

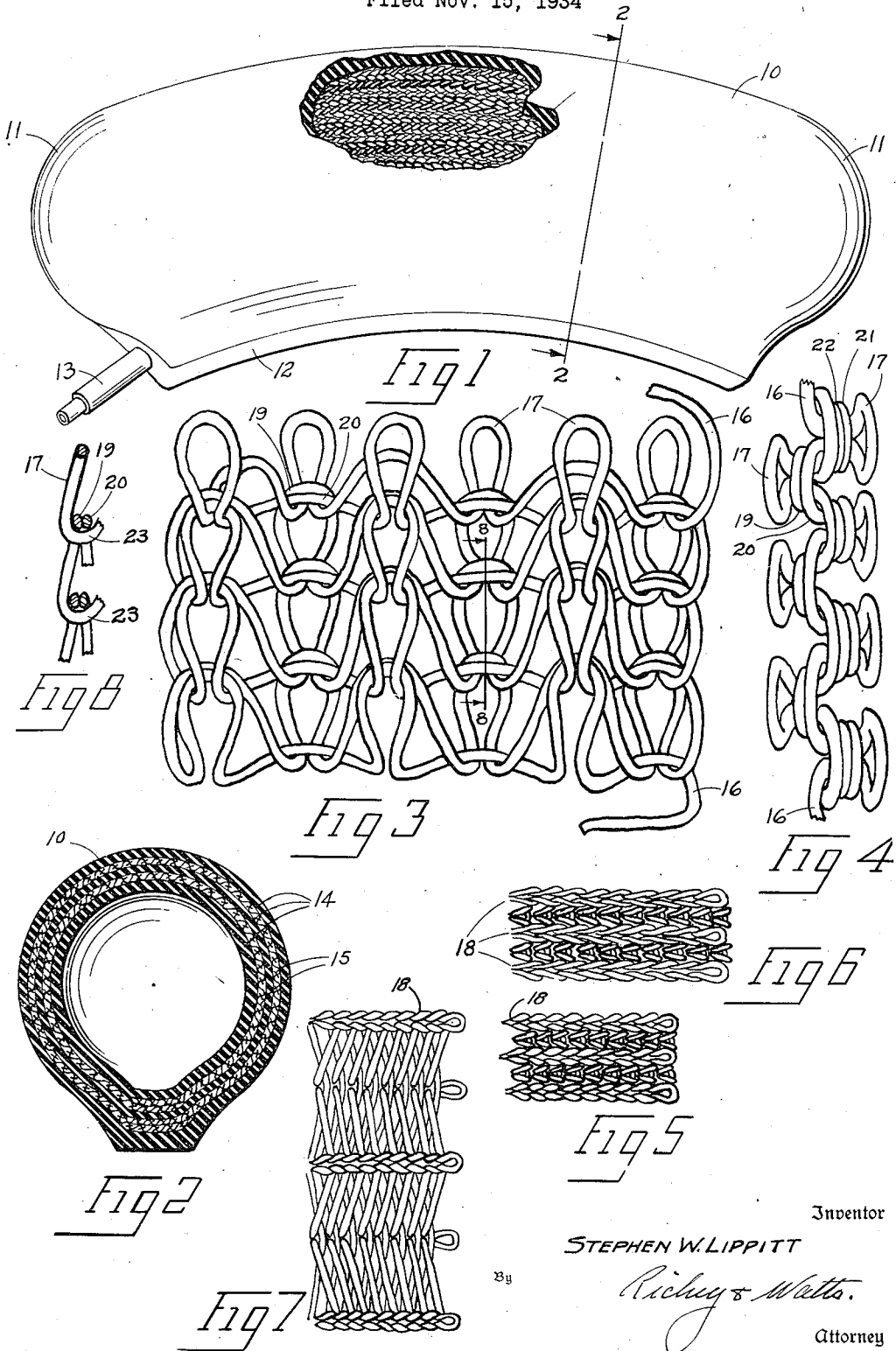
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AIR BAG FOR MENDING PNEUMATIC TIRES

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AIR BAG FOR MENDING PNEUMATIC
TIRES

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This invention relates broadly to air bags for use in vulcanizing pneumatic tire casings during the repair thereof and more specifically to an improved fabric for reinforcing the body of such air bags.

