven in the manner and on the same machines as ordinarily used for weaving like fabrics. The fabric may be worked with the rubber or other similar plastic in the ordinary way and the article vulcanized or cured by application of heat, thus automobile tires may be formed using the specially prepared fabric in the same way as when using other types of fabric. After formation of the tire it may be subjected to heat and pressure for the purpose of vulcanizing same. The temperature of vulcanization may be between 125° and 200° C. at which temperatures the solvent acts to destroy the weft threads. The weft threads become plastic and without strength while thus heated allowing the warp cords to assume a straight position. After cooling, the weft threads being somewhat disintegrated are without strength and exert no binding or cutting action on the warp cords. For the purpose of further describing the invention without desiring to be limited thereto the following examples are given:

Example I

Yarns consisting of cellulose acetate filaments are drawn over a furnishing roller that dips into a 10% solution of dimethylphthalate in benzol thus coating the yarns with 11%, based on the weight of the yarn, of dimethyl phthalate. This yarn is woven as the weft thread into a warp consisting of heavy cotton cords to form a tire fabric. The fabric is worked with rubber into a tire that is vulcanized at 150° C. temperature and super atmospheric pressure. The fabric is found to be rigid and the warp cords held firmly in place during the building of the tire. After vulcanization the fabric is found to consist of uneffected warp cords and strengthless ineffectual weft yarns.

Example II

Example I is repeated except that 20% on the weight of the yarn of monoethyl-para-toluenesulfonamide was used in place of dimethyl phthalate. The same results are obtained as in Example I.

Having described the invention what I desire to secure by Letters Patent is:

1. Method of forming a rubber tire or like vulcanized rubber article, which comprises embedding in rubber a cord fabric containing weft yarns of organic derivatives of cellulose that become ineffective at vulcanization temperatures, and shaping the article from the material thus formed, and thereafter subjecting the article to vulcanization.

2. Method of forming a rubber tire or like vulcanized rubber article, which comprises embedding in rubber a cord fabric containing weft yarns of cellulose acetate that become ineffective at vulcanization temperatures, and shaping the article from the material thus formed, and thereafter subjecting the article to vulcanization.

3. Method of forming a rubber tire or like vulcanized rubber article, which comprises embedding in rubber a cord fabric containing weft yarns of organic derivatives of cellulose that have applied thereto a relatively non-volatile substance that is a solvent for the organic derivative of cellulose at vulcanization temperatures, and shaping the article from the material thus formed, and thereafter subjecting the article to vulcanization.

4. Method of forming a rubber tire or like vulcanized rubber article, which comprises embedding in rubber a cord fabric containing weft yarns of cellulose acetate that have applied thereto a relatively non-volatile substance that is a solvent for the cellulose acetate at vulcanization temperatures, and shaping the article from the material thus formed, and thereafter subjecting the article to vulcanization.

5. A material for making vulcanized rubber articles, comprising a shaped rubber composition having embedded therein a fabric, the weft yarns of which contain an organic derivative of cellulose and become ineffective at vulcanization temperatures.

6. The method of forming rubber tires and like articles which comprises imbedding in uncured rubber a cord fabric containing weft yarns of organic derivatives of cellulose that have been pretreated with a substance that is a solvent for the organic derivatives of cellulose at the vulcanization temperature of the rubber and vulcanizing the rubber.

7. The method of forming rubber tires and like articles which comprises imbedding in uncured rubber a cord fabric containing weft yarns of cellulose acetate that have been pretreated with a substance that is a solvent for the cellulose acetate at the vulcanization temperature of rubber and vulcanizing the rubber.

8. The method of forming rubber tires and like

articles which comprises imbedding in uncured rubber a cord fabric, said fabric containing cotton rope warp and organic derivatives of cellulose weft yarns, the weft yarns having applied thereto a substance that is a solvent for the organic derivatives of cellulose at the vulcanization temperature of the rubber and vulcanizing the rubber.

9. The method of forming rubber tires and like articles which comprises imbedding in uncured rubber a cord fabric, said fabric containing a cotton rope warp and cellulose acetate weft yarns, the weft yarns having applied thereto a substance that is a solvent for the cellulose acetate at the vulcanization temperature of the rubber and vulcanizing the rubber.

10. A material for making vulcanized rubber articles comprising a shaped rubber composition having imbedded therein a fabric, the weft yarns of the same containing an organic derivative of cellulose and a substance that is a solvent for organic derivatives of cellulose at vulcanization temperature.

11. A material for making vulcanized rubber articles comprising a shaped rubber composition having imbedded therein a fabric, the weft yarns of the same containing cellulose acetate and a substance that is a solvent for cellulose acetate at vulcanization temperature.

12. A material for making vulcanized rubber articles comprising a shaped rubber composition having imbedded therein a fabric, the warp yarns consisting of cotton cords and the weft yarns consisting of organic derivatives of cellulose and a substance that is a solvent for the organic derivative of cellulose at vulcanization temperature.

13. A material for making vulcanized rubber articles comprising a shaped rubber composition having imbedded therein a fabric, the warp yarns consisting of cotton cords and the weft yarns consisting of cellulose acetate and a substance that is a solvent for the cellulose acetate at vulcanization temperature.

14. Cord fabric comprising a warp consisting wholly of relatively heavy cords composed of material other than an organic derivative of cellulose that do not become ineffective at vulcanization temperatures and a weft consisting wholly of relatively light yarns containing an organic derivative of cellulose that become ineffective at vulcanization temperatures.

15. Cord fabrics comprising a warp consisting wholly of relatively heavy cords composed of material other than an organic derivative of cellulose that do not become ineffective at vulcanization temperatures and a weft consisting wholly of relatively light yarns containing an organic derivative of cellulose to which has been added a substance that is a solvent for the organic derivative of cellulose at vulcanization temperatures, which weft yarns become ineffective at vulcanization temperatures.

16. Cord fabric comprising a warp consisting wholly of relatively heavy cords composed of material other than cellulose acetate that do not become ineffective at vulcanization temperatures and a weft consisting wholly of relatively light yarns containing cellulose acetate that become ineffective at vulcanization temperatures.

17. Cord fabrics comprising a warp consisting wholly of relatively heavy cords composed of material other than cellulose acetate that do not become ineffective at vulcanization temperatures and a weft consisting wholly of relatively light yarns containing cellulose acetate to which has been added a substance that is a solvent for the cellulose acetate at vulcanization temperatures, which weft yarns become ineffective at vulcanization temperatures.

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CERTIFICATE OF CORRECTION.

Patent No. 2,147,736. February 21, 1939.

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It is hereby certified that error appears in the printed specification of the above numbered patent requiring correction as follows: Page 1, second column, line 52, for "sulfanimide" read sulfonamide; page 2, first column, line 24, after "10%" insert the word solution; and that the said Letters Patent should be read with this correction therein that the same may conform to the record of the case in the Patent Office.

Signed and sealed this 18th day of April, A. D. 1939.

Henry Van Arsdale

(Seal) Acting Commissioner of Patents.