No. 797,138. PATENTED AUG. 15, 1905.

C. L. MARSHALL.

FABRIC FOR PNEUMATIC TIRES.

APPLICATION FILED OCT. 22, 1904.

2 SHEETS—SHEET 1.

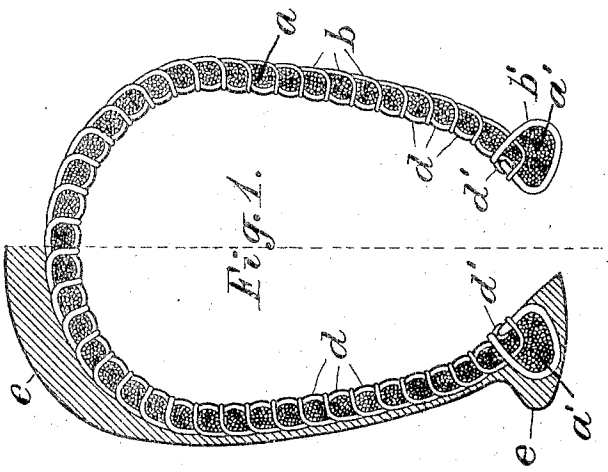


Fig. 1.

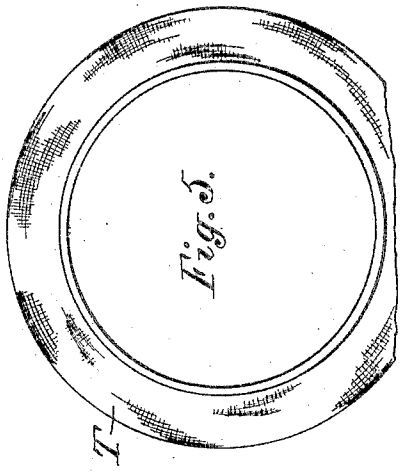


Fig. 5.

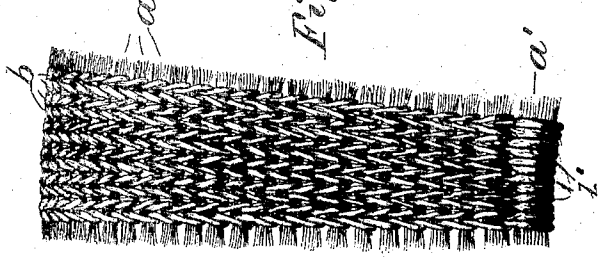


Fig. 2.

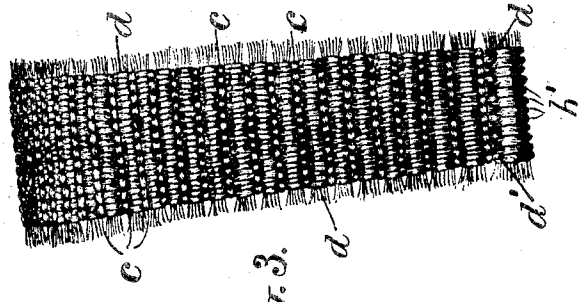


Fig. 3.

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2 SHEETS—SHEET 2.