In the construction of certain of the commercially recognized segmental air bags of current manufacture, the body or carcass of the air bag is formed of a so called "cord" reinforcing material. This material constitutes, in the strictest sense, a fabric comprising a plurality of relatively heavy warp threads separated and held together by light widely separated weft threads. The warp threads or cords are disposed in the aforesaid air bags parallel the longitudinal axis thereof while the weft threads are arranged within the circumference thereof, that is, within the perimeter of a transverse section of the bag.

In theory it is presumed that the longitudinal cords constitute tension members which delimit elongation of the bag. It is also presumed that circumferential expansion of the bag will occur during the inflation thereof since the warp threads or cords are transversely unrestricted and therefore subject to deflection from the parallel relation in which they are arranged in their unstressed form.

In practice it has been found that a cord fabric of adequate strength to sustain the stress imposed thereon when the air bag is inflated must necessarily be formed with the longitudinal warp threads or cords in intimate parallel engagement. When the fabric is so formed it is impossible to force the uncured rubber between the strands thereof or to fully coat each separate cord when the material is calendered. Moreover, it is impossible to impregnate the cords with rubber to any appreciable depth during the vulcanizing operation. The cords embodying the fabric are therefore, uninsulated from each other and are bonded transversely only by the thin film of rubber which adheres to the upper and lower face of the calendered sheet. Such fabric is consequently incapable of transverse flexure without fracture and is susceptible of only such longitudinal elongation as is inherent in the cords per se. Transverse yieldability of the fabric or circumferential expansion of the air bag is also impossible without rupture of the weft threads in the fabric. In the event such rupture should occur undue strains would be imposed upon the warp threads within the zone of the fracture thus imposing unequal tension upon the warp threads in other portions of the fabric.

The fabric constituting the present invention

is formed by knitting a single continuous cord in a looped and interlooped manner to form longitudinal ribs which are unsusceptible of any appreciable elongation. The loops forming these ribs are joined by a second series of loops or strands which are formed to permit substantial lateral extensibility of the fabric.

Among the objects of the present invention is the provision of a knitted fabric which is constructed when suitably assembled in the bag to restrain elongation of the bag yet permit circumferential expansion of the central portion thereof.

Another object of the invention is to provide a fabric which is formed with an open mesh capable of permitting the flow of rubber between the strands or loops thereof when the material is coated with rubber and calendered.

Another object of the invention is to form a knitted fabric in which the strands are double looped within the loops forming the ribs thereon and in which the rib loops are formed so that tensile strains imposed longitudinally thereon will be borne within relatively large arcuate bends thus obviating the tendency of shearing the cords at the throat of the respective loops.

Another object of the invention is to form a fabric which when coated with rubber and formed into an air bag will expand laterally more readily than an air bag reinforced with a woven fabric or a similar material embodying warp and weft threads or a fabric having longitudinal cords thereon to delimit the extensibility of the fabric.

Other objects more or less ancillary of the foregoing and the manner in which all the various objects are realized will appear in the following description which, considered in connection with the accompanying drawing, sets forth the preferred embodiment of the invention.

Referring to the drawing in which a preferred embodiment of the invention is illustrated—

Figure 1 is a view in perspective of a segmental air bag, a portion of the outer rubber coating thereof being broken away to illustrate the manner in which the fabric is arranged therein.

Figure 2 is a transverse sectional view of the air bag illustrated in Figure 1, the section being taken on a plane indicated by the line 2—2 in Figure 1.

Figure 3 is a plan view shown in an enlarged scale of a portion of the knitted fabric embodied in the present invention.

Figure 4 illustrates the edge of such fabric as viewed from the upper portion of Figure 3 where-

in the free ends of the loops are extended beyond the body of the fabric.

Figure 5 is a plan view of a fragmentary portion of the fabric as it appears in its unstressed form.

Figure 6 is a view of the same fragmentary portion of the fabric as it appears under longitudinal tension or as stretched in the direction of the ribs.

Figure 7 is another view of the fragmentary portion of the fabric shown in Figure 5, the fabric in this view being transversely tensioned.

Figure 8 is a sectional view through the fabric illustrated in Figure 3, the section being taken on a plane indicated by the line 8—8 in said figure.

As illustrated in Figures 1 and 2 the air bag 10 comprises a toric section having closed end walls 11 and a base or rib portion 12. The air bag, as illustrated in Figure 1, is provided with a valve 13 to accommodate the admission of compressed fluid.

