No. 649,720. Patented May 15, 1900.

# C. E. DURYEA.

## VEHICLE TIRE.

(Application filed Aug. 24, 1894.)

(No Model.) 2 Sheets—Sheet 1.

Fig. 1.

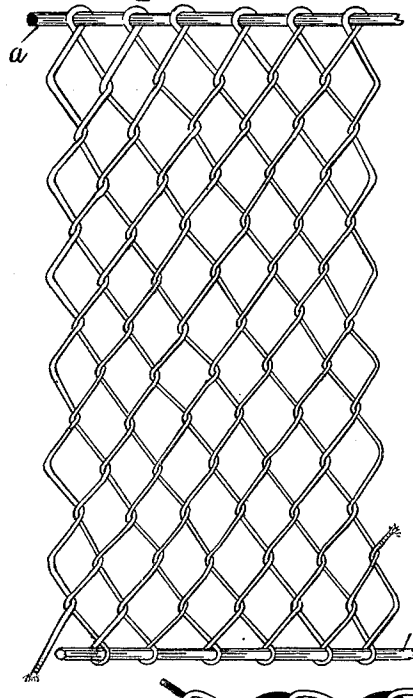



Fig. 2.

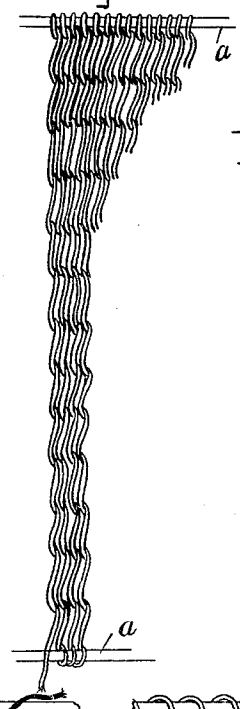



Fig. 5.

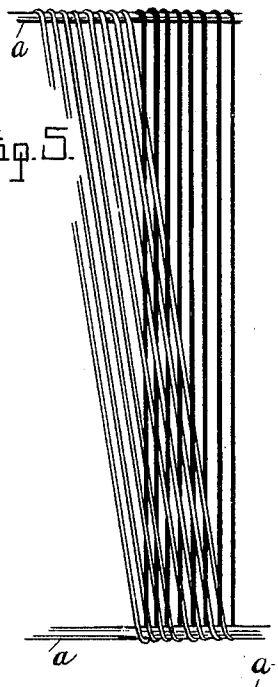
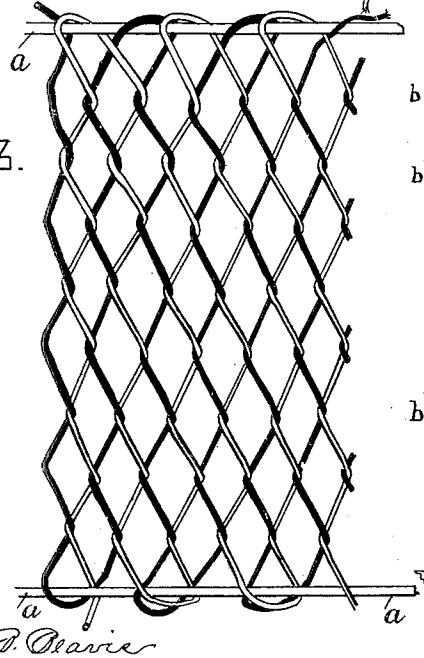



Fig. 3.



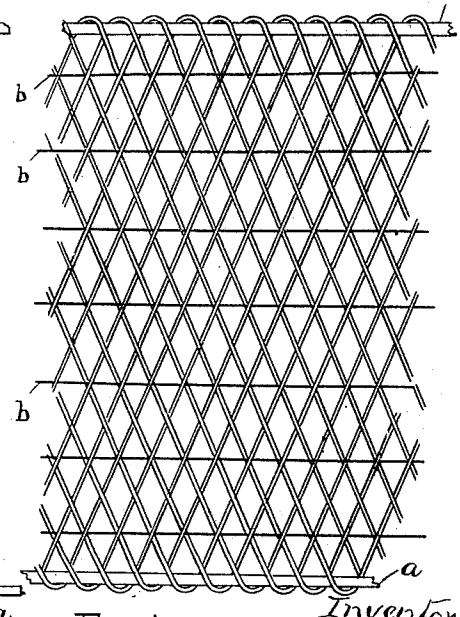




Fig. 4.