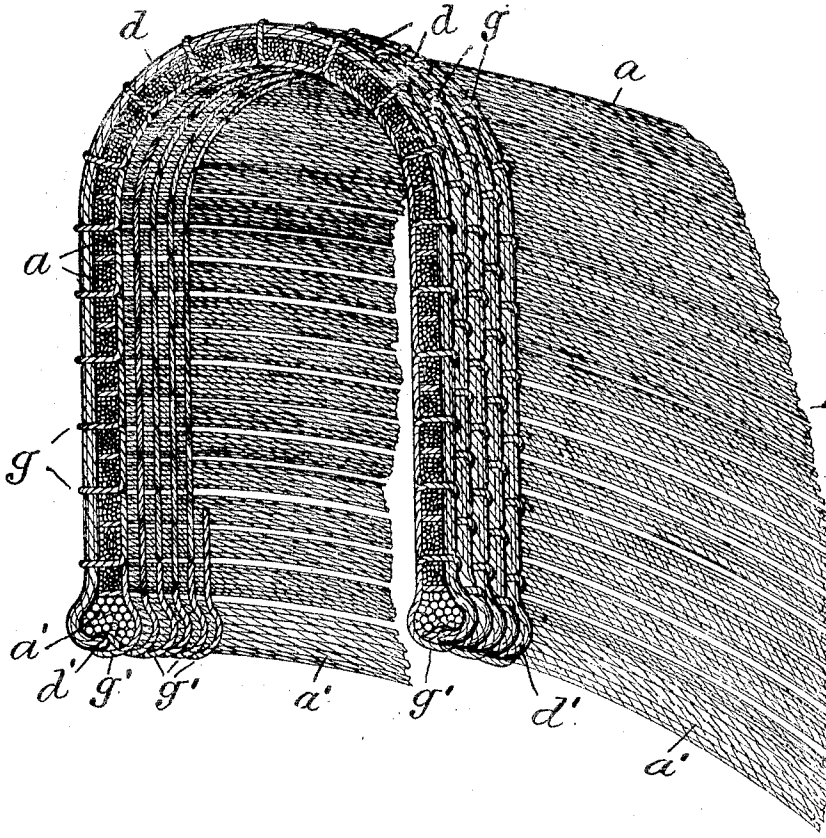


Fig. 4.

Fig. 6.

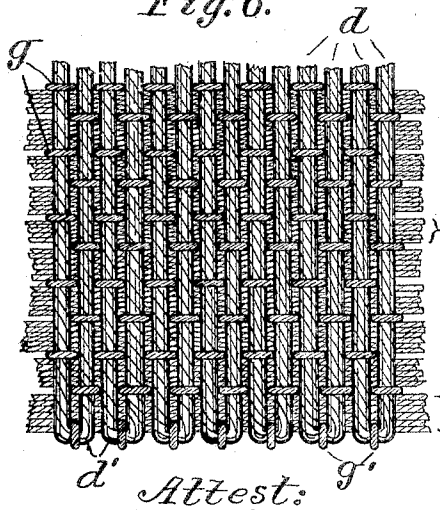


Fig. 7.

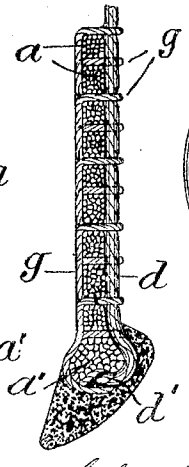
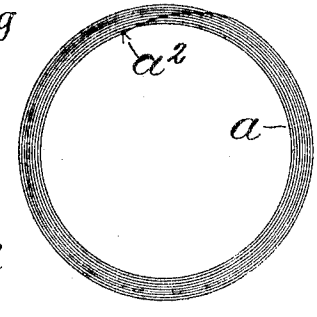


Fig. 8.



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UNITED STATES PATENT OFFICE.

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FABRIC FOR PNEUMATIC TIRES.

No. 797,138. Specification of Letters Patent. Patented Aug. 15, 1905

Application filed October 22, 1904. Serial No. 229,589

To all whom it may concern:

Be it known that I, CHARLES L. MARSHALL, a citizen of the United States, whose residence and post-office address is 832 Parker street, Newark, county of Essex, and State of New Jersey, have invented certain new and useful Improvements in Continuous-Formed Fabric for Pneumatic Tires, fully described and represented in the following specification and the accompanying drawings, forming a part of the same.