The air bag chosen to illustrate the present invention is constructed from alternate layers of rubber 14 and reinforcing fabric 15. As shown in Figure 2 two layers of such fabric are employed, although it is to be understood that a single layer of the improved fabric may be successfully employed and is contemplated as falling within the scope of the present invention. The end portions 11 of the bag may be formed by slitting the fabric and overlapping the tongues thus formed then working the rubber in its uncured state and the fabric into a homogeneous mass. When the bag is fashioned into the desired configuration the rubber is cured by the usual vulcanizing operation.

The reinforcing fabric contemplated herein is knitted from a single continuous cord preferably of the type employed in the manufacture of tires, that is a hard multistranded, twisted cord of approximately 15 to 20 pounds tensile strength. As will be seen in Figures 3 and 4 the cord 16 is formed in a series of parallel loops 17 disposed upon opposed surfaces of the fabric. Such loops form the ribs 18 as in base relief upon the opposed face of the fabric. The fabric is knitted with selvedge edges 24 which define the marginal breadth of the material, the ribs 18 being disposed parallel thereto although in assembly the ribs are disposed parallel the axis of the bag. Over each loop of the series of loops 17 there is cast a loop 19 and a second loop 20. Over the opposite series of rib loops 17 two loops are cast which comprise the strands 21, and 22 respectively. These loops are all formed from the continuous strand 16 and identified herein, by separate characters of reference, merely to indicate the position thereof in the plan and elevational views, Figures 3 and 4.

As will be seen in Figure 3 the rib loops 17 are relatively long or extended thus limiting the extensibility of the fabric in this direction. Conversely, transverse extensibility will occur when the loops are stretched crosswise or in a direction normal the longitudinal axis of the loops 17. The extended portions of the strands 19, 20, 21, and 22 are disposed in angular-relation to the ribs when the fabric is in its normal unstressed condition. When lateral tension is applied such strands will tend to be straightened and thus effectuate appreciable lateral extensibility of the fabric. The extensibility of the fabric will be recognized by comparing the fragmentary portion of the fabric illustrated in Figure 5 with the longitudinally tensioned fabric illustrated in Figure

6, the illustration of Figure 6 being of the same fragmentary section of material containing the same number of loops and stretched by longitudinal tension. The transverse extensibility of the fabric will be noted by comparing the fragmentary portion of material shown in Figure 5 with the transversely tensioned material illustrated in Figure 7. The transverse or transversewise distention of the fabric has been found to be substantially three hundred per cent (300%) greater than the longitudinal or ribwise elongation. Again it will be noted the fabric contains the same number of loops and is distended through the stress applied normal the longitudinal axis of the rib loops.

In forming the knitted fabric the multi-looped transverse strands 19, 20, 21, and 22 respectively will fall within the throat 23 of the longitudinal rib loops 17 which form arcuate bends thereabout of substantial size which will tend to prevent the transverse loops from cutting or shearing the throat of the rib loops. Moreover, the double cast loops intermediate the ribs add material strength to the fabric under transverse strains and also contribute to the restriction of the longitudinal extensibility of the fabric.

In the knitted fabric constituting the present invention the strands, intermediate the cross-over portions, are disposed in spaced relation, to permit impregnation of the rubber throughout the entire fabric. Each strand of the loops are fully coated and insulated one from the other, the engaging cords being bonded by the rubber coating. The resulting rubberized fabric will be thus reinforced, will be susceptible of greater lateral extensibility than a woven fabric and will retain and support a greater volume of rubber than may be applied to a material formed from warp and weft threads.

As illustrated in Figure 1 the knitted fabric is arranged with the ribs 18 disposed parallel the longitudinal axis of the bag and since these ribs are constructed to restrict the longitudinal extensibility, the endwise or longitudinal distention of the air bag will be restrained. On the other hand, the fabric being susceptible of substantial transverse extensibility, the circumference of the bag will be greatly enlarged when the air bag is inflated. Such distention of the bag is essential since the end walls of the vulcanizing mold are open and the end portions of the air bag are unsupported. Moreover, the air bag is usually assembled in the mold with the central portion thereof contiguous the fracture in the tire casing to be repaired. Therefore, it is desirable to maintain maximum pressure against the zone of the tire casing in which the fracture is located and to force the uncured rubber within such fracture against the side wall of the mold during the vulcanizing operation. Inasmuch as the end walls of the air bag are of substantial thickness due to the overlapped construction of the fabric and rubber, the distention of the bag will be of substantially fusiform configuration, the circumferential enlargement being disposed in the central body of the bag.