Witnesses.
Laura P. Clarke
F. S. Travis

Inventor
Charles E. Duryea

THE NORRIS PETERS CO., PHOTO-LITHO., WASHINGTON, D. C.

No. 649,720. Patented May 15, 1900.

# C. E. DURYEA.

## VEHICLE TIRE.

(Application filed Aug. 24, 1894.)

(No Model.) 2 Sheets—Sheet 2.

Fig. 6.

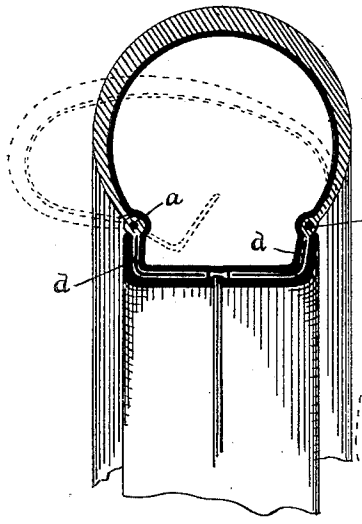
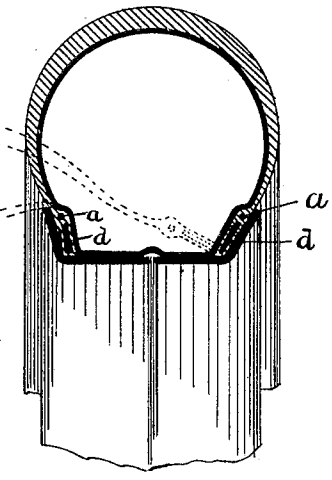



Fig. 7.




Witnesses.
Laura B. Bravis
F. S. Bravis

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# UNITED STATES PATENT OFFICE.

CHARLES E. DURYEA, OF PEORIA, ILLINOIS, ASSIGNOR TO THE INDIANA RUBBER AND INSULATED WIRE COMPANY, OF MARION, INDIANA.

## VEHICLE-TIRE.

SPECIFICATION forming part of Letters Patent No. 649,720, dated May 15, 1900.

Application filed August 24, 1894. Serial No. 521,256. (No model.)

*To all whom it may concern:*

Be it known that I, CHARLES E. DURYEA, of Peoria, in the county of Peoria and State of Illinois, have invented certain new and useful Improvements in Vehicle-Tires, of which the following is a specification.

My invention relates to that class of tires known as "pneumatic" tires, which consist of a shoe or cover of fabric covered with or incorporated into rubber adapted to receive and resist the wear due to contact with the road-surface. Inside this retaining-shoe air is held under pressure by an air-tube of rubber or other material, which may or may not be fixed to and a part of the shoe. This air being under pressure must be confined, and the fabric of the shoe serves to do this, and while any fabric or other material having proper strength may serve to confine the air it is evident that some forms of fabric are better adapted to hold the air while permitting its free action within the confined limits than others.

My invention consists of one or more forms of fabric adapted to hold the air properly and yet permit the tire to be compressed at any point freely and to a great extent without affecting other points, whereby a faster and more comfortable tire is obtained. This object was achieved with the fabric shown in my application of September 5, 1892, Serial No. 445,037, issued March 14, 1893; but a further object is to provide a cheaper and thinner fabric than the one there shown, while attaining as good or better results.

A further object of my invention is to provide a quick and easy means of fastening the tire to a rim or of detaching the same therefrom for repairs or other purposes; and it consists of a certain form of rim, in combination with wires or similar devices along that part of the shoe that lies at or near the edge of the rim, and a certain formation of that part of the shoe below and between the said wires, as will be explained further in the body of this specification.

Further minor objects may appear as the invention is described in full.

I attain these results by the means shown in the accompanying drawings, in which—

Figures 1 to 5, inclusive, are illustrative of my transverse thread fabric, Fig. 1 being an expanded view of the single-thread form shown in closed shape as used in Fig. 2. Fig. 3 is a double-thread form expanded, so as to show its construction. Fig. 4 is an expanded braided fabric shown in full size closed in Fig. 5. Figs. 6 and 7 are cross-sections of the tire on the rim and show two forms of carrying out in practice my method of holding the air-tube and shoe on the rim.

Similar letters refer to similar parts throughout the several views.