The object of this invention is to furnish for pneumatic tires a covering fabric provided with endless longitudinal strands of warp-threads and the strands strongly united together laterally, so that the cover may be fitted to withstand longitudinal and lateral strains. Such endless strands are readily formed by winding a suitable warp-thread several times in a circular groove around a suitably-shaped model and tying together the ends of such thread, thus forming an endless strand containing a plurality of warp-threads. The series of strands required to form the tire-cover may then be united by the common processes of sewing or weaving, so that transverse threads embrace all of the warp-threads and connect them together laterally. The bursting strain caused by the compressed air is principally resisted by the transverse threads, which should be of great strength, the longitudinal threads serving to keep the transverse threads in place and to determine and maintain the desired form of the tire. The most practical and economical means of uniting the required group of warp-threads laterally is by employing a zigzag-sewing machine containing a gang of needles of sufficient length to extend across the breadth of the group and feeding the warp-threads in the direction of their length, while the needles are vibrated transversely of the fabric, so as to loop the stitching-threads over the adjacent strands. On the under side of the fabric double transverse threads are laid and the stitching-threads extend under and around them when looped over the warp-strands, and double transverse threads thus connect all the stitches firmly together. Such a sewing operation can be performed upon all the circumference of the endless tire-cover, excepting a very short section in which the threads can be united laterally by stitching transversely in an ordinary sewing-machine. The strands upon the outer side of the tire-cover are necessarily of greater length than those upon its inner edge, as the tire-cover has a greater periphery upon its outer side than upon the inner edges, which fit the rim of the wheel, and the invention provides a means of effectively filling the enlarged space upon the outer part of the tire-cover by stitching the strands at such part of the tire with coarser stitching-threads.

This tire-cover is well adapted for use in the Dunlop tire, which requires the edges of the cover to be reinforced or enlarged to lock into the undercut flanges of the supporting-wheel, and such enlargement is readily effected in this invention by employing larger strands at the edges of the cover and proportioning them so as to give the edges the desired shape when coated with the usual india-rubber coating. Such enlarged strands can be most firmly and readily united to the intermediate portions of the tire by sewing-machine stitches, which connect all the adjacent strands in the tire-cover firmly together.

The invention will be understood by reference to the annexed drawings, in which—

Figure 1 is a cross-section of a tire-cover formed by sewing the strands transversely with zigzag stitches, the sewed fabric being shown at the right-hand side of the center line and the finished tire-cover with india-rubber coating vulcanized thereon at the left side. Fig. 2 is a side view of a short portion of the outer side of the tire-cover, the ends of the warp-strands being shown at opposite edges to show their relation to the stitches. Fig. 3 is a side view of a short portion of the inner side of the tire-cover, the fabric being turned inside out. Fig. 4 is a perspective view of a portion of a tire-cover having the endless warp-strands united by a lock-stitch sewing-machine. Fig. 5 is a side view of the endless tire-cover, upon a greatly-reduced scale, with the bottom of the view broken off for want of room. Fig. 6 shows a part of the fabric made with lock-stitches along one edge of the same, and Fig. 7 is a cross-section of such edge with the rubber coating applied. Fig. 8 shows one endless strand.

Referring to the fabric formed with zigzag stitches, as shown in Figs. 1, 2, and 3, *a* designates the strands which are shown in Fig. 1 formed with a plurality of warp-threads, and such strands are also shown projecting from the transverse threads at the right and left hand sides of Figs. 2 and 3. A portion of the strands near the inner edge of the cover are also shown in Fig. 4 almost in contact with

one another in readiness for union by transverse threads. Zigzag stitches *b* are shown uniting the strands in Fig. 2, each stitch being extended over two strands and the loops *c* of the stitches engaged on the under side of the fabric with transverse threads *d*, which are made materially coarser or stronger than the stitching-threads. In sewing with zigzag stitches a gang of needles is commonly used which operates upon the whole width of the fabric at once, and the transverse threads are supplied by a looper and are thus made double, with a loop *d'* at the end, and such transverse thread is clearly shown in Fig. 1 and the end loops *d'* engaged with the stitches *b'* upon the edges of the fabric, which are made of coarser thread than the other stitches, so as to give increased strength. The strands *a'* at each edge of the cover are shown of greater thickness or depth than the others to form the shoulder which is required upon the edges of the Dunlop tire-cover. Such a cover forms a pneumatic tire when combined with an inner pneumatic tube and the edges of the cover locked upon the rim in the usual manner.