The fabric is knitted under tension both longitudinally and transversely in order to form the aforesaid loops and maintain the relation thereof but the material is assembled in the bag in its unstressed form so the maximum extensibility of the fabric will be available when the air bag is inflated.

In the foregoing description an air bag of the segmental form only has been considered. It

is to be understood, however, that the knitted reinforcing fabric as disclosed herein is susceptible of the same advantages if assembled in an annular air bag, as the circumferential expansion of the bag as considered from a transverse section through the annulus would possess the same functions and utilities.

Although the foregoing description is necessarily of a detailed character, in order that the invention may be completely set forth, it is to be understood that the specific terminology is not intended to be restrictive or confining, and that various rearrangements of parts and modifications of detail may be resorted to without departing from the scope or spirit of the invention as herein claimed.

I claim:

1. A segmental air bag for use in the repair of tire casings, said air bag having walls formed of rubber reinforced with fabric, said fabric being knitted with relatively inextensible ribs, the fabric being arranged in the air bag with said ribs parallel the longitudinal axis of the bag.

2. A segmental air bag for use in the repair of tire casings embodying knitted fabric walls impregnated and coated with rubber, said fabric being knitted of a hard multi-strand twisted cord and being knitted with inextensible ribs, extending in parallel relation longitudinally of the bag.

3. A segmental air bag for use in the repair of tire casings embodying knitted fabric walls impregnated and coated with rubber, said fabric being knitted of tire cord and knitted with longitudinal ribs formed to restrain extensibility when the fabric is tensioned ribwise, said fabric being disposed in said air bag with said ribs parallel the longitudinal axis thereof.

4. A segmental air bag for use in the repair of tire casings comprising knitted fabric walls impregnated and coated with rubber, said fabric being knitted with lineal reinforcements formed to delimit extensibility of the fabric under tensile strains applied in line with said reinforcements, and being knitted to tension said reinforcements under tensile strains applied to the fabric normal said reinforcements, said fabric being disposed within said bag with the lineal reinforcements parallel the longitudinal axis of the bag.

5. A segmental air bag for use in the repair of tire casings comprising a closed end tube formed of a rib stitch knitted fabric impregnated and coated with rubber, said fabric being knitted of a

width to form the circumference of said tube, the marginal side edges of the fabric being disposed in contiguous relation and having said ribs parallel the longitudinal axis of the bag, said fabric being knitted with less extensibility ribwise than transribwise.

6. A segmental air bag for use in the repair of tire casings comprising a closed end tube formed of a rib stitch knitted fabric impregnated and coated with rubber, said fabric being knitted with selvedge edges at the sides defining the breadth thereof, said selvedge edges being juxtaposed to form said tube, the ribs in said fabric being disposed parallel the longitudinal axis of the bag, said fabric being knitted under tension and assembled in the bag in its unstressed form.

7. A segmental air bag for use in the repair of pneumatic tire casings, comprising a closed end tube formed of a rib stitch knitted fabric impregnated and coated with rubber, said fabric being formed of a hard multi-stranded, twisted textile of substantially seventeen pounds tensile strength, the fabric being arranged in said bag with said ribs parallel the longitudinal axis thereof.

8. A segmental air bag for use in the repair of pneumatic tire casings comprising a closed end tube, formed of a rib stitch knitted fabric impregnated and coated with rubber, said fabric being knitted of a continuous tire cord of approximately fifteen to twenty pounds tensile strength, the fabric being arranged in said bag with the ribs parallel the longitudinal axis of the bag.

9. A segmental air bag for use in the repair of pneumatic tire casings, comprising a closed end tube, formed of a rib stitch knitted fabric impregnated and coated with rubber, said fabric being knitted from a hard twisted textile and being knitted to distend transribwise substantially three hundred percent (300%) more than ribwise, the fabric being arranged in said bag with the ribs parallel the longitudinal axis of the bag.

10. A segmental air bag for use in the repair of tire casings embodying walls of a single layer of knitted fabric impregnated and coated with rubber, said fabric being knitted with inextensible ribs, extending in parallel relation longitudinally of the bag.

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