It will be seen that my fabrics differ from those in common use in that all threads run transversely to the tire, or approximately so. This arrangement is valuable in that it avoids the straining or drawing of the fabric threads when the tire passes over an obstacle, as is the case with all fabrics having longitudinal threads and largely true of those fabrics that have the threads diagonally placed. When a pebble is forced into my tire, it simply overcomes the air-pressure, and the few threads that it touches fall with it into the tire without drawing on the other threads or affecting them to any important distance on either side of the pebble. To secure this action and the other objects sought, I weave or knit or braid, as the case may be, one or more threads into a strip of fabric of the width desired and of length sufficient to form the circumference of the wheel, more or less. There are no warp-threads required in my fabrics, but to hold it in place while it is being applied or incorporated with the rubber it is sometimes advisable to have warp-threads placed therein which shall be of sufficient strength to hold the fabric together while in process of manufacture, but which shall be of so weak a nature that they break and do not interfere with the action of the tire in use. In some cases these may be placed at or near the edge only and with the cords *a* (shown in all the views) the fabric may be found sufficiently stable to be worked. In other cases the warp-threads may be required to be placed all across the fabric, as shown at *b b b* in Fig. 4, and may be as close together as each crossing of the threads. It will be understood that these are inserted or not, according to the requirements of the form of tire in which

the fabric is used, and that some forms require more of them than others because of the necessity of placing the fabric in the mold evenly, if it is to make an even and smooth tire with the strain evenly distributed over each part of the fabric.

If no warp-threads are used, my fabric consists of approximately-transverse threads twined, knit, or meshed together at intervals to prevent their separating accidentally and permitting the air-tube to escape. In the patent heretofore mentioned I united the threads in some manner that would hold them positively; but it is the experience of tire-builders that a tire in which the rubber is incorporated into the fabric and vulcanized there makes the most durable tire, and this is now the preferred method. I have found that in a tire made in this manner the rubber holds the threads from slipping one on the other to any serious extent and that the slight movement made possible by the elasticity of the rubber is an advantage rather than otherwise. The need for union at all lies in the fact that rubber tears very easily when once started, and a small puncture might be torn into a hole large enough to let the air-tube escape if not restrained in all directions. The object then of my inventions in fabric is to permit a free and unimpeded stretching of the tread of the tire, but only within certain limits. Beyond this limit the threads, although lying transversely, begin to act to prevent any danger of tearing the rubber. It will readily be seen that the smaller the mesh the less the amount of stretch possible at any point, and yet below this limit any portion is free to stretch in a direction lengthwise the tire. No stretch is permissible in a direction across the tire, for such would be taken up at once by the air-pressure, and a tire of increased size would be the result.

I am aware that a jersey or looped fabric has been patented in which one loop of one thread was put through a loop of the previous thread and served to receive a loop of the following; but such a fabric will not serve as does mine. To get the desired results, it is necessary that the threads lie approximately both transversely and straight, for if they are much crooked they no longer act as individual threads, but they carry the adjoining threads with them in their movements and act much as a woven fabric. I attain the desired results by carrying one thread spirally around the other a given number of times and a third around the second the same number of times in the same distance, and so on until a fabric is produced which if expanded looks much as shown in Fig. 1, although in use it is applied with the threads lying as close to each other as possible, (see Fig. 2,) so as to give them a position as straight and as free from their neighbors as possible. It is preferred to use but one ply of such fabric; but in practice I use as many as is necessary to give the required strength, placing one on top of the other with their threads lying as nearly in the same direction as is practicable to get them, just as canvas or other fabrics are placed two or more ply for strength. Such a fabric as I have described has no longitudinal strength, and so must be held to the rim by wires or other means of fastening. In Fig. 1 a single continuous thread is used; but it is evident that the same arrangement may be obtained by the use of two threads, as shown in Fig. 3, or more. In either case I prefer to make the fabric of the width desired and return the threads into the fabric, so as to form a pocket or loop for receiving the wires or beads or whatever is used to hold the fabric to the rim, and I have so shown all the fabrics in the accompanying drawings; but I may use the fabric in sheet form and make a tire by wrapping strips of it around a core, as is common practice with other fabrics, or I may make the fabric in tubular form and use it whole or split and laced along the side next to the rim. These methods are common in the use of other fabrics and are not new with me nor are they claimed by me.