The usual rubber coating *e* is shown upon the left-hand side of Fig. 1 molded upon the fabric and filling all the interstices of the strands and stitching-threads. The greater length of the outer strands compared with the inner strands is clearly shown in Fig. 2, and the filling of such length is effected by proportioning the thickness of the thread which is used in stitching the central strands and those intermediate to the center and the edges, so that each portion of the strands is united by stitching, which forms a filling proportioned to the length of the strand. The use of such coarser stitching-threads upon the outer side of the tire serves to reinforce and thicken such portion of the tire and increase its resistance to wear.

Figs. 4, 6, and 7 show the tire having the warp-strands *a* connected by ordinary lock-stitches, a single needle in such case being run back and forth across the width of the fabric to unite the strands and the tension of the upper transverse thread *d* being made greater than that of the lower thread *g*, so that the upper thread is stretched straight across the warp-strands and the loops of the under thread are pulled through the fabric to the outer side of the fabric, thus locking the endless warp-strands strongly to the transverse threads *d*. In Fig. 4 the outer thread *d* is shown thicker than the inner thread and drawn straight by this arrangement of the tension, thus supporting the lateral bursting strain in the most effective manner. When the warp-strands are united by a lock-stitch sewing-machine, either the upper or lower thread may be made coarser than the other and the tension arranged to draw the loops of either thread through the fabric, and the selvage is finished alike on both edges of the fabric by the looping of the upper and under threads at the edges. Such locking of the loops is clearly shown in Figs. 6 and 7, as well as the selvage on one edge of the fabric. To thicken such edge, the warp-strand at the edge is shown larger than the other strands.

It is to be understood that the warp-strands are made so as to extend continuously around the tire without interruption, so that their strength is uniform at all points, and that the transverse threads which join the warp-strands are also continuous, being extended back and forth upon the surface of the fabric and attached to its edge by means of loops *g'* and *d'*, so that they are unbroken in their continuity and possess a uniform strength throughout the entire fabric. The fabric is thus readily distinguished from any in which the warp extends transversely of the fabric, as the warp is then necessarily cut after the weft or filling is inserted, while in my construction the warp is in endless strands which extend around the fabric, so that they remain unbroken when the tire-cover is finished.

The invention is capable of forming an endless circular tire-cover of trough-shape with the opening of the trough upon the inner side and the endless strands having a length proportioned to their distance from the center of the circular covering, and whatever means be employed to connect the circular strands laterally it is desirable that a continuous transverse thread shall be extended back and forth across the circular strands with loops connected to the edges of the tire-cover, so that the transverse threads may reinforce one another by their continuous connection with one another at the edges of the fabric. The stitching-thread upon the opposite side of the fabric connects the warp-strands to the transverse thread by its loops, which do not, however, sustain the bursting strain, which is effectively borne by the continuous transverse thread, whose loops being engaged with the edges of the tire-cover are locked into the wheel-rim when the tire-cover is in use. Short transverse threads terminated at the edges of the fabric would require to be attached to the edges of the fabric separately and could not possess the same strength to resist the expansive strain of the pneumatic tube as a continuous thread extended back and forth across the circular strands.

Fig. 8 shows diagrammatically one of the endless warp-strands formed of a plurality of coils of the same thread with the ends of the thread knotted at a^2. All of the warp-strands indicated in the other figures of the drawings may be thus made to provide an endless warp before the transverse threads are connected therewith.

The warp may be saturated with india-rubber before the strands are united by trans-

verse threads, and the india-rubber absorbed by the strands is then vulcanized when the coating is put on.