It is not in the manner of placing the fabric as a fabric that my invention lies, but in the position of the threads composing the said fabric. The improved result is obtained by placing those threads in a position transverse to the rim of the wheel or so near thereto that the result is not affected and hold them from separating unduly by meshing them in a manner that will affect in as small a degree as possible their action as separate threads. To accomplish this result, it is not necessary that the second thread in Fig. 1 should make a continuous spiral around the first, as stated; but the results are the same if it passes around the first in one direction and after being engaged by the third again passes around the first in a reverse spiral, and so on. The meshing of one thread with another gives a diagonal strength that shows very plainly in the expanded form and that is not desirable to any great extent, if at all; but in the closed form this diagonal does not vary from the transverse more than as many thread diameters as there are meshes in the width of the fabric, and so the results are affected but little, if any. This being understood it will be seen that a similar result is obtained by meshing the threads over and under in a diagonal straight line, as shown in Figs. 4 and 5, Fig. 4 being an expanded form to show the construction more clearly, and Fig. 5 being the position when in use. This is in reality a braided fabric, but it is new in that it is not composed of threads that run lengthwise the fabric, as is the case with all previous braided fabrics. The threads of this fabric lie across its length, and it is necessary to either provide it with warp-threads of weak material, as before explained, or to make it around the wires or beads, as shown, or both, as the circumstances may require.

An inflated tire tends to expand in a direction radial to a cross-section of the tire itself and also in a direction radial to the wheel to which it is applied. My fabrics have little or no longitudinal strength or strength in the line of a circumference of the wheel, and so must be provided with wires or other strong and practically-non-stretching devices for holding the tire against the rim. These "wires," as I shall hereinafter term them, may not be placed in the tread portion of the tire, because they would be likely to interfere with the action of the fabric. They may be placed at almost any position near the rim and serve their purpose, but if placed one along each edge of the rim they serve to prevent any rolling tendency. This is the preferred position, and is not new with me, broadly, for others have used wires above or inside the edge of the rim. To meet the strain in a direction radial to a cross-section of the tire, the fabric provides a circumferential resistance to such parts of such section as it forms a part of, but below and between the wires the strain must be met by other means. In my application, filed March 13, 1893, Serial No. 465,843, I have shown a fabric to take this strain and proposed to lace or otherwise fasten it together, if split, for the purpose of getting at the inner air-tube. My present invention uses wires along that part of the tire which is adjacent to the edges of the rim, but differs from that of the application mentioned in that the rim is used to form a part of the cross-sectional circumference, and so receives a part of the strain. That it may do this necessitates a special shape to the edge of the rim and the edge of the tire, whereby they engage each other and meet the strain mentioned. For ease of repair and other purposes it is desirable that the tire should be easily detached when deflated and should be open along the base for easy access to the inner parts. To accomplish this, I use a rim having edges of a shape to offer resistance to the sidewise pressure of the air, while the body of the rim itself meets the inward pressure of the air. The edges of the shoe are adapted to lie against the edges of the rim and be held in place by the pressure mentioned. When deflated, the tire may be removed easily. The best results are obtained in practice by having the edge of the tire shaped to fit that portion of the rim it is to rest against and by stiffening it, so that it maintains its shape. This stiffening may be effected by the use of an increased quantity of canvas as is commonly used, but I prefer to place in the edge a stiff compound of rubber, such as vulcanite or something similar, so that while the tread portion of pure rubber is being vulcanized to be soft and flexible the edges will by the same vulcanization become stiff, owing to its being made up with a different compound. When so made, the wires may be larger or smaller or the same size as the edge of the rim and yet the tire will remain in place so long as it is inflated. Fig. 6 shows a form wherein the wires are larger than the greatest circumference of the rim, and when deflated it may easily be thrown into the position shown in the dotted lines and removed from the rim. Fig. 7 is a form in which the wires are not so large as the greatest circumference of the rim, and to remove it from its place requires that it should be thrown flat against the bottom of the rim for the greater portion of its length, which permits the remaining portion to be lifted over the edge of the rim. At O is a detail showing a form wherein the wire is smaller than the rim and yet lies outside of it. *a a* indicate the wires, and *d d* the stiff filling along the edges of the shoe. In all these forms the stiff edge serves to hold the wires in their place and prevent accidental displacement.

I claim—

1. A tire-shoe having stiffened edges adapted to lie within a rim and wires secured to lie adjacent to the edges of the rim, and provided with a restraining fabric extensible lengthwise but not transversely, consisting of threads interlocked or intermeshed and arranged approximately paralled with each other and transversely of the tire, substantially as described.

2. A rubber tire-shoe having a portion made stiffer than the other portions by the use of a compound adapted to vulcanize harder than the other portions and provided with a fabric consisting of strong threads interlocked and intermeshed and arranged approximately parallel with each other and transversely of the tire, but free to move with relation to each other substantially as described.

Witness my hand.

CHARLES E. DURYEA.

Witnesses:
LAURA B. BEAVIS,
FRANK S. BEAVIS.