If desired, the thickening of the edges of the cover to hold it upon the wheel-rim may be effected by making the reinforcing-piece separate and attaching it to the edge of the cover by stitching. The precise shape of such reinforcing-strip along the edges of the cover is immaterial, as it can be shaped by molding after the warp-threads are united by the transverse threads.

The strands *a'* at the edges of the cover in Fig. 1 are shown shaped after stitching into a desirable form to receive the india-rubber coating at the edges of the cover. The extension of the transverse threads *d* straight across the inner side of the fabric resists most effectively all lateral strains to which the fabric may be subjected.

The means employed for supporting the strands and uniting them transversely is wholly immaterial to the present invention, which consists in the cover having the characteristics described and which includes, broadly, a fabric having longitudinal strands of greater length at the middle of its width than at the edges and having transverse threads *d*, to which all of the strands are connected by weaving or stitching.

Having thus set forth the nature of the invention, what is claimed herein is—

1. An endless circular tire-cover of trough shape having a series of circular warp-strands connected transversely.

2. An endless circular tire-cover of trough shape having a series of circular endless strands of warp-threads connected transversely, and the strands at the edges of greater thickness to reinforce the edges.

3. An endless circular tire-cover having a series of circular warp-strands each composed of a plurality of warp-threads, the strands being connected transversely and having a greater length at the middle of the fabric than at the edges thereof.

4. An endless circular tire-cover having a series of separate circular endless warp-strands each composed of a number of coils of a single thread, the strands being connected upon one side by a continuous transverse thread with a thread upon the opposite side having loops engaged therewith.

5. An endless circular tire-cover of trough shape having a series of circular strands of warp-threads, a continuous transverse thread looped back and forth upon one side of the tire-cover, and a looped thread upon the opposite side of the tire-cover connecting the strands thereto, the endless strands having a length proportioned to their distance from the center of the circular covering.

6. An endless circular tire-cover of trough shape with its opening upon the inner side, having a series of circular strands of warp-threads, and the strands united by a continuous transverse thread looped at the opposite edges of the cover.

7. An endless circular tire-cover of trough shape with its opening upon the inner side, having a series of circular strands of warp-threads, and the cover having enlarged strands at the edges, and the strands united by a continuous transverse thread looped at the opposite edges of the fabric and connected to the thickened strands.

8. An endless circular tire-cover of trough shape having a series of circular endless strands of warp-threads connected by transverse threads and stitches.

9. An endless circular tire-cover of trough shape having a series of circular endless strands of warp-threads connected by transverse threads and stitches, and the strands near the middle of the width connected by coarser stitching-threads than the strands near the edge.

10. An endless circular tire-cover of trough shape having a series of circular endless strands of warp-threads, connected by transverse threads and stitches and having enlarged strands at the edges to reinforce the edges, and the strands near the middle of the width connected by coarser stitching-threads than the strands near the edge.

11. An endless circular tire-cover of trough shape with its opening upon the inner side, having a series of circular endless strands of warp-threads, each strand comprising a number of coils of a single thread.

12. An endless circular tire-cover of trough shape with its opening upon the inner side, having a series of circular endless strands of warp-threads, each strand comprising a number of coils of a single thread, with the ends of the thread in each strand connected together, and the strands connected by transverse threads.

13. An endless circular tire-cover of trough shape with its opening upon the inner side, having a series of circular endless strands of warp-threads and the cover having enlarged strands at the edges, and the strands united by a continuous transverse thread looped at the opposite edges of the fabric and connected to the thickened strands, and a rubber coating molded upon the cover and filling the interstices between the strands and the transverse threads.

In testimony whereof I have hereunto set my hand in the presence of two subscribing witnesses.

CHARLES L. MARSHALL.

Witnesses:

THOMAS S. CRANE,

ARTHUR F. HEATON.